ICSE CLASS 10 CHEMISTRY – PRACTICE PAPER

STEP-BY-STEP SOLUTIONS AND MARKING SCHEME

Chapter 11: Sulphuric Acid | Maximum Marks: 40

SECTION A (20 Marks)

Question 1 [8 × 1 = 8]

Part	Ans	Step-by-step reasoning
(i)	(b)	Vanadium pentoxide (V_2O_5) or platinum catalyses $2SO_2 + O_2 \leftrightarrow 2SO_3$. Iron is the Haber process catalyst.
(ii)	(b)	The acid is added slowly to water with constant stirring so that the heat evolved is dissipated in the large amount of water and spurting is avoided.
(iii)	(c)	$FeS + H_2SO_4 \rightarrow FeSO_4 + H_2S\uparrow$.
(iv)	(b)	$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$ (oleum). SO_3 is not absorbed in water because the reaction is violent and forms a mist of acid droplets.
(v)	(c)	Conc. H_2SO_4 removes water of crystallisation from $CuSO_4 \cdot 5H_2O$ (blue → white). The others show acidic, oxidising and non-volatile behaviour.
(vi)	(c)	Both are true; because H_2SO_4 is non-volatile (high boiling point 338 °C) it displaces volatile HCl from NaCl, so (R) explains (A).
(vii)	(a)	$BaCl_2 + H_2SO_4 \rightarrow BaSO_4\downarrow + 2HCl$. $BaSO_4$ is insoluble in dilute mineral acids.
(viii)	(b)	$Cu + 2H_2SO_4$ (conc.) $\rightarrow CuSO_4 + 2H_2O + SO_2\uparrow$.

Question 2 [3 + 3 = 6]

(i) **[3 × 1]**

(a) **acid, water** – the dilution is highly exothermic; adding water to the acid would make the water turn to steam and spurt out the acid.

(b) **green** – SO_2 reduces orange $K_2Cr_2O_7$ to green chromium(III) sulphate.

(c) **dibasic** – it ionises in two stages and gives two H^+ ions per molecule.

(ii) **[3 × 1]**

(a) Conc. H_2SO_4 + sugar → **1** (black spongy mass of carbon).

(b) Conc. H_2SO_4 + blue $CuSO_4 \cdot 5H_2O$ → **2** (crystals turn white).

(c) $BaCl_2$ + dilute H_2SO_4 → **3** (white precipitate insoluble in dil. HCl).

Statement 4 (reddish brown fumes) is the extra option.

Question 3 [3 + 3 = 6]

(i) **[3 × 1]**

(a) $\mathbf{S + O_2 \rightarrow SO_2}$

(b) The catalyst is **vanadium pentoxide ($\mathbf{V_2O_5}$)** (or platinum): $\mathbf{2SO_2 + O_2 \leftrightarrow 2SO_3}$ at about 450 °C.

(c) SO_3 does not dissolve in water satisfactorily; the reaction is violent and gives a lot of heat and a mist of sulphuric acid droplets. It is absorbed in conc. H_2SO_4 to give oleum, which is then diluted.

(ii) **[3 × 1]**

(a) The heat evolved turns the water into steam, which can spurt the acid and cause burns. The acid is heavier and settles in the water, where the heat is dissipated.

(b) It is hygroscopic and absorbs moisture from the air, which would dilute it.

(c) It oxidises hydrogen sulphide: $H_2S + H_2SO_4 \rightarrow S + 2H_2O + SO_2$.

SECTION B (20 Marks)

Question 4 [4 + 3 + 3 = 10]

(i) **[4 × 1]**

(a) The **Contact process**. In A, sulphur is burnt in air (oxygen): $S + O_2 \rightarrow SO_2$.

(b) **Vanadium pentoxide** (V_2O_5) at about **450 °C**.

(c) **Concentrated sulphuric acid (98%)**; oleum is $\mathbf{H_2S_2O_7}$ (pyrosulphuric acid).

(d) **Water** in the calculated amount: $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$.

(ii) **[3 × 1]**

(a) At a very low temperature the reaction is too slow; an optimum temperature of 410–450 °C is used.

(b) The forward reaction decreases the volume, so high pressure would help, but acid-resistant towers that withstand high pressure are difficult to build; 1–2 atm gives a good yield.

(c) The reaction is exothermic; the heat it produces maintains the temperature of 450 °C.

(iii) **[3 × 1]**

(a) $\mathbf{C + 2H_2SO_4 \rightarrow CO_2 + 2H_2O + 2SO_2}$

(b) $\mathbf{S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O}$

(c) $\mathbf{Cu + 2H_2SO_4 \rightarrow CuSO_4 + 2H_2O + SO_2}$

Question 5 [4 + 3 + 3 = 10]

(i) **[4 × 1]**

(a) **Hydrogen** ($Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$).

(b) **Carbon dioxide** ($2NaHCO_3 + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O + 2CO_2$).

(c) **Hydrogen sulphide** ($FeS + H_2SO_4 \rightarrow FeSO_4 + H_2S$).

(d) **Sulphur dioxide** ($Cu + 2H_2SO_4 \rightarrow CuSO_4 + 2H_2O + SO_2$).

(ii) **[3 × 1]**

(a) $\mathbf{2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O}$

(b) $\mathbf{CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O}$

(c) $\mathbf{Na_2SO_3 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O + SO_2}$

(iii) **[3 × 1]**

(a) A **white precipitate** of barium sulphate is formed.

(b) $\mathbf{BaCl_2 + H_2SO_4 \rightarrow BaSO_4\downarrow + 2HCl}$

(c) Both sulphate and sulphite give a white precipitate with $BaCl_2$, but barium sulphite dissolves in dilute mineral acids (with SO_2 evolved) while barium sulphate does not.

Question 6 [4 + 3 + 3 = 10]

(i) **[4 × 1]**

(a) The **dehydrating** property: the acid has a great affinity for water.

(b) **Sugar charcoal** (carbon). Steam is seen because the reaction is exothermic and the water removed from the sugar is turned to steam by the heat.

(c) $\mathbf{C_{12}H_{22}O_{11} \rightarrow 12C + 11H_2O}$ (conc. H_2SO_4).

(d) The wood also becomes black (charred), since it is mainly cellulose, a carbohydrate.

(ii) **[3 × 1]**

(a) The blue crystals turn white (dirty white): $\mathbf{CuSO_4 \cdot 5H_2O \rightarrow CuSO_4 + 5H_2O}$ (conc. H_2SO_4).

(b) $\mathbf{HCOOH \rightarrow CO + H_2O}$ (conc. H_2SO_4).

(c) It removes water from the skin tissues (carbohydrates and proteins), which chars the skin black and causes blisters.

(iii) **[3 × 1]**

(a) $\mathbf{NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl\uparrow}$

(b) $\mathbf{KNO_3 + H_2SO_4 \rightarrow KHSO_4 + HNO_3}$

(c) It displaces the volatile acids (HCl, HNO_3, acetic acid) from their salts, so it is used to prepare them.

Marks summary	Section A: Q1 = 8, Q2 = 6, Q3 = 6 → **20** | Section B: any two of Q4, Q5, Q6 at 10 each → **20** | Total = **40**