DAV CENTENARY PUBLIC SCHOOL

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NEW DELHI - 110087

XI - Chemistry Chapterwise Topicwise Worksheets with Solution

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CBSE TEST PAPER-01

CLASS - XI CHEMISTRY (Basic Concepts of Chemistry)

Topic: - Matter and it s classification

Marks: 20

1. What is chemistry? [1]
2. How has chemistry contributed towards nation's development? [1]
3. How can we say that sugar is solid and water is liquid? [2]
4. Differentiate solids, liquids & gases in terms of volume & shapes. [1]
5. How is matter classified at macroscopic level? [2]
6. Classify following substances as element, compounds and mixtures – water, tea, silver, steel, carbondioxide and platinum [2]
7. Name the different methods that can be used for separation of components of a mixture. [1]
8. Classify following as pure substances and mixtures – Air, glucose, gold, sodium and milk. [1]
9. What is the difference between molecules and compounds? Give examples of each. [1]
10. How can we separate the components of a compound? [1]

CBSE TEST PAPER-01

CLASS - XI CHEMISTRY (Basic Concepts of Chemistry)

Topic: - Matter and it s classification [ANSWERS]

Ans1: Chemistry is the branch of science that studies the composition, properties and interaction of matter.

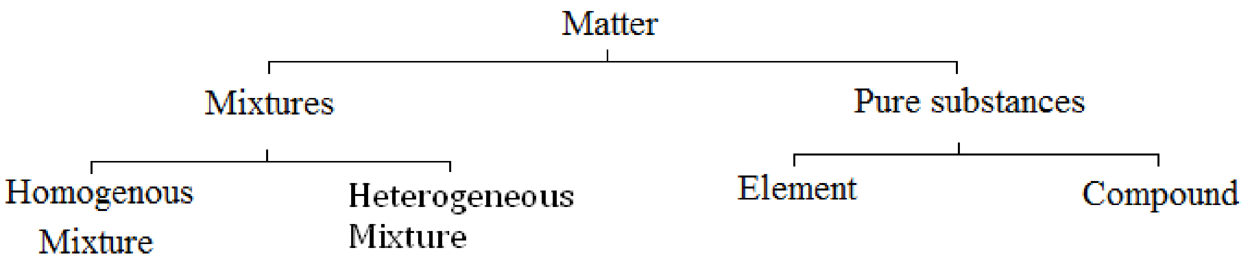
Ans2: chemical principles are important in diverse areas such as weather patterns, functioning of brain, operation of a computer, chemical industries, manufacturing , fertilizers, alkalis, acids, salts, dyes, polymers, drugs, soaps, detergents, metals, alloys, contribute in a big way to national economy.

Ans3: Sugar has close packing of constituent particles, have its own volume and shape therefore, it can be said to be solid whereas in water the constituent particles are not as closely packed as in solid. It has definite volume but not definite shape. Therefore it is a liquid.

Ans4:

Property	**Solids**	**Liquids**	**Gases**
1. Volume	Definite	Definite	Not definite
2. Shape	Fixed	Not fixed, take the shape of container,	Not fixed, takes the shape of the container

Ans5: Macroscopic classification of matter –



Ans6:	Compounds	Elements	Mixtures
	Water	Silver	Tea
	Carbondioxide	Platinum	Steel

Ans7 The components of a mixture can be separated by physical methods like handpicking, filtrations, crystallization, distillation etc.

Ans8:	Pure Substances	Mixtures
	Glucose	Air
	Gold	Milk
	Sodium	

Ans9: Molecules consist of different atoms or same atoms. e.g. molecule of hydrogen contains two atoms of hydrogen where as molecule of water contain two atoms of hydrogen and one of oxygen.

Compound is formed when two or more than two different atoms e.g. water carbondioxide, sugar etc.

Ans10: The constituents of a compound can not be separated by physical methods. They can only be separate by chemical methods.

CBSE TEST PAPER-02

CLASS - XI CHEMISTRY (Basic Concepts of Chemistry)

Topic: - Properties of matter and their measurement

Marks: 20

1. How are physical properties different from chemical properties? [1]
2. What are the two different system of measurement? [1]
3. Write seven fundamental quantities & their units. [2]
4. What is the difference between mass & weight? How is mass measured in laboratory? [2]
5. How is volume measured in laboratory? Convent 0.5L into ml and $30cm^3$ to dm^3 [2]
6. What is the SI unit of density? [1]
7. Convert 35^0C to ^oF & K. [2]
8. What are the reference points in thermometer with Celsius scale? [1]
9. What is the SI unit of volume? What is the other common unit which in not an SI unit of volume. [1]
10. What does the following prefixes stand for – [2]

    (a) pico (b) nano (c) centi (d) deci

CBSE TEST PAPER-02

CLASS - XI CHEMISTRY [ANSWERS]

Topic: - Properties of matter and their measurement

Ans1: Physical properties are those properties which can be measured or observed without changing the identity or the composition of the substance whereas the measurement of chemical properties require a chemical change to occur e.g. colour, odour etc are physical properties and combustion, basicity etc are chemical properties.

Ans2: The different system of measurement are English system and the metric system.

Ans3:

Physical Quantity	SI unit
1. Length (l)	Metre (m)
2. Mass (m)	Kilogram (kg)
3. Time (t)	Second (s)
4. Electric Current (I)	Ampere (A)
5. Thermodynamic Temperature (T)	Kelvin (K)
6. Amount of substance (n)	Mole (mol)
7. Luminous Intensity ($I\nu$)	Candela (Cd)

Ans4: Mass of a substance is the amount of matter present in it while weight is the force exerted by gravity on am object the mass of a substance is determined with the help of an analytical balance in laboratory.

Ans5: In the laboratory volume of a liquid can be measured by using graduated cylinder, burette, pipette etc.

1L = 1000 ml	1000cm3 = 1dm^3
0.5L = 500 ml	$30cm^3 = \frac{1}{100\cancel{0}} \times 3\cancel{0} dm^3$
	$= 0.03dm^3$

Ans6: The SI Unit of density is Kg m^{-3} or kg/m^3

Ans7

^oF	K
$^oF = \frac{9}{5}(^oC) + 32$	$K = ^oC + 273.15$
$^oF = \frac{9}{\cancel{5}}(\cancel{35}) + 32$	$= 35 + 273.15$
$= 63 + 32 = 95^oF$	$= 308.15K$

Ans8: The thermometers with Celsius scale are calibrated form 0^o to 100^o where there two temperatures are the freezing and boiling of water.

Ans9: The SI unit of volume is m^3 whereas litre (L) is the common unit which is not an SI unit.

Ans10: Pico = 10^{-12}

nano = 10^{-9}

centi = 10^{-2}

deci = 10^{-1}

CBSE TEST PAPER-03

CLASS - XI CHEMISTRY (Basic Concepts of Chemistry)

Topic: - Uncertainty in measurement

Marks: 20

1. What is the difference between precision and accuracy? [1]

2. What do you understand by significant figures? [1]

3. How many significant figures are present in [3]

   (a) 4.01×10^2

   (b) 8.256

   (c) 100

4. State law of definite proportions. [1]

5. Explain law of multiple proportions with an example. [2]

6. State Avogadro's law. [1]

7. Write Postulates of Dalton's atomic theory. [2]

8. Define one atomic mass unit (amu). [1]

9. Calculate molecular mass of – [2]

   C_2H_6, $C_{12}H_{22}O_{11}$, H_2SO_4, H_3PO_4

10. What is formula mass? [1]

CBSE TEST PAPER-03

CLASS - XI CHEMISTRY [ANSWERS]

Topic: - Uncertainty in measurement

Ans1: Precision means the closeness of various measurements for the same quantity. Accuracy is the agreement of a particular value to the true value of the result.

Ans2: Significant figures are meaningful digits which are known with certainty. The uncertainty in experimental or the calculated value is indicated by mentioning the number of significant figures.

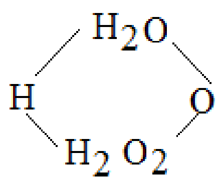
Ans3: (a) 4.01×10^2 – Three

(b) 8.256 – Four

(c) 100 – One

Ans4: Law of definite proportions states that a given compound always contains exactly the same proportion of elements by weight.

Ans5: The law of multiple proportions rays that if two elements can combine to form more than one compound, the masses of one element that combine with a fixed mass of other element are in a ratio of small whole numbers. e.g. hydrogen and oxygen can combine to form water as well as hydrogen peroxide.



Here, the masses of oxygen (16g & 32g) which combine with a fixed mass of hydrogen (2g) bear a simple ratio i.e., 16:32 = 1:2.

Ans6: According to Avogadro's law, equal volumes of gases at the same temperature and pressure should contain equal number of molecules.

Ans7 Postulates of Dalton's atomic theory –

1. Matter consists of indivisible atoms.
2. All the atoms of a given element have identical properties including atomic mass. Atoms of different element differ in mass.
3. Compounds are formed when atoms of different elements combine in a fixed ratio.
4. Chemical reaction involves reorganization of atoms. These are neither created nor destroyed

Ans8: One atomic mass unit (amu) is defined as a mass exactly equal to one – twelfth the mass of one carbon – 12 atom.

Ans9: $C_2H_6 = (2\times12) + (6\times1) = 30$

$C_{12}H_{22}O_{11} = (12\times12) + (22\times1) + (11\times16) = 342$

$H_2SO_4 = (2\times1) + 32 + (4\times16) = 98$

$H_3PO_4 = (1\times3) + 31 + (4\times16) = 98$

Ans10: When a substance does not contain discrete molecules as their constituent units and have a three dimensional structure, formula mass is used to calculate molecular mass which is sum of all the atomic masses of atom present in the formula.

CBSE TEST PAPER-04

CLASS - XI CHEMISTRY (Basic Concepts of Chemistry)

Topic: - Mole concept, percentage composition

Marks: 20

1. What is the value of one mole? [1]

2. At NTP, what will be the volume of molecules of 6.022×10^{23} H_2? [1]

3. Calculate the number of molecules present in 0.5 moles of CO_2? [1]

4. Give one example each of a molecule in which empirical formula and molecular formula are (i) same (ii) Different. [2]

5. 1L of a gas at STP weighs 1.97g. What is molecular mass? [1]

6. Write empirical formula of following – [4]

   CO, Na_2CO_3, KCl, C_6H_{12}, H_2O_2, H_3PO_4, Fe_2O_3, N_2O_4.

7. Calculate the number of moles in the following masses – [2]

   (i) 7.85g of Fe

   (ii) 7.9mg of Ca

8. Vitamin C is essential for the prevention of scurvy.

   Combustion of 0.2000g of vitamin C gives 0.2998g of CO_2

   and 0.819g of H_2O. What is the empirical formula of vitamin C? [3]

CBSE TEST PAPER-04

CLASS - XI CHEMISTRY [ANSWERS]

Topic: - Mole concept, percentage composition

Ans1: 1mole = 6.022×10^{23} atoms/ ions / entities

Ans2: 22.4 Litres.

Ans3: The number of molecules present in 0.5 moles of CO_2 is $6.022\times10^{23}\times0.5=3.011\times10^{23}$.

Ans4: (i) Same molecular formula and empirical formula.
Carbon dioxide, both is CO_2.
(ii) When molecular formula and empirical formula are different –
Hydrogen peroxide: molecular formula is H_2O_2 and empirical formula is HO

Ans5: 22.4 L of the gas at STP will weigh
$=1.97\times22.4=44.1g$
i.e. molecular mass = 44.1

Ans6:

Molecular formula	Empirical formula
CO	CO
Na_2CO_3	Na_2CO_3
KCl	KCl
C_6H_{12}	CH_6
H_2O_2	HO
H_3PO_4	H_3PO_4
Fe_2O_3	Fe_2O_3
N_2O_4	NO_2

Ans7 (i) 7.85g of Fe

56g of Fe contains 6.022×10^{23} atoms = 1mole

56g of Fe = 1mole

7.85g of Fe = $\frac{1}{56}\times7.85 = 0.14$moles

(ii) 40g of Ca = 40×10^{-3} mg of Ca

40g of Ca = 1mole

Or 4×10^{-2} mg of Ca = 1mole

7.9mg of Ca = $\frac{1}{4\times10^{-2}}\times7.9 moles$

$=1.97\times10^{-2} moles$

Ans8: Percentage of carbon = $\frac{12}{44}\times0.02998\times\frac{100}{0.2} = 47.69$

Percentage of Hydrogen $=\frac{2}{18}\times0.0819\times\frac{100}{0.2} = 4.55$

Percentage of oxygen $=100-(47.69+4.55)=47.76$

Element	**%**	**Atomic Mass**	**Relative no. of atoms**	**Simplest Ratio**
C	47.69	12	$\frac{47.69}{12} = 3.97$	$\frac{3.97}{2.98}=1.33$
H	4.55	1	$\frac{4.55}{1} = 4.55$	$\frac{4.55}{2.98}=1.5$
O	47.76	16	$\frac{47.76}{15} = 2.98$	$\frac{2.98}{2.98}=1$

Empirical formula = $C_{1.33} H_{1.5} O$,

= $C_8H_9O_6$

CBSE TEST PAPER-05

CLASS - XI CHEMISTRY (Basic Concepts of Chemistry)

Topic: - Stoichiometry and Stoichiometric calculations

Marks: 20

1. What is stoichiometry? [1]

2. How much potassium chlorate should be heated to produce 2.24L of oxygen at NTP? [2]

3. Write an expression for molarity and molality of a solution. [2]

4. Calculate the weight of lime (CaO) obtained by heating 2000kg of 95% pure lime stone ($CaCO_3$) [2]

5. The substance which gets used up in any reaction is called -------------- [1]

6. What is 1molal solution? [1]

7. 4 litres of water are added to 2L of 6 molar HCl solutions. What is the molarity of resulting solution? [2]

8. What volume of 10M HCl and 3M HCl should be mixed to obtain 1L of 6M HCl solution? [2]

CBSE TEST PAPER-05

CLASS - XI CHEMISTRY [ANSWERS]

Topic: - Stoichiometry and Stoichiometric calculation

Ans1: Stoichimetry deals with the calculations of masses of reactants and products involved in a chemical reactions.

Ans2: $2KClO_3 \rightarrow 2KCl + 3O_2$

2moles 3moles

$2(39 + 35.5 + 3 \times 16)$ $22.4 \times 3L$

= 245g = 67.2L

67.2L of oxygen is produced from 245g of $KClO_3$

2.24L of oxygen is produced from = $\frac{245}{67.2} \times 2.24$

= 8.17g of $KClO_3$

Ans3: $$\text{Molarity} = \frac{\text{number of moles of solute}}{\text{Volume of solution in Litres}}$$

$$\text{Molality} = \frac{\text{number of moles of solute}}{\text{Mass of solvent in kg}}$$

Ans4: 100kg impure sample has pure $CaCO_3$ = 95

= 95kg

$\therefore$ 200kg impure sample has pure $CaCO_3$ = $\frac{95 \times 200}{100}$

= 190kg

$CaCO_3 \rightarrow CaO + CO_2$

Since 100kg $CaCO_3$ gives CaO = 56kg

190kg $CaCO_3$ will give CaO = $\frac{56 \times 190}{100}$

= 106.4kg

Ans5: The substance that gets used up in any reaction is called limiting reagent.

Ans6: one molal solution is solution in which one mole of solute is present in 1000g of solvent.

Ans7 Initial volume, $V_1 = 2L$

Final volume, $V_2 = 4L + 2L = 6L$

Initial molarity, $M_1 = 6M$

Final molarity = M_2

$M_1V_1 = M_2V_2$

$$6M \times 2L = M_2 \times 6L$$

$$M_2 = \frac{6M \times 2L}{6L} = 2M$$

Thus the resulting solution is 2M HCl.

Ans8: Let the required volume of 10M HCl be V liters.

Then, the required volume of 3M HCl be (1 – V) Liters.

$M_1V_1 + M_2V_2 = M_3V_3$

$$10 \times V + 3 \times (1 - V) = 6 \times 1$$

$$10V + 3 - 3V = 6$$

$$7V = 3$$

$$V = \frac{3}{7} = 0.428L = 428mL.$$

Then the volume of 10M HCl required = 428mL

& volume of 3M HCl required = 1000mL – 428mL = 572mL

CBSE TEST PAPER-01

CLASS - XI CHEMISTRY (Structure of Atom)

Topic:-Discovery of Sub – Atomic Particles

Marks: 20

1. Name the sub – atomic particles of an atom. [1]
2. Name the scientist who first formulated the atomic structure. [1]
3. What is the e/m ratio of an electron? [1]
4. What is the charge (e) of an electron? [1]
5. What is the mass (m) of an electron? [2]
6. (i) What is the mass of a proton? [1]

   (ii) What is the charge of a proton? [1]
7. (i) What is the mass of a neutron? [1]

   (ii) What is the charge of a neutron? [1]
8. Which experiment led to the discovery of electrons and how? [2]
9. Give the main properties of canal ray experiment. [2]

CBSE TEST PAPER-01

CLASS - XI CHEMISTRY [ANSWERS]

Topic: - Discovery of Sub – Atomic Particles

Ans1: Electron, proton and neutron.

Ans2: John Dalton, a British teacher in 1808 first proposed a firm scientific basis known as Dalton's atomic theory.

Ans3: According to Thomson's experiment, e/m ratio for an electron is $1.76\times10^{8}cg^{-1}$

Ans4: From Millikan's experiment, the charge of an electron (e) is $-1.602\times10^{-19}C$.

Ans5: mass of an electron (m) = $\dfrac{e}{\left(e/m\right)}$

$$= \frac{1.602\times10^{-19}C}{1.76\times10^{8}Cg^{-1}}$$
$$= 9.10\times10^{-28}g$$
$$= 9.1\times10^{-31}kg$$

So, the mass of an electron is $=9.1\times10^{-31}kg$ or $1/1837$ th of the mass of a hydrogen atom.

Ans6: (i) The mass of a proton is$1.676\times10^{-27}kg$ or $1.676\times10^{-31}g$

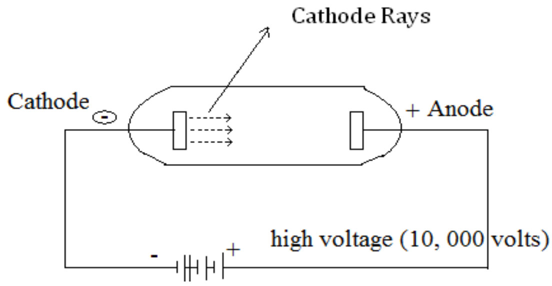
(ii) The charge of a proton is $+1.602\times10^{-19}C$

Ans7: (i) The mass of a neutron is $1.676\times10^{-24}g$

(ii) Neutron is electrically neutral i.e. it has no charge as an electron or a proton has.

Ans8: The cathode ray discharge tube experiment performed by J.J. Thomson led to the discovery of negatively charged particles called electron.

A cathode ray tube consists of two thin pieces of metals called electrodes sealed inside a glass tube with sealed ends. The glass tube is attached to a vacuum pump and the pressure inside the tube is reduced to 0.01mm. When fairly high voltage (10, 000V) is applied across the electrodes, invisible rays are emitted from the cathode called cathode rays. Analysis of this rays led to the discovery electrons.



Ans9: The canal ray experiment led to the discovery of –

(i) The anode rays, travel in straight line

(ii) They are positively charged as they get deflected towards the –ve end when subjected to an electric and magnetic field.

(iii) They depend upon the nature of gas present in the cathode tube.

(iv) The charge to mass ration (e/m) of the particle is found to depend on the gas from which they originate.

(v) They are also material particles

The analysis of these proportions led to the discovery of positively charged proton.

CBSE TEST PAPER-02

CLASS - XI CHEMISTRY (Structure of Atom)

Topic:-Atomic Models

Marks: 20

1. Name the scientist who first gave the atomic model. [1]
2. What is an isotope? [1]
3. What are isobars? [1]
4. What are isotones? [1]
5. What is an atomic number? [1]
6. What is a mass number? [1]
7. Find out atomic number, mass number, number of electron and neutron in an element $^{40}_{20}\times$? [2]
8. Give the main features of Thomson's Model for an atom. [2]
9. Give the drawbacks of J.J. Thomson's experiment. [1]
10. What did Rutherford conclude from the observations of $\alpha - ray$ scattering experiment? [2]
11. Why Rutherford's model could not explain the stability of an atom? [1]

CBSE TEST PAPER-02

CLASS - XI CHEMISTRY [ANSWERS]

Topic: - Atomic Models

Ans1: J.J. Thomson, in 1898 first proposed the atomic model called raising-pudding model.

Ans2: Atoms of the same elements having same atomic number but different mass number are called isotopes.

$eg: {}_1^1H, {}_1^2H \text{ and } {}_1^3H$

${}_{17}^{35}Cl, {}_{17}^{37}Cl \Big/ {}_{6}^{12}C, {}_{6}^{13}C, {}_{6}^{14}C$

Ans3: Atoms of different elements which have same mass number but different atomic nos.

eg: ${}_{6}^{14}C, {}_{7}^{14}N$

${}_{18}^{40}Ar, {}_{19}^{40}K, {}_{20}^{40}Ca$

Ans4: Atoms of different elements which contains the same number of neutron.

eg. ${}_{6}^{14}C, {}_{7}^{15}N, {}_{8}^{16}O$

Ans5: Atomic number is defined as the number of protons presents in the nucleus of an atom or the number of electron present in a neutral atom of an element.

Ans6: Maas number of an element is the number of proton and neutron present in the nucleus of an atom.

Ans7: The mass no. of $\times$ is 40

The atomic no. of $\times$ is 20

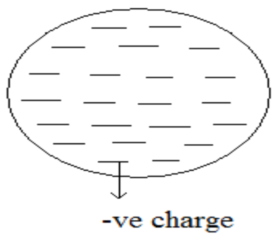
No. of proton is = Z – A = 40 – 20 = 20

No. of electron its (A) = 20

No. of proton is (A) = 20

Ans8: J.J. Thomson proposed that an atom consists of a spherical sphere (radius of about 10^{-10}m)in which the positive charges are uniformly distributed the electrons are embedded into it in such a manner so as to give stable electrostatic arrangement.

This model is also called raisin pudding model.



Ans9: (i) IT could not explain the origin of the spectral lines of hydrogen and other atoms,

(ii) It failed to explain scattering of $\alpha - particles$ in Rutherford's scattering experiment.

Ans10: Rutherford proposed the nuclear model of an atom as

(i) The positive charge and most of the mass of an atom was concentrated in an extremely small region. He called it nucleus.

(ii) The nucleus is surrounded by electrons that move around the nucleus with a very high speed in orbits.

(iii) Electron and nucleus are held together by electrostatic forces of attraction.

Ans11: According to the electromagnetic theory of Marwells, charged particles when accelerated should emit electromagnetic radiation. Therefore, an electron in an orbit will emit radiation; the orbit will then continue to shrink which does not happen in an atom.

CBSE TEST PAPER-03

CLASS - XI CHEMISTRY (Structure of Atom)

Topic:-Bohr's Model of an atom

Marks: 20

1. Give the range of wavelength of the visible spectrum. [1]
2. State the two developments that led to the formation of Bohr's model of atom. [1]
3. What is an electromagnetic radiation? [1]
4. Calculate the wavelength corresponding to a frequency of 98.8MHz. [2]
5. Define black body radiation. [1]
6. Define quantum. [1]
7. Give the relation of energy (E) and frequency (v) as given by Planck. [2]
8. Calculate the frequency and energy of a photon of radiation having wavelength 3000 $\overset{0}{A}$. [2]
9. What did Planck's theory explain? [1]
10. On what frequency does the frequency from a black body depend? [1]

CBSE TEST PAPER-03

CLASS - XI CHEMISTRY [ANSWERS]

Topic: - Bohr's Model of an atom

Ans1: 400nm to 750nm

Ans2: (1) Dual character of the electromagnetic radiations i.e. wave like and particle like properties, and

(2) Atomic spectra explained only by assuming quantized electronic energy levels in atoms.

Ans3: When electrically charged particles moves under acceleration, alternating electrical and magnetic fields are produced and transmitted. These fields are transmitted in the form of wave called electromagnetic waves or radiations.

Ans4: Wavelength, $\lambda = \frac{c}{v}$

Substituting $c = 3 \times 10^8 m/\sec$

And $v = 98.7 MHz$

$= 98.7 \times 10^6 cyles/ses$

$\left(\because 1MHz = 10^6 cycles/\sec\right)$

$\therefore \lambda = \frac{3 \times 10^8 m/\sec}{98.7 \times 10^6 /\sec} = 3.0395m$

Ans5: The ideal body, which emits and absorbs all frequencies, is called a black body and the radiation emitted by such a body is called black body radiation.

Ans6: Quantum is the smallest quantity of energy that can be emitted or absorbed in the form of electromagnetic radiation.

Ans7: The energy of quantum (E) is directly proportional to the frequency (v) of the radiation.

$$E \alpha v$$
$$or, E = hv$$
$$or, E = \frac{hv}{\lambda} \ where \ v = \frac{c}{\lambda} and$$
$$c = velocity \ and \lambda = wavelenght.$$

$'h'$ Planck's constant = $6.626\times10^{-34} Jh.$

Ans8: (i) Frequency, $v = \frac{c}{\lambda}$

We know, $c = 3\times10^{8} m/s$

$$\lambda = 3000 \overset{0}{A} = 3000\times10^{-10} m.$$
$$\therefore v = \frac{3\times10^{8} m/s}{3000\times10^{-10} m} = \frac{3\times10^{8} m/s}{3\times10^{3}\times10^{-3}}$$
$$= \frac{1\times10^{8}}{1\times10^{-7}} \sec^{-1} = 1\times10^{15} \sec^{-1}$$

(ii) Energy of the photon E = hv

We know, $E = 6.625\times10^{-34}\times10^{15}$

$$= 6.625\times10^{-19} \ joules$$

Ans9: Planck was able to explain the distribution of intensity in the radiation from black body as function of frequency or wavelength at different temperature.

Ans10: The exact frequency distribution of the emitted radiation from a black body depends only on its temperature.

CBSE TEST PAPER-04

CLASS - XI CHEMISTRY (Structure of Atom)

Topic:-Photoelectric Effect

Marks: 20

1. Define photoelectric effect. [1]
2. How does the intensity of light effect photoelectrons?
3. What is threshold frequency? [1]
4. Name the scientist who demonstrated photoelectric effect experiment. [1]
5. What did Einstein explain about photoelectric effect? [1]
6. What is the relation between kinetic energy and frequency of the photoelectrons? [2]
7. Calculate energy of 2mole of photons of radiation whose frequency is $5\times10^{14}\,Hz$. [1]
8. What is emission and absorption spectra? [2]
9. What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition, n = 4 to n = 2 of He^{+} spectrum? [2]
10. Spectral lines are regarded as the finger prints of the elements. Why? [2]

CBSE TEST PAPER-04

CLASS - XI CHEMISTRY [ANSWERS]

Topic: - Photoelectric Effect

Ans1: It is the phenomenon in which the surface of alkali metals like potassium and calcium emit electrons when a beam of light with high frequency is made to fall on them.

Ans2: The number of electron ejected and kinetic energy associated with them depend on the brightness of light.

Ans3: The minimum frequency below which photo electric effect is not observed is called threshold frequency (v_o)

Ans4: In 1887, H. Hertz demonstrated photo electric effect.

Ans5: Einstein in 1905 was able to explain the photoelectric effect using Planck's quantum theory of electromagnetic radiation.

Ans6: Kinetic energy of the ejected electron is proportional to the frequency of the electromagnetic radiation.

Ans7: Energy (E) of one photon = E = hv

Where $h = 6.626 \times 10^{-34} Js$

$v = 5 \times 10^{14} s^{-1}$

$\therefore E = \left(6.626 \times 10^{-34} \times 5 \times 10^{14}\right)$

$= 3.313 \times 10^{-19} J$

Energy of 2 mole of photon $= \left(3.313 \times 10^{-19} J\right) \times \left(2 \times 6.022 \times 10^{23} mol^{-1}\right)$

$= 3990.2 kJmol^{-1}$

Ans8: The spectrum of radiation emitted by a substance that has absorbed energy is called an emission spectrum.

When a sample of atomic vapors is placed in the path of white light from an arc lamp, it absorbs light of certain characteristic wave length and the light of other wavelength get transmitted. This produces a series of dark lines on a white background.

Ans9: For the Balmer transition, n = 4, to n = 2 in a He^+ ion, we can write.

$$\frac{1}{\lambda} = Z^2 R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$

$$= Z^2 R_H \left(\frac{1}{2^2} - \frac{1}{4^2} \right)$$

$$= \frac{3}{4} R_H \text{-------}(i)$$

For a hydrogen atom

$$\frac{1}{\lambda} = R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \text{------}(ii)$$

Equating equation (ii) and (i), we get

$$\frac{1}{n_1^2} - \frac{1}{n_2^2} = \frac{3}{4}$$

This equation gives $n_1 = 1$ and n = 2. Thus the transition n = 2 to n = 1 in hydrogen atom will have same wavelength as transition, n = 4 to n = 2 in He^+

Ans10: Spectral lines are regarded as the finger prints of the elements because the elements can be identified from these lines. Just like finger prints, the spectral lines of no two elements resemble each other.

CBSE TEST PAPER-05

CLASS - XI CHEMISTRY (Structure of Atom)

Topic:-Quantum Mechanical Model of the Atom

Marks: 20

1. States Heisenberg's Uncertainty Principle. [1]

2. Give the mathematical expression of uncertainty principle. [2]

3. How would the velocity be effected if the position is known? [1]

4. We don not see a car moving as a wave on the road why? [1]

5. Give the de – Broglie's relation. [1]

6. Why cannot the motion of an electron around the nucleus be determined accurately? [2]

7. Calculate the uncertainty in the momentum of an electron if it is confined to a linear region of length 1×10^{-10}. [2]

8. Calculate the uncertainty in the velocity of a wagon of mass 4000kg whose position is known accurately of $\pm 10m$ [1]

9. What is the physical significance of ψ^2 up? [1]

CBSE TEST PAPER-05

CLASS - XI CHEMISTRY [ANSWERS]

Topic: - Quantum Mechanical Model of the Atom

Ans1: It states that

'It is impossible to determine simultaneously the exact position and exact momentum (or velocity) of an electron.

Ans2: Mathematically, it can be given as

$$\Delta x \times \Delta p_x \geq h/4\pi$$

$$or, \Delta x \times \Delta(mv_x) \geq h/4\pi$$

$$or, \Delta x \times \Delta U_x \geq h/4\pi m$$

Where Δx is the uncertainty in position and $\Delta p_x \left(\Delta v_x\right)$ is the uncertainty in momentum (or velocity) of the particle.

Ans3: If the position of the electron is known with high degree of accuracy (Δx is small), then the velocity of the electron will be uncertain $\left(\Delta\left(V_x\right)\text{is large.}\right)$.

Ans4: According to de Broglie's relation, $\lambda = h/mv$ *i.e.* $\lambda \alpha \frac{1}{m}$ the mass of the car is very large and its wavelength (λ) or wave character is negligible. Therefore, we do not see a car moving like a wave.

Ans5: According to de Broglie, every particle in motion is associated with a wavelength and other wave characteristics. He deduced the relation that wavelength (λ) of a particle in motion is equal to the Planck's constant (h) divided by the momentum (p) of the particle.

i.e. $\lambda = \frac{h}{p} = \frac{1}{mv}$

Where m is the mass, v is the velocity after particles

Ans6: Because there is an uncertainty in the velocity of moving electron around the nucleus (Heisenberg's Uncertainty Principle).

Ans7: According to uncertainty Principle

$$\Delta x.\Delta p = \frac{h}{4\pi}$$

$$or, \Delta p = \frac{h}{4\pi\Delta x}$$

$$or, \Delta p = \frac{6.626\times10^{34} kgm^2 s^{-1}}{4\times3.143\times10^{-10} m)}$$

$$= 5.27\times10^{-26} kgms^{-1}$$

Ans8: Uncertainty in velocity (Δv) is given by

$$\Delta v \geq \frac{h}{4\pi m\Delta x}$$

$$= \frac{6.6\times10^{-34} kgm^2 s^{-1}}{4\times\frac{22}{7}\times4\times10^3 kg\times(\pm10m)}$$

$$= 1.3\times10^{-39} ms^{-1}$$

$\therefore$ The uncertainty in the velocity of the wagon is $= 1.3\times10^{-39} ms^{-1}$

Ans9: ψ^2 represent probability of finding an electron.

CBSE TEST PAPER-06

CLASS - XI CHEMISTRY (Structure of Atom)

Topic:- Orbital's and Quantum Numbers

1. Which orbital is non – directional? [1]

2. What is the meaning of quantization of energy? [1]

3. Why is energy of 1s electron lower than 2s electron? [1]

4. Which quantum number determines [2]

   (i) energy of electron (ii) Orientation of orbitals.

5. What is nodal surface or nodes? [1]

6. How many spherical nodal surfaces are there in 4s – sub-shell? [1]

7. Arrange the electrons represented by the following sets of quantem number in decreasing order of energy. [2]

   1. n = 4, l = 0, m = 0, s = +1/2
   2. n = 3, l = 1, m = 1, s = -1/2
   3. n = 3, l = 2, m = 0, s = +1/2
   4. n = 3, l = 0, m = 0, s = -1/2

8. What designations are given to the orbitals having [3]

   (i) n = 2, l = 1 (ii) n = 2, l = 0 (iii) n = 4, l = 3

   (iv) n = 4, l = 2 (v) n = 4, l = 1?

9. Write the electronic configuration of (i) Mn^{4+}, (ii) Fe^{3+} (iii) Cr^{2+} and Zn^{2+} Mention the number of unpaired electrons in each case. [3]

CBSE TEST PAPER-06

CLASS - XI CHEMISTRY (Structure of Atom) [ANSWERS]

Topic:- Orbital's and Quantum Numbers

Ans1. S – orbital is spherically symmetrical i. e it is non – directional.

Ans2. Quantization of energy means the energy of energy levels can have some specific values and not all the values.

Ans3. 1s electron being close to the nucleus experiences more force of attraction than 2s– electron which is away from the nucleus.

Ans4. (i) Principal quantum number (n), and
(ii) Magnetic quantum number (m).

Ans5. The region where the probability of finding an electron is zero i. e. $\Psi^2 = 0$

Ans6. In ns orbital, the number of spherical nodal surfaces are(n – 1), hence is 4s (4 – 1) = 3 nodal surfaces are present.

Ans7. (i) Represents 4s orbital
(ii) Represents 3p orbital
(iii) Represents 3d orbital
(iv) Represents 3s orbital
The decreasing order of energy 3d > 4s > 3p > 3s

Ans8. (i) Here, n = 2, and l = 1
Since l = 1 it means a p-orbital, hence the given orbital is designated as 2p.
(ii) Here, n = 2 and l = 0
Since l = 0 means s – orbital, hence the given orbital is 2s.
(iii) Here, n = 4 and l = 3

Since, l = 3 represents f – orbital, hence the given orbital is a 4f orbital.

(iv) Here, n = 4 and l = 2

Since, l = 2 represents d – orbital, hence the given orbital is a 4d – orbital.

(v) n = 4 and l = 1

since, l = 1 means it is a p – orbital, hence the given orbital can be designated as – 4p orbital.

Ans9. (i) Mn (z = 25), Mn^{4+} (z = 21)

The electronic configuration of Mn^{4+} to Given by

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3$

As the outermost shell 3d has 3 electrons, thus the number of unpaired electrons is 3.

(ii) Fe (z = 26), Fe^{3+} (z = 23)

The electronic configuration of Fe^{3+} is given lay

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5$

The number of unpaired electron is 5.

(iii) Cr (z = 24), Cr^{2+} (z = 22)

The electronic configuration of Cr^{2+} is

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^4$

The number of unpaired electron is 4.

(iv) Zn (z = 30), Zn^{2+} (z = 28)

The electronic configuration of Zn^{2+} is

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}$

The number of unpaired electron is 0.

CBSE TEST PAPER-01

CLASS - XI CHEMISTRY (Classification of Elements and Periodicity in Properties)

Topic: - Genesis of Periodic classification

1. How many elements are known at present? [1]

2. Who was the first scientist to classify elements according to their properties? [1]

3. What is the basis of triad formation of elements? [1]

4. Stale the modern 'Periodic law'? [1]

5. Define and state Mendeleev's periodic law. [1]

6. How did Mendeleev arrange the elements? [2]

7. Name the two elements whose existence and properties were predicted by Mendeleev though they did not exist then. [2]

8. Describe the main features of Mendeleev's periodic table? [3]

CBSE TEST PAPER-01

CLASS - XI CHEMISTRY (Classification of Elements and Periodicity in Properties)

Topic: - Genesis of Periodic classification [ANSWERS]

Ans1. There are about 114 elements known at present.

Ans2. The German Chemist, Johann Dobereiner in early 1829 was the first to consider the idea of trends among properties of element.

Ans3. The middle element of each of the triads had an atomic weight about half way between the atomic weights of the other two. Also the properties of the middle element were in between those of the other two members. Dobereiner's relationship is known as the haw of triads**.**

Ans4. The physical and chemical properties of the elements are periodic functions of their atomic numbers.

Ans5. Mendeleev's Periodic law states that
'The properties of the elements are periodic function of their atomic weights'.

Ans6. Mendeleev arranged elements in horizontal rows and vertical columns of a table in order of their increasing atomic weights in such a way that the elements with similar properties occupied the same vertical column or group.

Ans7. Mendeleev predicted not only the existence of gallium and germanium, but also described some of their general physical properties.

Ans8. (i) In Mendeleev table, the elements were arranged in vertical columns, and horizontal rows. The vertical columns were called groups and the horizontal rows were called periods.

(ii) There were in all eight groups. Group I to VIII. The group numbers were indicated by Roman numerals. Group VIII occupy three triads of the elements each i.e. in all nine elements.

(iii) There were seven periods to accommodate more elements the period 4, 5, 6 and 7 were divided into two halves. The first half of the elements were placed in the upper left corner and the second half in the lower right corner of each box.

CBSE TEST PAPER-02

CLASS - XI CHEMISTRY (Classification of Elements and Periodicity in Properties)

Topic: - Modern Periodic law and Nomenclature

1. Give the general characteristics of the long form of Modern periodic table? [1]

2. In short give the features of the seven periods. [1]

3. Define electronic configuration. [1]

4. What is the electronic configuration when elements are classified group wise? [1]

5. Give the main features of s-block elements. [2]

6. Give the main features of p-block elements. [2]

7. Give the main features of d-block elements. [2]

8. Give the main features of f-block elements. [2]

CBSE TEST PAPER-02

CLASS - XI CHEMISTRY (Classification of Elements and Periodicity in Properties)

Topic: - Genesis of Periodic classification [ANSWERS]

Ans1. General characteristics of the long form of Periodic table :-

(i) There are in all 18 vertical columns i.e. 18 groups in the long form periodic table.

(ii) There are groups numbered from 1 to 18 from the left.

(iii) There are seven horizontal rows called periods.

(iv) The elements of groups 1, 2 and 13 to 17 are called main group elements.

(v) The elements of group 3 to 12 are called transition elements.

Ans2. First period contains 2 elements, $_1H$ and $_2He$ and it is the shortest period.

Second and third periods contain 8 elements each namely $_3Li$ to $_{10}Ne$ and $_{10}Na$ to $_{18}Ar$ and is a short period.

Fourth and fifth period contains 18 elements each namely $_{19}K$ to $_{36}Kr$ and $_{37}Rb$ to $_{54}Xe$ and is a long period.

Sixth period contains 32 elements namely $_{55}Cs$ to $_{86}Rn$ and is the longest period.

Seventh period is incomplete. It has all other elements starting with $_{87}Fr$ onwards. Elements from 93 onwards are purely synthetic and are called trans–uranium elements and is incomplete period.

