OBJECTIVE

To verify the law of conservation of mass in a chemical reaction.

MATERIALS REQUIRED

(*i*) Barium chloride ($BaCl_2.2H_2O$)   (*ii*) Sodium sulphate ($Na_2SO_4.10H_2O$)

(*iii*) Distilled water   (*iv*) Two beakers (150 mL)

(*v*) One beaker (250 mL)   (*vi*) Physical balance

(*vii*) Spring balance (0–500 g)   (*viii*) Polythene bag

(*ix*) Two watch glasses of known masses   (*x*) Glass stirrer.

THEORY

Law of conservation of mass states that the mass remains conserved during a chemical reaction. In this experiment we shall verify the law of conservation of mass using a precipitation reaction. This reaction is considered as the simplest method to verify this law.

PROCEDURE

1. Pour 100 mL distilled water in two beakers (150 mL).

2. Using the physical balance and a watch glass of known mass, weigh 7.2 g of $BaCl_2.2H_2O$ and dissolve it in a beaker (150 mL) containing 100 mL distilled water.

3. Similarly, weigh 16.1 g of $Na_2SO_4.10H_2O$ in another watch glass of known mass and dissolve it in another beaker (150 mL) containing 100 mL distilled water.

4. Take the third beaker (250 mL) and weigh it using a spring balance and polythene bag (see Experiment no. 3 for details).

5. Mix both solutions of 150 mL beakers in the third beaker (250 mL). Mix the contents using a glass stirrer.

6. On mixing white precipitate of $BaSO_4$ appears due to precipitation reaction.

7. Weigh of beaker containing the reaction mixture again to determine the mass of the precipitation reaction products.

8. Compare the masses of before and after the chemical reaction.

OBSERVATION

(*i*) Mass of 100 mL distilled water   = 100.0 g

    (The density of distilled water is 1 g/mL.)

(*ii*) Mass of $BaCl_2.2H_2O$ = 7.2 g

(*iii*) Mass of $BaCl_2$ solution   = 107.2 g

(iv) Mass of $Na_2SO_4 \cdot 10H_2O$ = 16.1 g

(v) Mass of Na_2SO_4 solution = 116.1 g

(vi) Total Mass of reactants (solutions of $BaCl_2$ and Na_2SO_4) $\pm$ 223.3 g

(vii) Mass of empty 250 mL beaker, m_1 = ... g

(viii) Initial mass of reaction mixture and empty beaker

(before the precipitation), $m_2 = (m_1 + 223.3 \text{ g})$ = ... g

(ix) Final mass of reaction mixture in the beaker after the precipitation, m_3 = ... g
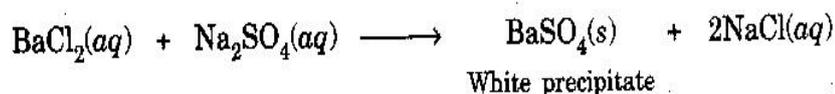
INFERENCE

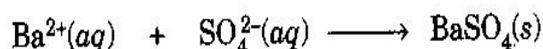We see that within the reasonable experimental limits.

Initial mass (m_2) (of reaction mixture) = Final mass (m_3) (of reaction mixture)

Thus, the law stands verified.

The chemical reaction involved is

$$BaCl_2(aq) + Na_2SO_4(aq) \longrightarrow BaSO_4(s) + 2NaCl(aq)$$

White precipitate

and more precisely

$$Ba^{2+}(aq) + SO_4^{2-}(aq) \longrightarrow BaSO_4(s)$$

PRECAUTIONS

1. The spring balance should be held vertical while taking measurements.

2. Before making use of the spring balance it must be ensured that its pointer is at zero mark. If not then ask your teacher to help.

3. The readings of the spring balance should be noted only when its pointer comes to rest.

4. Mixing of barium chloride and sodium sulphate solutions be done slowly with constant stirring.

VIVA-VOCE

Q. 1. Name any two laws of chemical combination.

Ans. (i) Law of multiple proportion.

(ii) Law of conservation of mass.

Q. 2. What is law of conservation of mass ?

Ans. Law of conservation of mass states that the mass remains conserved during a chemical reaction.

Q. 3. State law of conservation of matter.

Ans. Matter can neither be created nor be destroyed. It can only be changed from one form to other.

