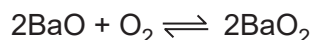


AS Level Chemistry B
H033/01 Foundations of chemistry

Question Set 2

- 1 Barium oxide, BaO, was once used to make oxygen gas. When heated above 500 °C, it combines with oxygen from the air to form barium peroxide, BaO₂. Above 700 °C, BaO₂ decomposes to give barium oxide and pure oxygen.



The removal of CO₂ from the air enabled the cycle to be carried out many times.

- (a) Suggest why the removal of carbon dioxide was necessary. [1]

- (b) Barium oxide is made by heating barium carbonate.



- (i) How does the thermal stability of barium carbonate compare with the thermal stability of calcium carbonate?

Explain your answer.

[4]

- (ii) Why is it valid to compare barium carbonate with calcium carbonate?

[1]

- (c) Barium oxide dissolves in water to form barium hydroxide, Ba(OH)₂.
In a titration 25.0 cm³ of a solution of Ba(OH)₂ reacts with 23.6 cm³ of 0.120 mol dm⁻³ HCl.

- (i) Write the equation for the reaction in the titration.

[1]

- (ii) Calculate the concentration of Ba(OH)₂ in mol dm⁻³.

concentration = mol dm⁻³

[2]

- (iii) Calculate the concentration of Ba(OH)₂ in g dm⁻³.

concentration = g dm⁻³

[1]

Some students carry out experimental work involving salts.

Salt **A** is used as a fertiliser. The students are given a sample of salt **A** to analyse.

They carry out a flame test. The result is a lilac flame.

They dissolve salt **A** in water and add hydrochloric acid followed by barium chloride solution. The result is the formation of a white precipitate.

- (a) Name salt **A**. [1]
- (b) The lilac flame colour is from a prominent line in the atomic emission spectrum of salt **A**.

- (i) Describe the appearance of an atomic emission spectrum. [1]
- (ii) The lilac line in the spectrum of the salt occurs at 405 nm.

Calculate the energy associated with this wavelength in kJ mol^{-1} .
($1 \text{ nm} = 10^{-9} \text{ m}$)

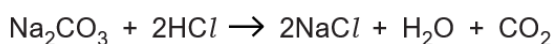
energy = kJ mol^{-1}

- (c) The students are then asked to make a pure dry sample of lead chloride, an insoluble salt. They suggest mixing lead nitrate solution and sodium chloride solution, then filtering and drying the solid formed. [3]

- (i) Write a **full** equation for the reaction that occurs. [1]
- (ii) The students' method would not produce a pure dry sample of lead chloride.

State how to improve the method.

- (d) The students are given a $0.150 \text{ mol dm}^{-3}$ solution of Na_2CO_3 . They titrate this against a solution of hydrochloric acid. [2]



- (i) 25.0 cm^3 of the Na_2CO_3 solution requires 23.6 cm^3 of HCl .

Calculate the concentration of the HCl .

concentration = mol dm^{-3} [2]

- (ii) A student says:
'There is no point writing $0.150 \text{ mol dm}^{-3}$ for the Na_2CO_3 solution. Writing 0.15 mol dm^{-3} means the same thing.'

Discuss whether or not the student's statement is correct.

[2]

- (e) The students are then given some $\text{FeSO}_4 \cdot x\text{H}_2\text{O}$.
The students dissolve the solid to make $\text{FeSO}_4(\text{aq})$.
- (i) Describe a test they can do on this solution to identify the cation.
Test and its result [1]
- (ii) Write an **ionic** equation, with state symbols, for the reaction that occurs in this test. [1]
- (f) The students then heat a sample of solid $\text{FeSO}_4 \cdot x\text{H}_2\text{O}$.
They find that 9.45g of $\text{FeSO}_4 \cdot x\text{H}_2\text{O}$ gives 5.16g of solid after heating.
- (i) Describe how the students could ensure that all the water had been lost. [1]
- (ii) Calculate the value of x .
 $x = \dots\dots\dots$ [2]

Total Marks for Question Set 2: 27

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