07 Practical Chemistry and Qualitative Analysis

Set B **Answer key**

A Competition questions

13 MARKS

1 **B** 2 and 3 only [1]

The known quantity of sodium carbonate is weighed on the mass balance, and the volume of acid is measured with the measuring cylinder.

The experiment measures a temperature change, not a volume of gas or a time, so the gas syringe and the stopwatch are not needed.

2 **A** 1, 3 and 4 only [1]

The gas syringe measures the volume of carbon dioxide, the stopwatch times the reaction, and the measuring cylinder measures out the acid.

The temperature is not measured, so the thermometer is not needed.

3 **B** Gas Q is either acidic or neutral. [1]

Concentrated sulfuric acid dries a gas only if the gas does not react with it. It reacts with ammonia, a basic gas, so gas Q cannot be basic.

The setup shows nothing about density, or about solubility in water. The gas bubbles through the acid, so it is not soluble in it.

4 **C** hydrogen and methane [1]

Method 1 collects the gas over water, so the gas must be insoluble or only slightly soluble in water. Method 2 is upward delivery, so the gas must be less dense than air.

Hydrogen and methane are insoluble and less dense than air. Ammonia and hydrogen chloride are very soluble in water, and carbon dioxide and sulfur dioxide are denser than air.

5 **B** hydrogen chloride gas [1]

The gas is dried with concentrated sulfuric acid, so it cannot be ammonia, which is alkaline and reacts with the acid. Steam is water vapour, which the acid absorbs.

The gas jar stands upright and the tube reaches its bottom, which is downward delivery, so the gas is denser than air. Hydrogen chloride is denser than air but hydrogen is not.

6

B rinsing the flask with hydrochloric acid [1]

Acid left in the flask from rinsing adds to the 25.0 cm^3, so more sodium hydroxide is needed and the calculated concentration is too high.

A is the right way to prepare a burette, C is the correct end-point, and reading at an angle could make the titre too high or too low.

7

C $FeSO_4$ [1]

A green precipitate that turns brown on standing is iron(II) hydroxide, so P contains Fe^{2+}.

The white precipitate with barium nitrate shows sulfate: $FeSO_4$.

8

D a green precipitate in a green solution [1]

0.010 mol of $FeSO_4$ needs 0.020 mol of NaOH, but only 0.010 mol is added, so half the iron(II) is left in solution.

Iron(II) hydroxide is a green precipitate and the leftover Fe^{2+} keeps the solution pale green.

9

D no solid residue [1]

Both hydroxides form at first, but both dissolve in excess aqueous ammonia.

Zinc gives a colourless solution and copper(II) a dark blue one, so nothing is left on the paper.

10

D row D [1]

The blue solution and the dark blue solution in excess ammonia show Cu^{2+}, and the white precipitate with barium nitrate shows SO_4^{2-}: P is copper(II) sulfate.

Barium sulfate is filtered off, leaving copper(II) nitrate in the filtrate, which crystallises as Q.

11

A row A [1]

Hydrochloric acid already contains chloride ions, so the white silver chloride forms whether or not the calcium has reacted.

Hydrogen escaping lowers the mass, acid used up raises the pH, and the white precipitate insoluble in excess shows Ca^{2+} has formed.

12

B ammonium sulfate with an acid [1]

Ammonia is released from an ammonium salt by an alkali, not by an acid.

A is the Haber process, C is the nitrate test, and warming aqueous ammonia drives off ammonia gas.

13

C row C [1]

The ideal gas equation is most nearly true at low pressure and high temperature (Chapter 4).

There the particles are far apart and move fast, so their own volume and the forces between them matter least.