Ans3. The distribution of electrons into orbitals of an atom is electronic configuration.

Ans4. Elements in the same vertical column or group have similar valence shell electronic configurations, the same number of electrons in the outer orbitals, and similar properties.

Ans5. S – block elements :- The elements in which the last electron enters the s – orbital of their outer most energy level are called s – block elements. It has elements of groups 1 and 2. The general electronic configuration of s – block elements is ns^{1-2}.

Ans6. p – block elements : The elements in which the last electron enters the p – orbital of their outermost energy level are called p – block elements. It contains elements of group 13,14, 15, 16, 17 and 18 of the periodic table. General electronic configuration of p – block elements is ns^2 np^{1-6}.

Ans7. d – block elements :- The elements in which the last electron enters the d – orbitals of their last but one energy level constitute d – block elements. There block consists of the elements lying between s and p block starting from 4th period and onwards. They constitute groups 3 to 12 in the periodic table. General electronic configuration is $(n-1)\,d^{1-10}$ ns^{1-2}.

Ans8. f – block elements : The elements in which the last electron enters the f – orbital of their atoms are called f – block elements. In these elements the last electron is added to the third to the outermost energy level. These consist of two series of elements placed at the bottom of the periodic table known as Lanthanoid and actinoid series. General electronic configuration is $(n-2)f^{1-14}$ $(n-1)d^{0-1}$ ns^2.

CBSE TEST PAPER-03

CLASS - XI CHEMISTRY (Classification of Elements and Periodicity in Properties)

Topic: - Trends in physical properties of elements

1. Predict the position of the element in the periodic table satisfying the electronic configuration (n-1) d^1 ns^2 for n=4, [1]
2. How does atomic size change in a group? [1]
3. Why Li and Mg show resemblance in chemical behaviour? [1]
4. The atomic radius of elements decreases along the period but Neon has highest size among III period element? Why [1]
5. Explain why cations are smaller and anions are larger in radii than their parent atom? [2]
6. Define ionization enthalpy and electron gain enthalpy? [2]
7. How does atomic size change in a group? [2]
8. The size of an atom can be expressed by three radii. Name them. Which of these given the highest, and the lowest value of the atomic radius of an element? [2]
9. Among the elements B, Al, C and Si [2]
   (a) Which has the highest first ionization enthalpy?
   (b) Which has the largest atomic radius?

8. Na^+ has higher value of ionization enthalpy than Ne, though both have same electronic configuration. [2]

CBSE TEST PAPER-03

CLASS - XI CHEMISTRY (Classification of Elements and Periodicity in Properties)

Topic: - Trends in physical properties of elements [ANSWERS]

Ans1. $(n-1)\ d^1\ ns^2 = (4-1)\ d^1\ 4s^2$

$= 3d^1\ 4s^2$

It lies in fourth period and III B group.

Ans2. It increases from top bottom in a group.

Ans3. Due to diagonal relationship, since their atomic size, electro negativity and ionisation potential are almost the same.

Ans4. Ne is the only element in III period element which has Van der walls radius whereas the rest has covalent radius. And it is known fact that Van der walls radius is always greater than covalent radius.

Ans5. The radius of cation is smaller than the parent atom. Cation is formed by the loss of one or more electron from the gaseous atom, but the nuclear charge remains the same. As a result, the nuclear hold on the remaining electrons increases because of the increases in the effective nuclear chanre per electron resulting in decrease in size.

Whereas anion is formed by the gain of one or more electrons by the gaseous atom but the nuclear charge is same though the number of electrons has increased. The effective nuclear charge per electron decrease in the anion and the cloud is held less tightly by the nucleus. This causes increase in size.

Ans6. Ionization enthalpy – It represents the energy required to remove an electron from an isolated gaseous atom (x) in ground state resulting in the formation of a positive ion.

$x(g) + \text{Energy} \rightarrow x^+(g) + e^-$

Electron gain enthalpy – When an electron is added to a neutral gaseous atom (x) to convert it into a negative ion, the enthalpy change accompanying the process is defined as the electron gain enthalpy.

$$x(g) + e^- \rightarrow x^- (g)$$

Ans7. It increases from top to bottom in a group

Ans8. The atomic size are generally expressed in terms of the following radii covalent radius, metallic radius and Van der waal's radius.

Van der waal's radius > Metallic radius > covalent radius.

Ans9. (a) Carbon has the highest first ionization enthalpy.

(b) Aluminum has the largest atomic radius.

Ans10. Na^+ and Ne both has 10 electrons but Na^+ having protons in its nucleus (Ne has 10 protons) exert higher effective nuclear charge and thus removal of electron from Na^+ requires more energy.

CBSE TEST PAPER-04

CLASS - XI CHEMISTRY (Classification of Elements and Periodicity in Properties)

Topic: - Chemical Properties of element

1.	Define valency.	[1]
2.	How does valency vary in a group and period in the periodic table?	[1]
3.	What is the valency of noble gases?	[1]
4.	How do metals react in a period?	[1]
5.	How do metals react in a group?	[1]
6.	How does the reactivity of non–metals changes in a period and group?	[2]
7.	Give the properties of the oxides in a particular period.	[2]
8.	What is an amphoteric oxide?	[1]
9.	Define a neutral oxide.	[1]
10.	Why does lithium form covalent bond unlike other alkali which forms ionic bond?	[2]

CBSE TEST PAPER-04

CLASS - XI CHEMISTRY (Classification of Elements and Periodicity in Properties)

Topic: - Chemical Properties of element [ANSWERS]

Ans1. The combining capacity of an element is known as valency.

Ans2. In a group, the valency of an element remains constant while in a period it increases from left to right.

Ans3. Noble gases on the extreme right are zero valent.

Ans4. The tendency of an element to lose electrons decreases in going from left to right in a period. Thus the reactivity of metals goes on decreasing in a period from left right.

Ans5. The tendency to lose electrons increases as we go down a group so the reactivity of metals increases down the group.

Ans6. The reactivity of non – metals is measured in terms of its tendency to gain electrons to form an ion. The reactivity of non – metals increases from left to right in a period whereas reactivity decreases in a group as we go down the group because the tendency to accept electrons decreases down the group.

Ans7. Elements on two extremes of a period easily combines with oxygen to oxides. The normal oxide formed by the element on extreme left is the most basic (eg. Na_2O) whereas that formed by the element on extreme right is the most acidic (eg. $cl_2 O_7$). Oxides at the centre are however amphoteric (eg. $Al_2 O_3$) or neutral (eg. CO).

Ans8. Oxides which behave as acids with bases and as a base with an acid are called amphoteric oxide.

Ans9. Neutral oxides have no acidic or basic properties.

Ans10. Lithium forms covalent bond which is different from its group members because of its anomalous behaviour Li is small in size, large charge / radius ratio and has high electro negativity value. Also it has only $1s^2 2s^1$ orbital for bonding.

CBSE TEST PAPER-05

CLASS - XI CHEMISTRY (Classification of Elements and Periodicity in Properties)

Topic: - Miscellaneous Questions

1.	What is the general outer electronic configuration of f – block elements?	[1]
2.	Why do Na and K have similar properties?	[1]
3.	Arrange the following elements in the increasing order of metallic character : Si, Be, Mg, Na, P.	[1]
4.	The atomic number of an element is 16. Determine its position in accordance to its electronic configuration.	[2]
5.	Why are elements at the extreme left and extreme right the most reactive?	[2]
6.	Why does the ionization enthalpy gradually decreases in a group?	[1]
7.	Why does electronegativity value increases across a period and decreases down period?	[2]
8.	How does electronegativity and non – metallic character related to each other?	[2]

CBSE TEST PAPER-05

CLASS - XI CHEMISTRY (Classification of Elements and Periodicity in Properties)

Topic: - Miscellaneous Questions [ANSWERS]

Ans1. The general outer electronic configuration of f – block element is
$(n-2)\,f^{1-14}\,(n-1)\,d^{0-11}\,ns^2$

Ans2. Na and K have similar physical and chemical properties because they have same number of valence electrons.

Ans3. P < Si < Be < Mg < Na

Ans4. The atomic of the element is 16.

The electronic configuration of the element is $1s^2\,2s^2\,2p^6\,3s^2\,3p^4$

Thus the element belongs to 'p-block' and is placed in third period and 16th group of the periodic table.

Ans5. The maximum chemical reactivity at the extreme left (among alkali metals) is exhibited due to the loss of an electron leading to the formation of a cation due to low ionization enthalpy and at the extreme right (among halogens) shown by the gain of an electron forming an anion.

Ans6. In a group, the increase in atomic and ionic radii with increase in atomic number generally results in a gradual decrease in ionization enthalpies.

Ans7. The attraction between the outer electrons and the nucleus increases as the atomic radius decreases in a period. The electeonegativity also increases. On the same account electronegativity value decreases with the increase in atomic radii down a group.

Ans8. Electronegativity is directly related to the non – metallic character of elements. Electronegativity is inversely related to the metallic properties of elements. Thus the increase in electronegativities across a period is accompanied by an increase in non – metallic properties of elements. Similarly, the decrease in electronegativity down a group is accompanies by a decrease in non – metallic properties of elements.

CBSE TEST PAPER-01

CLASS - XI CHEMISTRY (Chemical Bonding and Molecular Structure)

Topic: - Chemical Bonding (Kossel – Lewis approach)

1. Define a chemical bond. [1]

2. Give the main feature of Lewis approach of chemical bonding. [1]

3. Write electron dot structure (Lewis structure) of Na, Ca, B, Br, Xe, As, Ge, N^{3-}. [1]

4. Give the main feature of Kossel's explanation of chemical bonding. [2]

5. How can you explain the formation of NaCl according to kossel concept? [2]

6. Define electrovalent bond. [1]

7. Give the octet rule in short. [1]

8. Write the significance of octet rule. [2]

9. Write the Lewis structure for CO molecule [2]

10. Give the Lewis dot structure of HNO_3 [2]

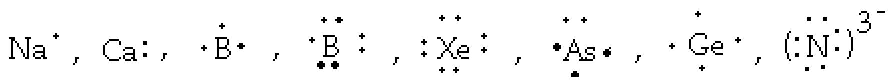
CBSE TEST PAPER-01

CLASS - XI CHEMISTRY (Chemical Bonding and Molecular Structure)

Topic: - Chemical Bonding (Kossel – Lewis approach)

Ans1. The attractive force which holds various constituents (atoms, ions etc.) together in different chemical species is called a chemical bond.

Ans2. Lewis postulated that atoms achieve the stable octet when they are linked by chemical bonds. He assured that atoms are positively charged centre and the outer shell that could accommodate a maximum of eight electrons. These electrons occupy the corners of a cube which surrounds the centre. Lewis introduced simple notations to represent valence electrons in an atom called Lewis symbol.

Ans3. 

Ans4. Kossel in relation to chemical bonding drew attention to the following facts –

(i) In the periodic table, the highly electronegative halogens and the highly electropositive alkali metals are separated by the noble gases.

(ii) In the formation of a negative ion from a halogen atom and a positive ion from an alkali metal, atom is associated with a gain and loss of an electron by the respective atoms.

(iii) The negative and positive ions so formed attain stable noble gas electronic configurations. The noble gases have particularly eight electrons, ns^2 np^6.

(iv) The –ve and +ve ions are stabilized by electrostatic attraction.

Ans5. The formation of NaCl from sodium and chlorine can be explained as

$Na \rightarrow Na^+ + e^-$

$[Ne]\ 3s^1 \rightarrow [Ne]$

$Cl + e^- \rightarrow Cl^-$

$[Ne]\ 3s^2\ 3p^5$. $[Ne]\ 3s^2\ 3p^6$ or $[Ar]$

$Na^+ + Cl^- \rightarrow Na^+ Cl^-$ or NaCl.

Ans6. The bond formed, as a result of the electrostatic attraction between the positive and negative ions are termed as the electrovalent bond.

Ans7. The atoms tend to adjust the arrangement of their electrons in such a way that they (except H and He) achieve eight electrons in their outermost shell. This is known as the octet rule.

Ans8. Octet rule signifies –

(i) It is useful for understanding the structures of most of the organic compounds.

(ii) It mainly applies to the second period elements of the periodic table.

Ans9. (i) The outer (valence) shell configurations of carbon and oxygen atoms are

Carbon : (6) – $1s^2\ 2s^2\ 2p^2$

Oxygen : (8) – $1s^2\ 2s^2\ 2p^4$.

The valence electrons (4 + 6 = 10)

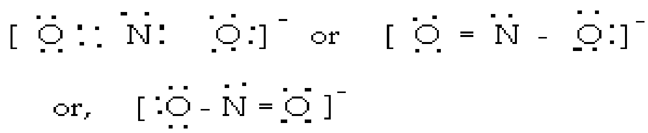
But it does not complete octet, thus multiple bond is exhibited.

Thus,

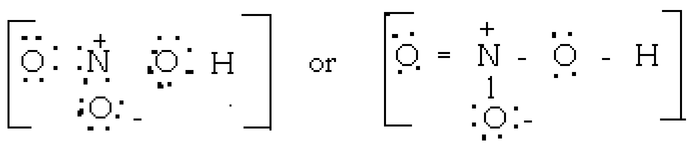
(ii) N ($2s^2\ 2p^3$), O ($2s^2\ 2p^4$)

5 + (2 x 6) + 1 = 18 electrons.

Thus,



Ans10. $HNO_3 \rightarrow$



CBSE TEST PAPER-02

CLASS - XI CHEMISTRY (Chemical Bonding and Molecular Structure)

Topic: - Ionic Bonding

1. Define an ionic bonding. [?]

2. What changes are observed in atoms undergoing ionic bonding? [2]

3. Mention the factors that influence the formation of an Ionic bond. [2]

4. Which one of the following has the highest bond order? N_2, N_2^+ or N_2^-. [1]

5. Define bond order. [1]

6. Give reason why H_2^+ ions are more stable than H_2^- though they have the same bond order. [2]

7. How would the bond lengths vary in the following species? C_2, C_2^- C_2^{2-}. [2]

8. What type of bond is formed when atoms have high difference of electornegativity? [1]

9. Out of covalent and hydrogen bonds, which is stronger. [2]

10. Define covalent radius. [2]

CBSE TEST PAPER-02

CLASS - XI CHEMISTRY (Chemical Bonding and Molecular Structure)

Topic: - Ionic Bonding (ANSWERS)

Ans1. An ionic bond (or electrovalent bond) is formed by a complete transfer of one of outer most electrons from the atom of a metal to that of a non – metal.

Ans2. Due to the electron transfer the following changes occurs –

(i) Both the atoms acquire stable noble gas configuration.

(ii) The atom that loses electrons becomes +vely charged called cation whereas that gains electrons becomes –vely charged called anion.

(iii) Cation and anion are held together by the coulombic forces of attraction to form an ionic bond.

Ans3. Ionic bond formation mainly depends upon three factors –

(i) Low ionization energy – elements with low ionization enthalpy have greater tendency to form an ionic bonds.

(ii) High electron gain enthalpy – high negative value of electron gain enthalpy favours ionic bond.

(iii) Lattice energy – high lattice energy value favours ionic bond formation.

Ans4. N_2 has the highest bond order.

Ans5. Bond order is defined as number of bonds between two atoms in a molecule.

Ans6. In H_2^- ion, one electron is present in anti bonding orbital due to which destabilizing effect is more and thus the stability is less than that of H_2^+ ion.

Ans7. The order of bond lengths in C_2 , C_2^- and C_2^{2-} is $C_2 > C_2^- > C_2^{2-}$.

Ans8. Electrovalent or ionic bond.

Ans9. Covalent bond.

Ans10. The covalent radius is measured approximately as the radius of an atom's core which is in contact with the core of an adjacent atom in a bonded situation.

CBSE TEST PAPER-03

CLASS - XI CHEMISTRY (Chemical Bonding and Molecular Structure)

Topic: - Bond Order, Resonance structure and Polarity of bonds

1.	Define dipole moment.	[1]
2.	Give the mathematical expression of dipole moment.	[1]
3.	Dipole moment is a scalar or a vector quantity?	[2]
4.	Why NH_3 has high dipole moment than NF_3 though both are pyramidal?	[2]
5.	Why is dipole moment of CO_2, BF_3, CCl_4 is zero?	[1]
6.	Why is BF_3 non – polar?	[1]
7.	Write the resonating structure of O_3 molecule.	[1]
8.	Draw the resonating structure of NO_3^-	[2]
9.	On which factor does dipole moment depend in case of polyatomic molecules.	[2]
10.	Dipole moment of Be F_2 is zero. Give reason.	[2]

CBSE TEST PAPER-03

CLASS - XI CHEMISTRY (Chemical Bonding and Molecular Structure)

Topic: - Bond Order, Resonance structure and Polarity of bonds [ANSWERS]

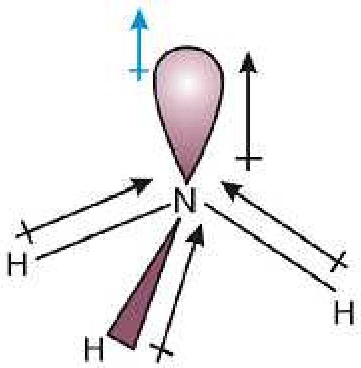
Ans1. Dipole moment is defined as the product of the magnitude of the charge and the distance between the centers of positive and negative charge.

Ans2. Mathematically dipole moment is expressed as dipole moment (M) = charge (Q) x distance of separation (r). Dipole moment is usually expressed in Debye units (D).

Ans3. Dipole moment is a vector quantity and is depicted by a small arrow with tail on the +ve centre and head pointing towards the negative centre .

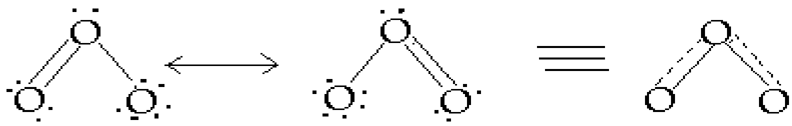
eg $H \longrightarrow F$

Ans4. In case of NH_3 the orbital dipole due to lone pair is in the same direction as the resultant dipole moment of the N-H bonds, whereas in NF_3 the orbital dipole is in the direction opposite to the resultant dipole moment of the three N-F bonds. The orbital dipole become of lone pair decreases, which results in the low dipole moment.

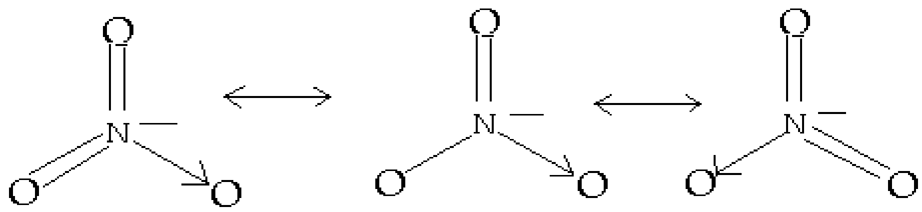


Ans5. Because there molecules have symmetrical shapes and thus the dipoles gets cancelled and the net dipole moment is zero.

Ans6. Because BF_3 has symmetrical shape, the net dipole moment is zero and thus it is non – polar.

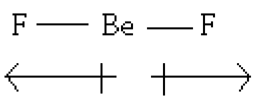
Ans7. 

Ans8. NO_3^-.



Ans9. The dipole moment of the polyatomic molecule depends on individual dipole moments of bonds and also on the spatial arrangement of various bonds in the molecule.

Ans10. In BeF_2 the dipole moment is zero because the two equal bond dipoles point in opposite directions and cancel the effect of each other.



Bond dipoles in Be F_2

CBSE TEST PAPER-04

CLASS - XI CHEMISTRY (Chemical Bonding and Molecular Structure)

Topic: - VSEPR 2 VBT

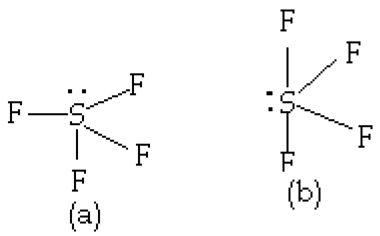
1. Give the main features of VSEPR Theory. [2]

2. What's difference between lone pair and bonded pair of electrons? [2]

3. CO_2 is linear whereas SO_2 is bend – shaped. Give reason. [2]

4. Why does H_2O have bent structure? [2]

5. For the molecule, [2]



Why is structure (b) more stable than structure (a)?

6. How would you attribute the structure of PH_3 molecule using VSEPR model? [2]

7. In SF_4 molecule, the lp electrons occupies an equatorial position in the trigonal bipyramidal arrangement to an axial position. Give reason. [2]

8. How is VBT different from Lewis concept? [2]

9. S – orbital does not show any preference for direction. Why? [2]

CBSE TEST PAPER-04

CLASS - XI CHEMISTRY (Chemical Bonding and Molecular Structure)

Topic: - VSEPR 2 VBT [ANSWERS]

Ans1. The main postulates of VSEPR theory are as follows :

(i) The shape of a molecule depends upon the number of valence shell electron pairs around the central atom.

(ii) Pairs of electrons in the valence shell repel one another since their electron clouds are negatively charged.

(iii) There pairs of electrons tends to occupy such position in space that minimize repulsion and thus maximize distance between them.

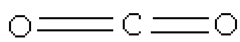
(iv) The valence shell is taken as a sphere with the electron pairs localizing on the sphere at maximum distance from one another.

(v) A multiple bond is treated as it is a single electron pair and two or three electron pairs of a multiple bond is treated as super pair.

(vi) When two or more resonance structures can represent a molecule, the VSEPR nodal is applicable to any such structure.

Ans2. Lone pair electrons do not take part in bond formation whereas bond pair electrons take part in bond formation.

Ans3. In CO_2, the bond electron are furtherest away from each other forming180^0 angle. Thus, CO_2 is linear.



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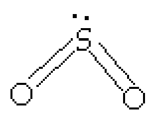
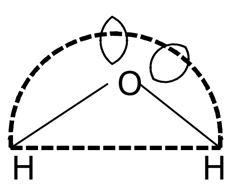
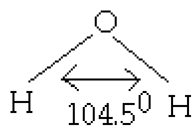
In SO_2, the number of bonding pairs is 4 where it has an lone pair of electron which does not participate in bond formation thereby repulsive strain is experienced.



Ans4. In water molecule, there are two bonding pairs and two lone pairs of electrons. The shape should have been tetrahedral if there were all bp but two lp are present. Thus the shaped is distorted to an angular shape. Because lp – lp repulsion is more than lp – bp repulsion.





Ans5. In (a) the lp is present at axial position so there are three lp – bp repulsions at 90^0 . Whereas in (b) the lp is in an equatorial position are there are two lp – bp repulsions. Hence, arrangement (b) is more stable than (a).

Ans6. Phosphorus atom has 5 electrons in its outermost orbit. H – atoms contribute one electron each to make in all 8 electron around P – atom. Thus 4 pairs of electrons would be distributed in a tetrahedral manner around the central atom. Three pairs from three P – H bonds while the fourth pair remains unused. Due to repulsion between the bp and lp, the shape is not of tetrahedral but trigonal pyramidal molecule.

Ans7. In SF_4 molecule, the lp electrons occupies an equatorial position because, lp – bp repulsion is minimum.

Ans8. In Lewis concept, bond formation is explained in terms of sharing of electron pairs and the Octet rule whereas in VBT bond formation is described in terms of hybridization and overlap of the orbitals.

Ans9. S – Orbital does not show any preference for direction because it is spherically symmetrical.

CBSE TEST PAPER-05

CLASS - XI CHEMISTRY (Chemical Bonding and Molecular Structure)

Topic: - Sigma and pi – bond

1. What is sigma bond? [1]

2. What is pi – bond? [1]

3. Why is σ– bond stronger than π - bond? [2]

4. How many σ – and π - bond are there in a molecule of C_2H_4 (ethane)? [1]

5. How many σ - and π - bonds are there in a molecule of $CH_2 = CH - CH = CH_2$? [1]

6. What type of bond exists in multiple bond (double / triple)? [1]

7. What are the different types of σ - bond formation? [2]

8. What type of bond are formed due to orbital overlap? [1]

9. How do covalent bonds form due to orbital overlapping? [1]

10. What is zero over lap? [2]

CBSE TEST PAPER-05

CLASS - XI CHEMISTRY (Chemical Bonding and Molecular Structure)

Topic: - Sigma and pi – bond [ANSWERS]

Ans1. A covalent bond formed due to the overlap of orbitals of the two atoms along the line going the two nuclei (orbital axis) is called sigma (σ) bond.

Ans2. A covalent bond formed between the two atoms due to the sideways overlap of their p – orbitals is called a pi (π) bond.

Ans3. Orbitals can overlap to a greater extent in a σ - bond due to axial orientation, so σ - bond is strong. Whereas, in a pi – bond sideways overlapping is not to an appreciable extent due to the presence of σ - bond which restricts the distance between the involved atoms.

Ans4. In a molecule of ethane, there are 5 σ - bonds (one between C-C , and four between C-H and one π - bond.

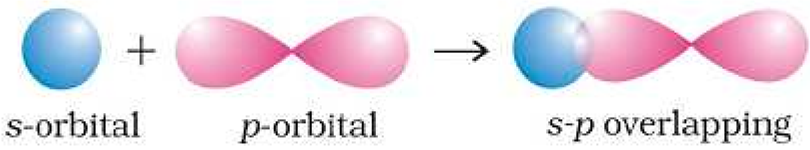
Ans5. There are 9 σ - bonds (three between C – C and 6 between C – H) and 2 π - bonds.

Ans6. pi (π) – bond is always present in molecules containing multiple bond.

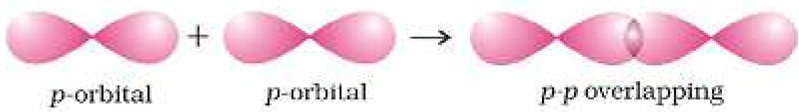
Ans7. σ - bond can be formed by any of the following types of combinations of atoms orbitals.

(a) S – S – overlapping : In this case, there is a lover lap of two half – filled S – orbitals along the inter nuclear axis.

(b) S- P overlapping : This type of over lapping occurs between half – filled s-orbitals of one atom and half-filled p-orbitals of another atom.



(c) P – P overlapping : This type of overlap takes place between half-filled p-orbitals of the two approaching atoms.



Ans8. Covalent bonds are formed due to the overlap of certain orbitals that are oriented favourably in the space.

Ans9. According to orbital overlap concept, the formation of a covalent bond between two atoms results by pairing of electrons present in the valence shell having opposite spins.

Ans10. The unsymmetrical overlap of orbitals results in zero overlap i-e; between px-s and px-py orbital

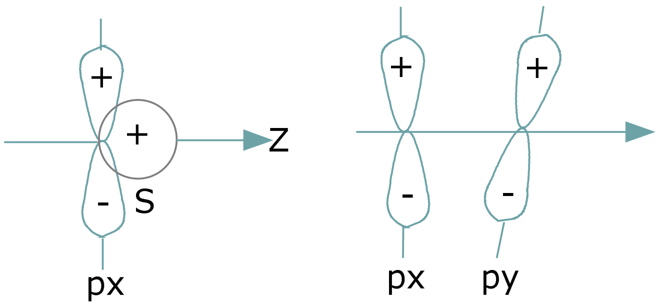


fig. zero overlap.

CBSE TEST PAPER-06

CLASS - XI CHEMISTRY (Chemical Bonding and Molecular Structure)

Topic: - Hybridisation

1.	Define hybridisation.	[1]
2.	Give the features of hybridisation.	[2]
3.	What are the important consolations for hybridisation?	[2]
4.	Describe the shape of sp, sp^2 and sp^3 hybrid orbital?	[2]
5.	State the hybrid orbitals associated with B in BCl_3 and C in C_2H_4	[1]
6.	What is the state of hybridization of carbon atoms in diamond and graphite?	[1]
7.	Ethylene is a planar molecule whereas acetylene is a linear molecule. Give reason.	[2]
8.	In H_2O, H_2S, H_2Se, H_2Te, the bond angle decreases though all have the same bent shape. Why?	[2]
9.	What type of hybridisation takes place in (i) p in PCL_5 and (ii) S in S F_6?	[1]
10.	Out of p-orbital and sp-hybrid orbital which has greater directional character and Why?	[2]

CBSE TEST PAPER-06

CLASS - XI CHEMISTRY (Chemical Bonding and Molecular Structure)

Topic: - Hybridisation [ANSWERS]

Ans1. Hybridisation is defined as the process of intermixing of the orbitals of slightly different energies so as to redistribute their energies, resulting in the formation of new set of orbitals of equivalent energies and shape.

Ans2. The main features of hybridization are

(i) The number of hybrid orbitals is equal to number of the atomic orbitals that get hybridized.

(ii) The hybridized orbitals are always equivalent in energy and shape.

(iii) The hybrid orbitals are more effective in forming stable bonds than the pure atomic orbitals.

(iv) The hybrid orbitals orient in a manner to minimize repulsion resulting in a particular geometrical shape.

Ans3. (i) The orbitals present in the valence shell of the atom are hybridised.

(ii) The orbitals undergoing hybridization should have almost the same energy.

(iii) It is not essential that electrons get promoted prior to hybridization.

(iv) It is necessary that only half filled orbitals participate in hybridisation even filled orbitlals can take part.

Ans4. (i) Sp-hybrid orbital is oriented to an angle 180^0.

(ii) Sp^2-hybrid orbital lie in a plane and is directed towards the corners of equilateral triangle making an angle of 120^0.

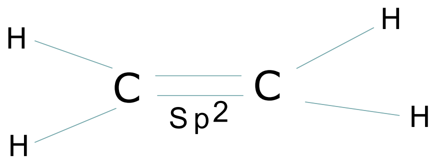
(iii) Sp^3-hybrid orbitals are directed towards the four corners of tetrahedron making an angle of $109^0\ 28'$

Ans5. (i) Sp^2 hybridization (ii) Sp^2 hybridization.

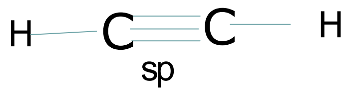
Ans6. In Diamond it is Sp^3

In graphite it is Sp^2

Ans7. In case of ethylene, C_2H_4, *show* Sp^2 hybridization where the four hydrogen atoms are placed in four corners of a plane sharing 120^0



Whereas acetylene shows sp hybridization and shares an angle of 180^0 and thus it is linear.



Ans8. In all the four cases, the molecules undergo Sp^3 hybridization forming four hybrid orbitals, two of which are occupied by lp of electrons and two by bp electrons. Thus they are expected to have $109^0 28'$ angle but this does not happen. In case of H_2O molecule, as oxygen is small in size and has high electronegativity value, the bp are closer due to which it is subjected to larger repulsion (bo-bp). In case of H_2S as S atom is larger than O, bp-bp repulsion is less as compared to H_2O and it is true for H_2Se and $\mathrm{H_2Te}$ as well.

Ans9. (i) Sp^3d (ii) Sp^3d^2.

Ans10. Sp-hybrid orbital has greater directional character than p-orbital. Because in case of p-orbitals, the two lobes are equal in size and equal electron density is distributed whereas in Sp-hybrid orbital, electron density is greater on one side.

CBSE TEST PAPER-07

CLASS - XI CHEMISTRY (Chemical Bonding and Molecular Structure)

Topic: - Molecular Orbital Theory

1.	Define bonding molecular orbital.	[1]
2.	Define antibonding molecular orbital.	[1]
3.	Explain diagrammatically the formation of molecular orbital by LCAO.	[1]
4.	Which one O_2^- and O_2^{2-}, may exhibit paramagnetism?	[1]
5.	Why are bonding molecular orbitals more stable than antibonding molecular orbitals?	[1]
6.	He_2 does not exist. Explain in terms of LCAO.	[2]
7.	Define bond order.	[1]
8.	Define hydrogen bonding	[1]
9.	What are the types of H-bonding? Which of them is stronger?	[1]
10.	NH_3 has higher boiling point than PH_3. Give reason.	[1]

CBSE TEST PAPER-07

CLASS - XI CHEMISTRY (Chemical Bonding and Molecular Structure)

Topic: - Molecular Orbital Theory [ANSWERS]

Ans1. The molecular orbital formed by the addition of atomic orbitals is called bonding molecular orbital.

$$\sigma = \Psi A - \Psi B$$

Ans2. The molecular orbital formed by the subtraction of atomic orbitals is called antibonding molecular orbital.

$$\sigma^{+} = \Psi A - \Psi B.$$

Ans3. Pg 122 (Pant I) – Fig . 4.19 NCERT.

Ans4. O_2 would exhibit paramagnetism because it contains one unpaired electron in its Mo configuration.

Ans5. Bonding molecular orbital has lower energy and hence greater stability than the corresponding antibonding molecular orbital.

Ans6. The electronic configuration of helium atom is $1s^2$. Each helium atom contains 2 electrons, therefore, in He_2 molecule there would be 4 electrons. These electrons will accommodated in $\sigma 1s$ snd $\sigma^{+}1s$ molecular orbitals leading to electronic configuration :

He_2 : $(\sigma 1\text{s})^2(\sigma^{+}1s)^2$

$Bond$ order of $\text{He}_2 is \frac{1}{2}(2-2)=0$

He_2 molecule is there unstable and does not exist.

Ans7. Bond order (b.o) is defined as one half the difference between the number of electrons present in the bonding and the antibonding orbitals i.e;

Bond order (b.o) = $\frac{1}{2}$ (N_b - N_a)

If $N_b > N_a$, molecule is stable and

If $N_b < N_a$, molecule is unstable.

Ans8. Hydrogen bond can be defined as the attractive force which binds hydrogen atom of one molecule with the electronegative atom (F, O or N) of another molecule.

Ans9. (i) Inter-molecular H-bonding

(ii) Intra molecular H-bonding. Inter molecular H-bonding is stronger than intra-molecular H-bonding.

Ans10. In NH_3, there is hydrogen bonding whereas in PH_3 there is no hydrogen bonding.

CBSE TEST PAPER-01

CLASS - XI CHEMISTRY (States of Matter: Gases and Liquids)

Topic: - Intermolecular forces

1. Define Van der waal's forces. [1]

2. Give an example to show dipole-dipole forces. [1]

3. What type of bond exists between H_2O ,HF, NH_3, C_2H_5 OH molecule.? [1]

4. Ice has lower density than water. Give reason. [2]

5. Water has maximum density at 4^0C. Give reason. [2]

6. Define thermal energy. [2]

7. What are the factors responsible for the strength of hydrogen bonds? [2]

CBSE TEST PAPER-01

CLASS - XI CHEMISTRY (States of Matter: Gases and Liquids)

Topic: - Intermolecular forces [ANSWERS]

Ans1. Attractive intermolecular forces between molecules is known as Van der waals forces.

Ans2. Dipole-dipole forces act between the molecules possessing permanent dipole. Ends of the dipoles possess partial charges which are responsible for the interaction eg. The interaction between two HCl molecules.

(a) electron cloud in HCl molecule (b) dipole - dipole interaction between two HCl molecule.

Ans3. In H_2O, HF, NH_3, C_2H_5OH molecule, hydrogen bond exists between hydrogen and the other electronegative atom attached to it.

Ans4. Hydrogen bonding affect the physical properties of compounds. Ice is H-bonded molecular solid having open cage structure whereas liquid water has H-bonding having closed cage structure that is why ice has lower density than water.

Ans5. Water has maximum density at 4^0C because when temperature is increased from o to 4^0C, some of the H-bonds break and molecules come closer and density increases till 4^0C because volume decreases. But, above 4^0C, the kinetic energy of molecules increases which leads to increase in volume and density decreases.

Ans6. Thermal energy is the energy of a body arising from motion of its atoms or molecules. It is directly proportional to the temperature of the substance.

Ans7. Strength of the hydrogen bond is determined by the coulombic interaction between the lone-pair electrons of the electronegative atom of one molecule and the hydrogen atom of other molecule.

CBSE TEST PAPER-02

CLASS - XI CHEMISTRY (States of Matter: Gases and Liquids)

Topic: - The Gaseous State & The Gas Laws

1. Define Boyle's law. [1]

2. Why helium and hydrogen gases not liquefied at room temperature by applying very high pressure? [1]

3. At what temperature will the volume of a gas at 0^0 c double itself, pressure remaining constant? [2]

4. How is the pressure of a given sample of a gas related to temperature at volume? [1]

5. Define absolute zero temperature. [1]

6. 50 cm^3 of hydrogen gas enclosed in a vessel maintained under a pressure of 1400 Torr, is allowed to expand to 125 cm^3 under constant temperature conditions. What would be its pressure? [2]

7. State the law depicting the volume-temperature relationship. [2]

8. State Avogadro's Law. Is the converse of Avogadro's law true? [2]

CBSE TEST PAPER-02

CLASS - XI CHEMISTRY (States of Matter: Gases and Liquids)

Topic: - The Gaseous State & the Gas Laws [ANSWERS]

Ans1. At constant temperature, the pressure of a fixed amount (i.e; number of moles n) of gas varies inversely with its volume.

Mathematically,

$p \propto \frac{1}{v}$ (at constant T and n)

=> $p = k_1 \frac{1}{v}$

Or, $\boxed{pv = K_1}$

Ans2. Because their critical temperature is lower than room temperature and gases cannot be liquefied above the critical temperature even by applying very high pressure.

Ans3. Let the volume of the gas at 0^0C = Vml.

Thus,

V_1 = Vml V_2 = 2Vml

T_1 = o + 273 T_2 = ?

= 273k

By applying charles law

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$=> \quad \frac{V}{273} = \frac{2V}{T_2}$$

$$=> \quad T_2 = \frac{2Vx273}{V} = 546k$$

T_2 = 546 - 273 = $\mathbf{273^0C}$

Ans4. Pressure is directly proportional to the temperature , i.e; $P \propto T$.

Ans5. The lowest hypothetical or imaginary temperature at which gases are supposed to occupy zero volume is called Absolute zero.

Ans6. Since, temperature is constant, we have

PV = constant

$\therefore P_1 V_1 = P_2 V_2$

$P_1 = 1400$; $P_2 = ?$

$V_1 = 50 cm^3$; $V_2 = 125\ cm^3$

$$\therefore \quad P_2 = \frac{P_1V_1}{V_2} = \frac{1400x50}{125} = 560 T0rr$$

The final pressure of the gas after expansion would be 560 Torr.

Ans7. The law is known Charle's law.

"Pressure remaining constant the volume of a given mass of a gas increases or decreases by 1/273 of its volume at 0^0C for every one degree centigrade or fall in temperature.

Mathematically, $V_t = V_o + \frac{V_o}{273} t$

$$= V_o (1+\frac{t}{273})$$

$$\boxed{V_t = V_o(\frac{273+t}{273)})}$$

Where V_t is the volume of the gas at t^0C and V_o is its volume at 0^0C.

Ans8. Avogadro's Hypothesis: This law was given by Avogadro in 1811. According to this law, "Equal volumes of all gases under the same conditions of temperature and pressure contain the same number of molecules."

Volume = a constant X Number of Moles (Temperature and pressure constant).

The converse of Avogadro's law is also true. Equal number of molecules of all gases occupy equal volume's under the same conditions of temperature and pressure. It follows that one gram molecular mass of any gas (containing $6.023x10^{23}$ molecules) will occupy the same volume under the same conditions. The volume occupied by one gram molecular mass of any gas at 0^0C and 760 mm of Hg is 2.4 dm^3 (liters) is called the gram molecular volume or simply molar volume.

