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Class XII Sci C

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[CHEMISTRY PROJECT]

Delhi Public School, Jaipur

CONTENTS

CERTIFICATE

THIS IS TO CERTIFY THAT THIS PROJECT WORK IS SUBMITTED BY VRINDA SINGH OF CLASS XII TO THE CHEMISTRY DEPARTMENT OF DELHI PUBLIC SCHOOL, JAIPUR. IT IS FURTHER CERTIFIED THAT WORK IS ORIGINAL AND IS OF STANDARD TO WARRANT PRESENTATION FOR AISSEC EXAMINATION.

MRS. MEENA BHARGAVA

CHEMISTRY TEACHER

ACKNOWLEDGEMENT

IT WOULD BE MY PLEASURE TO EXPRESS MY HEART FILLED GRATITUDE TO MY CHEMISTRY TEACHER MRS. MEENA BHARGAVA FOR PROVIDING A HELPING HAND IN MAKING THIS PROJECT AND INSTILLING IN ME THE DESIRE TO WORK. HER VALUABLE GUIDANCE, SUPPORT AND SUPERVISION THOUGH OUT THIS PROJECT ARE RESPONSIBLE FOR THIS TOPIC TO BECOME A SUCCESSFUL PROJECT.

I WOULD ALSO LIKE TO THANKS MY FAMILY AND FRIENDS AS THEY ENCOURAGED ME TO PUT FORWARD MY PROJECT.

OBJECTIVE

- **TO DETERMINE WHICH ADDED MATERIAL WILL MAKE ICE MELT FASTEST.**

INTRODUCTION

TO MAKE ICE CREAM WITH AN OLD FASHIONED HAND CRANK MACHINE, YOU NEED ICE AND ROCK SALT TO MAKE THE CREAM MIXTURE COLD ENOUGH TO FREEZE. IF YOU LIVE IN A COLD CLIMATE, YOU'VE SEEN THAT THE TRUCKS USE SALT AND SAND ON THE STREETS AFTER A SNOWFALL TO PREVENT ICE FROM BUILDING UP ON THE ROADS. HERE, SALT IS ACTING TO LOWER THE FREEZING POINT OF WATER. FOR THE ICE CREAM MAKER, AS THE ROCK SALT LOWERS THE FREEZING POINT OF THE ICE THE TEMPERATURE OF THE ICE-ROCK SALT MIXTURE CAN GO BELOW THE NORMAL FREEZING POINT OF WATER. THIS MAKES IT POSSIBLE TO FREEZE THE ICE CREAM MIXTURE IN THE INNER CONTAINER OF THE ICE CREAM MACHINE.

FOR THE SALT ON THE STREETS IN WINTERTIME, THE LOWERED FREEZING POINT MEANS THAT SNOW AND ICE CAN MELT EVEN WHEN THE WEATHER IS BELOW THE NORMAL FREEZING POINT OF WATER. BOTH THE ICE CREAM MAKER AND ROCK ALT ARE THE EXAMPLES OF FREEZING POINT DEPRESSION, SALT WATER IS AN EXAMPLE OF A CHEMICAL SOLUTION. A MOLECULE OF SOLUTE WILL DISSOLVE WHEN THE FORCE OF ATTRACTION BETWEEN SOLUTE MOLECULE AND THE SOLVENT MOLECULES IS GREATER THAN THE FORCE OF ATTRACTION BETWEEN THE MOLECULES OF THE SOLUTE. WATER IS A GOOD SOLVENT BECAUSE IT IS PARTIALLY POLARIZED. THE HYDROGEN ENDS OF THE WATER MOLECULE HAVE PARTIAL POSITIVE CHARGE, AND THE OXYGEN END OF THE MOLECULE HAS A PARTIAL NEGATIVE CHARGE. THIS IS BECAUSE THE OXYGEN ATOM HOLDS ON MORE TIGHTLY TO THE ELECTRONS IT SHARES WITH THE HYDROGEN ATOM.