Q. 4. Is there any relation between law of conservation of mass and law of conservation of matter ?

Ans. Yes. Law of conservation of mass is a special case of law of conservation of matter.

Q. 5. Who was the first scientist to verify law of conservation of mass ?

Ans. Antoine Lavoisier.

Q. 6. What do you mean by conservation of mass ?

Ans. Conservation of mass means total mass of reactant is equal to the total mass of products during a chemical reaction.

Q. 7. In laboratory, mass is measured by which device ?

Ans. Physical balance.

Q. 8. What are the weights less than 1 gm called ?

Ans. Fractional weight.

Q. 9. In this experiment which reaction is used to verify law of conservation of mass ?

Ans. Precipitation reaction between solution of Barium chloride and Sodium sulphate.

Q. 10. Why do we choose above reaction for verifying law of conservation of mass.

Ans. Because it is a very simple reaction to handle.

MULTIPLE CHOICE QUESTIONS

1. Who proposed law of conservation of mass ?
   (a) Ge lu sac
   (b) Priestley
   (c) Lavosier
   (d) None of these

2. Which one is a balanced chemical reaction ?
   (a) $BaCl_2(aq) + Na_2SO_4(aq) \longrightarrow BaSO_4(s) + 2NaCl(aq)$
   (b) $2NaCl(s) + BaSO_4(aq) \longrightarrow BaCl_2(aq) + Na_2SO_4(aq)$
   (c) Both are correct
   (d) None of these

3. Reaction between aquous solution of Barium Chloride and Sodium Sulphate is an example of :
   (a) displacement reaction
   (b) double displacement reaction
   (c) substitutic reaction
   (d) combination reaction

4. Reaction between aqueous solution of Barium Chloride and Sodium Sulphate is also known as :
   (a) Precipitation
   (b) Galvonisation
   (c) Isomerisation
   (d) None of these

5. White precipitate is the reaction of Barium Chloride and Sodium Sulphate is of :
   (a) $BaSO_4$
   (b) NaCl
   (c) None of the two
   (d) Sodium Borate

6. In experiment to verify law of conservation of mass, what is the colour of precipitate of Barium Sulphate :
   (a) buff
   (b) white
   (c) pink
   (d) yellow

7. The colour of Barium Chloride solution is :
   (a) green
   (b) yellow
   (c) blue
   (d) colourless

8. The colour of Sodium Sulphate solution is :
   (a) light blue
   (b) pale
   (c) grey
   (d) colourless

9. In the reaction mixture NaCl remains in the form :

    (a) solid   (b) aqueous solution

    (c) semi solid   (d) precipitate

10. Which compounds are present in the product mixture is the reaction of Barium Chloride and Sodium Sulphate ?

    (a) $BaSO_4$, NaCl   (b) $BaCl_2$, NaCl

    (c) $BaSO_4$, Na_2SO_4 (d) $BaCl_2$, Na_2SO_4

11. What happens when a solution of sodium sulphate is added to a solution of barium chloride ?

    (a) A yellow precipitate is formed

    (b) A white precipitate and a colourless solution is formed

    (c) Reaction takes place with evolution of heat but overall colourless solution is formed

    (d) No reaction appears to have taken place

12. When sodium sulphate solution is added to a solution of barium chloride, a white precipitate is formed in

    (a) an hour   (b) within a few seconds

    (c) two hours   (d) within a second only on heating

13. Which of the following is a combination reaction ?

    (a) Formation of white precipitate from mixing solutions of sodium sulphate and barium chloride

    (b) Formation of brown precipitate from heating of lead nitrate

    (c) Formation of white powder from heating of magnesium in air

    (d) Formation of zinc sulphate when zinc is added to sulphuric acid

14. When a solution of sodium sulphate is added to a solution of barium chloride the following combination represent the right conclusion :

    (a) a precipitate with a displacement reaction

    (b) a clear solution with a double displacement reaction

    (c) a precipitate with a double decomposition

    (d) a precipitate with a combination reaction

Answers

1. (c)	2. (a)	3. (b)	4. (a)	5. (a)	6. (b)
7. (d)	8. (d)	9. (b)	10. (a)	11. (b)	12. (b)
13. (c)	14. (c).				

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