CBSE TEST PAPER-03

CLASS - XI CHEMISTRY (States of Matter: Gases and Liquids)

Topic: - Ideal Gas equation

1. Define an ideal gas. [1]

2. Deduce the relation pv = nRT where R is a constant called universal. [2]

3. At 25^0C and 760 mm of Hg pressure a gas occupies 600ml volume. What will be its pressure at a height where temperature is 10^0C and volume of the gas is 640mL. [2]

4. Calculate the volume occupied by 5.0 g of acetylene gas at 50^0C and 740mm pressure. [2]

5. What is aqueous tension? [1]

6. What is the value of R at STP? [1]

7. Explain how the function pv/RT can be used to show gases behave non-ideally at high pressure. [2]

8. Molecule A is twice as heavy as the molecule B. which of these has higher kinetic energy at any temperature? [1]

CBSE TEST PAPER-03

CLASS - XI CHEMISTRY (States of Matter: Gases and Liquids)

Topic: - Ideal Gas equation [ANSWERS]

Ans1. A gas which obeys the ideal gas equation (PV = nRT) at all temperature and pressure is called an ideal gas.

Ans2. According to Boyle's law,

$$V \alpha \frac{1}{p} \text{ (at constant T and n)}$$

According to charle's law,

$$V \alpha T \text{ (at constant p and n)}$$

According to Avogadro's law,

$$V \alpha n \text{ (at constant T and p)}$$

By combining the three laws,

$$V \alpha n \times \frac{1}{p} \times T$$

$$or,\ V \alpha \frac{nT}{p} \quad \text{or} \quad \boxed{pV = nRT}$$

Where R is a constant called universal gas constant.

Ans3. P_1 = 760mm Hg, V_1 = 600mL

T_1 = 25 + 273 = 298 k

V_2 = 640 mL and T_2 = 10 = 273 = 283 k

According to combined gas law,

$$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$$

$$\Rightarrow \quad p_2 = \frac{p_1 T_2 V_1}{T_1 V_2}$$

$$= \frac{760 x 283 x 600}{640 \text{ x } 298}$$

$$P_2 = \underline{\underline{676.6mm}} \text{ of Hg}$$

Ans4. Molar mass of acetylene (C_2H_2)

$$M = (2x12+2x1)\ g/mol$$

$$= 26\ g/mol$$

Mass of acetylene, m = 50g.

Temperature, T = (50^0C + 273) = 323k

Pressure, p = 740mm Hg

$$= \frac{740}{760} mm = 0.9737 \text{ atm}$$

$$Pv = nRT = \frac{m}{M} RT$$

$$v = \frac{mRT}{pM} = \frac{5x0.082x323}{26x0.9737}$$

$$\underline{\underline{v = 5.23L}}$$

Ans5. Pressure exerted by saturated water vapors is called aqueous tension.

Ans6. At S. T. P, R = 8.20578×10^{-2} L at m k^{-1} mol^{-1}.

Ans7. The ratio pv/RT is equal to the number of moles of an ideal gas in the sample. This number should be constant for all pressure, volume and temperature conditions. If the value of this ratio changes with increasing pressure, the gas sample is not behaving ideally.

Ans8. Kinetic energy of a molecule is directly proportional to temperature and independent of mass so both the molecules will have the same kinetic energy.

CBSE TEST PAPER-04

CLASS - XI CHEMISTRY (States of Matter: Gases and Liquids)

Topic: - Behaviour of Real Gases

1. Write Van der waal's equation for n moles of a gas. [1]
2. Out of NH_3 and N_2, which will have (i) larger value of 'a' and (ii) larger value of 'b'? [1]
3. What property of molecules of real gases is indicated by van der waal's constant 'a'? [1]
4. Under what conditions do real gases tend to show ideal gas behaivour? [1]
5. How are Van der waal's constants 'a' and 'b' related to the tendency to liquefy? [1]
6. Mention the two assumptions of kinetic theory of gases that do not hold good. [2]
7. When does a gas show ideal behaivour in terms of volume? [1]
8. Define Boyle point. [1]
9. Calculate the pressure exerted by one mole of CO_2 at 273 k if the Van der waal's constant a = 3.592 dm^6 at m mol^{-1}. Assume that the volume occupied by CO_2 molecules is negligible. [2]
10. What is the value of compressibility factor Z, of a gas when [1]
    (i) pressure is low,
    (ii) pressure is high,
    (iii) at intermediate pressure.

CBSE TEST PAPER-04

CLASS - XI CHEMISTRY (States of Matter: Gases and Liquids)

Topic: - Behaviour of Real Gases [ANSWERS]

Ans1. $\left(p+\frac{an^2}{V^2}\right)(V-nb)=nRT$ is Van der waal's equation for n moles of a gas.

Ans2. (i) NH_3 will have larger value of 'a' because of hydrogen bonding.

(ii) N_2 should have large value 'b' because of larger molecular size.

Ans3. Intermolecular attraction

Ans4. When the pressure of the gas is very low and the temperature is very high.

Ans5. The Van der waal's constant 'a' is a measure of intermolecular attractions. Therefore, the value of 'a' reflects the tendency of the gas to liquefy. The gas having larger value of 'a' will liquefy more easily.

Ans6. The two assumptions of the kinetic theory that do not hold good are –

(i) There is no force of attraction between the molecules of a gas.

(ii) Volume of the molecules of a gas is negligibly small in comparison to the space occupied by the gas.

Ans7. The gases show ideal behaviors when the volume of the occupied is large so that the volume of the molecules can be neglected in comparison to it.

Ans8. The temperature at which a real gas obeys ideal gas law over an appreciable range of pressure is called Boyle temperature or Boyle point.

Ans9. According to Van der waal's equation

$$\left[P+\frac{a}{v^2}\right][v-b]V = RT \qquad \text{(for 1 mole of the gas)}$$

Since, the volume occupied by CO_2 molecules is negligible, therefore, b =o

$$\left(P=\frac{a}{v^2}\right)=RT$$

a = 3.592 dm^6 at m mol^{-1}

V = 22.4 dm^3

R = o.o82 L at m k^- mol^{-1}

T = 273 k.

$$\therefore P=\frac{RT}{V}-\frac{a}{V^2}=\frac{o.082 \text{ x } 273}{22.4}-\frac{3.592}{(22.4)^2}$$

$$= 0.9993 - 0.0071$$

$$p \ \underline{\underline{= 0.9922 atm.}}$$

Ans10. (i) At very low pressure, Z=1 and behave as ideal gas.

(ii) At high pressure, all gases have Z>1.

(iii) At intermediate pressures, most gases have Z<1.

CBSE TEST PAPER-05

CLASS - XI CHEMISTRY (States of Matter: Gases and Liquids)

Topic: - Liquid state

1. Define standard boiling point. [1]

2. What is surface energy? [1]

3. What is surface tension? What is its S.I unit? [1]

4. How does surface tension change when temperature is raised? [1]

5. Why does viscosity of liquids decrease as the temperature is raised? [2]

6. Why are tyres of automobiles inflated to lesser pressure, in summer than in winter? [1]

7. Why is glycerol highly viscous? [1]

8. What is the effect of temperature on [2]

   (i) density

   (ii) vapors pressure of a liquid?

9. Some tiny light hollow spheres are placed in a flask. What would happen to these spheres, if temperature is raised? [1]

10. The boiling points of a liquid rises on increasing pressure. Give reason. [1]

CBSE TEST PAPER-05

CLASS - XI CHEMISTRY (States of Matter: Gases and Liquids)

Topic: - Liquid state [ANSWERS]

Ans1. If the pressure is 1 bar then the boiling point is called standard boiling point of the liquid.

Ans2. The energy required to increase the surface area of the liquid by one unit is defined as surface energy.

Ans3. Surface tension is defined as the force acting per unit length perpendicular to the line drawn on the surface of liquid S.I unit is expressed as Nm^{-1}.

Ans4. Surface tension decreases as the temperature is raised.

Ans5. Viscosity of liquids decreases as the temperature rises because at high temperatures molecules have high kinetic energy and can overcome the intermolecular forces to slip past one another between the layers.

Ans6. The pressure of the air is directly proportional to the temperature. Since the temp is higher in summer than in winter, the pressure of the air in the tube of the tyre is likely to be quite high as compared to winter.

Ans7. Glycerol has three hydrogen bonds which results in an extensive hydrogen bonding. That is why glycerol is highly viscous.

Ans8. (i) $D = \frac{M}{V}$ The volume increases, with the increase of temperature. Therefore, density decreases with the rise of temperature.

(ii) As the temperature of a liquid is increased, the vapors pressure increases.

Ans9. The spheres would start moving faster randomly and colliding with each other.

Ans10. A liquid boils when its vapors pressure becomes equal to the atmospheric pressure. An increase in pressure on liquid, causes a rise in the boiling temperature of the Liquid.

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (Thermodynamics)

Topic : Thermodynamic Terms

1. Define a system. [1]

2. Define surroundings. [1]

3. State the first law of thermodynamics. [1]

4. What kind of system is the coffee held in a cup? [1]

5. Give an example of an isolated system. [1]

6. Name the different types of the system. [1]

7. What will happen to internal energy if work is done by the system? [1]

8. From thermodynamic point of view, to which system the animals and plants belong? [1]

9. How may the state of thermodynamic system be defined? [1]

10. Change in internal energy is a state function while work is not, why? [2]

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (Thermodynamics)

Topic : Thermodynamic Terms [ANSWERS]

Ans 1. A system in thermodynamics refers to that part of the universe in which observations are made.

Ans 2. The rest of the universe which might be in a position to exchange energy and matter with the system is called its surroundings.

Ans 3. The first law of thermodynamics stales that 'the energy of an isolated system is constant'.

Ans 4. Coffee held in a cup is an open system because it can exchange matter (water vapors) and energy (heat) with the surroundings.

Ans 5. Coffee held in a thermos flask is an isolated system because it can neither exchange energy nor matter with the surroundings.

Ans 6. There are three types of system –

(i) Open system (ii) Closed system (iii) Isolated system.

Ans 7. The internal energy of the system will decrease if work is done by the system.

Ans 8. Open system.

Ans 9. The state of thermodynamic system may be defined by specifying values of state variables like temperature, pressure, volume.

Ans 10. The change in internal energy during a process depends only upon the initial and final state of the system. Therefore it is a state function. But the wonk is related the path followed. Therefore, it is not a state function.

CBSE TEST PAPER 02
CLASS XI CHEMISTRY (Thermodynamics)

Topic : Application of Thermodynamic state Functions

1. Define enthalpy. [1]

2. Give the mathematical expression of enthalpy. [1]

3. With the help of first law of thermodynamics and H = U + pv, prove $\Delta H = q_p$ [2]

4. When is enthalpy change (ΔH) - [1]

   (i) positive (ii) negative.

5. Why is the difference between ΔH and ΔU not significant for solids or liquids? [2]

6. Give the relationship between ΔU and ΔH for gases. [3]

7. What is an extensive and intensive property? [2]

8. Give the expression for [1]

   (i) isothermal irreversible change, and

   (ii) isothermal reversible change.

CBSE TEST PAPER 02
CLASS XI CHEMISTRY (Thermodynamics)
Topic : Application of Thermodynamic state Functions [ANSWERS]

Ans 1. It is defined as total heat content of the system.

Ans 2. Mathematically,

H = U + pv where U is internal energy.

Ans 3. The enthalpy is defined as

H = U + pv

For a change in the stales of system,

$\Delta H = \Delta\ (U + \text{pv})$

$= \ \Delta U + \Delta(pv)$

$= \ \Delta U + p\Delta v + v\Delta p$ …………(i)

The first law of thermodynamics states that –

$\Delta U = q + w$

$= \ q - \Delta v$ ……………………..(ii)

From (i) and (ii),

$\Delta H = q - \cancel{\Delta} v + p\cancel{\Delta} v + v\Delta p$

$= \ q + V\Delta p$

When the pressure is constant,

$\Delta p = o,$ then vΔp=o,

$\therefore \Delta H = q(at \text{ constant pressure})$ $\boxed{\Delta H = qp}$

Ans 4. (i) ΔH is positive for endothermic reaction which absorbs heat from the surroundings.

(ii) ΔH is negative for exothermic reactions which evolve heat to the surroundings.

Ans 5. The difference between ΔH and ΔU is not usually significant for systems consisting of only solids and / or liquids because they do not suffer any significant volume changes upon heating.

Ans 6. For gases the volume change is appreciable.

let V_A be the total volume of gaseous reactants, and

V_B be the total volume of gaseous product.

n_A be the number of moles of the reactant and

n_B be the number of moles of the product,

Then at constant pressure and temperature,

$p V_A = n_A RT$

$p V_B = n_B RT$

or $p V_B - pV_A = (n_B - n_A) RT$

or $p \Delta V = (\Delta n)_g RT$

where $(\Delta n)_g = n_B n_A$ and is equal to the difference between the number of moles of gaseous products and gaseous reactants.

Substituting the value of p ΔV awe get.

$$\Delta H = \Delta U + (\Delta n)_g RT$$

$\therefore$ $\Delta H = qp$ (heat change under constant pressure)

$\Delta U = qv$ (heat change under constant volume)

$\therefore$ for gaseous system. $\boxed{qp = qv + (\Delta n)_g RT}$

Ans 7. Extensive property is a property whose value depends on the quantity or size of matter present in the system.

Intensive property is a property which do not depend upon the quantity or size of matter present.

Ans 8. (i) For isothermal irreversible change Q = -w = pex ($v_f - v_i$)

(ii) For isothermal reversible change $q = - w = nRT \ln \frac{v_f}{v_i}$

$= 2.303 \, nRT \log \frac{v_f}{v_i}$

CBSE TEST PAPER 03
CLASS XI CHEMISTRY (Thermodynamics)

Topic : Heat Capacity

1. Define Heat capacity [1]

2. Define specific heat. [1]

3. Give the mathematical expression of heat capacity. [1]

4. It has been found that 221.4J is needed to heat 30g of ethanol from 15^0C to 18^0C. calculate (a) specific heat capacity, and (b) molar heat capacity of ethanol. [3]

5. Show that for an ideal gas Cp- Cv = R [2]

6. Show that for an ideal gas, the molar heat capacity under constant volume conditions is equal to 3/2 R. [2]

7. A 1.25g sample of octane (C_{18} H_{18}) is burnt in excess of oxygen in a bomb calorimeter. The temperature of the calorimeter rises from 294.05 to 300.78K. If heat capacity of the calorimeter is 8.93 KJ/K. find the heat transferred to calorimeter. [2]

CBSE TEST PAPER 03

CLASS XI CHEMISTRY (Thermodynamics)

Topic : Heat Capacity [ANSWERS]

Ans 1. The heat capacity for one mole of the substance is the quantity of heat needed fo raise the temperature of one mole by one degree Celsius.

Ans 2. Specific heat /specific heat capacity is the quantity of heat required to raise the temperature of one unit mass of a substance by one degree Celsius (or one Kelvin).

Ans 3. The mathematical expression of heat capacity

$q = c \times m \times \Delta T$

$= C\Delta T$

where c = specific heat

m = mass

ΔT = temperature change.

Ans 4. (a) Specific heat capacity

$$\frac{\textit{Heat} \text{ absorbed by the substance}}{\textit{Mass} \text{ of the substance x Rise in temp.}}$$

$$C = \frac{221.4\,j}{30g\ \left(18^0c - 15^0c\right)} = \frac{221.4}{30 \times 3}\ Jg^{-1}\ {}^0c^{-1}$$

$$= \underline{\underline{2.46J}}\ g^{-1}\ {}^0c^{-1}$$

Since 1^0C is equal to 1k, the specific heat capacity of ethanol = $2.46 Jg^{-1}\ {}^0c^{-1}$.

(b) Molar heat capacity, Cm = specific heat x molar mass.

Therefore, Cm (ethanol) = 2.46 x 46

= $113.2\ Jmol^{-1}\ {}^0c^{-1}$

The molar heat capacity of ethanol is $113.2\ J\ mol^{-1}\ {}^0c^{-1}$.

Ans 5. When a gas is heated under constant pressure, the heat is required for raising the temperature of the gas and also for doing mechanical work against the external pressure during expansion.

At constant volume, the heat capacity, C is written as Cv and at constant pressure this is denoted by Cp.

we write heat q

at constant volume as qv = Cv ΔT = ΔU

at constant pressure as qp = $Cp\Delta T$ = Δ+H

The difference between Cp and Cv can be derived for an ideal gas as :

For a mole of an ideal gas, $\Delta H = \Delta U + \Delta(pv)$

$$= \Delta U + \Delta(RT)$$

$$= \Delta U + R\Delta T$$

∴ ΔH = ΔU + RΔT_ _ _ _ _ _ _ _ (i)

On putting the values of ΔH and ΔU, we have;

$$Cp\Delta T = Cv\Delta T + R\Delta T$$

Cp = Cv +R $\boxed{Cp - Cv = R}$

Ans 6. For an ideal gas, from kinetic theory of gases, the average kinetic energy per mole (Ek) of the gas at any temperature T_k is given by $Ek = \frac{3}{2}RT$

At (T+1)k, the kinetic energy per mole (Ek^1) is Ek^1 = $\frac{3}{2}R(T+1)$

Therefore increase in the average kinetic energy of the gas for 1^0C (or 1K) rise in temperature is $\Delta\overline{E}_k = \frac{3}{2}R(T+1) - \frac{3}{2}RT = \frac{3}{2}R$

$\overline{E}_k$ by definition is to the molar heat capacity of a gas at constant volume, Cv.

∴ $\boxed{Cv = \frac{3}{2}R}$

Ans 7. Mass of octane,

M = 1.250g.

= 0.00125.

Heat capacity, c = 8.93 kJ/k

Rise in temp, $\Delta T = 300.78 - 294.05$

= 6.73K

Heat transferred to calorimeter

$= m$ x c x ΔT

= 0.00125 x 8.93 x 6.73

= 0.075 kJ

CBSE TEST PAPER 04
CLASS XI CHEMISTRY (Thermodynamics)

Topic : Enthalpy Change of a Reaction

1. Define reaction enthalpy. [1]

2. Define standard enthalpy. [1]

3. The standard heat of formation of Fe_2O_3 (s) is 824.2kJ mol^{-1} Calculate heat change for the reaction. [1]

$$4Fe(s) + 3O_2\,(g) \rightarrow 2Fe_2O_3(s)$$

4. Calculate the heat of combustion of ethylene (gas) to from CO_2 (gas) and H_2O (gas) at 298k and 1 atmospheric pressure. The heats of formation of CO_2, H_2O and C_2H_4 are – 393.7, - 241.8, + 52.3 kJ per mole respectively. [2]

5. Give two examples of reactions which are driven by enthalpy change. [2]

6. Will the heat released in the following two reactions be equal? Give reasons in support of your answer. [2]

   (i) $H_2\,(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(g)$

   (ii) $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$

7. What is the relation between the enthalpy of reaction and bond enthalpy? [2]

8. The reaction C (graphite) + O_2 (g) $\rightarrow CO_2(g)$ + 393.5 kJ mol^{-1} represents the formation of CO_2 and also combustion of carbon. Write the ΔH^O values of the two processes. [2]

CBSE TEST PAPER 04

CLASS XI CHEMISTRY (Thermodynamics)

Topic : Enthalpy Change of a Reaction [ANSWERS]

Ans 1. The enthalpy change accompanying a reaction is called the reaction enthalpy (ΔrH).

Ans 2. The standard enthalpy of reaction is the enthalpy change for a reaction is the enthalpy change for a reaction when all the participating substances are in their standard states.

Ans 3. $\Delta H^o = \sum \Delta H_f^o (products) - \sum \Delta H_f{}^o (reac\tan ts)$

$= [2 \text{ X } \Delta H_f{}^o Fe_2O_3(s)] - [4 \Delta H_f{}^o Fe(s) + 3 \Delta H_f{}^o O_2(g)]$

$= 2(-824.2kJ) - [4 \text{ x o} + 3 \text{ x o}]$

$= -\underline{\underline{1648.4kJ}}$

Ans 4. $C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(g)$

$\Delta H_f(CO_2) = -393.7kJ$

$\Delta H_f(H_2O) = -241.8kJ$

$\Delta H_f(C_2H_4) = +52.3kJ$

$\Delta Hreaction = \sum \Delta H_f{}^o products - \sum \Delta H_f{}^o$ reactants

$= [2 \text{ x } \Delta H_f{}^O(CO_2) + 2 \text{ x } \Delta H_f{}^O(H_2O)] - \left[\Delta H_f{}^O(C_2H_4) + 3 \text{ x } \Delta H_f{}^O(O_2)\right]$

$= 2 \text{ x}[(-393.7)m + 2\text{x }(-241.8)] - [(523.0) + 0)]$

$\left[\therefore \Delta H_f{}^O \text{ fot elementary substance } = 0\right]$

$= [-787.4 - 483.6] - 53.3$

$= -1323.3 \text{ kJ.}$

Ans 5. Examples of reactions driven by enthalpy change:

The process which is highly exothermic, i.e. enthalpy change is negative and has large value but entropy change is negative is said to be driven by enthalpy change, eg.

(i) $H_2(g)+\frac{1}{2}O_2(g)\rightarrow H_2O(l)$

$\Delta H_f^O = -285.8kJ\ \text{mol}^{-1}$

(ii) $N_2(g)+3H_2(g)\rightarrow 2NH_3(g)$

$\Delta H^O = -92k\ \text{J mol}^{-1}$.

Ans 6. No, the heats released in the two reactions are not equal. The heat released in any reaction depends upon the reactants, products and their physical states. Here in reaction (i), the water produced is in the gaseous state whereas in reaction (ii) liquid is formed. As we know, that when water vapors condensed to from water, heat equal to the latent heat of vaporization is released. Thus, more heat is released in reaction (ii).

Ans 7. A chemical reaction involves the breaking of bonds in reactants and formation of new bonds in products. The heat of reaction (enthalpy change) depends on the values of the heat needed to break the bond formation .Thus

(Heat of reaction = (Heat needed to break the bonds in reactants – Heat liberated to from bonds in products).

ΔH^O = Bond energy in (to break the bonds) X

Bond energy out (to form the bonds)

= Bond energy of reactants – Bond energy of products.

Ans 8. (i) The standard enthalpy of formation of CO_2 is -393.5 kJ per mole of CO_2.

That is $\Delta H_f^O(CO_2, g) = -393.5kJ\ \text{mol}^{-1}$.

(ii) The standard enthalpy of combustion of carbon is - 393.5 kJ per mole of carbon i.e. $\Delta H^O comb(c) = -393.5\ \text{kJ mol}^{-1}$.

CBSE TEST PAPER 05

CLASS XI CHEMISTRY (Thermodynamics)

Topic : Spontaneity

1. Define spontaneous process. [1]

2. Define non-spontaneres process. [1]

3. What is the sign of enthalpy of formation of a highly stable compound? [1]

4. Predict the sign of ΔS for the following reaction [1]

   CaCo3 (s) $\xrightarrow{\Delta} CaO_5 + CO_2(g)$.

5. Two ideal gases under same pressure and temperature are allowed to mix in an isolated system – what will be sign of entropy change? [1]

6. Predict the sign of the entropy change for each of the following changes of state. [2]

   (a) $Hg(l) \rightarrow Hg(g)$

   (b) $AgNO_3(S) \rightarrow AgNO_3(aq)$

   (c) $I_2(g) \rightarrow I_2(S)$

   (d) $C(graphite) \rightarrow C(diamond)$

7. Explain how is enthalpy related to spontaneity of a reaction? [2]

8. The ΔH and ΔS for $2Ag_2O(s) \rightarrow 4Ag(s) + O_2(g)$ are given + 61.17kJ mol^{-1} and + 132 $Jk^{-1}mol^{-1}$ respectively. Above what temperature will the reaction be spontaneous? [2]

CBSE TEST PAPER 05

CLASS XI CHEMISTRY (Thermodynamics)

Topic : Spontaneity [ANSWERS]

Ans 1. A spontaneous process is an irreversible process and may only be reversed by some external agency.

Ans 2. A process is said to be non-spontaneous if it does not occur of its own under given condition and occur only when an external force is continuously applied.

Ans 3. Negative.

Ans 4. ΔS is positive.

Ans 5. Entropy change is positive. It is because disorder or degree of freedom increase on mixing.

Ans 6. (a) +ve (because gases are highly random than liquid)

$$\Delta S = S(g) - S(e) = +ve$$

(b) +ve (because ions are in more random state in aqueous solution as compared to solid state).

$$\Delta S = S(aq) - S(s) = +ve.$$

(c) -ve (because gases are highly more random than solid).

$$\Delta S = S(s) - S(g) = -ve.$$

(d) zero, diamond and graphite both are solid and in crystalline state.

Ans 7. Majority of the exothermic reactions are spontaneous because there is decrease in energy.

Burning of a substance is a spontaneous process.

$C(s) + O_2(g) \rightarrow CO_2(g)$; $\Delta H = -394 kJ\ mol^{-1}$

Neutralisation of an acid with a base is a spontaneous reaction.

$HCl + Na\ OH \rightarrow NaCl + H_2O.\Delta H = -57kJ\ mol^{-1}$

Many spontaneres reactions proceed with the absorption of heat. Conversion of water into water vapour is an endothermic spontaneous change. Therefore change in enthalpy is not the only criterion for deciding the spontaneity of a reaction.

Ans 8. The reaction

$$2Ag_2O\ (s) \rightarrow 4Ag(s) + O_2(g)$$

Will be spontaneous when ΔG is negative.

Since ΔH is +ve and ΔS is also +ve, the relation

$$\Delta G = \Delta H - T\Delta S$$

Shows that ΔG would be –ve when,

$$\Delta H = T\Delta SLO$$

$$\text{Or } T > \frac{\Delta H}{\Delta S} = \frac{61170\ mol^{-1}}{132Jk^{-1}mol^{-1}} = 463.4K$$

$\therefore$ The process will be spontaneous above a temperature of $\underline{\underline{463.4K}}$.

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (Equilibrium)

Topic : Equilibrium in physical processes

1. Define dynamic equilibrium. [1]

2. Name the three group into which chemical equilibrium can be classified. [3]

3. What is physical equilibrium? Give an example. [1]

4. What is meant by the statement 'Equilibrium is dynamic in nature'? [1]

5. On what factor does the boiling point of the liquid depends? [1]

6. State Henry's law. [1]

7. What happens to the boiling point of water at high altitude? [1]

8. On which factor does the concentration of solute in a saturated solution depends? [1]

9. Mention the general characteristics of equilibria involving physical processes. [2]

10. What conclusion is drawn from the following – [1]

    Solid $\rightleftharpoons$ Liquid

    $H_2O(s) \rightleftharpoons H_2O(l)$

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (Equilibrium)

Topic : Equilibrium in physical processes [ANSWERS]

Ans 1. When the reactants in a closed vessel at a particular temperature react to give products, the concentrations of the reactants keep on decreasing, while those of products keep on increasing for sometime after which there is no change in the concentrations of either the reactants or products. This stage of the system is the dynamic equilibrium.

Ans 2. Chemical equilibrium can be classified into three groups –

(i) The reaction that proceeds nearly to completion and only negligible concentrations of the reactants are left.

(ii) The reactions in which only small amounts of products are formed and most of the reactants remain unchanged at equilibrium stage.

(iii) The reactions in which the concentrations of the reactants and products are comparable, when the system is in equilibrium.

Ans 3. Physical equilibrium is an equilibrium between two different physical states of same substance e.g. $H_2O(s) \rightleftharpoons H_2O(l)$

Ans 4. At equilibrium, reaction does not stop rather it still continues, the equilibrium is dynamic in nature. It appears to stop because rate of forward reaction is equal to the rate of backward reaction.

Ans 5. Boiling point depends on the atmospheric pressure.

Ans 6. The mass of a gas dissolved in a given mass of a solvent at any temperature is proportional to the gas above the solvent.

Ans 7. Boiling point of water depends on the altitude of the place. At high altitude the boiling point decreases.

Ans 8. The concentration of solute in a saturated solution depends upon the temperature.

Sugar (soln.) $\rightleftharpoons$ sugar (solid).

Ans 9.
(a) For solid $\rightleftharpoons$ liquid equilibrium, there is only one temperature at 1 atm at which two phases can co-exist. If there is no exchange of heat with the surroundings, the mass of the two phases remain constant.
(b) For liquid $\rightleftharpoons$ vapors equilibrium, the vapors pressure is constant at a given temperature.
(c) For dissolution of solids in liquids, the solubility is constant at a given temperature.
(d) For dissolution of gases in liquids, the concentration of a gas in liquid is proportional to pressure of the gas over the liquid.

Ans 10. Melting point is fixed at constant pressure.

CBSE TEST PAPER 02

CLASS XI CHEMISTRY (Equilibrium)

Topic : Equilibrium in Chemical processes – Dynamic equilibrium

1. State the law of chemical equilibrium. [1]

2. Write the equilibrium constant for the following equation : [1]

   $$aA + bB \rightleftharpoons cC + dD$$

3. Write the expression for the equilibrium constant for the reaction : [2]

   $$4NH_3\,(g) + 5O_2\,(g) \rightleftharpoons 4NO\,(g) + 6H_2O\,(g)$$

4. Write the chemical equation for the following chemical constant. [1]

   $$Kc = \frac{[HI]^2}{[H_2][I_2]}$$

5. When the total number of moles of product and reactants are equal, K has no unit. Give reason. [2]

6. What is the unit of equilibrium for the reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3\,(g)$. [2]

7. Give the relation Kp = Kc $(RT)^{\Delta n}$. [2]

8. Write the relationship between Kp and Kc for the following reactions: [2]

   (a) $PCl_5 \rightleftharpoons PCl_3\,(q) + Cl_2(q)$

   (b) $N_2\,(q) + 3H_2\,(q) \rightleftharpoons 2NH_3(g)$

   (c) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

   (d) $2H_2O(g) \rightleftharpoons 2H_2O\,(g) + O_2(g)$

9. Write the expression for equilibrium constant Kp for the reaction [1]

   $$3Fe\,(s) + 4H_2O \rightleftharpoons Fe_3O_4\,(s) + 4H_2(g)$$

10. The equilibrium constant for the reaction $H_2O + CO \rightleftharpoons H_2 + CO_2$ [1]

    Is 0.44 at 1260k. What will be the value of the equilibrium constant for the reaction : $2H_2\,(g) + 2CO\,(g) \rightleftharpoons 2CO(g) + 2H_2O\,(g)$ at 1260 K

CBSE TEST PAPER 02

CLASS XI CHEMISTRY (Equilibrium)

Topic : Equilibrium in Chemical processes – Dynamic equilibrium [ANSWERS]

Ans 1. At a given temperature, the product of concentrations of the reaction products raised to the respective stoichiometric coefficient in the balanced chemical equation divided by the product of concentrations of the reactants raised to their individual stoichiometric coefficients has a constant value. This is known as the equilibrium law or law of chemical equilibrium.

Ans 2. The equilibrium constant for a general reaction

$aA + bB \rightleftharpoons cC + dD$

is expressed as

$$Kc = \frac{[C]^C[D]^d}{[A]^a[B]^b}$$

Where [A], [B], [C] and [D] are the equilibrium concentrations of the reactants and products.

Ans 3. The equilibrium constant is given by

$$Kc = \frac{[NO]^4[H_2O]^6}{[NH_3]^4[O_2]^5}$$

Ans 4. The chemical equation is given by

$H_2\ (g) + I_2(g) \rightleftharpoons 2HI(g)$

Ans 5. When the total number of moles of products is equal to the total number of moles of reactants the equilibrium has no unit for eg.

$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

$$K = \frac{[HI(g)]^2}{[H_2(g)][I_2(g)]}$$

Units of $K = \frac{mol/L \text{ x mol/L}}{mol/L \text{ x mol/L}} = No$ units .

Ans 6. $K = \frac{[NH_3(g)]^2}{[N_2(g)][H_2(g)]^3}$

$units$ of K = $\frac{(mol/L)^2}{(mol/L)(mol/L)^3} = \frac{1}{(mol/L)^2}$

= $(mol/L)^{-2}$

$= \underline{\underline{L^2 mol^{-2}}}$

Ans 7. Let us consider a reaction

aA +bB $\rightleftharpoons$ cC + dD

$Kc = \frac{[C]^c[D]^d}{[A]^a[B]^b}$ ..... (i) < Kp = $\frac{p_C{}^c \ p_D{}^d}{p_A{}^a \ p_B{}^b}$

Assuming the gaseous components to behave ideally,

Pi Vi = ni RT ...

Or, $pi = \frac{ni}{vi} RT = CiRT = [c]RT ....(iv)$.

Where [i] is the molar concentration of the species i

Then,

$$Kp = \frac{p_C{}^c p_D{}^d}{p_A{}^a p_B{}^b} = \frac{([c]RT)^C x([D]RT)^d}{([A]RT)^a \ x([B]RT)^b}$$

$$= \frac{[C]^c [D]^d}{[A]^a [B]^b} x(RT)(\overline{c+d} \quad - \quad \overline{a+b})....(v)$$

$$\Delta n = (\overline{c+d} \quad - \quad \overline{a+b})$$

$\therefore$ Kp = Kc $(RT)^{\Delta n}$

Ans 8. (a) $\Delta n = 1+1-1=1$

$\therefore$ Kp = Kc (RT)' = KcRT

(b) $\Delta n = 2-(3+1) = -2$

$\therefore$ Kp = Kc $(RT)^{-2}$

(c) $\Delta n = 2-(-1+1) = 0$

$\therefore$ Kp $= Kc(RT)^{0} = Ke$

(d) $\Delta n = 2 = 1-2 = 1$

$\therefore$ Kp=Kc$(RT)' = KcRT.$

Ans 9. $Kp = \dfrac{PH_2}{PH_2O}.$

Ans 10. The reaction is reversed and also doubled,

$\therefore$ Kc $= \left(\dfrac{1}{0.44}\right)^2 = \underline{\underline{5.16}}.$

CBSE TEST PAPER 03

CLASS XI CHEMISTRY (Equilibrium)

Topic : Applications of Equilibrium constants

1. Give the generalizations concerning the composition of equilibrium mixtures. [3]

2. Define reaction quotient. [1]

3. If Qc > Kc, what would be the type of reaction? [1]

4. What inference you get when Qc = Kc? [1]

5. The value of Kc for the reaction [2]

   $2A \rightleftharpoons B+C$ is $2x10^{-3}$. At a given time, the composition of the reaction mixture is [A] = [B] =[C] = $3x10^{-4}$ M. In which direction the reaction will proceed?

6. Write the equilibrium constant expression for each of the following reactions. [2]

   In each case, indicate which of the reaction is homogeneous or heterogeneous.

   (a) $2CO(g) + O_2(g) \rightleftharpoons 2CO_2(g)$

   (b) $N_2O_5(g) \rightleftharpoons NO_2(g) + NO_3(g)$

   (c) $Zn(s) + 2HCl(g) \rightleftharpoons ZnCl_2(s) + H_2(g)$

   (d) $2H_2O(l) \rightleftharpoons 2H_2O(l) + O_2(g)$

7. The dissociation of HI is independent of pressure, while dissociation of PCl_5 depends upon the pressure applied. Why? [2]

8. On what factors does the value of the equilibrium constant of a reaction depend? [2]

CBSE TEST PAPER 03

CLASS XI CHEMISTRY (Equilibrium)

Topic : Applications of Equilibrium constants [ANSWERS]

Ans 1. (i) If Kc > 10^3, products predominates over reactants i.e; if Kc is very large, the reaction proceeds nearly to completion.

(ii) If Kc < 10^{-3}, reactants predominates over products i.e; if Kc is very small, the reaction proceeds rarely.

(iii) If Kc is in the range of 10^{-3} to 10^3, appreciable concentration of both reactants and products are present.

Ans 2. The reaction quotient, Q is same as equilibrium constant Kc, except that the concentrations in Qc are not necessarily equilibrium values.

Ans 3. If Qc > Kc, the reaction will proceed in the direction of the reactants (reverse reactions)

Ans 4. If Qc = Kc, the reaction mixture is already at equilibrium.

Ans 5. For the reaction the reaction Qc is given by

$$Qc = \frac{[B][C]}{[A]^2}$$

As [A] = [B] = [C] = 3x10^{-4M}

$$Qc = \frac{\left(3x10^{-4}\right)\left(3x10^{-4}\right)}{\left(3x10^{-4}\right)^2} = 1$$

As Qc > Kc so the reaction will proceed in the reverse direction.

Ans 6. (a) Kc $= \frac{[CO_2]}{[CO]^2[O_2]}$ (b) Kc $= \frac{[NO_2][NO_3]}{[N_2O_5]}$

(c) $Kc = \frac{[H_2]}{[HCl]^2}$ (d) Kc $= [O_2]$

Homogeneous : a, b

Heterogeneous : c, d

Ans 7. For 2HI $\rightleftharpoons$ H_2 + I_2

Kc $= \frac{x^2}{4(1-x)^2}$

Where x is degree of dissociation

For $PCl_5 \rightleftharpoons PCl_3 + Cl_2$

Kc $= \frac{x^2}{v(1-x)}$

Where x is degree of dissociation

Since Kc for HI does not have volume terms and thus dissociation of HI is independent of pressure. On the other hard Kc for PCl_5 has volume in denominator and thus an increase in pressure reduces volume. And to have kc constant, x decrease.

Ans 8. The equilibrium constant of a reaction depends upon

(i) Temperature

(ii) Pressure, &

(iii) Stoichiometry of the reaction

CBSE TEST PAPER 04

CLASS XI CHEMISTRY (Equilibrium)

Topic : Factors Affecting Equilibria

1. State Le chatelier's principle. [1]

2. Can a catalyst change the position of equilibrium in a reaction? [1]

3. What is the effect of reducing the volume on the system described below? [1]
$2C(s) + O_2(g) \rightleftharpoons 2CO(g)$

4. Why the addition of inert gas does does not change the equilibrium? [2]

5. What happens when temperature increases for a reaction? [1]

6. The equilibrium constant of a reaction increases with rise in temperature. Is the reaction exo – or endothermic? [2]

7. Can a catalyst change the position of equilibrium in a reaction? [1]

8. If Qc < Kc, when we continuously remove the product, what would be the direction of the reaction? [1]

9. Using Le – chatelier principle, predict the effect of [2]
   (a) decreasing the temperature
   (b) increasing the temperature

   in each of the following equilibrium systems:

   (i) $N_2 (g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + \Delta$

   (ii) $N_2(g) + O_2(g) + \Delta \rightleftharpoons 2NO(g)$

10. (i) In the reaction equilibrium [2]

    $A + B \rightleftharpoons C + D$,

    What will happen to the concentrations of A, B and D if concentration of C is increased.

    (ii) what will happen if concentration of A is increased?

CBSE TEST PAPER 04

CLASS XI CHEMISTRY (Equilibrium)

Topic : Factors Affecting Equilibria [ANSWERS]

Ans 1. It states that a change in any of the factors that determine the equilibrium conditions of a system will cause the system to change in such a manner so as to reduce or to counteract the effect of the change.

Ans 2. No, a catalyst cannot change the position of equilibrium in a chemical reaction. A catalyst, however, affects the rate of reaction.

Ans 3. The forward reaction is accompanied by increase in volume. Hence according to Chatelier's principle, reducing the volume will shift the equilibrium in the forward direction.

Ans 4. It is because the addition of an inert gas at constant volume does not change the partial pressures or the molar concentrations of the substance involved in the reaction.

Ans 5. The equilibrium constant for an exothermic reaction $(\Delta H - ve)$ decreases as the temperature increases.

Ans 6. The equilibrium constant increases with a rise in temperature. Therefore, the reaction is endothermic.

Ans 7. No, a catalyst cannot change the position of equilibrium in a chemical reaction. A catalyst affects the rate of reaction.

Ans 8. Continuous removal of a product maintains Qc at a value less than Kc and reaction continues to move in the forward direction.

Ans 9. (i) For an exothermic reaction increase in temperature shifts the equilibrium to the left and decrease in temperature shifts it to the left.

(ii) For an endothermic reaction increase in temperature shifts the equilibrium to the right and decrease in temperature shifts it to the left.

Ans 10. (i) For an equilibrium reaction

A + B $\rightleftharpoons$ C + D

$$Kc = \frac{[C][D]}{[A][B]}$$

If the concentration of a product is increased, the concentration of other components changes in such a way that the conc of C decreases and vice – versa.