THE PARTIAL CHARGES MAKE IT POSSIBLE FOR WATER MOLECULE TO ARRANGE THEMSELVES AROUND CHARGED ATOMS(IONS) IN THE SOLUTION, LIKE THE SODIUM AND CHLORIDE IONS THAT DISSOLVE IN WATER ALSO LOWER THE FREEZING POINT OF THE SOLUTION. THE AMOUNT BY WHICH THE FREEZING POINT IS LOWERED DEPENDS ONLY ON THE NUMBER OF MOLECULE DISSOLVED, NOT ON THEIR CHEMICAL NATURE THIS IS AN EXAMPLE OF A COLLIGATIVE PROPERTY. IN THIS PROJECT, WE INVESTIGATE DIFFERENT SUBSTANCES TO SEE HOW THEY AFFECT THE RATE AT WHICH ICE CUBES MELT, WE WILL TEST SUBSTANCES THAT DISSOLVE IN WATER, LIKE SALT AND SUGAR, AS WELL AS SUBSTANCES THAT DON'T DISSOLVE IN WATER LIKE SAND.

REQUIREMENTS

- ICE CUBES
- ELECTRICAL KITCHEN BALANCE(ACCURATE TO 0.1GM)
- IDENTICAL PLATES OR SAUCERS
- SUGAR
- SAND
- TABLE SALT
- TIMER
- MEASURING CUP

PROCEDURE

1. TAKE A CLEAN PLATE AND SEVERAL ICE CUBES FOR EACH OF THE SUBSTANCES TO BE TESTED.
2. NOTE THE STARTING TIME, THEN CAREFULLY SPRINKLE ONE TEASPOON OF SUBSTANCE TO BE TESTED OVER THE ICE CUBES(SAY SALT).
3. AFTER A FIXED AMOUNT OF TIME (HERE 10 MINUTES), POUR OFF THE MELTED WATER INTO A MEASURING CUP, AND USE THE BALANCE TO MEASURE THE MASS. SUBTRACT THE MASS OF THE EMPTY CUP FROM THE MASS OBSERVED AND YOU'LL HAVE THE MASS OF THE MELTED WATER. REPEAT THE SAME FOR EQUAL INTERVALS OF TIME.
4. MEASURE THE REMAINING MASS OF ICE CUBE.
5. REPEAT THREE TIMES FOR EACH SUBSTANCE TO BE TESTED.

6. USE THE SAME PROCEDURE TO MEASURE THE MELTING RATE FOR ICE CUBES WITH NOTHING ADDED.

7. FOR EACH TEST, CALCULATE THE PERCENTAGE OF THE ICE CUBE THAT MELTED:

[MASS OF MELTED WATER]/[INITIAL MASS OF CUBE] X 100

8. FOR EACH TEST, CALCULATE THE PERCENTAGE OF ICE CUBE REMAINING:

[REMAINING MASS OF ICE CUBE]/ [INITIAL MASS OF ICE CUBE] X 100

9. FOR EACH SUBSTANCE YOU TESTED, CALCULATE THE AVERAGE AMOUNT OF MELTED WATER PRODUCED (AS A PERCENT OF INITIAL MASS), AND THE AVERAGE REMAINING ICE CUBE MASS(AS A PERCENTAGE OF INITIAL MASS).

OBSERVATIONS

MASS OF THE CUP = 40GM

ROOM TEMPERATURE=25

INITIAL WEIGHT OF ICE=10GM

MIXTURE	WEIGHT OF THE MELTED WATER (W_{M_2}) AT T= 10 MIN	WEIGHT OF THE MELTED WATER (W_{M_1}) AT T= 20 MIN	WEIGHT OF THE MELTED WATER (W_{M_3}) AT T= 30 MIN
ICE	2.62GM	1.08GM	1.18GM
ICE+SAND	2.92GM	1.28GM	1.47GM
ICE+SUGAR	3.35GM	1.76GM	1.62GM
ICE+SALT	4.93	2.05GM	0.15GM

CALCULTIONS

$$\%\ \text{OF MELTING} = \frac{[\text{MASS OF MELT WATER}]}{[\text{INITIAL MASS OF ICE CUBE}]} \times 100$$