If the conc of C is increased the conc of D will decrease and those of A and B will increase simultaneously so that the numerical value of Kc is the same and vice – versa. The equilibrium shifts to the left.

(ii) If the conc of A is increase, conc of B will decrease and those of C and D will increase simultaneously so that the numerical value of Kc is the same and vice – versa. The equilibrium shifts to the right

CBSE TEST PAPER 05

CLASS XI CHEMISTRY (Equilibrium)

Topic : Ionic Equilibrium In solution

1. Define strong and weak electrolyte. [1]

2. Write the conjugate acids for the following Bronsted bases : NH_2, NH_3 and $HCOO^-$. [1.5]

3. Which conjugate base is stronger CN^- or F^- ? [1]

4. Give two examples of actions which can act as hour's acids. [2]

5. What is the difference between a conjugate acid and a conjugate base? [1]

6. Select Lewis acid and Lewis base from the following : [1]

   Cu^{2+} , H_2O, BF_3 OH^-

7. Predict if the solutions of the following salts are neutral, acidic or basic : [4]

   NaCl, KBr, NaCN, NaOH H_2SO_4, $NaNO_2$, NH_4 NO_3, KF

8. Justify the statement that water behaves like an acid and also like a base on the basis of protonic concept. [2]

CBSE TEST PAPER 05

CLASS XI CHEMISTRY (Equilibrium)

Topic : Ionic Equilibrium In solution [ANSWERS]

Ans 1. Those electrolytes which dissociate almost completely into ions in aqueous solutions are Known as strong electrolytes while those which show poor dissociation into ions in aqueous solutions are called weak electrolytes.

Ans 2.

Species	Conjugate acids
NH_2	NH_3^+
NH_3	NH_4^+
$HCOO^-$	HCOOH.

Ans 3. $F^- < CN^-$ basic character.

Ans 4. Ag^+, H^+.

Ans 5. A conjugate acid and base differ by a proton.

Ans 6. Lewis acids : Cu^{2+}, BF_3

Lewis bases : H_2O, OH^-

Ans 7.

NaCl	-	Neutral
KBr	-	Neutral
NaCN	-	Basic
NaOH	-	Basic
H_2SO_4	-	Acidic
$NaNO_2$	-	Basic
NH_4NO_3	-	Acidic
KF	-	Basic

Ans 8. Water ionizes as $H_2O + H_2O \rightleftharpoons H_3O^+ + OH^-$

With strong acid water behaves as a base and accept the proton given by the acid e.g. $HCl + H_2O \rightleftharpoons Cl^- + H_3O^+$

While with strong base, water behaves as an acid by liberating a proton e.g. :

$H_2O + NH_3 \rightleftharpoons NH_4^+ + OH^-$.

CBSE TEST PAPER 06

CLASS XI CHEMISTRY (Equilibrium)

Topic : Ionization of Acids and Bases

1. The dimethyl ammonium ion, $(CH_3)_2\ NH_2^+$, is a weak acid and ionizes to a slight degree in water what is its conjugate base? [1]

2. If p^H of a solution is 7, calculate its p^{OH} value. [1]

3. What happens to the p^H if a few drops of acid are added to CH_3COONH_4 solution? [1]

4. What is the concentration of H_3O^+ and OH^- ions in water at 298K? [1]

5. The degree of dissociation of N_2O_4, [2]
   $N_2O_4(g) \rightleftharpoons 2NO_2(g)$, at temperature T and total pressure is α. Find the expression for the equilibrium constant of this reaction at this temperature and pressure?

6. The p^{ka} of acetic acid and p^{kb} of ammonium hydroxide are 4.76 and 4.75 respectively. Calculate the p^H of ammonium acetate solution. [1]

7. A solution give the following colors with different indicators. Methyl orange – yellow, methyl red – yellow, and bromothymol blue Orange . what is the p^H of the solution? [2]

8. Show that, in aqueous solutions [2]
   $p^H + p^{OH} = p^{kw}$
   What is the value of $p^H + p^{OH}$ at 25^0c?

9. Calculate the pH of the solution [1]
   0.002 MHBr

10. The concentration of H^+ in a soft drink is 3.8×10^{-3} M. what is its p^H? [2]

CBSE TEST PAPER 06

CLASS XI CHEMISTRY (Equilibrium)

Topic : Ionization of Acids and Bases [ANSWERS]

Ans 1. $(CH_3)_2\,NH$

Ans 2. $p^H + p^{OH} = 14$

$\therefore p^{OH} = 14 - p^H$

$= 14 - 7$

$= 7.$

Ans 3. pH will almost remain constant.

Ans 4. $[H_3O^+] = [OH^-] = 1 \times 10^{-7}\ mol^{-1}$

Ans 5. $N_2O_4 \rightleftharpoons 2NO_2$

At eq 1-α 2α

If p is the total pressure then

$$P_{N2O4} = P_{N_2O_4} = \frac{(1-\alpha)}{(1+\alpha)}p$$

$$P_{NO2} = P_{NO_2} = \frac{2\alpha}{1+\alpha}P$$

$$\text{Then}\quad K_P = \frac{p^2{}_{NO_2}}{P_{N_2O_4}} = \frac{\left[2\alpha p/(1+\alpha)\right]^2}{\left[(1-\alpha)\,p/(1+\alpha)\right]} = \frac{4\alpha^2 p}{(1-\alpha^2)}$$

Ans 6. $PH = 7 + \frac{1}{2}[P^{ka} - p^{kb}]$

$$= 7 + \frac{1}{2[4.76 - 4.75]}$$

$$= 7 + \frac{1}{2}[0.01]$$

$= 7 + 0.005$

$= 7.005$

Ans 7. (i) The colors in methyl orange indicates that $p^H > 4.5$

(ii) Colors in methyl red indicates that $p^H > 6.0$ and

(iii) colors in bromothymol blue indicates that $p^H < 6.3$.

Therefore, the pH of the solution is between 6.0 to 6.3.

Ans 8. The ionic product constant of water is given by

$K_w = [H^+][OH^-]$

Taking logarithm,

$\text{Log } k_w = \log [H^+] + \log [OH^-]$

Or, $-\log k_w = \log [H^+] - \log [OH^-]$

Or, $p\,k_w = p^H + p^{OH}$

At 25^0c, $k_w = 1.0 \times 10^{-14}$

$P\,k_w = -\log k_w$

$= -\log (1.0 \times 10^{-14}) = 14.$

Thus, $p^H + \underline{\underline{p^{OH} = 14}}$.

Ans 9. p^H value of 0.002M HBr.

$HBr + H_2O \xrightarrow{aq} H_3O^+(aq) + Br^-(aq)$

0.002M

$pH = -(\log H_3O^+) = -\log (2x10^{-3})$

$= (3-\log 2) = 3-0.3010 \underline{\underline{= 2.7}}$

Ans 10. $[H^+] = 3.8 \text{ x}10^{-3}$ M

$pH = -\log [H^+] = \log (3.8 \times 10^{-3})$

$= -\log 3.8 - \log 10^{-3}$

$= -0.5798 + 3 \underline{\underline{= 2.42}}$.

CBSE TEST PAPER 07

CLASS XI CHEMISTRY (Equilibrium)

Topic : Buffer solution and solubility Product

1. Define Buffer solution. [1]

2. Define solubility product. [2]

3. When is a solution called unsaturated? [1]

4. Give an example of acidic buffer? [1]

5. Ksp for $Hg\ SO_4$ is 6.4×10^{-5}. What is the solubility of the salt? [2]

6. How does dilution with water affect the pH of a buffer solution? [1]

7. Calculate the pH of a buffer solution containing 0.1 mole of acetic acid and 0.15 mole of sodium acetate. Ionisation constant for acetic acid is 1.75×10^{-5}. [2]

8. Calculate the solubility of Ag Cl (s) in pure water. [1]

9. Name a basic buffer having pH around 10. [1]

CBSE TEST PAPER 07

CLASS XI CHEMISTRY (Equilibrium)

Topic : Buffer solution and solubility Product [ANSWERS]

Ans 1. The solutions which resist change in pH on dilution or with the addition of small amounts of acid or alkali are called Buffer solutions.

Ans 2. The solubility product of a salt at a given temperature is equal to the product of the concentration of its ions in the saturated solution, with each concentration term raised to the power equal to the number of ions produced on dissociation of one mole of the substance.

Ans 3. When the ionic product is less than the solubility product the solution is unsaturated.

Ans 4. CH_3 COOh + CH_3 COONa.

Ans 5. $S = (k_{sp})^{1/2}$

$= (6.4 \times 10^{-5})^{1/2}$

$= (64 \times 10^{-6})^{1/2}$

$= \underline{\underline{8x10^{-3}}}$

Ans 6. Dilution with water has no effect on the pH of any buffer. This is because pH of a buffer depends on the ratio of the salt, acid or salt base and dilution does not affect this ratio.

Ans 7. $p^H = p^{ka} + \log \frac{salt}{acid}$

$pH = -\log 1.75 \times 10^{-5} + \log \frac{0.15}{0.10}$

or, $p^H = -\log 1.75 \times 10^{-5} + \log 1.5 \underline{\underline{= 4.9}}$

Ans 8. Let the solubility of Ag Cl in water be S mol L^{-1}

$Ag\,Cl\,(S) \rightleftharpoons Ag^{+} + Cl^{-}$

$[Ag^{+}] = S;\ [Cl^{-}] = S$

$k_{sP} = [Ag^{+}]\,[Cl^{-}]$

$2.8 \times 10^{-10} = s \times s$

Or $S = \sqrt{2.8x10^{-10}}$

$= \underline{\underline{1.673x10^{-5}}}$ mol^{-1}

Ans 9. Basic buffer

$Na_2B_4O_7$ + Na OH

Borax sodium hydroxide.

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (Redox Reactions)

Topic : Oxidation and Reduction Reactions

1. Define oxidation reaction? [1]

2. Define reduction reaction? [1]

3. In the reactions given below, identify the species undergoing oxidation and reduction. [1]

   $H_2S\ (g) + Cl_2\ (g) \rightarrow 2HCl\ (g) + S\ (S)$

4. What is the most essential conditions that must be satisfied in a redox reaction? [1]

5. In the reaction [1]

   $MnO_2 + 4HCl \rightarrow Mn\ Cl_2 + Cl_2 + 2H_2O$

   Which species is oxidized?

6. Why the following reaction is an example of oxidation reaction? [1]

   $CH_4\ (g) + 2O_2\ (g) \rightarrow CO_2\ (g) + 2H_2O$

7. Explain why [3]

   $3Fe_3O_4\ (S) + 8Al(S) \rightarrow 9Fe\ (S) + 4Al_2O_3$

   Is an oxidation reaction. ?

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (Redox Reactions)

Topic :Oxidation and Reduction Reactions [ANSWERS]

Ans 1. Addition of oxygen /electronegative element to a substance or removal of hydrogen / electropositive element from a substance.

Ans 2. Removal of oxygen / electronegative element form a substance or addition of hydrogen / electropositive element to a substance.

Ans 3. H_2S is oxidized because a more electronegative element, Chlorine is added to hydrogen (or more electropositive element hydrogen has been removed from S). Chlorine is reduced due to addition of hydrogen to it.

Ans 4. In a redox reaction, the total number of electrons lost by the reducing agent must be equal to the number of electrons gained by the oxidizing agent.

Ans 5. HCl is oxidized to Cl_2.

Ans 6. Methane is oxidized owing to the addition of oxygen to it.

Ans 7. Aluminum is oxidized because oxygen is added to it Ferrous ferric oxide (Fe_3O_4) is reduced because oxygen has been removed from it.

CBSE TEST PAPER 02

CLASS XI CHEMISTRY (Redox Reactions)

Topic : Redox Reactions in terms of Electron Transfer reactions

1. Define oxidation in terms of electron transfer. [1]

2. What is meant by reduction? [1]

3. Define an oxidizing agent. Name the best reducing agent. [1]

4. What is meant by reducing? Name the best reducing agent. [1]

5. What is the oxidation number of Mn in $KMnO_4$? [1]

6. What happens to the oxidation number of an element in oxidation? [1]

7. Name one compound in which oxidation number of Cl is + 4. [1]

8. Indicate the oxidizing and reducing agents in the following reaction : [?]

   $2Cu^{2+} + 4I^{-} \rightarrow 2CuI + I_2$.

9. A metal ion M^{3+} loses 3 electrons. What will be its oxidation number? [1]

10. Find the oxidation state of sulphur in the following compounds : [5]

    H_2S, H_2SO_4, $S_2O_4^{2-}$, $S_2O_8^{2-}$ and HSO_3^{-}.

CBSE TEST PAPER 02

CLASS XI CHEMISTRY (Redox Reactions)

Topic : Redox Reactions in terms of Electron Transfer reactions [ANSWERS]

Ans 1. Oxidation is a process in which loss of electrons takes place.

Ans 2. Reduction is a process in which gain of electrons take place.

Ans 3. Oxidising agent is a substance which can gain electrons easily. F_2 is the best oxidizing agent.

Ans 4. Reducing agent is a substance which can lose electrons easily. Li is the best reducing agent.

Ans 5. Let oxidation number of Mn be x

$1 + x + 4(-2) = 0$

$X = \underline{\underline{+7}}$

Ans 6. It increases.

Ans 7. ClO_2

Ans 8. Cu^{2+} : Oxidising agent

I^- : Reducing agent.

Ans 9. Oxidaton number changes from +3 to + 6.

Ans 10 In H_2S

$2 + x = o$

$X = -2$

In HSO_3^-

$+ 1 + x - 6 = -1$

or $x-5 = -1$

or $x = +4$

In H_2SO_4

$+2 + x - 8 = 0$

Or $x = + 6$

In $S_2O_5^{2-}$

There is peroxide linkage, thus

oxidation state of S is $\underline{\underline{6}}$

In $S_2O_4^{2-}$

$2x - 8 = -2$

$2x = 6$

$X = +3$

CBSE TEST PAPER 03

CLASS XI CHEMISTRY (Redox Reactions)

Topic : Types of Redox Reduction

1.	Name the different types of reductions.	[2]
2.	Identify the type of redox reaction this reaction follows. $3Mg\ (S) + N_2\ (g) \xrightarrow{\Delta} Mg_3N_2\ (S)$	[1]
3.	The displacement reactions of Cl, Br, I using fluorine are not generally carried out in aqueous solution. Give reason.	[1]
4.	Which is the strongest oxidizing agent?	[1]
5.	Why F^- ions Cannot be converted to F_2 by chemical means?	[1]
6.	Define disproportionation reaction.	[1]
7.	Why ClO_4^- does not show disproportionation reaction where as ClO^-, ClO_2^- , ClO_3^- shows?	[2]
8.	Identify the reaction $2H_2O_2\ (aq) \rightarrow 2H_2O(e) + O_2\ (g)$	[1]
9.	Which gas is produced when less reactive metals like Mg and Fe react with steam?	[1]
10.	All decomposition reactions are not redox reactions. Give reason.	[1]

CBSE TEST PAPER 03

CLASS XI CHEMISTRY (Redox Reactions)

Topic : Types of Redox Reduction [ANSWERS]

Ans 1. The different types of redox reactions are

(i) Combination reactions

(ii) Decomposition reactions

(iii) Displacement reactions

(iv) Disproportionation reactions.

Ans 2. The above equation represents a combination reaction.

Ans 3. Fluorine is so reactive that it can replace chloride bromide and iodide ions in solution and it attacks water and displaces the oxygen of water.

Ans 4. Fluorine is the strongest oxidizing agent.

Ans 5. F- ions cannot be converted to F_2 by chemical means because fluorine is the strongest oxidizing agent.

Ans 6. In a disproportionation reaction an element in one oxidation state is simultaneously oxidized and reduced.

Ans 7. ClO_4^- does not disproportionate because in this oxoanion chlorine is present in its highest oxidation state that is +7 whereas in ClO^-, ClO_2^- and ClO_3-, chlorine exists in + 1, +3 and +5 respectively.

Ans 8. The decomposition of hydrogen peroxide is an example of disproportionation reaction where oxygen experiences disproportionation reaction.

$$\overset{+-1}{2H_2O_2} \rightarrow \overset{+1\ -2}{2H_2O} + \overset{O}{O_2}$$

Ans 9. Less reactive metals such as Mg and fFe react with steam to produce dihydrogen gas

$Mg + 2H_2O \xrightarrow{\Delta} Mg(OH)_2 + H_2$ $\quad$ $Fe + 3H_2O \xrightarrow{\Delta} Fe_2O_3 + 3H_2$.

Ans10. Decomposition of calcium carbonate is not a redox reaction

$$\overset{+2\ +4\ -2}{CaCO_3(S)} \xrightarrow{\Delta} \overset{+2\ -2}{CaO(S)} + \overset{+4\ (-2)}{CO_2}(g).$$

CBSE TEST PAPER 04

CLASS XI CHEMISTRY (Redox Reactions)

Topic : Balancing of Redox Reactions

1. Balance the following equations by oxidation number method: [4]

    (i) $CuO + NH_3 \rightarrow Cu + N_2 + H_2O$

    (ii) $K_2\,MnO_4 + H_2O \rightarrow MnO_2 + KMnO_4 + KOH$

2. How would you know whether a redox reaction is taking place in an acidic / alkaline or neutral medium? [1]

3. Write the following redox reactions in the oxidation and reduction half reaction reactions in the oxidation and reduction half reactions. [2]

    (i) $2K(S) + Cl_2(g) \rightarrow 2KCl\ (S)$

    (ii) $2Al\ (S) + 3Cu^{2+}\ (aq)\ \ 2Al^{3+}\ (aq) + 3Cu(S)$

4. Complete the following redox reactions and balance the following equations- [1]

    (i) $Cr_2O_7^{2-} + C_2O_4^{2-} \rightarrow Cr^{3+} + CO_2$ (in presence of acid)

    (ii) $Sn^{2+} + Cr_2O_7^{2-} \rightarrow Sn^{4+} + Cr^{3+}$ (in presence of acid)

5. Write correctly the balanced half – reaction and the overall equations for the following skeletal equations. [1]

    (i) $NO_3^- + Bi(S) \rightarrow Bi^{3+} + NO_2$ (in acid solution)

    (ii) $Fe\ (OH)_2\ (S) + H_2O_2 \rightarrow Fe\ (OH)_3(S) + H_2O$ (in basic medium)

CBSE TEST PAPER 04

CLASS XI CHEMISTRY (Redox Reactions)

Topic : Balancing of Redox Reactions [ANSWERS]

Ans 1. (i) Skeleton of equation $\overset{+2}{Cu}O + \overset{-3}{N}H_3 \rightarrow \overset{o}{Cu} + \overset{o}{N_2} + \overset{-2}{H_2O}$

Oxidation number of copper decreases from +2 to O and ox no of Nitrogen increases from – 3 to 0.

In order to balance the increase of O.N with decease of O. N there should be three atoms of copper and two atoms of nitrogen. Hence $3CuO + 2NH_3 \rightarrow 3Cu + N_2 + H_2O$

Balancing hydrogen and oxygen atoms we have $3\,CuO + 2\,NH_3 \rightarrow 3Cu + N_2 + 3H_2O$

(ii) Writing $K_2\,MnO_4$ twice O.N of Mn, we have the skeleton of the equation

$K_2\overset{+6}{Mn}O_4 + K_2\overset{+6}{Mn}O_4 + H_2O \rightarrow \overset{+4}{Mn}O_2 + K\overset{+7}{Mn}O_4 + KOH$

O.N of Mn in 1 mol k_2MnO_4 decreases from + 6 to + 4 (MnO_2) and in the other mol increases from +6 to +7 (KMnO4) i.e. 1 mol acquires two electrons while the other loses 1 electrons .

In order to balance the O. N of Mn, 1 mol. K_2MnO_4 and $kMnO_4$ are multiplied by 2.

Hence $K_2MnO_4 + 2K_2MnO_4 + H_2O \rightarrow MnO_2 + 2KMnO_4 + KOH$

In order to balance the number of K and H atoms KOH is multiplied by 4 and H2O by 2. $3K_2MnO_4 + 2H_2O \rightarrow MnO_2 + 2KMnO_4 + 4KOH$

Ans 2. If H^+ or any acid appears on either side of the chemical equation, the reaction takes place in the acidic solution.

If OH^- or any base, appears on either side of the chemical equation, the solution is basic. If neither H^+, OH^- nor any acid or base is present in the chemical equation, the solution is neutral.

Ans 3. (i) $K(S) \rightarrow K^+(aq) + e$ (oxidation)

$Cl_2(g) + 2e^- \rightarrow 2Cl^-$ (reduction)

(ii) $Al\,(S) \rightarrow Al^{3+}(aq) + 3e^-$ (oxidation)

$Cu^{2+} + 2e \rightarrow Cu\,(S)$ (reduction)

Ans 4. (i) $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$

$[C_2O_4^{2-} \rightarrow 2CO_2 + 2e^-] \times 3$

$Cr_2O_7^{2-}\ 14H^+ + 3C_2O_4^{2-} \rightarrow 2Cr^{3+} + 6\ CO_2 + 7H_2O$

(ii) $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$

$[Sn^{2+} \rightarrow Sn^{4+} + 2e^-] \times 3$

$Cr_2O_7^{2-} + 3Sn^{2+} + 14H^+ \rightarrow 2Cr^{3+} + 3Sn^{4+} + 7H_2O$

Ans 5. (i) In this reaction, H+ ions are available.

Therefore,

Oxidation half reaction $Bi\ (S)\ Bi^{3+} + 3e^-$

Reduction half reaction $[NO_3^- + 2H^+ + e^- \rightarrow NO_2 + H_2O\ ] \times 3$

Balanced equation $Bi\ (S) + 3NO_3^- + 6H^+ \rightarrow Bi^{3+} + 3NO_2 + 3H_2O$

(ii) $Fe(OH)_2\ (S) + H_2O_2 \rightarrow Fe\ (OH)_3\ (S) + H_2O$

The solution is basic. Therefore, OH- are involved in the reaction, Then

Oxidation half – reduction $[Fe\ (OH)_2 + OH^- \rightarrow Fe\ (OH)_3 + e^-] \times 2$

Reduction half reaction $H_2O_2 + 2e^- \rightarrow 2OH^-$

Balanced equation $2Fe\ (OH)_2 + H_2O_2 \rightarrow 2Fe(OH)_3$.

CBSE TEST PAPER 05

CLASS XI CHEMISTRY (Redox Reactions)

Topic : Redox Reactions and Electrode Processes

1. Define half – cell. [1]

2. Set up an electrochemical cell for the redox reaction [1]

   $Ni^{2+}(aq) + Fe(S) \rightarrow Ni(S) + Fe^{2+}(aq)$

3. Can we store copper sulphate in an iron vessel? [1]

4. What is the role of a salt bridge in an electro chemical cell? [1]

5. An electrochemical cell is constituted by combining Al electrode (E^0 = - 1.66v) and Cu electrode (E^0 = + 0.34v). Which of these electrodes will work as cathode and why? [2]

6. The E^0 of Cu^{2+} / Cu is + 0.34V. What does it signify? [2]

7. If reduction potential of an electrode is 1.28V. What will be its oxidation potential? [2]

8. What is the electrode potential of a standard hydrogen electrode? [2]

9. Which reaction occurs at cathode in a galvanic cell? [1]

10. Define a redox couple. [2]

CBSE TEST PAPER 05

CLASS XI CHEMISTRY (Redox Reactions)

Topic : Redox Reactions and Electrode Processes [ANSWERS]

Ans 1. Combination of an electrode and the solution in which it is dipped is called a half – cell.

Ans 2. Fe (S) / Fe^{2+}(aq) || Ni^{2+} (aq) / Ni(S)

Ans 3. We cannot store $CuSO_4$ in an iron vessel because iron is more reactive than Cu and thus holes will be developed in iron vessel.

Cu^{2+} (aq) + Fe(S) $\rightarrow$ Fe^{2+} (aq) + Cu(S)

Ans 4. To complete the electric circuit without mixing the two solution of two half cells. It avoids the accumulation of electric charges in two half – cells.

Ans5. Since the electrode potential of Cu is higher than that of Al, therefore, Cu has a higher tendency to get reduced and hence Cu electrode acts as a cathode.

Ans 6. Cu lies below hydrogen in the activity series.

Ans 7. - 1. 28V.

Ans 8. Zero.

Ans 9. Reduction.

Ans 10. A redox couple is defined as having together oxidized and reduced forms of a substance taking part in an oxidation and reduction half – reaction.

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (Hydrogen)

Topic: Properties and preparation of hydrogen

1. Which isotope of hydrogen [1]

   (i) does not contain neutron?

   (ii) is radioactive?

2. Give the electronic configuration of hydrogen [1]

3. Why does hydrogen occupy unique position in the periodic table? [2]

4. Name the isotopes of hydrogen. [1]

5. Give the main characteristics of isotopes. [2]

6. What is syn-gas? [1]

7. What is coal gasification? [1]

8. Give the laboratory method of preparation of hydrogen. [1]

9. Give the commercial method of preparation of dihydrogen. [1]

10. What is water – gas shift reaction? [1]

CBSE TEST PAPER 01
CLASS XI CHEMISTRY (Hydrogen)
Topic: Properties and preparation of hydrogen [ANSWERS]

Q1.Ans. (i) Protium

(ii) Tritium

Q2.Ans. 1s'

Q3.Ans. Inspite of the fact that hydrogen, to a certain extent resembles both with alkali metals (ns') and halogens (ns^2 np^5), it differs from them as well. Hydrogen has very small size as a consequence H^+ does not exist freely and is always associated with other atoms or molecules. Thus, it is unique in behaviors and is therefore, best placed separately in the periodic table.

Q4.Ans. Hydrogen has three isotopes:

Protium, ${}_{1}^{1}H$

deuterium, ${}_{1}^{2}H$

tritium, ${}_{1}^{3}H$

Q5.Ans. Since, the isotopes have the same electronic configuration, they have almost the same chemical properties. The only difference is in their rates of reactions, mainly due to their different enthalpy of bond dissociation. However, in physical properly of these isotopes differ considerably due to their large mass differences.

Q6.Ans. Mixture of CO and H_2 is used for the synthesis of methanol and a number of hydrocarbons it is also called synthesis gas or 'syngas'

Q7.Ans. The process of producing syn gas from coal is called 'coal gasification.

$$C(s)+H_2O(g)\xrightarrow{1270k}CO(g)+H_2(g).$$

Q8Ans. Hydrogen is usually prepared by the reaction of granulated zinc with dilute hydrochloric acid

$Zn + 2H^{+} \rightarrow Zn^{2+} + H_2.$

Q9.Ans. Electrolysis of acidified water using platinum electrodes give hydrogen.

$$2H_2O(l) \xrightarrow[\text{Traces of acid / base}]{\text{Electrolysis}} 2H_2(g) + O_2(g)$$

H^{+}/OH^{-}

Q10.Ans. The production of dihyrogen can be increased by reacting carbon monoxide of syn gas mixtures with steam in the presence of iron chromate as catalyst.

$$CO(g) + H_2O\ (g) \xrightarrow[\text{Catalyst}]{673k} CO_2(g) + H_2(g)$$

This is called water gas – shift reaction.

CBSE TEST PAPER 02

CLASS XI CHEMISTRY (Hydrogen)

Topic: Properties of Dihydrogen

1.	Why is dihydrogen gas not preferred in balloons?	[?]
2.	What is the pH of water?	[1]
3.	How is methrol prepared using dihydrogen?	[1]
4.	How is ammonia prepared using dihydrogen?	[1]
5.	How can the production of dlhydrogen obtained from ‘coal gasification be increased’?	[2]
6.	Why is dihydrogen used an fuel cells for generating electrical energy?	[2]
7.	What is understood by hydrogenation?	[2]
8.	Which fuel is used as a rocket fuel?	[2]

CBSE TEST PAPER 02

CLASS XI CHEMISTRY (Hydrogen)

Topic: Properties of Dihydrogen [ANSWERS]

Q1.Ans. Dihydrogen is the lightest gas and should have been used in balloons. But it is not preferred due to its highly combustible nature.

Q2.Ans. The pH value of water is 7.

Q3.Ans. CO on reacting with dihydrogen yields bulk amount of methanol.

$$CO(g) + 2H_2(g) \xrightarrow[\text{Catalyst}]{\text{Cobalt}} CH_3OH(l)$$

Q4.Ans. With dinitrogen it form ammonia.

$$3H_2(g) + N_2(g) \xrightarrow[\text{Fe}]{\text{673k, 200atm}} 2NH_3(g)$$

This is the method for the manufacture of ammonia by the Haber process.

Q5.Ans. By reacting carbon monoxide of syngas mixtures with steam in the presence of iron chromate as catalyst

$$CO(g) + H_2O(g) \xrightarrow[\text{Catalyst}]{\text{673k}} CO_2(g) + H_2(g)$$

Q6.Ans. Because it does not produce any pollution and releases greater energy per unit mass of fuel in comparison to gasoline or any other fuel.

Q7.Ans. Hydrogenation is used for the conversion of polyunsaturated oils into edible fats.

Q8.Ans. Dihydrogen is used as a rocket fuel in space research.

CBSE TEST PAPER 03

CLASS XI CHEMISTRY (Hydrogen)

Topic: Hydrides

1. Name the categories into which hydrides are categorized. [1]

2. What are hydrides? [1]

3. Give an example of each of an ionic hydride and a covalent hydride. [1]

4. What happens when water is added to calcium hydride? [1]

5. Give an example of electron – deficient hydride. [1]

6. What is the behavioral similarity between NH_3, H_2O HF compounds? [1]

7. What happens when sodium hydride reacts with water? [2]

8. What is the geometry of the compound formed by group 14 to form molecular hydride? [2]

9. What are the characteristic features of ionic or saline hydrides? [2]

10. Which gas is produced on electrolysis of ionic hayride? [2]

CBSE TEST PAPER 03

CLASS XI CHEMISTRY (Hydrogen)

Topic: Hydrides [ANSWERS]

Q1.Ans. The hydrides are classified into three categories -

(i)Ionic or saline or salt like hydrides.

(ii) Covalent or molecular hydrides

(iii) Metallic or non-stoichiometric hydrides.

Q2.Ans. Dihydrogen under certain reaction conditions combines with almost all elements, except noble gases, to form binary compounds, called hydrides.

Q3.Ans. Ionic hydride: LiH, NaH Covalent hydride CH_4, NH_3 and H_2O

Q4.Ans. Calcium hydroxide is formed $CaH_2 + H_2O \rightarrow Ca(OH)_2$

(Calcium hydride) Calcium hydroxide

Q5.Ans. Diborane.

Q6.Ans. They behave as Lewis is bases i.e. electron donors. The presence of lone pairs on highly electronegative atoms like N, O and F in hydrides results in hydrogen bond formation between the molecules.

Q7.Ans. Saline hydride (sodium hydride) react violently with water producing dihydrogen gas $NaH(s) + H_2O(aq) \rightarrow NaOH(aq) + H_2(g)$.

Q8.Ans. Tetrahedral in structure.

Q9.Ans. The ionic hydrides are crystalline, non – volatile non – conducting in solid state. However their melts conduct electricity.

Q10.Ans. Dihydrogen gas is produced at the anode on electrolysis of ionic hydride.

CBSE TEST PAPER 04

CLASS XI CHEMISTRY (Hydrogen)

Topic: Water

1. Give a reaction in which water acts as an oxidizing agent. [1]

2. Write the Name of a zeolite used in softening of hard water. [1]

3. Define hard water. [1]

4. How does H^+ ion forms hydronium ion (OH_3^+) in water? [2]

5. Show with reaction the amphoteric nature of water. [2]

6. Why is ice less dense then water and what kind of attractive forces must be overcome to melt ice? [2]

7. Why does hard water not form lather with soap? [2]

8. Why is water an excellent solvent for ionic or polar substances? [2]

9. What is calgon? [1]

10. How many hydrogen – bonded water molecule are associated in $CuSO_4.\ 5H_2O$? [2]

CBSE TEST PAPER 04

CLASS XI CHEMISTRY (Hydrogen)

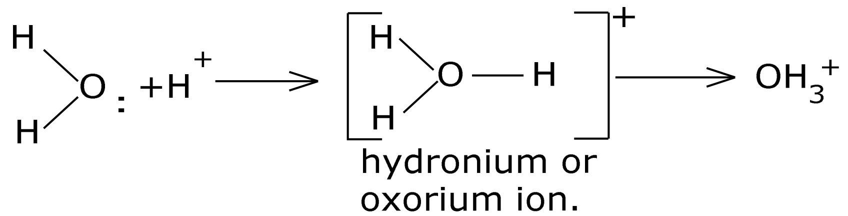
Topic: Water [ANSWERS]

Q1.Ans. $Na + H_2O \rightarrow NaOH + \frac{1}{2}H_2.$

Q2.Ans. Sodium aluminum silicate $Na_2Al_2Si_2O_8$. X H_2O.

Q3.Ans. Water which does not produce lather with soap solution readily is called hard water. eg. hand pump water, river water, sea water etc.

Q4.Ans. In water H^+ ion forms a covalent bond with H_2O and forms hydronium ion, (OH_3^+).



Q5.Ans. Water acts as an acid with NH_3 and base with H_2S

$$H_2O(i) + NH_3(aq) \rightleftharpoons OH^- + (aq) + NH_4^+(aq)$$

$$H_2O(i) + H_2S(aq) \rightleftharpoons H_3O^+(aq) + HS^-(aq).$$

Q6.Ans. The structure of ice is an open structure having a number of vacant spaces. Therefore, the density of ice is less than water. When ice melts the hydrogen bonds are broken and the water molecules go in between the vacant spaces. As a result, the structure of liquid water is less open than structure of ice. Thus ice is less dense than water.

Q7.Ans. Hard water does not produce lather with soap readily because the cations (Ca^{2+} and Mg^{2+}) present in hard water react with soap to precipitate of calcium and magnesium salts of fatly acids.

$$M^{2+} + 2C_{17}H_{35}COONa \rightarrow \left(C_{17}H_{35}COO\right)_2 M + 2Na^{+}$$

From hard water   sodium serrate Metal serrate

Q8.Ans. Water is a polar solvent with a high dielectric constant. Due to high dielectric constant of water the force of attraction between cation and anion gets weakened. Thus water molecules are able to remove ions from the lattice site using in dipole forces easily.

Q9.Ans. Sodium hexameta phosphate ($Na_6P_6O_{18}$) is commercially called calgon.

Q10.Ans. Only one water molecule, which is outside the brackets (coordinator spheres), is hydrogen bonded. The other four molecules of water are co-ordinated.

CBSE TEST PAPER 05

CLASS XI CHEMISTRY (Hydrogen)

Topic: Hydrogen Peroxide (H_2O_2)

1. Why is H_2O_2 a better oxidant than water? [1]

2. What happens when H_2O_2 reacts with acidified $KMnO_4$? [2]

3. What happens when H_2O_2 reacts with ethylene? [1]

4. What do you mean by 100 volume of hydrogen peroxide? [1]

5. Hydrogen peroxide acts as oxidizing agent as well as a reducing agent. Why? [2]

6. Why is hydrogen peroxide stored in wax-lined glass or plastic vessels in dark? [2]

7. What is the volume strength of 2M-H_2O_2? [2]

8. Calculate the strength in volumes of a solution containing 30.36 g/l of H_2O_2. [2]

9. What happens when hydrogen peroxide reacts with acidified $K_2Cr_2O_7$? [2]

10. What happens when BaO_2 is treated with phosphoric acid? [1]

CBSE TEST PAPER 05

CLASS XI CHEMISTRY (Hydrogen)

Topic: Hydrogen Peroxide (H_2O_2) [ANSWERS]

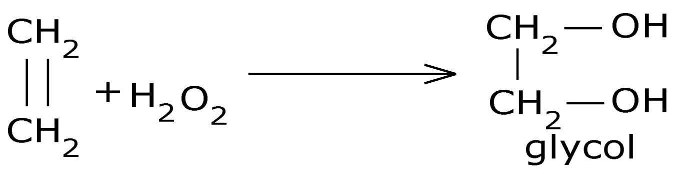
Q1.Ans. H_2O_2 is easily reduced to form O and H_2O.

$H_2O_2 \rightarrow H_2O + O.$

Q2.Ans. Reducing property of H_2O_2 is observed.

$2MnO_4^- + 6H^+ + 5H_2O_2 \rightarrow 2Mn^{2+} + 8H_2O + 5O_2$

Q3.Ans.



Q4.Ans. It means that one milliliter of 30% H_2O_2 solution will give 100v of oxygen at STP

Q5.Ans. Hydrogen peroxide can act as an oxidizing agent because it readily decomposes to evolve oxygen and also take up oxygen from water.

Q6.Ans. H_2O_2 decomposes slowly on exposure to light

$2H_2O_2 \rightarrow 2H_2O(l) + O_2(g)$

In the presence of metal surfaces or traces of alkali (present in glass containers), the above reaction is catalyzed.

Q7.Ans. Since 1M – H_2O_2 solution contains 17g H_2O_2

∴ 2 M – H2O2 solution contains 34g of H_2O_2

But 68g of H_2O_2 contains = $\frac{22400x34}{68}$

= 11200ml of O_2 at NTP

Thus 1000ml of H_2O_2 soln. gives off O_2 = 11200ml at NTP

Hence 1 ml of H_2O_2 soln gives off

$$= \frac{11200}{1000} = 11.2ml$$

Thus volume strength of H_2O_2 = $\underline{\underline{11.2}}$

Q8.Ans. $2H_2O_2 \rightarrow 2H_2O + O_2$

22.4l at NTP

68g of H_2O_2 produce 22.4 l O2 at NTP

30.36g of H_2O_2 produce = $\frac{22.4}{08} x30.36$

= 10l O_2 at NTP

∴ volume strength = 10 volumes.

Q9.Ans. Acidified $K_2Cr_2O_7$ is oxidized to blue peroxide of chromium (Cr_2O_3) which is unstable.

However, it is soluble in ether and produces blue colored solution.

$$K_2Cr_2O_7 + 4H_2SO_4 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + 4H_2O + 3(O)$$

$$[H_2O_2 + O \rightarrow H_2O + O_2] \times 3$$

$$\underset{\text{Orange}}{K_2Cr_2O_7} + 4H_2SO_4 + 3H_2O_2 \rightarrow K_2SO_4 + \underset{\text{green.}}{Cr_2(SO_4)_3} + 7H_2O + SO_2$$

Q10.Ans. H_2O_2 is obtained

$$3BaO_2 + 2H_3PO_4 \rightarrow Ba_3(PO_4)_2 \downarrow + \underline{3H_2O_2}$$

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (The s-Block Elements)

Topic: Group 1 Elements: Alkali Metals

1. Why is Group I elements known as the most electropositive element? [1]

2. Why is lithium salts mostly hydrated? [1]

3. Why are melting and boiling points of alkali metals low? [1]

4. What do you mean by diagonal relationship in the periodic table? [1]

5. Why is lithium kept under kerosene oil? [1]

6. Why are lithium halides covalent in nature? [2]

7. What makes lithium show properties different from rest of the alkali metals? [2]

8. Why do alkali metals and salts impart color to an oxidizing flame? [2]

9. What type of oxide is made by sodium? [2]

10. Why is potassium lighter than sodium? [2]

11. Name the lightest metal. [1]

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (The s-Block Elements)

Topic: Group 1 Elements: Alkali Metals [ANSWERS]

Q1.Ans. The loosely held s-electron in the outermost valence shell of these elements makes them the most electropositive metals. They readily lose electron to give monovalent H^+ ions.

Q2.Ans. Li^+ has maximum degree of hydration and for this reason lithium salts are mostly hydrated eg. LiCl, $2H_2O$.

Q3.Ans. The melting and boiling points of the alkali metals are low indicating weak metallic bonding due to the presence of only a single valence electron in them.

Q4.Ans. The diagonal relationship is due to the similarity in ionic sizes and /or charge / radius ratio of the elements.

Q5.Ans. Because of their high reactivity towards air and water, they are normally kept in kerosene oil.

Q6.Ans. Lithium halides are covalent because of the high polarization capability of lithium ion The Li^+ ion is very small is size and has high tendency to distort electron cloud around the negative halide ion.

Q7.Ans. Lithium is a small atom and it forms smaller Li^+. As a result, it has very high charge to radius ratio. This is primarily responsible for the anomalous behavior of lithium.

Q8.Ans. This is because the heat from the flame excites the outer orbital electron to a higher energy level.

Q9.Ans. Sodium mostly form peroxide when reacted with oxygen

$$2Na + O_2 \rightarrow Na_2O_2(peroxide)$$

Q10.Ans. Potassium is lighter than sodium probably because of an unusual increase in atomic size of potassium.

Q11.Ans. Lithium is the lithest known metal (density 0.534g (em^3)

CBSE TEST PAPER 02

CLASS XI CHEMISTRY (The s-Block Elements)

Topic: General Characteristics of the Compounds of the alkali metals

1. Why alkali metal hydroxides are make the strongest bases? [1]

2. Why are peroxides and super oxides stable in comparison to other oxides? [1]

3. Name the anomalous properties of lithium. [1]

4. Why are lithium compounds soluble in organic solvents? [1]

5. Name the alkali metals that form super oxides when heated in excess of air. [2]

6. Write a reaction to show that bigger cat ions stabilize bigger anions. [2]

7. Lithium shows similarities with magnesium in its chemical behavior. What is the cause of these similarities? [2]

8. Why metals like potassium and sodium can not be extracted by reduction of their oxides by carbon? [2]

Topic: General Characteristics of the Compounds of the alkali metals [ANSWERS]

Q1.Ans. The alkali metal hydroxides are the strongest of all bases because the dissolve freely in water with evolution of much heat on account of intense hydration.

Q2.Ans. The stability of peroxides and super oxides is due to the stabilization of large anions by larger cat ions through lattice energy effects.

Q3.Ans. The anomalous behaviors of lithium is due to the following-

(i) Exceptionally small size of its atom and ion., Li^+

(ii) High polarizing power (I, e; charge / radius radio)

Q4.Ans. Due to high polarizing power, there is increased covalent character of lithium compounds which is responsible for their solubility in organic solvents.

Q5.Ans. Potassium, rubidium and caesium form super oxides when heated in excess of air.

Q6.Ans. In the reaction

$LiI + KF \rightarrow LiF + KI,$

The larger Cation K^+ stabilizes the larger anion I^-

Q7.Ans. Due to (diagonal relationship)

(i) Similarity in atomic size

(ii) Similar charge to size ratio.

Q8.Ans. Potassium and sodium are strong electropositive metals and have great affinity for oxygen than that of carbon. Hence they Cannot be extracted from their oxides by reduction with carbon.

CBSE TEST PAPER 03

CLASS XI CHEMISTRY (The s-Block Elements)

Topic: Some Important compounds of sodium

1.	How is sodium carbonate prepared?	[1]
2.	Give the important uses of sodium carbonate.	[2]
3.	What is sodium amalgam?	[1]
4.	Why is sodium hydrogen carbonate known as baking powder?	[1]
5.	Why does table salt get wet in rainy season?	[1]
6.	What is the difference between baking soda and baking powder?	[2]
7.	Which compound of sodium is used: (i) as a component of baking powder. (ii) for softening hard water.	[2]
8.	What is the formula of soda ash?	[1]
9.	Give two uses of sodium carbonate?	[2]
10.	Solution of $Na_2\,CO_3$ is alkaline. Give reason.	[2]

CBSE TEST PAPER 03

CLASS XI CHEMISTRY (The s-Block Elements)

Topic: Some Important compounds of sodium [ANSWERS]

Q1.Ans. Sodium carbonate is generally prepared by Solvay's process.

Q2.Ans. (i) It is used in water softening laundering and cleaning
(ii) It is used in the manufacture of glass, soap, borax and caustic soda.

Q3.Ans. Sodium metal discharged at the cathode combines with mercury to form sodium amalgam.

Q4.Ans. Sodium hydrogen carbonate is known as baking soda because it decomposes on heating to generate bubbles of CO_2 (leaving holes in cakes and bread)

Q5.Ans. Table salts contains impurities of $CaCl_2$ and $MgCl_2$ which being deliquescent compounds absorbs moisture from the air in rainy reason.

Q6.Ans. Baking soda is sodium bicarbonate ($NaHCO_3$). Which baking powder is a mixture of sodium bicarbonate ($NaHCO_3$) and potassium hydrogen tartar ate.

Q7.Ans. (i) $NaHCO_3$ (ii) Na_2CO_3

Q8.Ans. Na_2CO_3

Q9.Ans. (i) It is used in the manufacture of soap, glass, paper, borax and caustic soda etc.
(ii) It is used in textile industry and also in petroleum refining.

Q10.Ans. The solution of Na_2CO_3 is alkaline in nature because when Na_2CO_3 is treated with water, it gets hydrolyzed to form an alkaline solution:

$$CO_3^{2-} + H_2O \rightarrow HCO_3^- + OH^-$$

CBSE TEST PAPER 04

CLASS XI CHEMISTRY (The s-Block Elements)

Topic: Group 2 : Alkaline Earth Metals

1. Name the elements present in Group 2 [2]

2. The atomic radii of alkaline earth metals are smaller than those of the corresponding alkali metals. Explain why? [2]

3. Why do alkaline earth metals have low ionization enthalpy? [1]

4. The second ionization enthalpy of calcium is more than the first. How is that calcium forms $CaCl_2$ and not CaCl give reasons. [2]

5. State one reason for alkaline earth metals in general having a greater tendency to form complexes than alkali metals. [1]

6. Name the metal amongst alkaline earth metals whose salt do not impart colour to a non-luminous flame. [2]

7. Compounds of alkaline earth metals are more extensively hydrated than those of alkali metals. Give reason. [1]

8. The melting and boiling points of alkaline metals are higher than alkali metals. Give reason. [1]

9. Which member of the alkaline earth metals family has: [2]

   (i) least reactivity (ii) lowest density (iii) highest boiling point

   (iv) maximum reduction potential

10. The alkaline earth metals are called s – block elements. Give reasons. [2]

CBSE TEST PAPER 04

CLASS XI CHEMISTRY (The s-Block Elements)

Topic: Group 2 : Alkaline Earth Metals [ANSWERS]

Q1.Ans. Beryllium, Magnesium, Calcium, Strontium, Barium and Radium.

Q2.Ans. The atomic and ionic radii of the alkaline earth metals are smaller than those of the corresponding alkali metals in the same period because of the increased nuclear charge in there elements.

Q3.Ans. The alkaline earth metals have low iodization enthalpies due to fairly large size of atoms.

Q4.Ans. The higher value of second ionization enthalpy is more than compensated by the higher enthalpy of hydration of Ca^{2+}. Therefore formation of $CaCl_2$ becomes more favorable than CaCl energetically.

Q5.Ans. Because of small size and high charge, the alkaline earth metals have a tendency to form complexes.

Q6.Ans. Beryllium does not impart colour to a non-luminous flame.

Q7.Ans. The hydration enthalpies of alkaline earth metal ions are larger than those of alkali metal ions.

Q8.Ans. The melting and boiling points of these metals are higher than the corresponding alkali metals due to smaller sizes.

Q9.Ans. (i) Be (ii) Ca (iii) Be (iv) Be

Q10.Ans. Alkaline earth metals are called s – block elements because the last electron in their electronic configuration occupies the s – orbital of their valence shells.

CBSE TEST PAPER 05

CLASS XI CHEMISTRY (The s-Block Elements)

Topic: General Characteristics of Compounds of the Alkaline Earth Metals.

1. What is the nature of oxide formed by Be? [1]
2. Why does beryllium show similarities with Al? [1]
3. Why is Calcium preferred over sodium to remove last traces of moisture from alcohol? [2]
4. Why is beryllium carbonate unusually unstable thermally as compared to the other carbonates of this group? [1]
5. Name the metal amongst alkaline earth metals whose salt do not impart colour to a non – luminous flame. [2]
6. Why sulphates of Mg and Be soluble in water? [1]
7. Why does the solubility of alkaline earth metal hydroxides in water increase down the group? [2]
8. Why beryllium is not attacked by an acid easily? [1]
9. Give the reaction of magnesium with air? [2]
10. Beryllium is reducing in nature. Why? [2]

CBSE TEST PAPER 05

CLASS XI CHEMISTRY (The s-Block Elements)

Topic: General Characteristics of Compounds of the Alkaline Earth Metals. [ANSWERS]

Q1.Ans. BeO is amphoteric while oxides of other elements are ionic in nature.

Q2.Ans. Because of their similarity in charge / radius ratios

$\left(Be^{2+}, 2/31 = 0.064 \text{ and } \mathrm{Al}^{3+}, 3/50 = 0.66.\right)$.

Q3.Ans. Both sodium and calcium react with water forming their respective hydroxides. In contrast, sodium reacts with alcohol to form sodium alkoxide but Ca does not.

Q4.Ans. This is due to strong polarizing effect of small Be^{2+} on the larger and more polarizable CO_3^{2-} anions.

Q5.Ans. Beryllium does not impart colour to a non – luminous flame.

Q6.Ans. The greater hydration enthalpies of Be^{2+} and Mg^{2+} ions overcome the lattice enthalpy factor and therefore their sulphates are soluble in water.

Q7.Ans. Among alkaline earth metal hydroxides, the anion being common the cationic radius coil influence the lattice energy since lattice enthalpy decreases much more than the hydration enthalpy with increasing ionic size as we go down the solubility increases

Q8.Ans. Beryllium is not readily attacked by acids because of the presence of an oxide film on the metal.

Q9.Ans. Magnesium burns with dazzling brilliance in air to give Mg O and Mg_3N_2

Q10.Ans. Reducing nature is due to large hydration energy associated with the small size of Be^{2+} ion and relatively large value of the atomization enthalpy of the metal.

CBSE TEST PAPER 06

CLASS XI CHEMISTRY (The s-Block Elements)

Topic: Important Compounds of Calcium

1. Mention the main compounds which constitute Portland cement. [1]

2. Give two uses of [2]

   (i) caustic soda

   (ii) quick lime

3. What is quick lime? What happens when we add water to it? [2]

4. What happens when gypsum is heated to 390K? [1]

5. Anhydrous calcium sulphate can not be used as plaster of Paris. Give reason. [1]

6. What is the formulae of caustic potash? [2]

7. Mention the natural sources of calcium carbonate. [1]

8. What is milk of lime? [1]

9. What happens when $CaCO_3$ is subjected to heat? [1]

10. Show with an example that Ca O is a basic oxide? [1]

CBSE TEST PAPER 06

CLASS XI CHEMISTRY (The s-Block Elements)

Topic: Important Compounds of Calcium [ANSWERS]

Q1.Ans. The main compounds present in Portland cement are-

(i) Dicalcium silicate $(Ca_2SiO_4) - 26\%$

(ii) Tricalcium silicate $(Ca_3SiO_4) - 51\%$

(iii) Tricalcium aluminate $(Ca_3Al_2O_6) - 11\%$

Q2.Ans. (i) Caustic soda –

(a) It is used in the manufacture of soap, paper, artificial silk and a number of chemicals.

(b) It is used in petroleum refining and purification of bauxite

(ii) Quick time –

(a) It is used in the manu facture of dye stuffs.

(b) It is used in the manu facture of sodium carbonate from caustic soda.

Q3.Ans. Ca O is quick lime. When we add water to it slaked limes Ca $(OH)_2$ is formed.

Q4.Ans. Plaster of parts is formed

$$2CaSO_4.2H_2O \xrightarrow{390K} (CaSO_4)_2\, H_2O + 3H_2O$$

Q5.Ans. Because it does not have the ability to set like plaster of Paris.

Q6.Ans. KOH.

Q7.Ans. Calcium carbonate occurs in nature in several forma like limestone, chalk, marble etc.

Q8.Ans. A suspension of slaked lime in water is known as milk of lime.

Q9.Ans. On heating $CaCO_3$, quick lime is obtained

$$CaCO_3 \xrightleftharpoons{\Delta} CaO + CO_2$$

Q10.Ans. Ca O combines with acidic oxides at high temperature

$$CaO + SiO_2 \rightarrow CaSiO_3.$$

$$6CaO + P_4O_{10} \rightarrow 2Ca_3(PO_4)_2$$

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (The p-Block Elements)

Topic: General Characteristics of p-block elements

1.	How many groups are there in p-block?	[1]
2.	What is 'inert pair effect'?	[1]
3.	How does metallic and non-metallic character vary in a group?	[1]
4.	Why do third – period elements expand their covalence above four?	[1]
5.	Why do heaver elements form π – bonds?	[1]
6.	Why the elements of group 13 are called p-block elements?	[2]
7.	The elements B, Al, Ca, In and Tl are placed in the same group of the periodic table. Give reason.	[2]
8.	Where does metalloids and non – metals exist?	[1]

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (The p-Block Elements)

Topic: General Characteristics of p-block elements [ANSWERS]

Q1.Ans. There are six groups of p-block elements in the periodic table numbering from 13 to 18.

Q2.Ans. The occurrence of oxidation states two unit less than the group oxidation states are sometimes attributed to the 'inert pair effect'.

Q3.Ans. The non-metals and the metalloids exist only in the p-block of the periodic table. The non-metallic character of elements decreases down the group. In fact the heaviest element in each p-black group is the most metallic in nature.

Q4.Ans. The third – period elements of p-groups included d-orbital, which can be utilized to form bond and expand octet.

Q5.Ans. The heavier elements of p-block elements forms π – bonds because of the combined effect of size and availability of d-orbital's considerably influences the ability of there elements to form π – bonds.

Q6.Ans. Group 13 elements are called p-block elements because the last electron is present in the p-orbital (np^1). The valence shell configurations are B ($2s^2$ $2p^1$), Al ($3s^2$, $3p^1$), Ca ($4s^2$, $4p^1$), In ($5s^2$ $5p^1$) Tl ($6s^2$ $6p^1$)

Q7.Ans. The elements B, Al, Ca, In and Tl are placed in the same group of the periodic table because each one has the same number of elections (ns^2 np^1) in its valance shell.

Q8.Ans. It is interesting to note that the non-metals and metalloids exist only in the p-block of the periodic labels.

CBSE TEST PAPER 02

CLASS XI CHEMISTRY (The p-Block Elements)

Topic: Group 13 Elements: The Boron Tamely

1. How does boron interact with Na OH? [1]

2. Give two examples of electron deficient molecules. [1]

3. Arrange the following halides of boron in the increasing order of acidic character: BF_3, BCl_3, BBr_3, BI_3. [?]

4. Boron is unable to form BF_6^{3-} ion why? [1]

5. Why is boron metalloid? [?]

6. Aluminium forms $[AlF_6]^{3-}$ *whereas* $[BF_6]^{3-}$ in not formed why? [2]

7. How do Boron and Aluminium interact with Na OH? [?]

8. The atomic radius of Ca is less than that of Al. Why? [2]

9. Why do boron have unusual high melting point? [1]

10. Why does BF_3 act as Lewis acids? [1]

CBSE TEST PAPER 02

CLASS XI CHEMISTRY (The p-Block Elements)

Topic: Group 13 Elements: The Boron Tamely [ANSWERS]

Q1.Ans. $2B + 6NaOH \rightarrow 2Na_3BO_3 + 3H_2$

Q2.Ans. BF_3, B_2H_6.

Q3.Ans. $BF_3 < BCl_3 < BBr_3 < BI_3$.

Q4.Ans. Due to non – availability of d – orbital's, boron is unable to expand its octet. Therefore, the maximum covalence of boron cannot exceed 4.

Q5.Ans. Because, boron resembles both with metals and non-metals, therefore boron is metalloid.

Q6.Ans. Due to presence of vacant d-orbital's, Al can expand its octet to form bonds with six fluoride ions whereas B cannot . Boron does not have d-orbital's.

Q7.Ans. Both boron and aluminium dissolve in Na OH to liberate hydrogen gas.

$$2B + 6NaOH \rightarrow 2Na_3BO_3 + 3H_2$$

$$2Al + 2NaOH + 2H_2O \rightarrow 2NaAlO_2 + 3H_2$$

Q8.Ans. This is due to the variation in the inner core of the electronic configuration. The presence of additional 10 d-electrons offer only poor screening effect for the outer electrons from the increased nuclear charge in gallium.

Q9.Ans. Due to very strong crystalline lattice, boron has unusually high melting point.

Q10.Ans. Boron in its halides has only six electrons in its valence shell. Therefore, it can accept a pair of electrons from any electron-rich molecule. Therefore, it acts as an electron – acceptor and called Lewis acid.

CBSE TEST PAPER 03

CLASS XI CHEMISTRY (The p-Block Elements)

Topic: Group 14 Elements: The Carbon family

1. What is the electronic configuration of Group -14 elements? [?]

2. Name the metalloid found in Group 14 element? [?]

3. C and S are always tetravalent but Ge, Sn And Pb show divalency. Why? [2]

4. Which of the following reacts with water and aqueous solution becomes acidic: $SiCl_4$ or CCl_4? [1]

5. Why carbon does not form ionic compounds? [3]

6. Some halides of group 14 elements form complexes of the type $[Mx_6]^{2-}$. Give reason. [2]

7. Why CCl_4 behaves as an electron precise molecule? [1]

8. Why is lead unaffected by water? [1]

9. $[SiF_6]^{2-}$ is lead known whereas $[SiCl_6]^{2-}$ not. Give reason. [2]

10. PbI_4 does not exist. Why? [2]

CBSE TEST PAPER 03

CLASS XI CHEMISTRY (The p-Block Elements)

Topic: Group 14 Elements: The Carbon family [ANSWERS]

Q1.Ans. The electronic configuration is ns^2np^2.

Q2.Ans. Germanium is a metalloid found in group – 14.

Q3.Ans. Inert pair is more prominent as we move down the group in p – block elements. Ge, Sn and Pb show divalency due to inert pair effect.

Q4.Ans. $Si\ Cl_4$.

Q5.Ans. The electronic configuration of carbon atom is $1s^2\ 2s^2\ 2px^1\ 2py^1$ and has four valence electrons. In order to form ionic compound, it has to either lose four electrons or gain four electrons. Since very high energy are involved in doing so. Carbon does not form ionic compounds. It completes its octet by sharing of electrons and forms covalent compounds.

Q6.Ans. The halides of the elements having vacant d-orbital's can form complexes like $\left[SiF_6\right]^{2-}$ *and* $\left[SnCl_6\right]^{2-}$, because in such a case the central atom can increase its coordination number from 4 to 6 due to availability of vacant d–orbital's.

Q7.Ans. Carbon in CCl_4, the number of electrons around the central atom in a molecule is eight and thus is electron precise molecule.

Q8.Ans. Lead is unaffected by water, probable because of a protective oxide film formation.

Q9.Ans. The main reasons are that
(i) Six large chloride ions cannot be accommodated around Si^{4+} due to limitation of its size.
(ii) Interaction between lone pair of chloride ion and Si^{4+} is not very strong.

Q10.Ans. PbI_4 does not exist because Pb – I bond initially formed during the reaction does not release enough energy to unpair $6s^2$ electrons and excite one of them to higher orbital to have four unpaired electrons around lead atom.

CBSE TEST PAPER 04

CLASS XI CHEMISTRY (The p-Block Elements)

Topic: Important trends and Anomalous Behaviour of Carbon

1. Why is carbon different from other member of the group? [2]

2. Why does the covalence of carbon not expand beyond four? [2]

3. Why does the heavier elements do not form pπ – pπ multiple bond as carbon do? [3]

4. Why does carbon show different allotropic forms? [2]

5. What is the common name of recently developed allotrope of carbon i.e. C_{60} molecule? [1]

6. Silicon has no allotropic form analogous to graphite. Why? [2]

7. Why does graphite conduct electricity? [2]

8. How are fullerenes obtained? [1]

9. Diamond is the hardest substance known. Why? [1]

10. Graphite is used as lubricant. Give reason. [2]

CBSE TEST PAPER 04

CLASS XI CHEMISTRY (The p-Block Elements)

Topic: Important trends and Anomalous Behaviour of Carbon [ANSWERS]

Q1.Ans. Carbon differs from rest of the members of its group due to its smaller size, higher electro negativity, higher ionization enthalpy and unavailability of d-orbital's.

Q2.Ans. In carbon, only s and p orbital's are available for bonding and therefore it can accommodate only four pairs of electrons around it. This limit the maximum covalence to four whereas other members can expand their covalence due to the presence of d-orbital's.

Q3.Ans. Carbon has the unique ability to form $p\pi - p\pi$ multiple bond with itself and with other atoms of small size and high electro negativity whereas heavier elements do not from $p\pi - p\pi$ bonds because their atomic orbital's are too large and diffuse to have effective overlapping.

Q4.Ans. Due to property of catenation and $p\pi$ - $p\pi$ bond formation Carbon is able to show different allotropic forms.

Q5.Ans. Fullerene.

Q6.Ans. Due to large size. Si has little or no tendency for $p\pi - p\pi$ bonding. Whereas carbon atom forms easily $p\pi - p\pi$ bonds due to smaller size in graphite structure. Hence, Si does not exhibit graphite structure.

Q7.Ans. Graphite forms hexagonal ring and undergoes sp^2 hybridization. The electrons are delocalized over the whole sheet. Electrons are mobile and therefore graphite conducts electricity over the sheet.

Q8.Ans. Fullerenes are made by the heating of graphite in an electric arc in the presence of inert gases such as helium or argon.

Q9.Ans. Diamond is the hardest substance on the earth because it is very difficult to break extended covalent bonding.

Q10.Ans. Graphite has sp^2 hybridized carbon with a layer structure due to wide separation and weak inter – layer bonds the two adjacent layers can easily slide over each other. This makes graphite act as a lubricant.

CBSE TEST PAPER 05

CLASS XI CHEMISTRY (The p-Block Elements)

Topic: Important Compounds of Carbon and Silicon

1. What is water gas? [1]

2. Why is CO considered poisonous ? [3]

3. Silicon dioxide is treated with hydrogen fluoride. Explain? [1]

4. What are silicones? [1]

5. What is dry ice? [1]

6. What are silicates? [1]

7. How are silicones manufactured? [2]

8. Write the resonance structures of carbon dioxide. [1]

9. Why does CO_2 have a linear shape with no dipole moment [2]

10. What is silica-gel used as? [1]

CBSE TEST PAPER 05

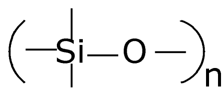
CLASS XI CHEMISTRY (The p-Block Elements)

Topic: Important Compounds of Carbon and Silicon [ANSWERS]

1.Ans. The mixture of CO and H_2 is known as water gas or synthesis gas.

2.Ans. The highly poisonous nature of CO arises because of its ability to form a complex with haemoglobin which is about 300 times more stable than the oxygen – haemoglobin complex. This prevents haemoglobin in the red blood corpuscles from carrying oxygen round the body and ultimately resulting in death.

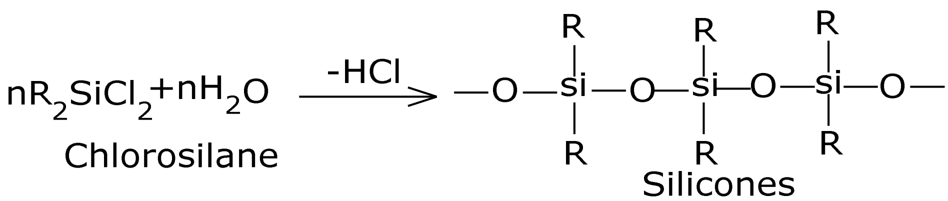
3.Ans. $SiO_2 + 4HF \rightarrow SiF_4 + 2H_2O$

4.Ans. Simple silicones consists of  chains in which alkalyl or phenyl groups occupy the remaining bonding position on each silicon. They are hydrophobic in nature.

5.Ans. Solid CO_2 is known as dry ice.

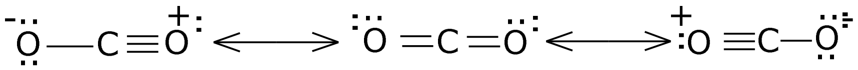
6.Ans. The structural unit of silicates is SiO_4^{4-} in which silicon atom is bonded to four oxygen atoms in tetrahedron fashion.

7.Ans. They are manufactured by hydrolysis of chlorosilanes –



where R is a methyl or phenyl group.

8.Ans.



Resonance structures of carbon dioxide.

9.Ans. In CO_2 molecule carbon atom undergoes sp hybridization. Two sp hybridized orbital of carbon atom overlap with two p-orbital's of oxygen atoms to make two sigma bonds while other two electrons of carbon atom are involved in pπ – pπ bonding with oxygen atom. This results in its linear shape [with both c-o bond of equal length (115 pm)] with no dipole moment.

10.Ans. Silica gel is used as a drying agent and as a support for chromato graphic materials and catalysts.

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (Organic Chemistry Some Basic Principle and Techniques)

Topic: Tetra valence of Carbon: Shapes of Organic Compounds

1. Write the expanded form of the following condensed formulas into their complete structural formulas. [2]

   (a) $CH_3CH_2COCH_2CH_3$.

   (b) $CH_3CH=CH(CH_2)_3CH_3$.

2. How does hybridization affect the electronegativety ? [?]

3. Why is sp hybrid orbital more electronegative than sp2 or sp3 hybridized orbitals? [2]

4. What type of hybridization of each carbon atom in the following compounds? [4]

   (a) CH_3Cl (b) $(CH_3)_2CO$ (c) CH_3CN (d) $CH_3CH = CHCN$.

5. What is the shape of the following molecules: [3]

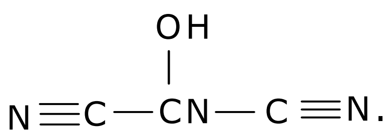
   (a) $H_2\ C=O$ (b) CH_3F (c) $HC\equiv N$.

6. How many σ and π bonds are present in each of the following molecules? [?]

   (a) $HC\equiv CCH\equiv CHCH_3$ (b) $CH_2=C=CHCH_3$.

7. Why are electrons easily available to the attacking reagents in π – bonds? [?]

8. Write the bond line formula for [1]

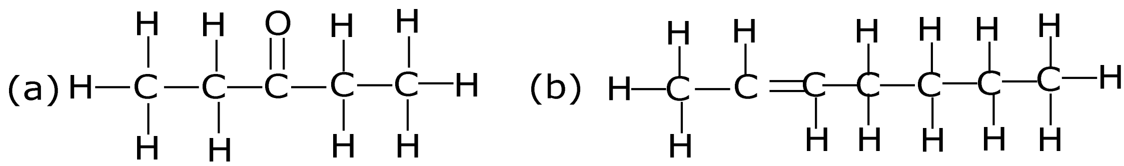


CBSE TEST PAPER 01

CLASS XI CHEMISTRY (Organic Chemistry Some Basic Principle And Techniques)

Topic: Tetra valence of Carbon: Shapes of Organic Compounds [ANSWERS]

Q1.Ans.



Q2.Ans. The greater the s – character of the hybrid orbital's, the grater is the electro negativity.

Q3.Ans. The greater the s – character of the hybrid orbital's, the greater is the electro negativity. Thus, a carbon atom having an sp hybrid orbital with 50% s – character is more electro negative than that possessing sp^2 or sp^3 hybridized orbital's.

Q4.Ans. (a) sp^3 (b) sp^3-sp^2 (c) sp^3, sp (d) sp^3, sp^2, sp^2,sp.

Q5.Ans. (a) sp^2 hybridized carbon, trigocal planar

(b) sp^3 hybridized carbon, tetrahedral

(c) sp hybridized carbon, linear.

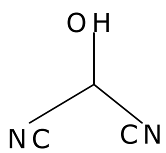
Q6.Ans. (a) σ C = C : 4 (b) σ C = C : 3

σ C – H : 6 σ C – H : 6

π C = C : 3 π C = C : 2

Q7.Ans. The electron charge cloud of the π – bond is located above and below the plane of bonding atoms. This results in the electrons being easily available to the attacking reagents.

Q8.Ans.



CBSE TEST PAPER 02

CLASS XI CHEMISTRY (Organic Chemistry Some Basic Principle and Techniques)

Topic: Classification of Organic Compounds

1. How are organic compounds classified? [1]

2. What is a functional group? [2]

3. Define homologous series? [1]

4. Give two examples of aliphatic compounds. [2]

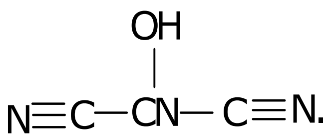
5. Write an example of non – benzenoid compound. [1]

6. Write an example of alicyclic compound. [2]

7. Name the chain isomers of C_5H_{12} which has a tertiary hydrogen atom. [1]

8. For each of the following compounds write a condensed formula and also their bondline formula. [2]

   (a) $HOCH_2\ CH_2\ CH_2CH\ (CH_3)\ CH\ (CH_3)\ CH_3$

   (b) 

CBSE TEST PAPER 02

CLASS XI CHEMISTRY (Organic Chemistry Some Basic Principle and Techniques)

Topic: Classification of Organic Compounds [ANSWERS]

Q1.Ans. (i) Acyclic or open chain compounds

(ii) Alicyclic or closed chain or ring compounds.

(iii) Aromatic compounds.

Q2.Ans. It may be defined as an atom or group of atoms joined in a specific manner which is responsible for the characteristic chemical properties of the organic compounds.

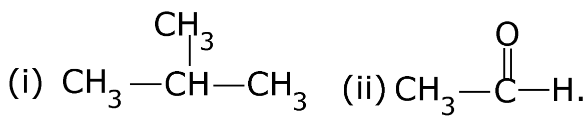
eg: hydroxyl group (- OH)

aldehyde group (- CHO)

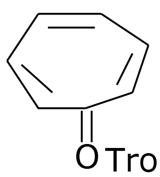
carboxylic acid group (-COOH) etc.

Q3.Ans. A group or a series of organic compounds each containing a characteristic functional group forms a homologous series and the members of the series are called homologous.

Q4.Ans.



Q5.Ans.



Tropolene

Q6.Ans.

Cyclopropane Cyclohexane Cyclohexene Tetrahydrofuran

Q7.Ans. 2 – methyl butane, $(CH_3)_2\,CH - CH_2 - CH_3$.

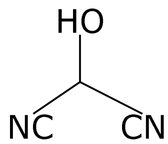
Q8.Ans. Condensed formula

(a) $HO\,(CH_2)_5CH\,CH_3\,CH\,(CH_3)_2$

(b) $HOCH\,(CN)_2$.

Bond line formula.

(a) 

(b) 

CBSE TEST PAPER 03

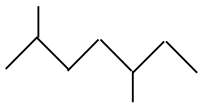
CLASS XI CHEMISTRY (Organic Chemistry Some Basic Principle and Techniques)

Topic: Nomenclature of Organic Compounds and Isomerism

1. Write the structural formula of [2]
(a) p – Nitro aniline (b) 2,3 – Dibromo-1-phenylpentane.

2. Derive the structure of 3 – Nitrocyclohexene. [2]

3. Give the IUPAC of the following – [2]

(a)  (b) $Cl_2CH\ CH_2OH$

4. What is the cause of geometrical isomerism in alkenes? [1]

5. Draw the two geometrical isomers of, σ but – 2 – en – 1, 4 dioic acid. Which of the will have higher dipole movement? [2]

6. Name the chain isomers of C_5H_{12} which has a tertiary hydrogen atom. [1]

7. How many structural isomers and geometrical isomers are possible for a cyclohexane derivative having the molecular formula C_8H_{16}? [2]

8. Alkynes does not exhibit geometrical isomers. Give reason. [2]

9. Which of the following shows geometrical isomerism? [2]
(a) CH Cl = CH Cl (b) CH_2 = C Cl_2 (c) C Cl_2 = CH Cl.

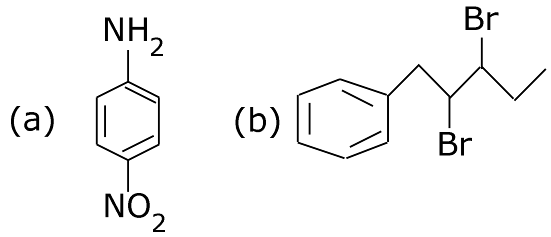
10. How many isomers are possible for monosubstituted and disubstituted benzene? [2]

CBSE TEST PAPER 03

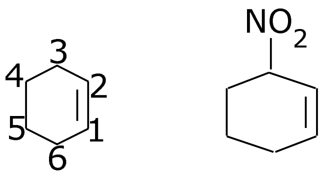
CLASS XI CHEMISTRY (Organic Chemistry Some Basic Principle and Techniques)

Topic: Nomenclature of Organic Compounds and Isomerism [ANSWERS]

Q1.Ans.



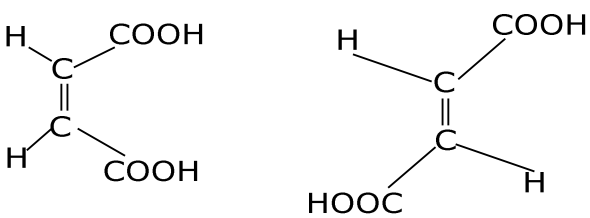
Q2.Ans. Six membered ring containing a carbon – carbon double bond is implied by cyclohexene, which is numbered. The prefix 3 – nitro means that a nitro group is parent on C – 3. Thus complete structured formula of the compound is derived. Double bond is suffixed functional group whereas NO_2 is prefixed functional group; therefore double bond gets preference over – NO_2 group:



Q3.Ans. (a) 2,5 – dimethyl heptanes (b) 2,2 – dichloro ethanol.

Q4.Ans. Alkene have a π – bond and the restricted rotation around the π – bond gives rise to geometrical isomerism.

Q5.Ans.



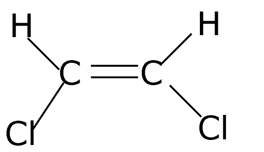
Cis-1,2-dichloro ethene Trans-Higner dipole moment

Q6.Ans. 2 – Methyl butane $(CH_3)_2\ CH - CH_2 - CH_3$

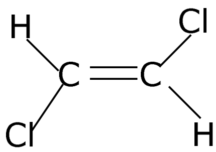
Q7.Ans. Five structural isomers; ethyl cyclohexane, 1:1, 1:2, 1:3 and 1:4 dimethyl cyelohexane, 4 – dimethyl cyclohexane has two geometrical isomers (cis and trans).

Q8.Ans. Because of linear geometry.

Q9.Ans. (a) CH Cl = CH Cl

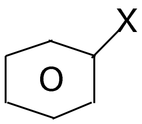


Cis-1,2-dichloro ethenc

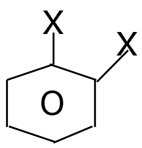


trans-1,2-dichloro ethenc

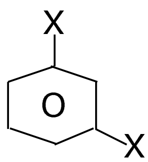
Q10.Ans. There is one, monosubstituted benzene as



There are three disubstituted benzenes.



ortho



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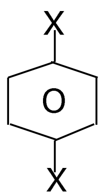


para

CBSE TEST PAPER 04

CLASS XI CHEMISTRY (Organic Chemistry Some Basic Principle and Techniques)

Topic: Fundamental Concepts in Organic Reaction Mechanism

1. Define heterolytic cleavage. [1]

2. Define carbocation. [1]

3. What are the nucleophiles? [1]

4. Giving justification, categories the following molecules or ions as nucleophle or electrophile: HS^-, BF_3, $C_2H_5O^-$, $(CH_3)_3N:$, Cl^-, $CH_3C^+ = O$, $H_2\dot{N}$, $\overset{+}{N}O_2$ [3]

5. Identify electrophilic centre in the following: $CH_3CH = O, C\overset{+}{H}_3C, CH_3I.$ [2]

6. Using curved – arrow notation, show the formation of reactive intermediates when the following covalent bond undergo heterolysis cleavage. [3]
(a) $CH_3 - SCH_3$, (b) $CH_3 - CN$, (c) $CH_3 - Cu$.

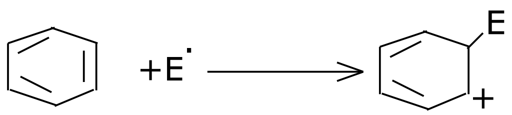
7. Identify the reagents show in hold in the following equations as nucleophiles or electreophiles. [4]

(a) $CH_3\ COCH_3 + \overset{-}{C}N \rightarrow (CH_3)_2\ C\ (CN)\ (OH)$

(b) $C_6H_5 + CH_3\overset{+}{C}O \rightarrow C_6H_5COCH_3$

8. For the following bond cleavages, use curved arouse to the electron flow and classify each as photolysis or heterolysis. Identify the reaction intermediates products as free radical carbocation or carban ion. [2]

(a) $CH_3\ O - O\ CH_3 \rightarrow CH_3\ \overset{-}{O} + \overset{-}{O}CH_3.$

(b) 

9. Benzyl carbonation is more stable than ethyl carbonation. Justify. [3]

CBSE TEST PAPER 04

CLASS XI CHEMISTRY (Organic Chemistry Some Basic Principle and Techniques)

Topic: Fundamental Concepts in Organic Reaction Mechanism [ANSWERS]

Q1.Ans. In heterolytic cleavage the bond breaks in such a fashion that the shared pair of electrons remains with one of the fragments.

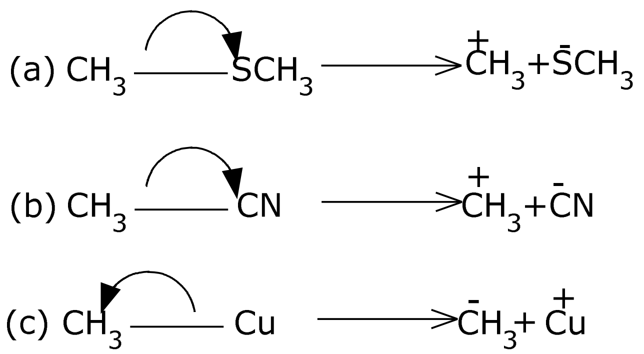
Q2.Ans. A species having a carbon atom possessing sextet of electrons and a positive charge is called carbocation.

Q3.Ans. The electron rich species are called mucleopiles. A nucleophile has affection for a positively charge centre.
eg OH^-, I^-, CN^-, : NH_3, NO_2^-.

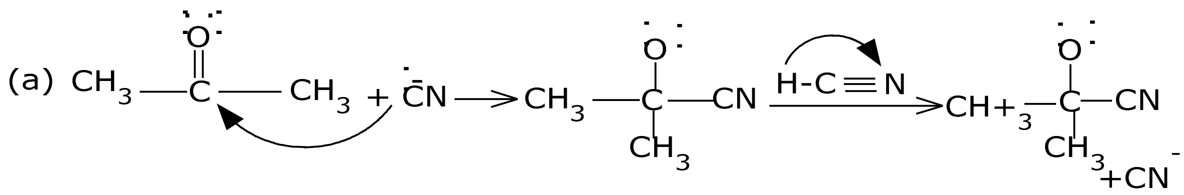
Q4.Ans. Nucleophiles : HS^-, $C_2H_5O^-$, $(CH_3)_3$ N:, H_2N^-: (have unshared pair of electrons which can be donated and shared with an electrophile)
Electrophile : BF_3, Cl^+, $CH_3C^+ = O^+$ NO_2[have only six electrons which can be accept electron from a nucleophile].

Q5.Ans. The shared carbon atoms are electrophilic centres as they will have partial positive charge due to polarity of the bond. CH_3 HC = O, H_3 CC = N, H_3 C – I.