- $\%\ \text{OF (ICE+SALT MELTED)}_1 = \frac{W_{M_1}}{W_I} \times 100 = 49.3\%$
- $\%\ \text{OF (ICE+SALT MELTED)}_2 = \frac{W_{M_2}}{W_I} \times 100 = 20.5\%$
- $\%\ \text{OF (ICE+SALT MELTED)}_3 = \frac{W_{M_3}}{W_I} \times 100 = 1.5\%$

$$\text{AVERAGE \%OF (ICE+SALT MELTED)} = \frac{\%_1+\%_2+\%_3}{3} = 23.78\%$$

CALCULTIONS

$$\%\ \text{OF MELTING} = \frac{[\text{MASS OF MELT WATER}]}{[\text{INITIAL MASS OF ICE CUBE}]} \times 100$$

- $\%\ \text{OF (ICE+SAND MELTED)}_1 = \frac{W_{M_1}}{W_I} \times 100 = 29.2\%$
- $\%\ \text{OF (ICE+SAND MELTED)}_2 = \frac{W_{M_2}}{W_I} \times 100 = 12.8\%$
- $\%\ \text{OF (ICE+SAND MELTED)}_3 = \frac{W_{M_3}}{W_I} \times 100 = 14.8\%$

$$\text{AVERAGE \%OF (ICE+SAND MELTED)} = \frac{\%_1+\%_2+\%_3}{3} = 18.9\%$$

CALCULTIONS

$$\%\ \text{OF MELTING} = \frac{[\text{MASS OF MELT WATER}]}{[\text{INITIAL MASS OF ICE CUBE}]} \times 100$$

- $\%\ \text{OF (ICE+SUGAR MELTED)}_1 = \frac{W_{M_1}}{W_I} \times 100 = 33.5\%$
- $\%\ \text{OF (ICE+SUGAR MELTED)}_2 = \frac{W_{M_2}}{W_I} \times 100 = 17.6\%$
- $\%\ \text{OF (ICE+SUGAR MELTED)}_3 = \frac{W_{M_3}}{W_I} \times 100 = 16.2\%$

$$\text{AVERAGE \%OF (ICE+SUGAR MELTED)} = \frac{\%_1+\%_2+\%_3}{3} = 22.43\%$$

INFERENCE

WE KNOW THAT THE MELTING AND THE FREEZING POINT OF WATER ARE IN EQUILIBRIUM. WE ALSO KNOW THAT, MORE IS THE %OF MELTING OF A SUBSTANCE MORE WILL BE THE RATE OF MELTING. AND IF THE RATE OF MELTING INCREASES AFTER ADDING THE SOLUTE THEN THERE IS A DEPRESSION IN THE FREEZING POINT (HERE, MELTING POINT FOR WATER). SO THE SOLUTION IN WHICH THE RATE OF MELTING WILL BE THE HIGHEST WILL SHOW HIGHEST DEPRESSION IN FREEZING POINT. THIS PHENOMENON CAN BE USED TO DETERMINE THE SOLUTE TO BE MIXED WITH ICE IN SNOWY AREA SO THAT IT MELTS EVEN T NEGATIVE LOW TEMPERATURES AND WILL HELP TO MAKE THE ROADS IN THESE AREAS SNOW FREE.

RESULT

THE SOLUTION OF ICE AND SALT SHOWS MAXIMUM INCREASE IN % OF MELTING MEANING THAT SOLUTION OF ICE AND SALT WILL MELT FASTEST.

THE ORDER IN WHICH THEY SHOW DEPRESSION IN FREEZING POINT IS :

(ICE+SALT)>(ICE+SUGAR)>(ICE+SAND)>ICE

PRECAUTIONS

- READING FROM THE MEASURING CUP SHOULD BE DONE APPROPRIATELY.
- READING SHOULD BE TAKEN AT SAME TIME INTERVALS.
- DIFFERENT ICE CUBES FOR DIFFERENT MATERIALS SHOULD E USED AND AVOID MIXING OF THE ICE CUBES.

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