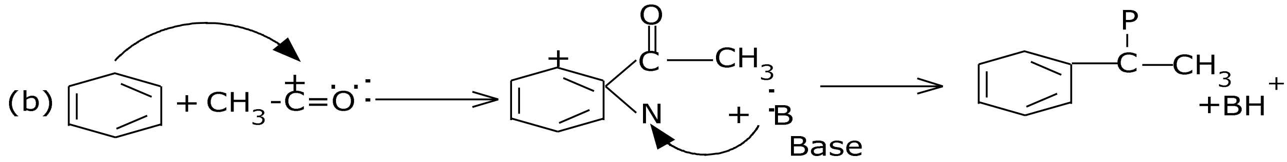
Q6.Ans.



Q7.Ans

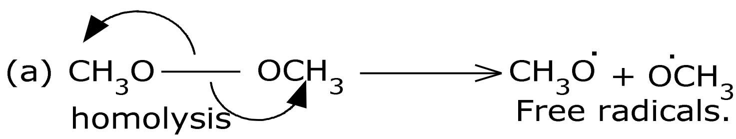


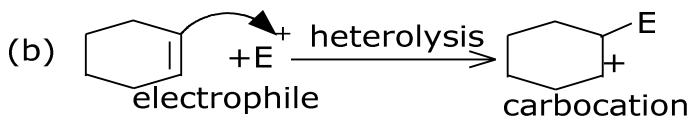
CN- is a negative nuclcophile.



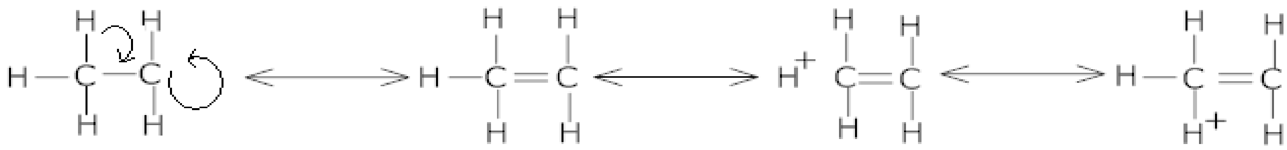
$CH_3\overset{+}{C}O$ is a positive electrophone.

Q8.Ans.

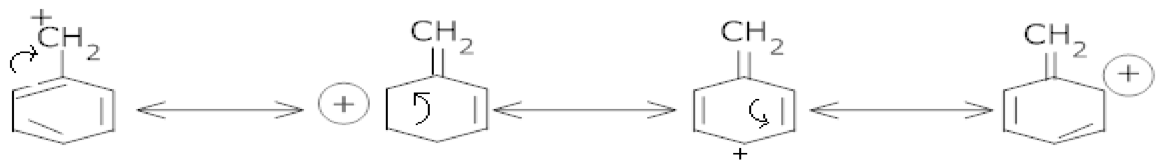




Q9.Ans. In ethyl carbocation, there is only hyper conjugation of the three α – hydrogen atoms and as a result, the following contributing structures are feasible.



But benzyl carbocation is more stable due to the presence of resonance and the following resonating structures are possible



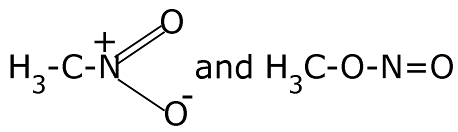
CBSE TEST PAPER 05

CLASS XI CHEMISTRY (Organic Chemistry Some Basic Principle and Techniques)

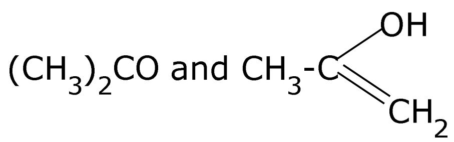
Topic: Resonance structure and Resonance effect

1. Which of the following pairs of structures do not constitute resonance structures? [3]

(a)



(b)



(c) $CH_3CH{=}CHCH_3$ and $CH_3CH_2CH = CH_2$.

2. Write resonance structures of $CH_2 = CH - CHO$. Indicate relative stability of the contributing structure. [2]

3. Write resonance structures of [3]

(a) CH_3COO^- (b) $C_6H_5NH_2$.

4. Write the resonance structures of [2]

(a) $CH_3\,NO_2$ (b) $CH_3\,COO^-$

5. Draw the resonance structures for the following compounds [3]

(a) C_6H_5OH (b) C_6H_5 - $\overset{+}{C}H_2$

6. Explain why is $(CH_3)_3\,C^+$ more stable than $CH_3CH_2^+$ and CH_3^+ is the least stable cation. [2]

7. Show how hyper conjugation occurs in propene molecule. [2]

8. Draw the orbital diagram showing *hyperconjugation* in ethyl cation [2]

CBSE TEST PAPER 06

CLASS XI CHEMISTRY (Organic Chemistry Some Basic Principle and Techniques)

Topic: Methods of Purification of Organic Compounds

1.	Name the common techniques used for purification of organic compounds.	[2]
2.	Will C Cl_4 give white precipitate of Ag Cl on heating it with Ag NO_3?	[2]
3.	How can the mixture of kerosene oil and water be separated?	[1]
4.	Which technique can be used for purification of iodine that contains traces of NaCl?	[1]
5.	Without using column chromatography, how will you separate a mixture of camphor and benzoic acid?	[2]
6.	A liquid (1.0g) has three components. Which technique will you employ to separate them?	[2]
7.	Lasaigne's test is not shown by diazonium salts. Why?	[1]
8.	Name two methods which can be safely used to purify aniline.	[2]
9.	What is the basic principle of chromatography?	[2]
10.	How will you separate a mixture of two organic compounds which have different solubility's in the same solvent?	[2]

CBSE TEST PAPER 05

CLASS XI CHEMISTRY (Organic Chemistry Some Basic Principle and Techniques)

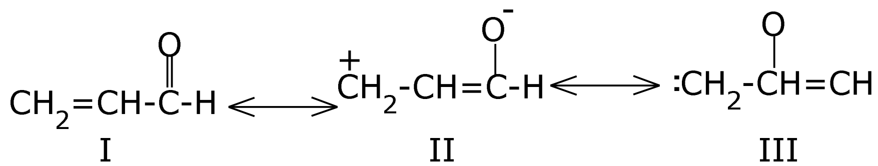
Topic: Resonance structure and Resonance effect [ANSWERS]

Q1.Ans. (a) $H_3C\text{-}O\text{-}N{=}O$

(b) $(CH_3)_2\ CO$

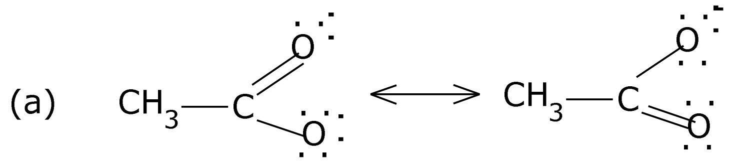
(c) $CH_3CH_2CH{=}CH_2$.

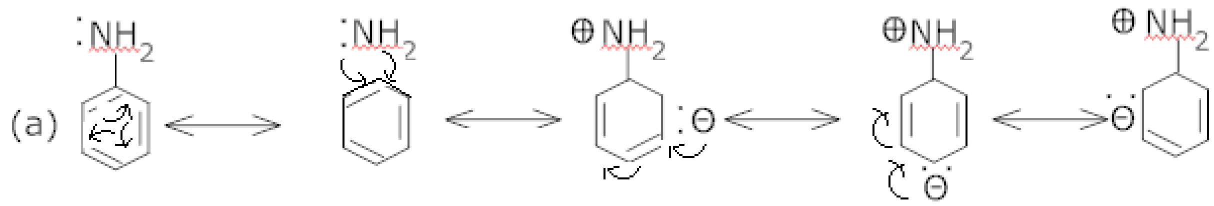
Q2.Ans.



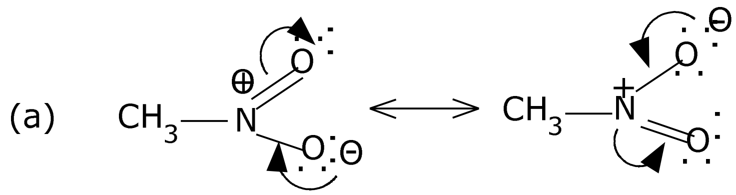
Stability I>II>III.

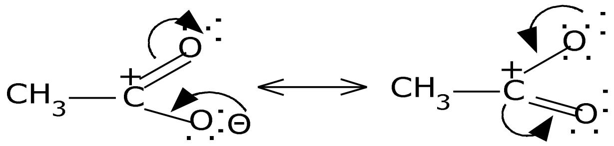
Q3.Ans.





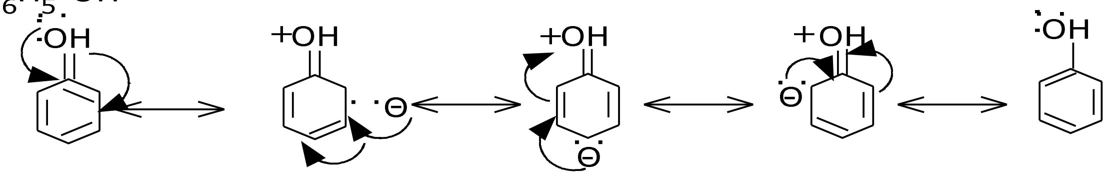
Q4Ans.



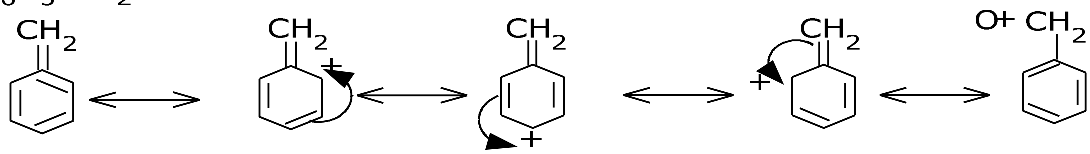
(b) 

Q5.Ans.

(a) C_6H_5-OH

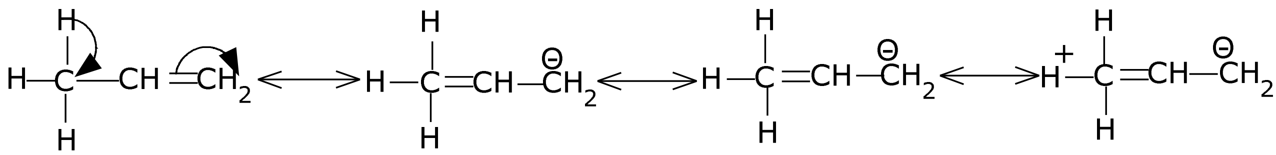


(b) C_6H_5-$\overset{+}{C}H_2$

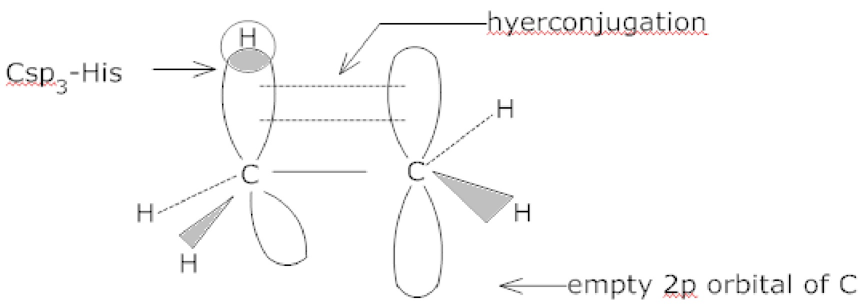


Q6.Ans. Hyper conjugation interaction in $(CH_3)_3C^+$ is greater than in $CH_3CH_2^+$ as $(CH_3)_3C^+$ has nine C-H bonds. In CH_3^+, The C-H bond the nodal plane of the vacant 2p orbital and hence can not overlap with it. Thus, CH_3^+ locus hyper conjugat*e stability.*

Q7.Ans.



Q8.Ans.



CBSE TEST PAPER 06

CLASS XI CHEMISTRY (Organic Chemistry Some Basic Principle and Techniques)

Topic: Methods of Purification of Organic Compounds [ANSWERS]

Q1.Ans. (i) Sublimation (ii) Crystallization (iii) Distillation (iv) Differential extraction and (v) Chromatography.

Q2.Ans. CCl_4 does not give white precipitate with silver nitrate solution.

$CCl_4 + Ag\ NO_3 \rightarrow$ No reaction.

Carbon tetrachloride contains chlorine but it is bonded to carbon by a covalent bond. Therefore it is not in ionic form. Hence, it does not combine with Ag NO_3 solution.

Q3.Ans. The mixture of kerosene oil and water can be separated by using a separating funnel.

Q4.Ans. The mixture of iodine and sodium chloride can be separated by sublimation method.

Q5.Ans. Sublimation can not be used since both camphor and benzoic acid sublime on heating. Therefore a chemical method using $NaHCO_3$ solution is used when benzoic acid dissolves leaving camphor behind. The filtrate is cooled and then acidified with dil HCl, to get benzoic acid.

Q6.Ans. Column chromatography.

Q7.Ans. Diazonium salts usually leave N_2 on heating much before they have a chance to react with the fused sodium metal. Therefore, diazonium salts do not show positive lassaigne's test for nitrogen.

Q8.Ans. (i) vacuum distillation method
(ii) steam distillation method.

Q9.Ans. The method of chromatography is based on the difference in the rates at which the components of a mixture are adsorbed on a suitable adsorbent.

Q10.Ans. By fractional crystallization.

CBSE TEST PAPER 07

CLASS XI CHEMISTRY (Organic Chemistry Some Basic Principle and Techniques)

Topic: Qualitative Analysis of Organic Compounds.

1. In which C – C bond of $CH_3CH_2CH_2Br$, the inductive effect is expected to be the least? [1]

2. Can you use potassium in place of sodium for fusing an organic compound in Lassaigne's test? [1]

3. Can you use calcium in place of sodium for fusing an organic compound? [1]

4. 0.395 g of an organic compound by Carius method for the estimation of sulphur gave 0.582 g of $BaSO_4$. Calculate the percentage of sculpture in the compound. [3]

5. 0.40g of an organic compound gave 0.3g of Ag Br by Carious method. Find the percentage of bromine in the compound. [3]

6. 0.12g of organic compound containing phosphorus gave 0.22g of $Mg_2P_2O_7$ by the usual analysis. Calculate the percentage of phosphorus in the compound. [3]

7. Ammonia produced when 0.75g of a substance was kjeldahlized, neutralized $30cm^3$ of 0.25 N H_2SO_4. Calculate the percentage of nitrogen in the compound. [3]

8. Write the chemical composition of the compound formed when ferric chloride is added containing both N and S. [1]

CBSE TEST PAPER 07

CLASS XI CHEMISTRY (Organic Chemistry Some Basic Principle and Techniques)

Topic: Qualitative Analysis of Organic Compounds. [ANSWERS]

Ans 01. Magnitude of inductive effect diminishes as the number of intervening bonds increases. Hence the effect is least in $C_3 - H$ bond.

Ans 02 No, because potassium is more reactive than sodium.

Ans 03 No, because calcium is less reactive than sodium.

Ans 04 Mass of $BaSO_4$ = 0.582g

$BaSO_4 = S$

233 32

233g of $BaSO_4$ contain sulphur = 32g

0.582g of $BaSO_4$ contains sulphur $= \frac{32}{233} x 0.582$

Percentage of sulphur = $\frac{wt.of \text{ sulphur}}{wt.of \text{ compound}} x100$

$$= \frac{32x0.582}{233x0.395} x100$$

20.24%

Ans 05 Mass of the compound = 0.40g

Now 188g of Ag Br will contain Br = 80g

Therefore, 0.3g of Ag Br will contain Br = $\frac{80}{188} x0.3 = 0.127g$

The percentage of Br in the organic compound

$$= \frac{0.127}{0.40} x100 = 31.75\%$$

Ans 06 Here the mass of the compound taken = 0.12g

Mass of $Mg_2P_2O_7$ formed = 0.22g of atoms of P

Now 1 mole of $Mg_2P_2O_7$ = (2x24+2x31+1687)

= 222g of $Mg_2P_2O_7$

= 62%

i.e; 222g of $Mg_2P_2O_7$ contain phosphorus = 62g.

∴ 0.22g of $Mg_2P_2O_7$ will contain phosphorus.

$$= \frac{62}{222} x 0.22$$

But this is the amount of phosphorus present in 0.12g of organic compound

Hence, percentage of phosphorus

$$= \frac{62}{222} \frac{x0.22}{0.12} x100$$

$$= \underline{51.20}$$

Ans 07 Mass of organic compound = 0.75g

Volume of H_2SO_4 used us = 30cm^3

Normality of H_2SO_4 = 0.25N

30cm^3 of H_2SO_4 of normality 0.25N ≡ 30ml of NH_3 solution of normality 0.25N

But 1000cm^2 of NH_3 of normality 1 contains 14g of nitrogen

∴ 30cm^3 of 0.25N NH_3 contains nitrogen $\frac{=14}{1000} x 30 x 0.25$

% of nitrogen = $\frac{Mass \text{ of nitrogen}}{Mass \text{ of substance}} x1000$

$$= \frac{14}{1000} x \frac{30x0.25}{0.75} x100$$

$$\underline{\underline{=14.00}}.$$

Ans08	3Na CNS + $FeCl_3$ →	Fe(CNS)	+ 3NaCl
	Sod. Sulphocyanide	ferric sulphocyanide	
		(blood red)	

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Classification of Hydrocarbons. (Alkanes)

1. Classify the hydrocarbons according to the carbon – carbon bond [1]

2. What are cycloalkanes? [1]

3. The boiling point of hydrocarbons decreases with increase in branching. Give reason. [2]

4. Unsaturated compounds undergo addition reactions. Why? [2]

5. Why carbon does have a larger tendency of catenation than silicon although they have same number of electrons? [1]

6. To which category of compounds does cyclohexane belong? [?]

7. Draw the structure of the following compounds all showing C and H atoms. [2]
   (a) 2-methyl -3-iso propyl heptanes
   (b) Dicyclopropyl methane.

8. Draw all the possible structural isomers with the molecular formula C_6H_{14}, Name them. [2.5]

9. Write IVPAC names of the following [1]

$$\begin{array}{l} CH_3\,(CH_2)_4\,\underset{|}{CH}\,(CH_2)_3\,CH_3 \\ \qquad\qquad\;\; CH_2 - CH\,(CH_3)_2. \end{array}$$

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Classification of Hydrocarbons. (Alkanes) [ANSWERS]

Ans 01. Hydrocarbons are categorized into three categories according to the carbon – carbon bond that exists between then-

(a) saturated hydrocarbon (b) Unsaturated hydrocarbon

(c) Aromatic hydrocarbon.

Ans 02 When carbon atoms form a closed chain or a ring, they are termed as cycloalkanes.

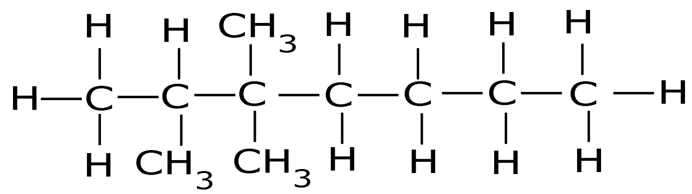
Ans 03. Branching result into a more compact (nearly spherical) structure. This reduces the effective surface area and hence the strength of the Vander wall's forces, thereby leading to a decrease in the boiling point.

Ans 04. Unsaturated hydrocarbon compounds contain carbon – carbon double or triple bonds. The π-bond is multiple bond is unstable and therefore addition takes place across the multiple bonds.

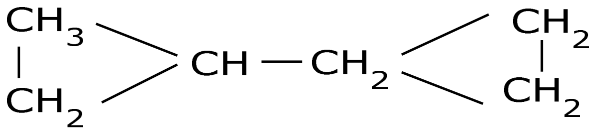
Ans 05. It is due to the smaller size C-C bond which is stronger (335 KJ mol^{-1}) than in Si bond (225.7 KJ mol^{-1}).

Ans 06. Unsaturated alicyclic hydrocarbons.

Ans 07. (a)



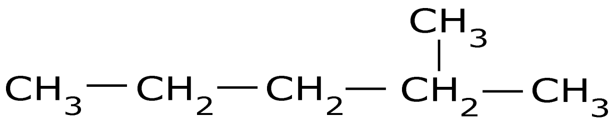
(b)



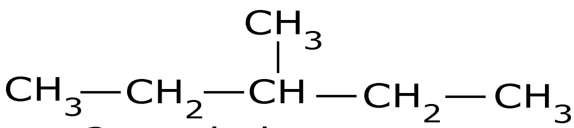
(dicyclopropyle methane)

Ans 08. (i) $CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3$

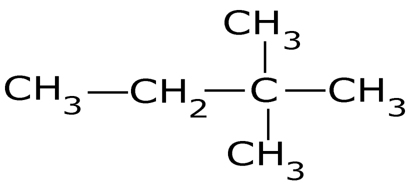
(n – hexane)

(ii) 

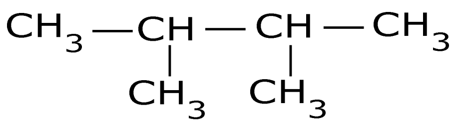
2-methyl pentane

(iii) 

3-methyl pentane

(iv) 

2,2-dimethyl butane

(v) 

2,3-dimethyl butane

Ans 09. 5-(2 – Methyl propyl) – decane.

CBSE TEST PAPER 02

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Preparation of Alkanes

1. What is hydrogenation section? [1]

2. How would you convert ethene to ethane molecule? [1]

3. Give the IUPAC name of the lowest molecular weight alkane that contains a quaternary carbon. [1]

4. Methane does not react with chlorine in dark. Why? [1]

5. Sodium salt of which acid will be needed for the preparation of propane? Write chemical equation for the reaction. [2]

6. Cyclobutane is less reactive than cyclopropane. Justify. [2]

7. How will you prepare isobutane? [2]

8. N – pentane has higher boiling point than neopentane but the melting point of neopentane is higher than that of n – pentane. [3]

CBSE TEST PAPER 02

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Preparation of Alkanes [ANSWERS]

Ans 01. Dihydrogen gas gets added to alkenes and alkenes in the presence of finely divided catalysts like Pt, Pd or Ni to form alkanes. This process is called hydrogenation.

Ans 02 $$\underset{ethene}{CH_2 = CH_2 + H_2} \xrightarrow[hydrogenation]{Pt/Pd/Ni} \underset{ethane}{CH_3 - CH_3}$$

Ans 03. 2, 2-dimethyl propane.

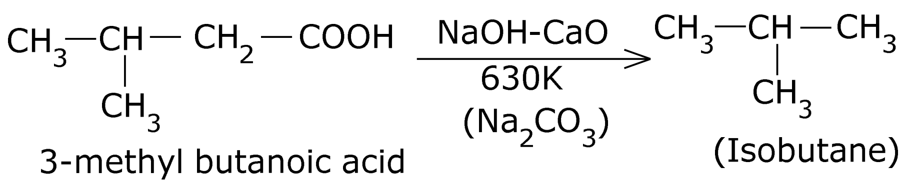
Ans 04. Chlorination of methane is a free radical substitution reaction. In dark, chlorine is unable to be converted into free radicals, hence the reaction does not occur.

Ans 05. Butanoic acid,

$CH_3CH_2CH_2COO\text{-}Na^{+}+NaOH \xrightarrow{Cao} CH_3CH_2CH_3+Na_2CO_3$.

Ans 06. In cyclobutane molecule, the C-C-C bond angle is 90^0 while it is 60^0 in cycloprpane. This shows that the deviation from the tetrahedral bond angle (109^0 $28'$) in cyclobutane is less than in cyclopropane. In other words, cyclopropane is under great strain compared with cyclobutane and is therefore more reactive.

Ans 07. Isobutane is obtained by decarboxylation of 3-methyl butanoic acid with soda lime at 630K.



Ans 08. Because of the presence of branches in neo-pentane the surface area and van der walls forces of attraction are very weak in neopentane than in n-pentane. Therefore the b.p of neopentane is lowerthan that of n-pentane.

M.P depends upon the packing of the molecules in the crystal lattice. Since neopentane are more symmetrical than n-pentane therefore, it packs much more closely in the crystal lattice than n-pentane and hence neopentane has much higher m.p than n-pentane.

CBSE TEST PAPER 03

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Chemical and Physical Properties of Alkanes

1. The boiling point of alkanes shows a steady increase with increase in molecular mass. Why? [2]
2. Pentane has three isomers i.e; pentane, 2-methyl butane and 2,2-dimethyl propane . The b.p of pentane is 309.1K whereas 2,2-dimethyl propane shows a b.p of 282.5k. Why? [2]
3. Which conformation of ethane is more stable? [1]
4. Draw the New man's projection formula of the staggered form of 1,2-dichloro ethane. [2]
5. The dipole moment of trans 1,2-dichloroethane is less than the **cis** – isomer. Explain. [3]
6. All the four C-H bonds in methane are identical. Give reasons. [2]
7. When alkanes are heated, the C-C bonds rather than the C-H bonds break. Give reason. [2]
8. Explain wurtz reaction with an example. [3]
9. How would you convert cyclohexane to benzene? [2]
10. How is iso-butane prepared? [2]

CBSE TEST PAPER 03

CLASS XI CHEMISTRY (Hydrocarbons)

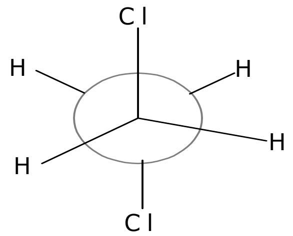
Topic: Chemical and Physical Properties of Alkanes [ANSWERS]

Ans 01. This is due to the fact that the intermolecular van der walls forces increase with increase of the molecular size or the surface area of the molecule.

Ans 02. With the increase in number of branched chains, the molecule attains the shape of a sphere. This results in smaller area of contact and therefore weak inter molecular forest between spherical molecules, which are overcome a relatively lower temperatures.

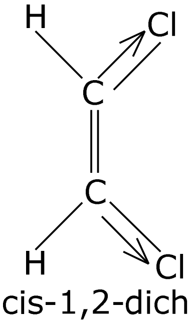
Ans 03. Staggered conformation.

Ans 04.

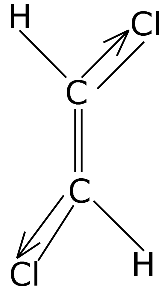


staggared form of 1,2-dichloro ethane.

Ans 05. The structure of trans isomer is more symmetrical as compared to the cis – isomer. In the trans – isomer, the dipole moments of the polar C-Cl bonds are likely to cancel effect of each other and the resultant dipole moment of the molecule is nearly zero. But in the cis – isomer, these do not cancel. Therefore, the cis isomer has a specific moment but is zero in case of trans isomer.



cis-1,2-dichloro ethane
(M=1.900)



trans -1,2-dichloro ethane
(M=1:0)

Ans 06. The four C-H bonds of methane are identical because all of these are formed by the overlapping of the same type of orbital's i.e; hybrid orbital's of carbon and s-orbital of hydrogen.

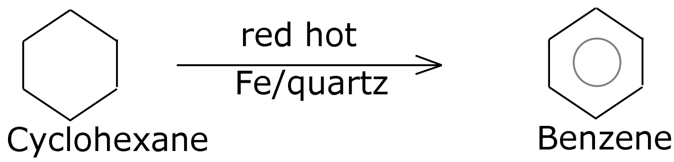
Ans 07. When alkanes are heated, the C-C bonds rather than the C-H bonds breaks because the C-C bond has a lower bond energy (ΔH=83K Cal/mole) than the C-H bond (ΔH=99 K Cal / mole).

Ans 08. Wurtz reaction – This reaction is employed to obtain higher alkanes from the halides of lower alkanes. The halides of lower alkanes are treated with sodium metal in ether:

$$\underset{\text{alkyl halide}}{RX} + 2Na + \underset{\text{alkyl halide}}{XR^1} \xrightarrow{ether} R - R^1 + 2Na - X$$

$$\underset{\text{(methyl iodide)}}{CH_3I} + 2Na + CH_3I \xrightarrow{ether} \underset{\text{(ethane)}}{CH_3 - CH_3} + 2NaI$$

Ans 09. Cyclohexane when treated with iron or quartz in a red hot tube undergoes oxidation to form benzene.



Ans 10. By decarboxylation of 3 – methyl butanoic acid with soda lime at 630 K.

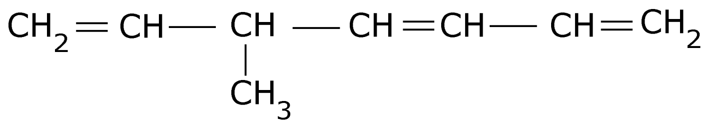
$$\underset{\text{3-methyl butanoic acid}}{CH_3 - \underset{\substack{| \\ CH_3}}{CH} - CH_2 - COOH} \xrightarrow[\substack{630\ K \\ (Na_2CO_3)}]{NaOH - CaO} \underset{\text{Iso butane}}{CH_3 - \underset{\substack{| \\ CH_3}}{CH} - CH_3}$$

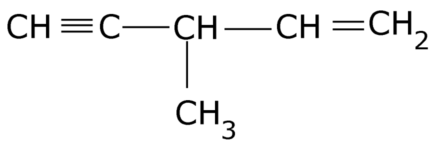
CBSE TEST PAPER 04

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Alkenes (Structure and Isomerism)

1.	Why is alkene considered a weaken molecule than alkane?	[1]
2.	Draw orbital picture of ethane depicting σ-bond only.	[2]
3.	What is the origin of geometrical isomerism in alkenes?	[1]
4.	Write IUPAC names of the following molecules:	[2]

(a) 

(b) 

5.	Which of the two exhibit geometrical isomerism? 2-Butene or 1Butene.	[1]
6.	What is the shape of $CH_2 = CH_2$?	[1]
7.	The physical properties of geometrical isomers are different while those optical isomers are same. Why?	[2]
8.	Dipole moment of cis – but – 2 – ene is 0.33 D whereas dipole moment of the trans form is almost zero. Why?	[2]
9.	Why will $C_6H_5CH = CH - CH_3$ show cis – trans isomerism?	[1]
10.	What are geometrical isomers?	[2]

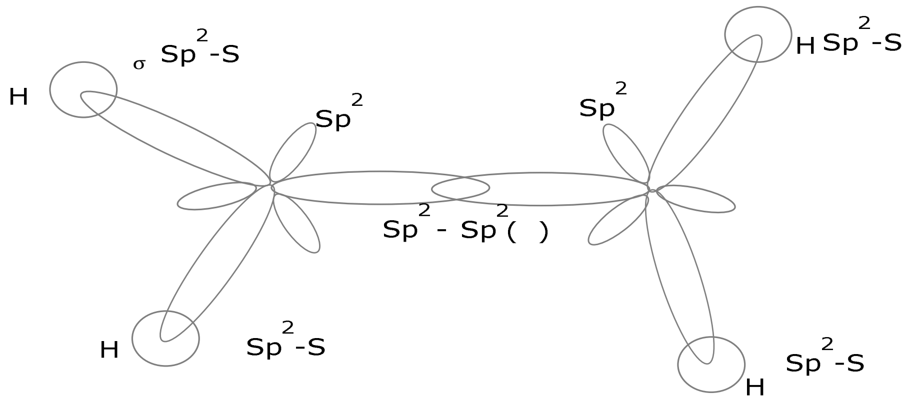
CBSE TEST PAPER 04

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Alkenes (Structure and Isomerism) [ANSWERS]

Ans 01. The presence of weaker π-bond makes alkenes unstable molecules in comparison to alkenes and thus alkenes can be changed into single bond compounds by combining with the electrophoilic reagents.

Ans 02.



Orbital picture of ethene
dopicting -bonds

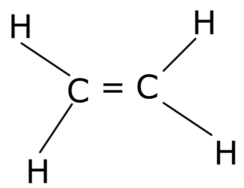
Ans 03. Geometrical isomerism in alkenes is due to the lack of free rotation of the double-bonded carbon atoms due to the double bond between them.

Ans 04. (a) 3 – methyl – hepta – 1, 4, 5 diene

(b) 3 – methyl – penta – 4, - en – 1 yne.

Ans 05 2 – Butene

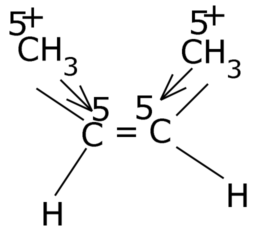
Ans 06.



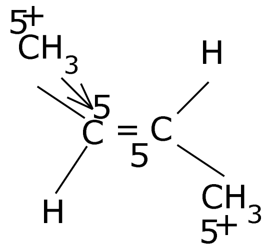
Planar 120^0

Ans 07. The repulsion between the same group on the same side is more in cis – form than trans – form therefore their physical properties are different.

Ans 08.



cis-But-2-ene
(M=0.330)



trans-But-2-ene
(M=O)

In the trans – but – 2-ene, the two methyl groups are in opposite directions. Therefore, dipole moments of C-CH_3 bonds cancel, thus making the trans form non-polar.

Ans 09. Because two different groups are attached to one of the doubly bonded carbon atom.

Ans 10. The restricted rotation of atoms or groups around the doubly bonded carbon atoms gives rise to different geometries of such compounds. The stereo isomers of this type are called geometrical isomers.

CBSE TEST PAPER 05

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Preparation of Alkenes

1. What is a Lindlars' catalyst? [1]

2. How is alkene produced by Kolbe's electrolytic method? [2]

3. How is alkene produced by vicinal dihalide? [1]

4. Arrange the following halogen atom to determine rate of the reaction. [1]

   Iodine, chlorine. Bromine.

5. What is β-elimination reaction? [1]

6. How is alkene prepared from alcohol by acidic dehydration? [2]

7. How are trans alkenes formed by alkynes? [2]

8. How are cis – alkenes formed by alkynes? [2]

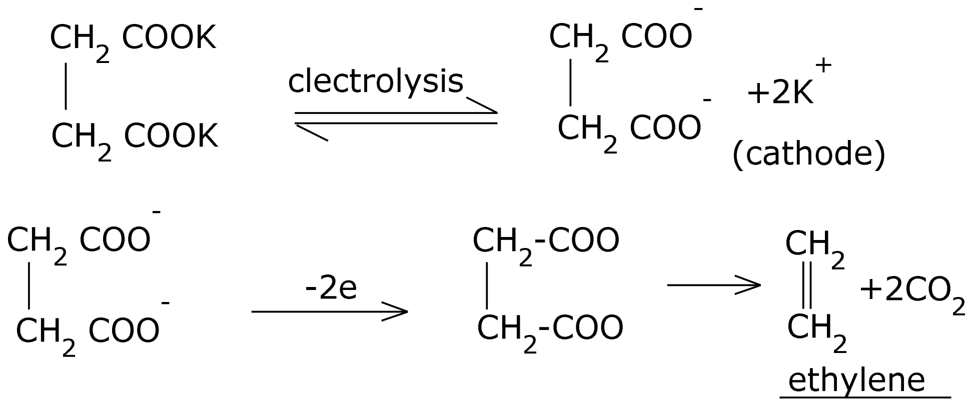
CBSE TEST PAPER 05

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Preparation of Alkenes [ANSWERS]

Ans 01. Partially deactivated palletized charcoal is known as Lindlar's catalyst.

Ans 02.



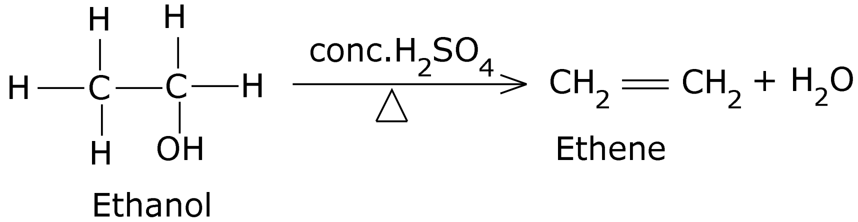
Ans 03. Vicinal dialyses on treatment with Zn metal lose a molecule of ZnX_2 to from an alkene. This reaction is known as dehalogenation.

$CH_2Br\text{-}CH_2Br+Zn \rightarrow CH_2{=}CH_2+ZnBr_2$.

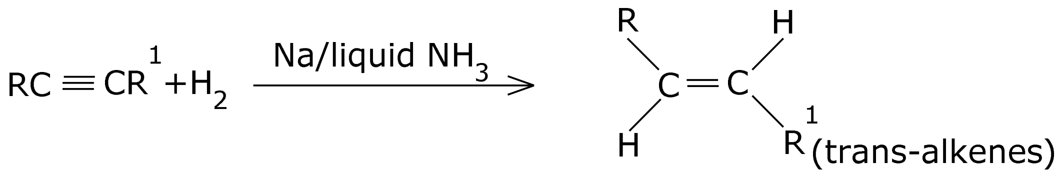
Ans 04. iodine > bromine > chlorine.

Ans 05. When hydrogen atom is eliminated from the β-carbon atom (carbon atom next to the carbon to which halogen is attached).

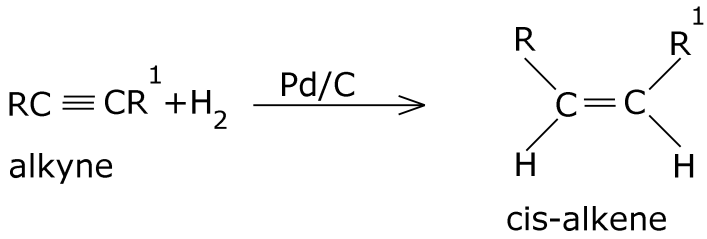
Ans 06. Alcohols on heating with concentrated sulphuric acid form alkenes with the elimination of one water molecule.



Ans 07. Alkynes on reduction with sodium in liquid ammonia form trans alkenes.



Ans 08. Alknes on partial reduction with calculated amount of dihydrogen in the presence of palladised charcoal partially deactivated with poisons like sulphur compounds or quinoline give cis-alkene.



CBSE TEST PAPER 06

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Properties of Alkenes

1. Stale Markownikov's Rule. [2]

2. Discuss the hybridization of carbon atoms in alkene C_3H_4 and show the π-orbital overlaps. [3]

3. Write the chemical equations of reactions involved in ozonolysis of alkenes. [2]

4. Write IUPAC name of the products obtained by addition reactions of HBr to hex – 1 – ene. [3]

   (i) in the absence of peroxide, and

   (ii) in the presence of peroxide.

5. How will you distinguish between butene – 1 and butene – 2? [2]

6. Explain the term polymerization with two examples. [3]

7. State kharasch effect. [2]

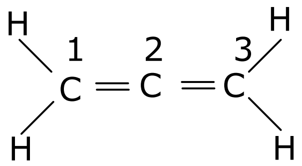
CBSE TEST PAPER 06

CLASS XI CHEMISTRY (Hydrocarbons)

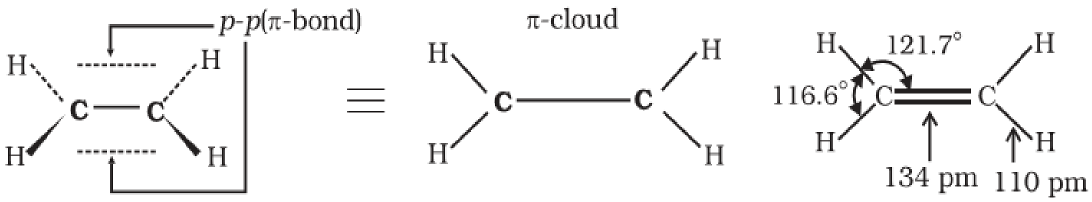
Topic: Properties of Alkenes [ANSWERS]

Ans 01. It states that when a polar compound is added to an unsymmetrical alkenes, or alkynes positive part goes to the most substituted carbon atom and negative part goes to the least substituted carbon atom.

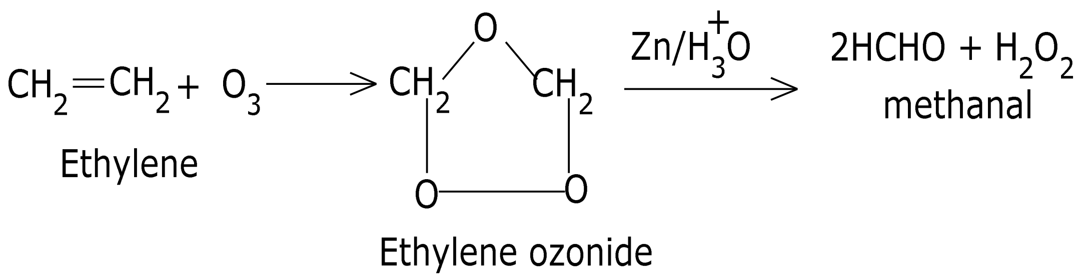
Ans 02. The structure of alkene (C_3H_4) is given here.



The carbon atom 1 and 3 are sp2 hybridised since each one of them is joined by a double bond. In contrast, carbon atom 2 is sp hydridiesed since it has two double bonds thus the two double bonds in alkenes are perpendicular to each other.



Ans 03. It is a process in which alkenes react with ozone to form ozonide which on reduction in presence of Zn give aldehyde and ketones. E.g;



Ans 04.

(i) $CH_2{=}CH{-}CH_2{-}CH_2{-}CH_2{-}CH_3 + H{-}Br \xrightarrow{\text{No Peroxide}} CH_3{-}\underset{\underset{Br}{|}}{CH}{-}CH_2{-}CH_2{-}CH_2{-}CH_3$

Hex-1-ene   2-Bromohexane

(ii) $CH_2{=}CH{-}CH_2{-}CH_2{-}CH_2{-}CH_3 + H{-}Br \xrightarrow{\text{Peroxide}} \underset{\underset{Br}{|}}{CH_2}{-}CH_2{-}CH_2{-}CH_2{-}CH_2{-}CH_3$

1-Bromohexane

Ans 05. Butene – 1 and butene – 2 can be distinguished either by ozonolysis or by oxidation with acidic $KMnO_4$ solution which they give different carbonyl compounds.

$CH_3 - CH_2 - CH = CH_2 \xrightarrow{O_3} CH_3\,CH_2\,CHO + HCHO$

Butane   Propionaldehyde   formaldehyde.

$CH_3 - CH = CH\,CH_3 \xrightarrow{O_3} CH_3\,CHO + CH_3\,CHO$

Butane – 2   acetaldehyde   (2 moles)

Ans 06. Polymerization – when two or more molecules of unsaturated compounds are made to combine under suitable conditions to form a bigger compound, the compound formed is known as the polymer and the process is known as polymerization.

(a) Addition polymerization –

The bigger molecule i.e; polymer is an exact multiple of the smaller molecule and nothing is lost during the reaction

$nCH_2 = CH2 \xrightarrow{Polymerisation} (..... CH_2 - CH_2 ...)_n$

(b) Condensation polymerization : There is generally the loss of molecules such as water, hydrochloric acid etc. During the polymerization, the polymer is not an exact multiple of the smaller molecule.

Ans 07. It states that in presence of peroxides such as benzoyl peroxide, addition of HBr (but not of HCl or HI) to unsymmetrical alkenes occurs contrary to Markontkov's rule.

$CH_3CH = CH_2 + HBr \xrightarrow{Peroxide} CH_3 - CH_2 - CH_2\text{- }Br$

1 – bromopropane.

CBSE TEST PAPER 07

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Alkynes

1. Draw the orbital picture of ethyne showing. [3]

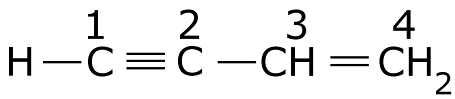
   (a) sigma overlaps

   (b) pi – overlaps.

2. What is the number of σ and π bond in [1]

   N ≡ C – CH = CH – C ≡ N?

3. Name the type of hybridization in C (2) and C (3) in the following molecule [1]



4. Why do alknes not show geometrical isomerism? [1]

5. Give the different isomers formed by C_5H_8 along with their IUPAC name. [3]

6. Write the general formula for alkynes. [1]

7. Name the simplest alkyne. [1]

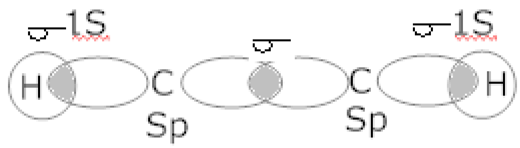
CBSE TEST PAPER 07

CLASS XI CHEMISTRY (Hydrocarbons)

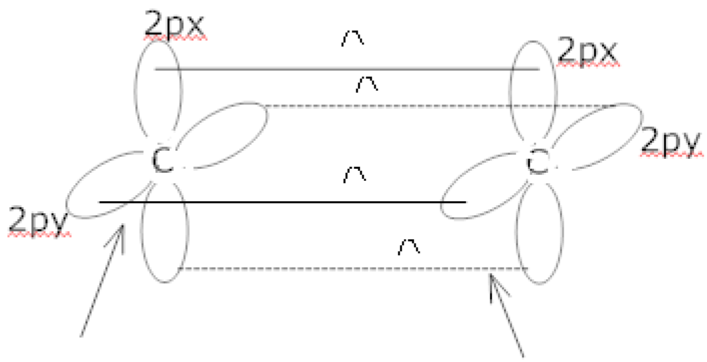
Topic: Alkynes [ANSWERS]

Ans 01.

(a)



(b)



Ans 02. There are 7σ bonds and 5 π-bonds.

Ans 03. C(2) is sp-hybridized and C(3) is sp^2 hybridized.

Ans 04. Alkynes have linear structure. So they cannot show geometrical isomerism.

Ans 05.

	Structure	**IUPAC name**
I.	$\overset{1}{H}C\equiv\overset{2}{C}-\overset{3}{C}H_2-\overset{4}{C}H_2-\overset{5}{C}H_3$	Pent–1-yne
II.	$H_3\overset{1}{C}-\overset{2}{C}\equiv\overset{3}{C}-\overset{4}{C}H_2-\overset{5}{C}H_3$	Pent–2-yne
III.	$H_3\overset{4}{C}-\overset{3}{C}H(CH_3)-\overset{2}{C}\equiv\overset{1}{C}H$	3-Methylbut–1-yne

Structures I and II are position isomers and structures I and III or II and III are chain isomers.

Ans 06. $C_nH_{2n}-2$.

Ans 07. Ethyne is the simplest alkyne.

CBSE TEST PAPER 08

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Preparation of alkynes

1. How is alkyne prepared from calcium carbide? [2]

2. How is alkyne prepared by Kolbe's method? [2]

3. Write structures of different isomers formed by C_6H_{10}. Also write IUPAC names of the all the isomers. [3]

4. How is alkyne prepared from vicinal dihalides? [2]

5. How will you distinguish between ethylene and methane? [2]

6. Although acetylene is acidic in nature, it does not react with NaOH or KOH. Give reason? [2]

7. Write the conversion of ethene to ethyne. [2]

CBSE TEST PAPER 08

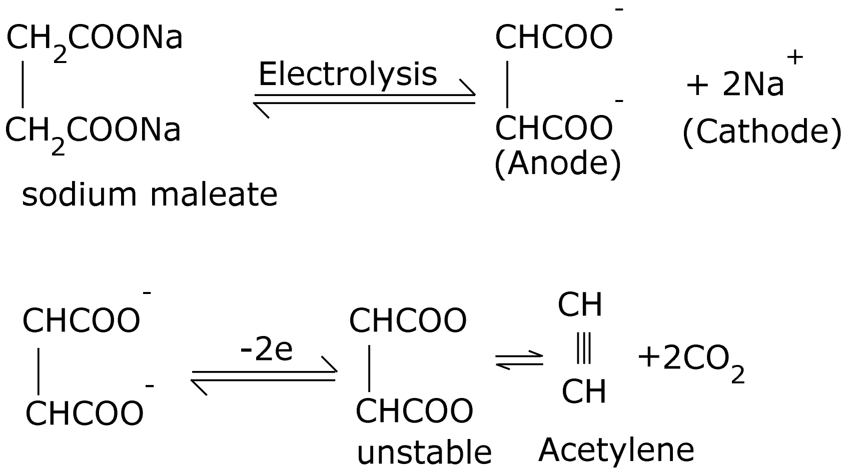
CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Preparation of alkynes [ANSWERS]

Ans 01. Calcium carbide is treated with water to get ethyne.

$CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2$

Ans 02.



Ans 03. The possible isomers are

(a) $HC \equiv C - CH_2 - CH_2 - CH_2 - CH_3$

Hex – 1- yne.

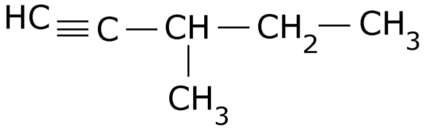
(b) $CH_3 - C \equiv C - CH_2 - CH_2 - CH_3$

Hex – 2- yne

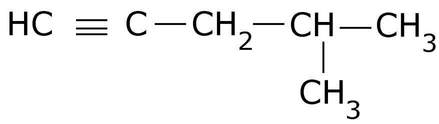
(c) $CH_3 - CH_2 - C \equiv C - CH_2 - CH_3$

Hex- 3- yne

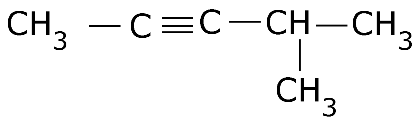
(d)



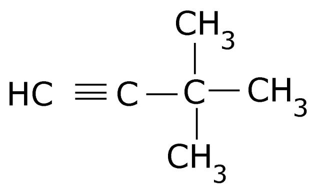
3- Methyl-pent-1-yne

(e) 

4- Methyl-pent-1-yne

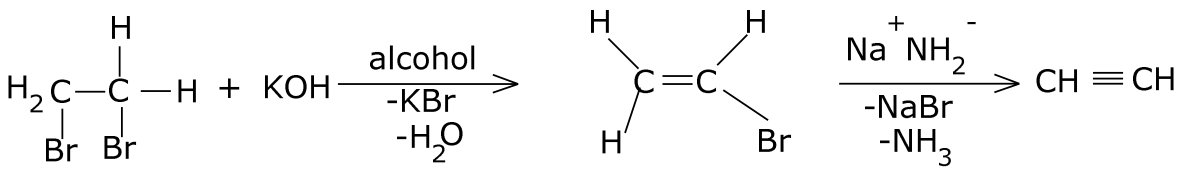
(f) 

4- Methyl-pent-1-yne

(g) 

3,3-Dimethyl-but-1-yne

Ans 04. Vicinal dihalides on treatment with alcoholic potassium hydroxide undergo dehydrohalogenation. One molecule of hydrogen halide is eliminated to form alkenyl halide which on treatment with sodiumamide gives alkynes.



Ans 05. Ethylene discharges bromine water colour and Baeyer's reagent colour while methane does not.

Ans 06. Acetylene is a very weak acid (pKa=25) and hence only an extremely strong base like amide ion (NH_2^-) can successfully remove a proton.

Ans 07. $CH_2 = CH_2 \xrightarrow{Br_2} Br - CH_2 - CH_2 - Br \xrightarrow{KOH(alc.)} CH \equiv CH$

Ethene 1,2-Dibromomethane Ethyne

CBSE TEST PAPER 09

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Properties of alkynes

1. Ethyne is acidic in nature in comparison to ethene and ethane. Why is it so? [3]

2. How would you distinguish between butyne – 1 and butyne – 2? [2]

3. Butanone is formed when an alkyne is passed through a dil sol of H_2SO_4 at 330K in presence of mercuric sulphate. Write the possible structure of the alkyne. [3]

4. How would you carry out the following conversion propene to ethyne. [2]

5. How will you convert propyne to propanone? [2]

6. How will you convert ethyne to ethane? [2]

7. Convert 2- butyne to trans – 2- butane. [2]

8. Write combustion reaction for hexyne. [1]

9. How will you convert ethyne to benzene? [1]

10. How will you prepare 3-methyl but -1 – yne by starting with ethyne? [2]

CBSE TEST PAPER 09

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Properties of alkynes [ANSWERS]

Ans 01. Hydrogen atoms in ethyne are attached to the sp hybirdised carbon atoms whereas they are attached to sp^2 hybridized carbon atoms in ethene and sp^3 hydridised carbons in ethane. Due to the maximum percentage of s – character (50%), the sp hybridized orbital's of carbon atoms in ethyne molecules have highest etcetronegativity : Which attracts the shared pair of the C-H bond of ethyne to a greater extent than that of the sp^2 hybridized orbital's of carbon in ethene and the sp3 hybridized orbital of carbon in ethane. Thus in ethyne molecule, hydrogen atoms can be liberated as protons more easily as compared to ethene and ethane.

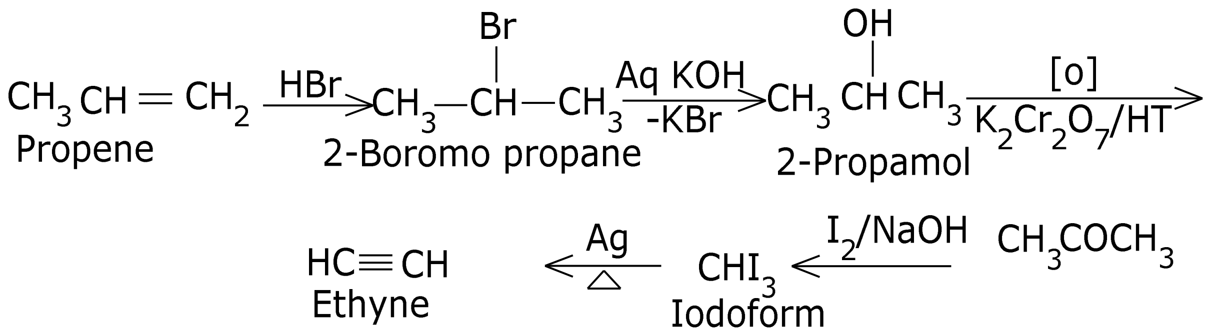
Ans 02. Butyne – 1 ($CH_3CH_2C \equiv CH$), having an acetylene hydrogen atom will give white precipitate with ammonical silver nitrate and red precipitate with ammonical cuprous chloride. On the other hand, butyne – 2 ($CH_3C \equiv C\ CH_3$) having no acetylene hydrogen atom does not respond to either of the two reagent.

Ans 03. Since Butanone is a four carbon atom, therefore both but – 1- yne and but – 2 – yne on hydration will produce butanone.

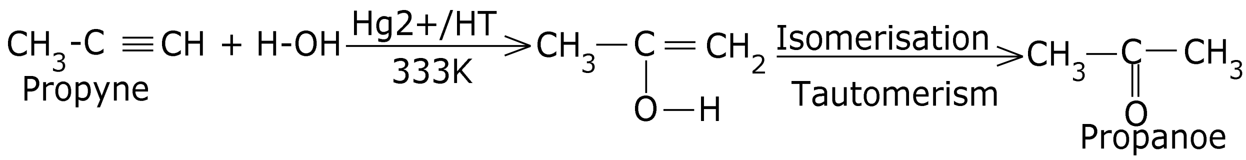
$$\underset{\text{But-1-yne}}{CH_3CH_2\,C \equiv CH} + H_2O \xrightarrow[HgSO_4,330K]{dil.H_2SO_4} \underset{\text{Butanone}}{CH_3CH_2\,\overset{\overset{\displaystyle O}{\|}}{C} - CH_3}$$

$$\underset{\text{But-2-yne}}{CH_3C \equiv C - CH_3} + H_2O \xrightarrow[HgSO_4,330K]{dil.H_2SO_4} \underset{\text{Butanone}}{CH_3CH_2\,\overset{\overset{\displaystyle O}{\|}}{C} - CH_3}$$

Ans 04.



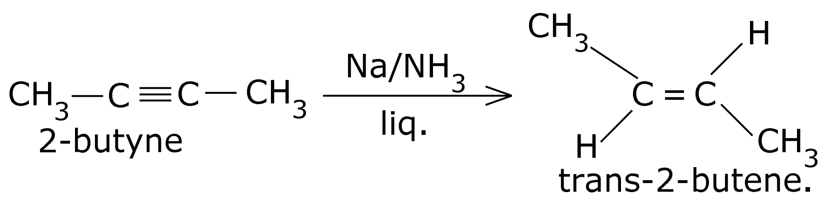
Ans 05.



Ans 06.

$$\underset{\text{ethyne}}{HC \equiv CH} + H_2 \xrightarrow{\text{Pt/Pd/Ni}} [H_2C{=}CH_2] \xrightarrow{H_2} \underset{\text{ethane}}{CH_3 - CH_3}$$

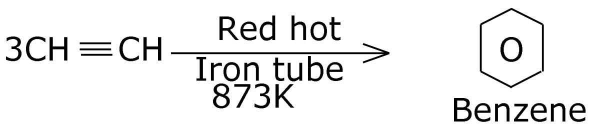
Ans 07.



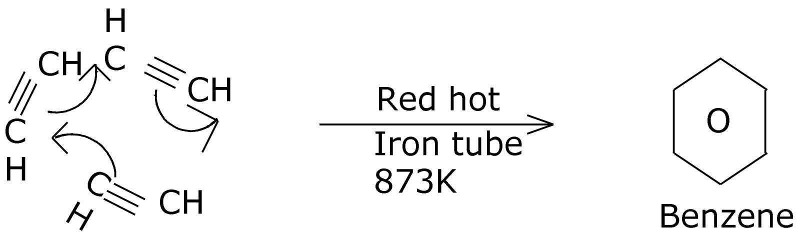
Ans 08. Combustion reaction for hexyne.

$$\underset{\text{hexyne}}{HC \equiv C - CH_2 - CH_2 - CH_2 - CH_3(g)} + 17/2O_2(g) \xrightarrow{\triangle} 6CO_2(g) + 5H_2O(g)$$

Ans 09.



Or



Ans 10.

$$HC \equiv CH \xrightarrow[196K]{Na,\ NH_3(l)} HC \equiv C^{-}\text{-}Na^{+}$$

$$\underset{\text{Isopropyl iodide}}{CH_3 - \overset{\displaystyle CH_3}{\overset{|}{C}H} - I} + HC \equiv C^{-} Na^{+} \longrightarrow \underset{\text{3-methyl but-1-yne}}{CH_3 - \overset{\displaystyle CH_3}{\overset{|}{C}H} - C \equiv CH} + NaI$$

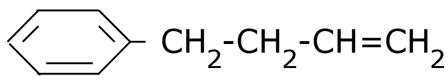
CBSE TEST PAPER 10

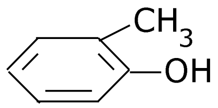
CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Aromatic Hydrocarbon

1. What are benzenoids? [1]

2. Write the IUPAC name of the following compound- [2]

(i) 

(ii) 

3. What do you mean by delocalization? [2]

4. What do you understated by Resonance energy? [2]

5. Although benzene is highly unsaturated; it does not undergo addition reactions. Give reason. [1]

6. How is aromaticity of a compound judged? [2]

7. Give some examples of aromatic compounds. [2]

8. How will you account for the structure of benzene? [1]

CBSE TEST PAPER 10

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Aromatic Hydrocarbon [ANSWERS]

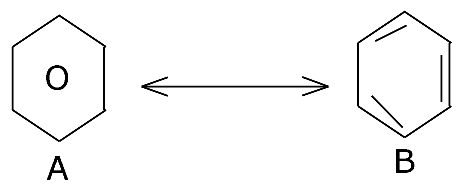
Ans 01. Aromatic hydrocarbon compound containing benzene ring are known as benzenoids.

Ans 02. (i) 4 – phenyl – but – 1 – ene.

(ii) 2 – Methyl phenol.

Ans 03. Delocalisation – Delocalisation implies that pairs of bonding electrons extend over three or more atoms and belong to the whole molecule. Delocalized π-orbitals are much larger than the localized π-orbitals and are therefore more stable.

Ans 04. The difference between the energy of the most stable contributing structure and the energy of the resonance hybrid is known as resonance energy. In case of benzene, the resonance hybrid has ($147KJ/mol^{-1}$) less energy than either A to B. Thus resonance energy of benzene is 147KJ/mole.



Ans 05. Unlike olefins, π-electrons of benzene are delocalized (resonance) and hence these are uncreative towards addition reactions.

Ans 06. The following characteristics decides aromaticity of a compound-:

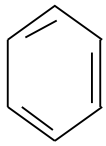
(i) Planarity

(ii) Complete delocalization of the π-electrons in the ring.

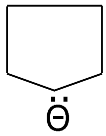
(iii) Presence of (4n+2) π electrons in the ring where n is an integer (n=0, 1, 2 ----)

This is often referred to as Huckel Rule.

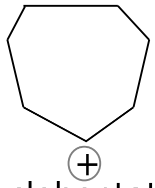
Ans 07.



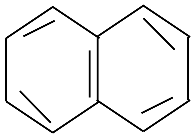
Benzene



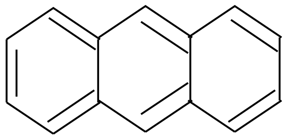
Cyclopentadienyl anion



Cycloheptatrienyl cation

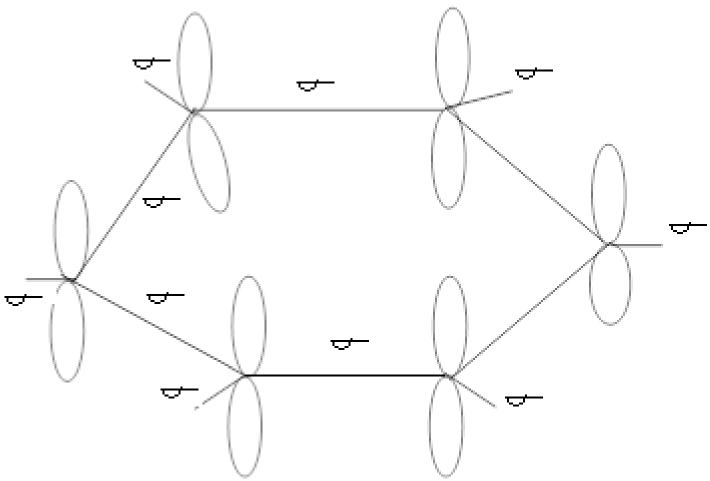


Napthalene



Anthracene

Ans 08. All the six carbon atoms in benzene are sp2 hydridised. Two sp2 hydrid orbitals of each carbon atom overlap with sp2 hydrid orbitals of adjacent carbon atoms to form six C-C sigma bonds with are in the hexagonal plane. The remaining sp2 hybrid orbital of each carbon atom overlaps with s-orbital of a hydrogen atom to form six C-H sigma bonds. Each carbon atom is now left with one hybridized p-orbital perpendicular to the plane of the ring.



CBSE TEST PAPER 11

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Preparation of Benzene

1. How is benzene prepared from aromatic acids? [2]

2. How is phenol reduced to benzene? [2]

3. How would you convert ethanoic acid into benzene? [3]

4. How will you convert the following compounds to benzene? [8]

   (i) Acetylene (ii) Benzoic acid

   (iii) Cyclohexane (iv) Benzene diazonium chloride.

5. How will you convert the following compounds into benzene? [1]

   (i) ethene (ii) hexane.

6. Why is benzene extra ordinarily stable though it contains three double bounds? [2]

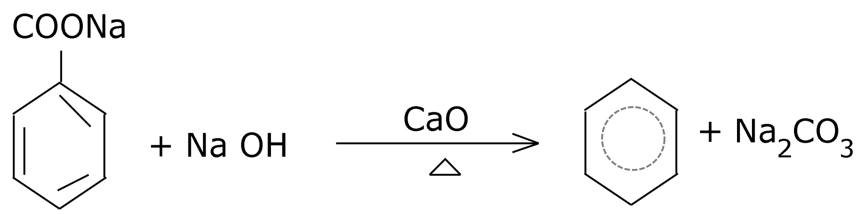
7. How would you prepare benzene from lime? [4]

CBSE TEST PAPER 11

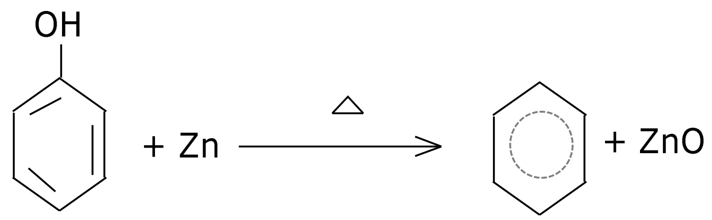
CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Preparation of Benzene [ANSWERS]

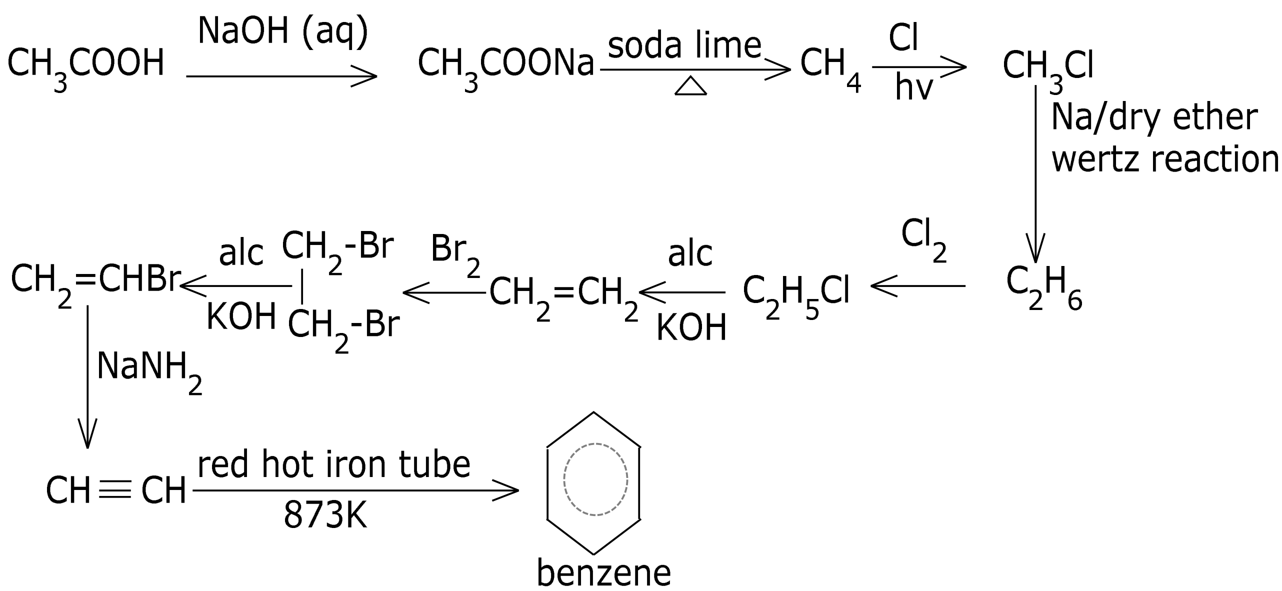
Ans 01. Sodium salt of benzoic acid on heating with soda lime gives benzene.



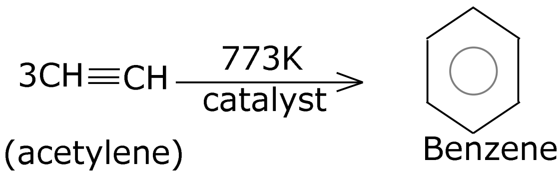
Ans 02. Phenol is reduced to benzene by passing its vapours over heated zinc dust.



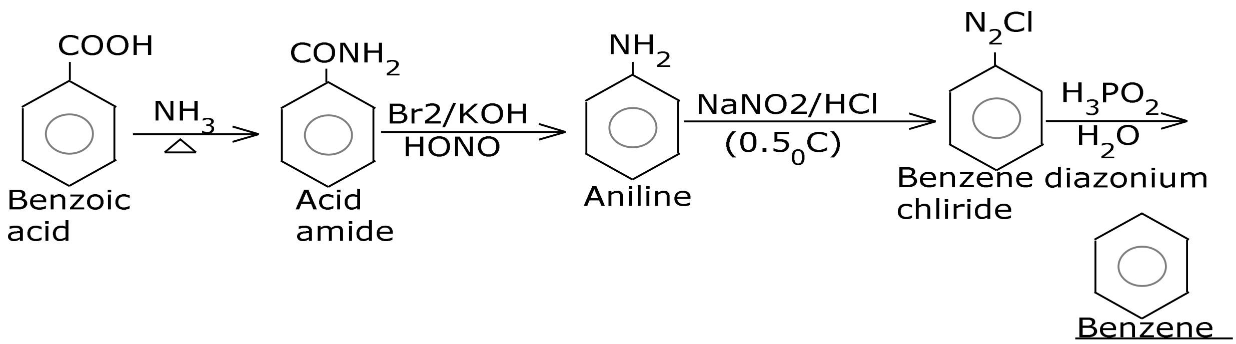
Ans 03.



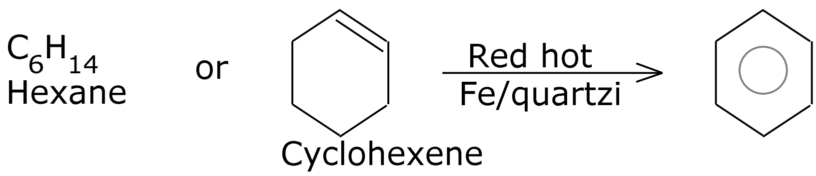
Ans 04. (i) When ethyne is heated at a higher temperature it polymerizes to give bnzene.



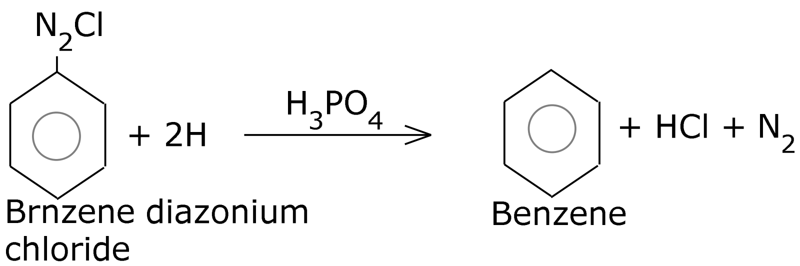
(ii) Benzoic acid when treated with NH_3 and heat changes to amide which on treatment with Br_2 / KOH gives aniline which converts to diazonium salt which on acid hydrolysis gives benzene.



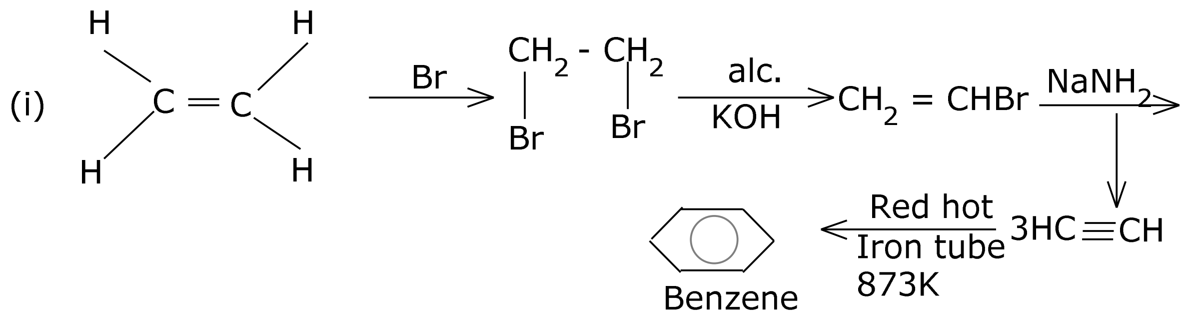
(iii) Cyclohexane when treated with iron or quartz in a red hot tube under goes oxidation to form benzene.

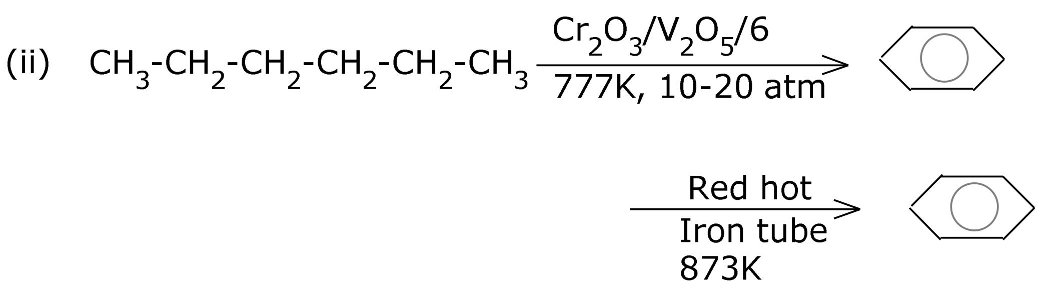


(iv) In the presence of hypoposphorus acid benzene diazonium chloride is converted into benzene. (diazo group is replaced by H)



Ans 05.





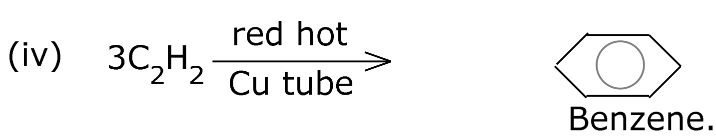
Ans 06. Due to resonance.

Ans 07. Benzene can be prepared from lime be the following methods:

(i) $\underset{\text{Lime Stone}}{CaCO_3} \xrightarrow{\triangle} CaO + CO_2$

(ii) $\underset{\text{Lime}}{CaO + C} \xrightarrow[\text{discharge}]{\text{electric}} \underset{\text{Calcium carbide}}{CaC_2}$

(iii) $CaC_2 + 2H_2O \xrightarrow{\text{Furnace}} \underset{\text{acetylene}}{C_2H_2} + Ca(OH)_2$



CBSE TEST PAPER 12

CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Properties of Benzene

1. What is friedel craft's reaction? Give an example. [2]

2. How will you convert benzene into [8]

   (i) p – Nitro bromo benzene

   (ii) m – Nitrochloro benzene

   (iii) p – Nitro toluene

   (iv) Aceto phenone?

3. What happens when benzene is oxidized at 770K in presence of V_2O_5? Give chemical equation. [2]

4. How will you convert benzene to iodobenzene? Give chemical equation. [2]

5. What are electrophilic substitution reactions? [2]

6. How will you distinguish between Ethene and benzene [2]

7. p-chloro nitro benzene has less dipole moment (2.4 D) than p-nitro toluene (4.4 D). Why? [4]

8. How is benzene converted to benzene hexachloride? [2]

9. Name some carcinogenic hydrocarbons. [3]

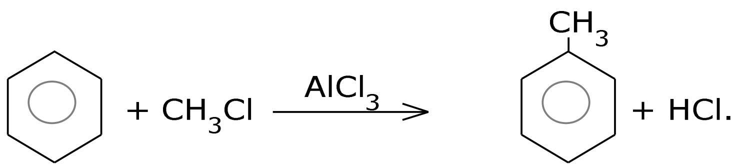
10. How will you convert benzene to hexachlorobenzene? [2]

CBSE TEST PAPER 12

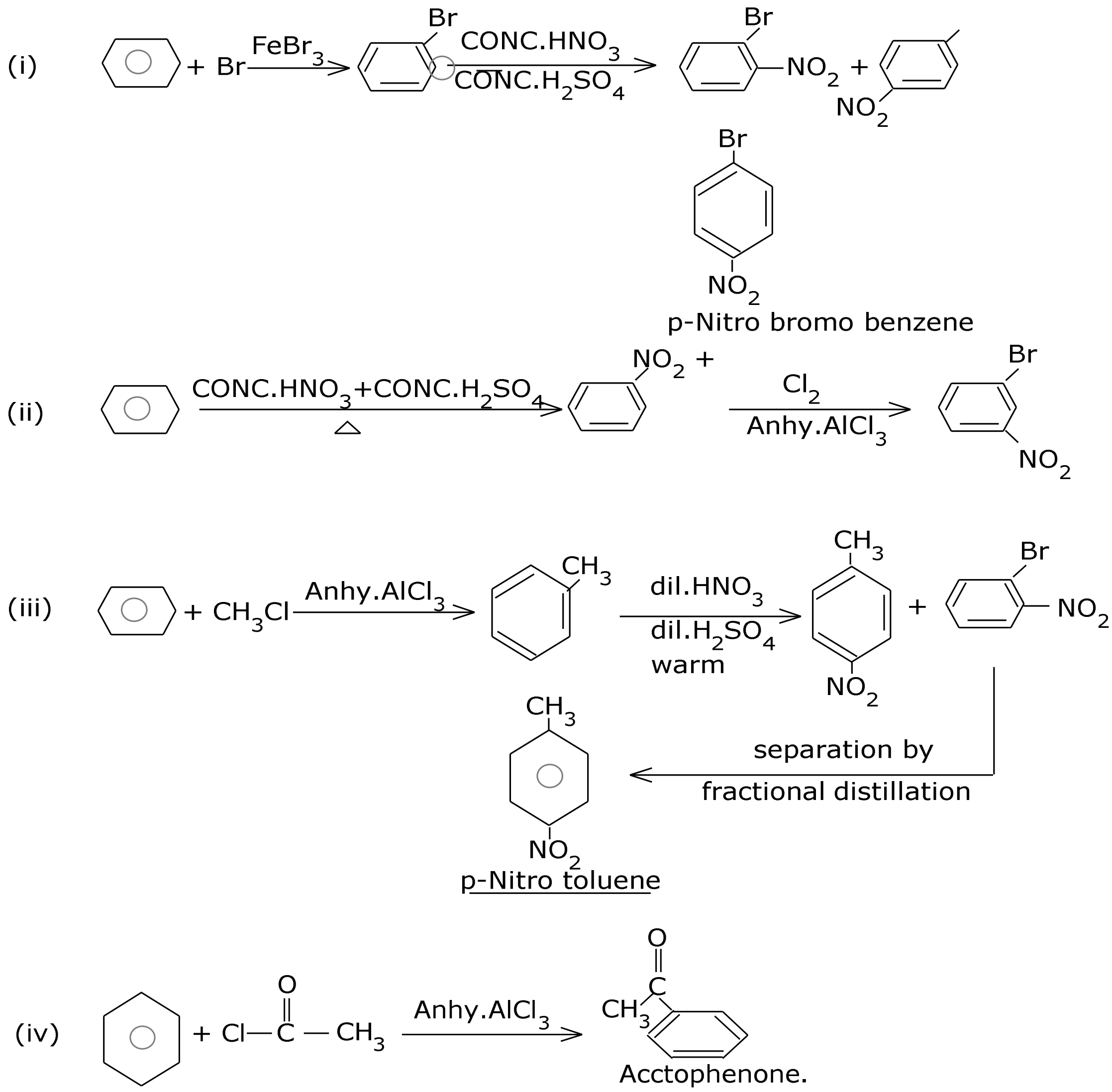
CLASS XI CHEMISTRY (Hydrocarbons)

Topic: Properties of Benzene [ANSWERS]

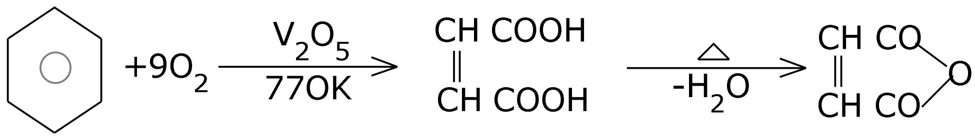
Ans 01. When benzene or its derivative reacts with alkyl halide in presence of $AlCl_3$, we get alkyl benzene.



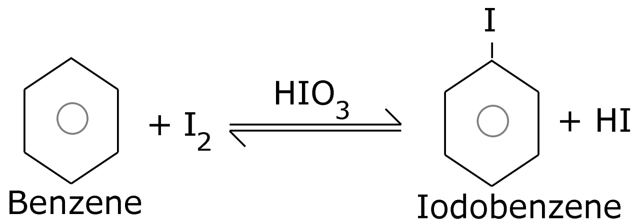
Ans 02.



Ans 03.



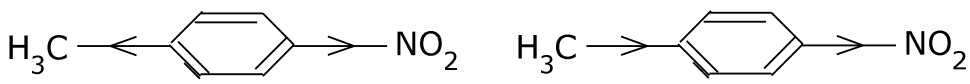
Ans 04.



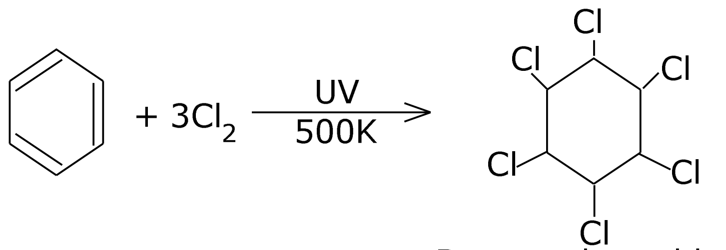
Ans 05. Those reactions in which weaker electrophile are replaced by a stronger electrophile are called electrophilic substitution reactions.

Ans 06. Ethene discharges bromine water colour and Baeyer's reagent colour while benzene does not.

Ans 07 In p-chloral nitro benzene the individual moments are in opposite directions and hence partially cancel. When in p-nitro toluene, both moments are in the same direction and hence add each

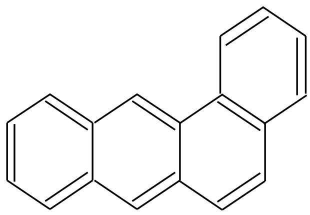


Ans 08. Under ultra-violet light, three chlorine molecules add to benzene to produce benzene hexachloride, $C_6H_6Cl_6$ which is also called gammaxane.

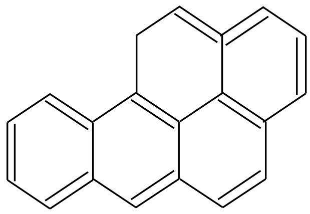


Benzene hecachloride
(BHC)

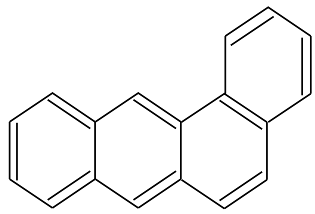
Ans 09.



1,2-Benzanthracene

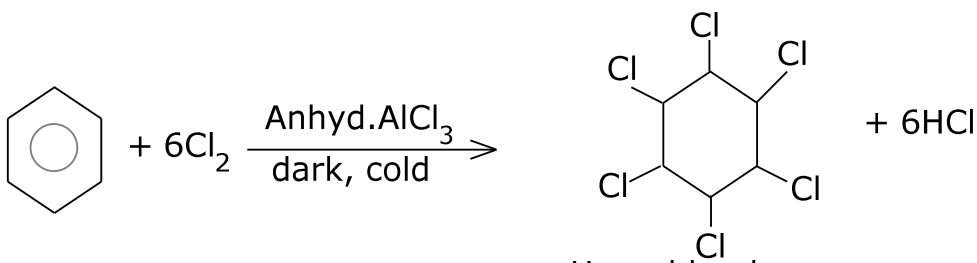


1,2-Benzpyrene



9,10-Dimethyl-1,2-benzanthracene

Ans 10. Benzene on treatment with of chlorine in the presence of anhydrous $AlCl_3$ in dark yields hexachloroben - zene (C_6Cl_6)



Hexachlorobenzene
(C_6Cl_6)

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (Environmental Chemistry)

Topic: Atmospheric Pollution

1.	What is troposphere?	[1]
2.	What is the role of ozone layer in the stratosphere?	[2]
3.	Name some gaseous air pollutants.	[1]
4.	What are the diseases caused by sulphur dioxide?	[1]
5.	What includes stratospheric pollutants? Give examples.	[2]
6.	What are the harmful effects of oxides of nitrogen in oxygen?	[3]
7.	Why is carbon monoxide considered to be poisonous?	[2]
8.	What are the ill-effects of hydrocarbons?	[2]
9.	What is harmful effect of nitrogen dioxide?	[3]

CBSE TEST PAPER 01

CLASS XI CHEMISTRY (Environmental Chemistry)

Topic: Atmospheric Pollution [ANSWERS]

Ans 01 The lowest region atmosphere in which the human beings along with other organisms live is called troposphere. It extends upto the height of ~ 10 km from sea level.

Ans 02 The presence of ozone in the stratosphere prevents about 99.5% of the sun's harmful ultraviolet (uv) radiations from reaching the earth's surface and thereby protecting humans and other animals from its effect.

Ans 03. Gaseous air pollutants are oxides of sulphur, nitrogen and carbon, hydrogen sulphide, hydrocarbons, ozone and other oxidants.

Ans 04 Sulphur dioxide causes respiratory diseases eg. asthma, bronchitis, emphysema in human beings, sulphur dioxide causes irritation to the eyes, resulting in tears and redness.

Ans 05 Depletion of ozone layer in stratospheres leading to harmful uv radiation on earth is the result of stratospheric pollution. The presence of chloro fluoro carbon compounds in the atmosphere is responsible for this depletion.

Ans 06 (i) High concentration of NO_2 in atmosphere is harmful to plants resulting in leaf spotting, retardation of photosynthetic activity and also suppression the vegetation growth.

(ii) Nitrogen dioxide (NO_2) results in respiratory problems in human beings and leads to bronchitis.

(iii) Oxides of nitrogen have harmful effects on the nylon, rayon and cotton yarns and also cause cracks in rubber.

(iv)They also react with react with ozone (O_3) present in the atmosphere, and, their decrease the density of ozone.

Ans 07 Carbon monoxide binds to hemoglobin to form carboxyl – haemoglobin, which is about 300 times more stable than the oxygen – haemoglobin complex. In blood when the concentration of carboxyl hemoglobin is greatly reduced. This oxygen deficiency, results into headache, weak eyesight, nervousness and cardiovascular disorder.

Ans 08 Hydrocarbons are carcinogenic i. e; they cause cancer. They harm plants by causing ageing, breakdown of tissues and shedding of leaves flowers and trigs.

Ans 09 Nitrogen dioxide is extremely toxic to living tissue and harmful to plants, paints, textiles and metals. It causes acid rain. It produces photochemical smog.

CBSE TEST PAPER 02

CLASS XI CHEMISTRY (Environmental Chemistry)

Topic: Global Warming and greenhouse Effect

1. List gases which are responsible for green house effect? [1]

2. What is the effect of CFC's on ozone layer? [1]

3. Give one main reason of ozone depletion? [2]

4. Which zone is called ozonosphere? [2]

5. What is 'greenhouse effect'? How does it affects the global climate? [2]

6. Name the factors that are responsible for the depletion of ozone layer? [3]

7. What is the effect of CFC's on ozone layer? [1]

8. Which disease is caused due to ozone layer depletion? [1]

9. What are the ill effects of ozone hole? [3]

CBSE TEST PAPER 02

CLASS XI CHEMISTRY (Environmental Chemistry)

Topic: Global Warming and greenhouse Effect [ANSWERS]

Ans 01 Carbon dioxide, methane, water vapors, nitrous oxide, CFC's and ozone are responsible for green house effect.

Ans 02 Chlorofluorocarbon (CFC's) damage the ozone layer and creates holes in ozone layer.

Ans 03 The main reason of ozone depletion is the release of chlorofluoro compounds (CFC's) in the atmosphere also known as Freon.

Ans 04 Stratosphere zone is called ozonosphere.

Ans 05 The warming of the earth or global warming due to re-emission of sun's energy absorbed by the earth followed by its absorption by CO_2 molecules and H_2O vapours present in the atmosphere, near the earth's surface and then its radiation back to the earth is called greenhouse effect.

Greenhouse affects the climate. If the rate at which solar radiation are arriving the earth continues, then the entire global climate is going to change drastically.

Ans 06 Due to human activity two types of compounds have been found to be most responsible for depleting ozone layer and creating a hole into it. These two agents are :

(i) Nitric oxide (NO) : NO reacts with ozone decreasing the amount of ozone and forms NO_2 which absorbs energy from sunlight and breaks up in NO.

$$NO + O_3 \rightarrow O_2 + NO_2$$

$$NO_2 + O \rightarrow NO + O_2$$

(ii) Chlorofluorocarbons (CFC's) : In the stratosphere, they first undergo photochemical decomposition to give chlorine atoms

$$CF_2Cl_2 \xrightarrow{h\upsilon} CF_2Cl + Cl.$$
$$Cl. + O_3 \rightarrow ClO. + O_2$$
$$ClO. + O \rightarrow Cl. + O_2$$

It has been observed that one molecule of CFC can destroy one lakh O_3 molecules in the stratosphere.

Ans 07 Chlorofluoro carbons (CFC's) damage the ozone layer and create holes in ozone layer.

Ans 08 Ultraviolet rays reaching the earth passing through the ozone hole cause skin cancer.

Ans.09 Consequences of Ozone hole:

The ultraviolet rays entering into the earth through ozone hole leads to

(i) Increase cases of skin cancer

(ii) It affects plants, chlorophyll, proteins and causes harmful mutation in them.

(iii) Upset the heat balance of the earth

(iv) Ecological imbalance, which would adversely affect man and animals.

CBSE TEST PAPER 03

CLASS XI CHEMISTRY (Environmental Chemistry)

Topic: Acid Rain and Photochemical smog

1. What is smog? [1]

2. The London smog is caused in which season and time of the day? [1]

3. Name two air pollutants which forms photochemical smog. [1]

4. Name two gases which form acid rain. [1]

5. Which acid is present is the acid rain? [1.5]

6. What is PAN? [1]

7. What is the composition of photochemical smog? [2]

8. When does rain water become acid rain? [1]

9. Why does rain water normally have a pH of about 5.6? When does it become acid rain, [3]

10. How can photochemical smog be controlled? [2]

CBSE TEST PAPER 03

CLASS XI CHEMISTRY (Environmental Chemistry)

Topic: Acid Rain and Photochemical smog [ANSWERS]

Ans 01 When smoke with fog, it is called smog.

Ans 02 The London smog is caused during summer season and in the afternoon pant of the day when it is very hot.

Ans 03 PAN and O_3.

Ans 04 SO_2 and NO_2.

Ans 05 The acids present in the acid rain are
H_2SO_4, HNO_3 and HCl.

Ans 06 PAN is Peroxy acetyl nitrate.

Ans 07 Photochemical smog is formed as a result of photochemical reaction (i. e; in the presence of sunlight) between oxides of nitrogen and hydrocarbons.

Ans 08 When pH of rain water becomes as low as 2 to 3.5. It forms acid rain.

Ans 09 Rain water normally has a pH of 5.6 due to the formation of H^+ ions from the reaction of rain water with CO_2 present in the atmosphere.

$$H_2O + CO_2 \rightarrow 2H^+ + CO_3^{2-}$$

When the value of pH drops below 5.6, it becomes acidic. Acid rain is also formed due to the presence of oxides of sulphar and nitrogen in the atmosphere.

$$2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4$$

$$4NO_2 + O_2 + 2H_2O \rightarrow 4HNO_3.$$

Ans 10 If we control the primary precursors of photochemical smog such as NO_2 and hydrocarbons, the secondary precursors such as ozone and PAN, the photochemical smog will automatically be reduced. Usually catalytic converters are used in the automobiles which prevent the release of nitrogen oxide and hydrocarbon to the atmosphere. Certain plants eg. Pines, Juniparus, Quercus, Pyrus and Vitis can metabolise nitrogen oxide and their plantation could help in this matter.

CBSE TEST PAPER 04

CLASS XI CHEMISTRY (Environmental Chemistry)

Topic: Water and Soil Pollution

1. What is BOD? [1]

2. What does the amount of BOD signify? [2]

3. Define green chemistry. [1]

4. What are pesticides? [1]

5. What should be the pH of drinking water? [1]

6. What is the effect of excess of SO_4^{2-} ion in drinking water [1]

7. What is the desirable concentration of fluoride ion (F^-) in drinking water? [1]

8. What is pneumoconiosis? [2]

9. Discuss the water pollution caused by industrial water? [3]

10. What is an insecticide? [1]

CBSE TEST PAPER 04

CLASS XI CHEMISTRY (Environmental Chemistry)

Topic: Water and Soil Pollution [ANSWERS]

Ans 01 BOD stands for Biochemical Oxygen Demand.

Ans 02 The amount of BOD in water is a measure of the amount of organic material in the water, in terms of how much oxygen will be required to break it down biologically. Clean water would have BOD value of less than 5 ppm whereas highly polluted water would have a BOD value of 17 ppm or more.

Ans 03 The branch of chemistry that emphasizes on the processes and products that reduce or eliminate the use and generation of toxic / hazardous substances is called green chemistry.

Ans 04 Pesticides are those chemicals which are used to destroy pests, rats, parasites and fungi.

Ans 05 The pH of drinking water should be between 5.5 and 9.5.

Ans 06 Excess of SO_4^{2-} in drinking water (> 500 ppm) may cause a laxative effect.

Ans 07 1ppm or 1 mg dm^{-3} is desirable concentration of F^- ions in drinking water.

Ans 08 The smaller particulate pollutants are more likely to penetrate into the lungs. These five particles are carcinogens Inhalation of small particles irritates the lung and exposure to such particles for long period of time causes fibrosis of the lung lining. These type of disease is termed as pneumoconiosis.

Ans 09 The compounds of lead, mercury, Cd, Ni, Co, Zn etc which are the products of chemical reactions, carried in the industrial units, pollute water to a large extent and are responsible for many disease. Mercury leads to minimarts disease, lead poisoning leads to many deformities. In addition, these substances adds to the soil and harmfully affect the plant growth and the whole soil biotic system. Both ground water and water bodies are polluted due to chemical reactions known as leaching.

Ans 10 Insecticides are used to control insects and curve disease (for eg. malaria and yellow fever) and protect crops. Eg. DDT.

CBSE MIXED TEST PAPER-01

(First Unit Test)

CLASS - XI CHEMISTRY

[Time : 1.50 hrs.] **[M. M.:** 50]

General Instructions:-

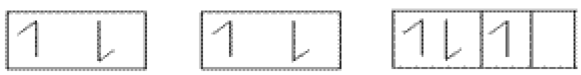
(i) Attempt all questions.
(ii) Q. No. 1 to 5 carries 1 mark each.
(iii) Q. No. 6 to 10 carries 2 marks each.
(iv) Q. No. 11 to 15 carries 4 marks each.
(v) Q. No. 16 carries 5 marks.

1.	Write are isoelectronic species. Which of the following are isoelectronic Ca^{+2}, Mg^{+2} and Ar.	½ + ½ = 1-mark
2.	At STP what will be the volume of 6.023 x 10^{23} molecules of SO_2 gas.	1-mark
3.	Express the number 54000 in scientific notation to show four significant figures.	1-mark
4.	How are 0.50 mol Na_2 CO_3 and 0.50 M Na2 CO_3 different?	1-mark
5.	Boron occurs in nature in the form of Two Isotopes in ration of 81% and 19% respectively. Calculate its average atomic mass.	1 -mark
6.	What will be the mass of one C^{12} in grams.	2-marks
7.	Define mole. Calculate the number of atoms in 52 U of He.	1+1-marks
8.	A container contains 2 liters of milk. Calculate the volume of the milk in $m^{3.}$	2-marks
9.	Define the following:- (i)Formula mass (ii) Accuracy (iii) Homogeneous mixture (iv) Molar Mass.	2-marks
10	'X' and 'Y' are known to form two compounds the 'X' content in one is 5.93%	2-marks

while in other is 11.2%. Show that this data is in agreement with the law of multiple proportions.

11. (a) State and explain (n + 1) Rule with suitable example. 4-marks

(b) Write the rule due to which following electronic configuration for Nitrogen is not possible. Explain it.



12. (a) A compound on analysis. Give the following % composition 4-marks

C = 54.54%, H = 9.09%, 0 = 36.36%

Molecular mass of the compound is 88.

(b) Find out the empirical and Molecular formula of the compound.

13. (a) Using S, P, d notation, describes the orbital with the following quantum numbers 4-marks
(i) n = 2, I = 0
(ii) n = 3, I = 2
(b) Which of the following orbital are not possible? Give reasons.
4s, 3 f, 2 d, 1p.

14. (a) Define empirical formulae. Give empirical formula of Glucose. 4-marks

(b) A compound on analysis gave the following composition c = 54.54%, H = 9.09% 0 = 36.36%. Molecular mass of the compound is 88. Find out its molecular formula.

15. Define Molarities. Calculate the molarities of NaOH for the solution prepared by dissolving its 0.4 g in enough water to form 250 ml of the solution. 5-marks

16. (a) Differentiate between the following pairs with the help of one example
(i) Isotopes and Isobars
(ii) Orbit and orbital.
(b) Write electronic configuration of cu^{+2} species. [at NO. of copper = 2g]
(c) What is the limiting reagent in the reaction:-
$Zn_{(s)} + 2HCI \dashrightarrow ZnCI_{2(ag)} + H_{2(g)}$
If 0.30 mol Zn is added to HcI containing 0.52 mol of HcI. How many mol of H_2 are produced.

CBSE MIXED TEST PAPER-02

FIRST TERM UNIT TEST

CLASS - XI CHEMISTRY

[Time : 1.50 hrs.] **[M. M.:** 50]

Note: Attempt all questions.

Q1. Write IUPAC name of element with atomic number 111.1 [1]

Q2. Using s, p, d notations, describe the orbitals if n = 4, 1 = 2. [1]

Q3. Write modern periodic law. [1]

Q4. If 10 volume of H_2 gas reacts with 5 volume of O_2 gas. How many volume of water vapour would be produced. [1]

Q5. How many significant figures are present in the 0.0025. [1]

Q6. Calculate the number of atoms in 52u of He. [1]

Q7. Name a species that will be is electronic each of the following [2]

(a) Mg^{2+}

(b) Ar

(c) F^-

Q8. Write the number of unpaired electrons in Cr(At. No. -24) [2]

Q9. Which of the following species will have the largest and the smallest size. [2]

Mg, Mg^{2+}, Al, Al^{3+}

Q10. What will be the wavelength of a ball of mass 0.1kg moving with the velocity of 10m/s. [2]

Q11. Calculate molality of a solution of ethanol in water in which the mole fraction of ethanol is 0.40 [3]

Q12. Write the electronic configurations of – [3]

(i) H^-

(ii) Na^+

(iii) O^{2-}

Q13. What is the number of photons of light with the wavelength 4000pm that provide 1J of energy. [3]

Q14. Write the general outer electronic configuration of s-, p-, d- Block elements. [3]

Q15. Give the number of electrons in the species H_2^+, H_2 and O_2. [3]

Q16. The density of 3M solution of NaCl is 1.25g/ml calculate molality of the solution. [5]

Q17. Determine the empirical formula of an oxide of iron which has 69.9% Iron and 30.1% dioxygen by mass. [5]

Sample Paper for Cumulative Examination
Class- XI
Subject – Chemistry

Time Allowed : 3 Hrs. M.M.70

General Instructions:

All questions are Compulsory.

1) Question nos. 1 to 8 are very short answer questions and carry 1 mark each.
2) Question nos. 9 to 18 are short answer questions and carry 2 marks each.
3) Question nos. 19 to 27 are also short answer questions and carry 3 marks each.
4) Question nos. 28 to 30 are long answer questions and carry 5 marks each.
5) Use Log tables if necessary, use of calculators is not allowed.

Q1 Given that density of water is 1 gmL^{-1}. What is its density in Kgm^{-3}?

Q2 Define Law of multiple proportions.

Q3 How many electrons will be present in the sub-shells having m_s value of -1/2 for n=4?

Q4 Why standard heat of formation of diamond is not zero though it is an element?

Q5 Write conjugate acids for the following Bronsted bases: $HCOO^-$, NH_3

Q6 For the following equilibrium $K_c = 6.3 \times 10^{-14}$ at 1000 k

$$NO(g)+O_3(g) \rightleftharpoons NO_2(g) + O_2(g)$$

What is K_c for the reverse reaction?

Q7 What is the oxidation number of S in $H_2S_2O_7$?

Q8 In the reaction $H_2S(g) + Cl_2(g) \longrightarrow 2HCl(g) + S(s)$

Which species is reduced?

Q9 Calculate the molecular mass of CO_2 , H_2O

Q10 Out of 3d and 4s orbital , which is filled first and why?

Q11 What is the total number of sigma and Pi bonds in the following molecules?

a) C_2H_2
b) C_2H_4

Q12 What is the basic difference between the terms electron gain enthalpy and electronegativity ?

Q13 State first law of thermodynamics. Give its mathematical expression.

Q14 Using the equation of state pv =nRT , show that at a given temperature density of a gas is proportional to gas pressure p ?

Q15 Give four conditions to have better yield of ammonia in Haber's process

$$3H_2(g) + N_2(g) \rightleftharpoons 2NH_3 \; ; \quad \Delta H = -92.3KJ$$

Q16 Yellow light emitted from a sodium lamp has a wavelength ( ) of 580nm. Calculate the frequency (v) and wavenumber (v) of the yellow light.

OR

Calculate the wavelength, frequency of a light wave whose period is 2.0×10^{-10}s.

Q17 Balance the following equation by half equation method.

$$MnO^-_4 + H^+ + I^- \longrightarrow Mn^{2+} + H_2O + I_2$$

Q18 Write the names of isotopes of hydrogen. What is the mass ratio of these isotopes?

Q19 You are told by your chemistry teacher to dissolve 4g of sodium hydroxide in 250 ml of solution . Find out

a) Strength of solution
b) Molarity of Solution

Q20 Calculate the uncertainity in the momentum of an electron if it is confined to a linear region of Length 1×10^{-10} metre.

Q21 How would you explain the fact that the first ionization enthalpy of sodium is lower than that of magnesium but its second ionization enthalpy is higher than that of magnesium?

Q22 Discuss the shape of the following molecules using VSEPR model

i. $BeCl_2$
ii. BCl_3

Q23 (a) What will be the conjugate bases for the following Bronsted acids:

HF , H_2SO_4

(b) What are buffer solutions? Give one example of natural buffer.

Q24 (a) What is meant by '10V' H_2O_2 solution?

(b) What are Non- stoichiometric hydrides? Give one example.

(c) What causes the temporary and permanent hardness of water.

OR

(a) What do you understand by the terms

(i) syn gas

(ii) water gas shift reaction

(b) How does H_2O_2 behave as a bleaching agent?

Q25 (a) In terms of Charle's law explain why -273^{o}C is the lowest possible temperature.

(b) Critical temperature for Carbon Dioxide and methane are 31.1^{o}C and - 81.9^{o}C respectively.Which of these has stronger intermolecular forces and why?

Q26 Depict the galvanic cell in which the reaction

$Zn(s) + 2Ag^+(aq) \longrightarrow Zn^{2+}(aq) + 2Ag(s)$ takes place,

Further show:

(i) Which of the electrode is negatively charged.

(ii) The carriers of the current in the cell , and

(iii) Individual reaction at each electrode.

Q27 A neon – dioxygen mixture contains 70.6 g dioxygen and 167.5g neon. If pressure of the mixture of gases in the cylinder is 25 bar. What is the partial pressure of dioxygen and neon in the mixture?

Q28 (a) State Boyle's Law and Charle's law through graphs only.

(b) Give relations between volume and number of moles of a gas.

(c) What is the S.I. value of universal gas constant 'R'.

(d) What do you understand by STP now a days.

OR

(a) What is absolute zero?

(b) Define compressibility factor 'Z'.

(c) What type of intermolecular forces exist in the following:

i. Alcohol and water

ii. NaCl in water

iii. CH_4

Q29 (a) Give the shape of molecules ammonia, water , PCl_5 , CH_4, $BeCl_2$, BCl_3

(b) Describe the shape of ethene on the basis of hybridization.

OR

(a) Which of the following molecules are polar and which are non- polar and why?

BF_3, NH_3 , H_2O

(b) Which of the following does not exist and why? (Explain on the basis of molecular orbital theory)

He_2 and H_2

Q30 (a) Define the following:-

i. $\triangle_r H^o$ = Enthalpy of reaction

ii. Hess's Law

(b) Calculate the Enthalpy of formation of $CH_3OH(I)$ from the following data

(i) $CH_3OH(l) + 3/2\, O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$ $\triangle H = 1726 KJ$

$C(s) + O_2(g) \longrightarrow CO_2(g)$ $\triangle H = -393$ KJ

$H_2(g) + ½\, O_2(g) \longrightarrow H_2O(l)$ $\triangle H = -286 KJ$

OR

(a) Give relationship between

(i) $\triangle_r H^o$ and $\triangle_f H^o$

(ii) $\triangle_r G^o$ and $\triangle_f S^o$

(iii) $\triangle_r H^o$ and Bond Enthalpy

(b) Define

(i) Spontaneous reaction

(ii) Second law of Thermodynamics

Sample Paper for Cumulative Examination
Class- XI
Subject – Chemistry

Time Allowed : 3 Hrs. M.M.70

General Instructions:

All questions are Compulsory.

1) Question nos. 1 to 8 are very short answer questions and carry 1 mark each.
2) Question nos. 9 to 18 are short answer questions and carry 2 marks each.
3) Question nos. 19 to 27 are also short answer questions and carry 3 marks each.
4) Question nos. 28 to 30 are long answer questions and carry 5 marks each.
5) Use Log tables if necessary, use of calculators is not allowed.

Q1. Give that relationship which relates wavelength and momentum of a moving electron.

Q2. Express the 32.968 number to three significant figure.

Q3. Write the equilibrium constant expression for the following reaction

$$AgBr\ (s) \rightleftharpoons Ag^{+}{}_{(aq)} + Br^{-}{}_{(aq)}$$

Q4. State zeroth law of thermodynamics.

Q5. Why do elements in the same group have similar physical and chemical properties?

Q6. Draw the Lewis structure for the following molecules

$SiCl_4$, BeF_2

Q7. What is the oxidation number of oxygen in H_2O_2?

Q8. Give mathematical expression of Charle's Law.

Q9. Write electronic configuration of dioxygen molecule (O_2).Prove that it is paramagnetic.

Q10. Find the pH of the following:-

(a) 2×10^{-3} M HCL(aq)

(b) 1×10^{-3} M KOH(aq)

Q11. A solution is prepared by adding 2g of a substance A to 18g of water. Calculate the mass percent of the solute.

Q12. Calculate the wavelength of an electron moving with a velocity of 2.05×10^{7} ms^{-1}.

Q13. What is the basic difference in approach between Mendeleev's Periodic Law and Modern Periodic Law?

Q14. Enthalpy of combustion of carbon to CO_2 is -393.5 KJ vol $^{-1}$. Calculate the heat released upon formation of 35.2g of CO_2 from carbon and dioxygen gas.

Q15. Balance the following redox reaction by ion – electron method:-

MnO_4^- (aq) $+Br^-$(aq) → MnO_2(s) + BrO_3^-(aq) (in basic medium)

Q16. Give two limitations of Bohr's Atomic model?

O R

Give two limitations of Rutherford's model ?

Q17. (a) Give any method of preparation of hydrogen.

(b) What is oxidation number of hydrogen in NaH.

Q18 What is electronegativity? How does it varies in group. Give reason.

Q19 (a) State Heinsberg's uncertainty Principle.

(b) The uncertainity in the position and velocity of a particle are 10^{-2} m and $5.27x10^{-24}$ m/s respectively Calculate mass of the particle

L = 6.626×10^{-34} kg

Q20 Write the molecular orbital configuration of the following species

(a) O_2^-

(b) O_2^+

(i) Calculate their bond orders.

(ii) Perdict their magnetic behaviour.

OR

Write the resonating structures for NO_3^-, CO_3^{2-}, SO_2

Q21 (a) Identify the substance oxidized , reduced , oxidizing agent and reducing agent for the following :-

$Pb_{(s)} + PbO_2(s) + 2H_2SO_{4\,(aq)} \longrightarrow PbSO_{4\,(s)} + 2H_2O_{(l)}$

(c) Write formulas for the following Compounds

(i) Mercury(II) Chloride

(ii) Chromium (III) Oxide

Q22 Calculate the enthalpy of formation of acetic acid if its enthalpy of combustion is -867 kg/mol. The enthalpy of formation of CO_2 (g) and $H_2O_{(l)}$ are -393.5 KJ/mol and 285.9 KJ / mol respectively.

Q23 (a) Name the isotope of Hydrogen which is radioactive.

(b) Give formula and molecular mass of heavy water.

(c) Name two ions which cause hardness in water.

Q24 (a) Explain why BeH_2 molecule has a zero dipole moment although the Be-H bonds are polar.

(b) Use molecular orbital theory to explain why Be_2 molecule does not exist.

(c) Out of LiF and LiCl which has more ionic character and why?

Q25 A compound contains 4.07% hydrogen , 24.27% carbon and 71.65% chlorine. Its molar mass is 98.96g . What are its empirical and molecular formulas?

Q26 A neon – dioxygen mixture contains 70.6g dioxygen and 167.5g neon . If pressure of the mixture of gases in the cylinder is 25 bar . What is the partial pressure of dioxygen and neon in the mixture?

Q27 Explain the terms:-

(a) Solubility product

(b) Common ion effect

(c) Buffer Solutions

Q28 The following represents a gaseous system at equilibrium

$2SO_2\ (g) + O_2 \rightleftharpoons 2SO_3\ (g) + Heat$

Indicate the direction in which the equilibrium will shift when the following changes are made.

(i) Temperature of the system is decreased.

(ii) Total Pressure is added.

(iii) A Catalyst is added

(iv) Volume of Container is increased.

(v) 1 mole of He (g) is added at constant pressure.

OR

State Le Chatelier 's principle. Under what condition is it applicable ?

Discuss its application in the manufacture of ammonia by Habers Process.

Q29 What happens to work , when?

(i) Gas expands irreversibly against an external pressure

(ii) Gas is compressed.

(iii) Gas expands into vacuum.

(iv) An ideal gas expands reversibly and isothermally.

(v) Gas expands adiabatically.

OR

Under what conditions , the heat evolved or absorbed in a reaction is equal to its free energy change.

(i) The standard free energy of a reaction is found to be zero, what is its equilibrium constant.

(ii) The dissolution of ammonium chloride in water is endothermic still it dissolves in water .

(iii) A real crystal has more entrophy than an ideal crystal.

(iv) If $\triangle_r H^o$ is negative and and $\triangle_r S^o$ is also negative whether the reaction will be spontaneous or non- spontaneous at high temperature.

Q30 (a) Give the shape of molecules ammonia, water , PCl_5 , CH_4, $BeCl_2$, BCl_3

(b) Describe the shape of ethene on the basis of hybridization.

OR

(a) Which of the following molecules are polar and which are non- polar and why?

BF_3, NH_3 , H_2O

(b) Which of the following does not exist and why? (Explain on the basis of molecular orbital theory)

He_2 and H_2

CBSE TEST PAPER-05
Class – XI Chemistry

Time :-11/2 Hrs. **M.M. 40**

Note: (i) Attempt all questions.
(ii) Marks allotted to each question are Indicated against the question.

Q1. Write significant figures in – 0.0025, 8008 [1]

Q2. How many unpaired electrons are present in Fe^{+2} ion (Z for Fe is 26). [1]

Q3. What is (n + l) rule? [1]

Q4. Write IUPAC name of the element with atomic number 107. [1]

Q5. Which is preferred? Molarity or molality and why? [1]

Q6. What are possible values of I and m_l for an atomic orbital having principal quantum number 3. [2]

Q7. Which has first ionization enthalpy higher B or Be and why? [2]

Q8. Calculate the number of atoms in [2]

(a) 4.4g of CO_2 (b) 52 u of He.

Q9. The expected electronic configuration of Cu is [Ar] $3d^9\ 4s^2$ but actually it is [Ar] $3d^{10}\ 4s^1$. Explain why? [2]

Q10. State pauli's exclusion principle. Why it is called so? [2]

Q11. The density of 3M solution of Nacl is 1.25 g/ml. Calculate its molality. [At Mass Na = 23, Cl = 35.5] [3]

Q12. A Photon of wavelength 4×10^{-7} strikes on metal surface. The work function of the metal being 2.13ev. Calculate. [3]

(a) Energy of photon (ev)

(b) Kinetic energy of the emission.

(c) The velocity of the photoelectron.

(1 ev = 1.602×10^{-19} J, Mass of $e^{-} = 9.1 \times 10^{-31}$ kg).

Q13. Give reason (s) for. [3]

(i) Chlorine has higher electron gain enthalpy (negative) than fluorine.

(ii) Nitrogen has higher first lonization enthalpy than 0-atom.

(iii) Mg^{2+} ion is smaller than O^{2-} ion, although both have same electronic structures.

Q14. Arrange the elements as directed. [3]

(i) F, Cl, Br, l (increasing order of electron affinity)

(ii) N, P, O, S (increasing non-metallic characters)

(iii) F, Cl, O, N (increasing oxidizing property)

Q15. A 100 W bulb emits monochromatic light of wavelength 400 nm. Calculate no. of photons per second by the bulb. [3]

Q16. A compound contains 54.2% carbon, 9.2% hydrogen and 36.6% oxygen. Determine its Molecular formula if its Molecular weight is 88u. (At. Wt. of C = 12, H = 1, 0 = 16u) [5]

OR

(a) Why is the +2 oxidation state of Mn (25) is quite stable while the same is not true for iron (26)?

(b) State Avogadro's law.

(c) If the density o Methanol is 0.793 kg L^{-1}. What is its volume needed for making 2.5L of its 0.25M solution?

Q17. What Transition in the H-spectrum would have the same wavelength as the Balmer transition n = 4 to n = 2 of He^{+} spectrum? [5]

OR

Determine wavelength and frequency of light emitted when the electron a H-atom undergoes transition from an energy level n = 5 to n = 2.

CBSE TEST PAPER-06
Class – XI Chemistry

Time :-3 Hrs. **M.M.70**

General Instructions:
(i) All questions are compulsory.
(ii) Q. No. 1 to 8 carry 01 mark each.
(iii) Q No. 9 to 18 carry 02 marks each.
(iv) Q No. 19 to 27 carry 03 marks each.
(v) Q. No. 28 to 30 carry o5 marks each.
(vi) Use log table if necessary, calculator is not permitted.

Q1. How many inner transition series are present in the f-block? [1]

Q2. Give the general electronic configuration of the members of the carbon family. [1]

Q3. Write Charles's law. [1]

Q4. When is bond energy equal to bond dissociation energy? [1]

Q5. What are conjugate acid and conjugate base of H_2O? [1]

Q6. Write formula of Kc for following equilibrium. [2]

$N_2 + O_2 \rightleftharpoons 2NO$

Q7. Balance the following reaction in acidic medium. [2]

$NO_3^- \rightleftharpoons NO_2$

Q8. Give one use of dihydrogen (H_2). [2]

Q9. Give reasons: [2]

(i) Water can extinguish most fires but petrol fire.

(ii) Temporary hard water becomes soft on boiling.

Q10. Calculate the molar mass of water if water sample contains 50% heavy water (D_2O). [2]

Q11. State as to why: [3]

(i) The hydroxide of alkali metals are strong bases.

(ii) Sodium is stored in kerosene oil.

Q12. Define disproportionate with suitable example. [3]

Q13. Write short notes on any two. [3]

(i) Adiabatic process

(ii) Extensive properties

(iii) Entropy

(iv) Isolated system

Q14. Same mass of diamond and graphite (both being carbon) are burnt in oxygen. Will the heat produced be same or different? Why? [3]

Q15. Calculate the no. of atoms in 64 g of SO_2 at N. T. P. [3]

(S = 32, O = 16)

Q16. Sodium Chloride (NaCl) gives white ppt with $AgNO_3$ solution but chloroform doesn't. Explain. [5]

Q17. Explain the following: [5]

(i) Fluorine is most electronegative element.

(ii) Cesium is used in photoelectric cell.

Q18. Give the electronic configuration of the following ions:

(i) CO^{3+} (At No. of CO = 27)

(ii) Fe^{2+} (at. No. of Fe = 26)

Q19. Chorine is prepared by action of HCl on MnO_2.

$4HCl + MnO_2 \rightarrow MnCl_2 + 2N_2O + Cl_2$

How many grams of HCl react with 3.84 g. (At mass of Mn = 55μ)

Q20. The mass of an electron is 9.1×10^{-31} kg. If its K.E. is 3×10^{-25} J. Calculate its wavelength.

Q21. (a) What is the basic differences between the terms electron gain enthalpy and electro negativity.

(b) In terms of period and group, where would you locate the element with atomic number 10.

Q22. Calculate No. of sigma and pi bond in following:

(i) $CH_2 = CH - CH_3$

(ii) $CH_3C \equiv CCH_2OH$

(iii) $CH_3CH_2CH_3$

Q23. Predict the type of hybridization and shape of the following molecules on the basis of VSEPR theory.

(i) BF_3

(ii) SF_4

(iii) CH_4

Q24. Calculate the total pressure in a mixture of 8 g of oxygen and 4 g of hydrogen confined in a vessel of 1 dm^3 at 27^0 C.

(R = o.o83 bar dm^3 K^{-1} mol^{-1})

Q25. Balance the following equation by used oxidation number method in basic medium.

$P_4 + OH- \rightarrow PH_3 + H_2PO^-_2$

Q26. What do you mean by solubility product. Calculate K_{sp} of AgCl at 27^0 C. It its solubility in a saturated solution is 1.435 x $10^{-3}gL^{-1}$ at same temperature.

(Ag = 108, Cl = 35.5)

Q27. What are hydrides. Write different types of hydrides with examples.

Q28. What transition in the hydrogen spectrum would have same wavelength as Balmer transition n = 4 to n = 2 of He^+ spectrum.

OR

The work function for calcium atom is 1.9 e.v. Calculate:

(a) The threshold wavelength

(b) the threshold frequency

If the metal is irradiated with a wavelength 500 nm. Calculate Kinetic energy and the velocity of the ejected photoelectrons.

Q29. (a) State the law governing entropy and temperate.

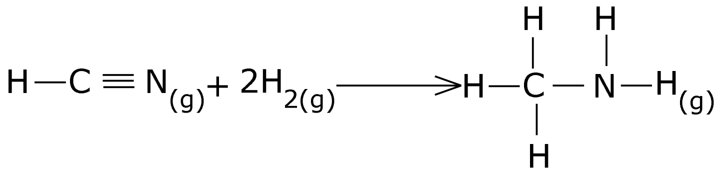
(b) Define enthalpy of formation under standard conditions.

Calculate the enthalpy of formation of methane at 298 K. If enthalpies of combustion of methane, graphite and hydrogen at 298 K are – 890.2 KJ, -393.4 KL and – 285 mol^{-1} respectively.

OR

(a) State and explain first law of thermodynamics with its mathematical form.

(b) ΔH for the reaction



Is – 150 KJ. Calculate the bond energy of $C \equiv N$ bond.

Bond energy of C – H = n414 KL mol^{-1}, H – H = 435 KJ mol^{-1},

C – N = 293 KJ mol^{-1}, N – H = 396 KJ mol^{-1}

Q30. (a) For a general reaction, derive a relation between K_c and K_p with absolute temperature and gas constant R^x is $aA + bB \rightleftharpoons cC + dD$.

(b) What is the importance of HCl during the precipitation of sulphide of 2nd group.

OR

(a) What do you mean by Le-Chatelier's principle. By using it identify the suitable conditions for good yield of ammonia.

$N_2 + 3H_2 \rightleftharpoons 2NH_3$.

(b) For reaction:

$2A \rightleftharpoons B + C$

the equilibrium constant Kc is 2.0×10^{-3}. In which direction the reaction will proceed if the composition of the reaction mixture at any time is:

$[A] = [B] = [C] = 3.0 \times 1^{-2}$ mol L^{-1}.