

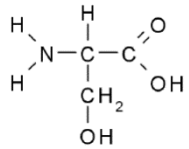
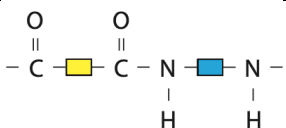
Yishun Secondary School
 Mark Scheme
 Preliminary Examination 2024
 Secondary 4 Pure Chemistry 6092
 Paper 1
 Date of exam: 28/08/2024
 Setter: Widayah

Answers to Paper 1

Qn	Answer	Explanation																				
1	A	For the experiment, the following apparatus is needed: • 2.35 g of a salt: electronic balance • 25.0 cm³ of water: measuring cylinder • Endothermic reaction: thermometer • Stopwatch is not needed as no time interval is required																				
2	C	Mr of: carbon monoxide, CO = 12 + 16 = 28 ethane, C ₂ H ₆ = 30 helium, He = 4 sulfur dioxide, SO ₂ = 64 Gas which has Mr lower than air (average Mr = 28), will go through the porous pot and increase the volume in the porous pot, causing the air to leave the set-up thru the delivery tube, causing bubbles to form.																				
3	D	• Locating agents are needed only used for the chromatography of colourless substances. They are chemicals that react with the colourless substances to form coloured spots. • As the substance at level X is travels more distance from the start line this means that it has higher R_f value and is more soluble than the substance at level Y in the solvent.																				
4	C	At stage R to S, the temperature is decreasing towards the freezing point. Volume of liquid is decreasing as temp reaches S, the liquid turned to solid.																				
5	A	<table><tr><td></td><td>²⁰₁₀Ne</td><td>¹⁵₇N³⁻</td><td>¹⁶₈O²⁻</td><td>¹⁷₉F⁻</td></tr><tr><td>no of p</td><td>10</td><td>7</td><td>8</td><td>9</td></tr><tr><td>no of e</td><td>10</td><td>10</td><td>10</td><td>10</td></tr><tr><td>no of n</td><td>10</td><td>8</td><td>8</td><td>8</td></tr></table>		²⁰ ₁₀ Ne	¹⁵ ₇ N ³⁻	¹⁶ ₈ O ²⁻	¹⁷ ₉ F ⁻	no of p	10	7	8	9	no of e	10	10	10	10	no of n	10	8	8	8
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6	C	Mr of C ₂ H ₃ Br ₃ = 12 × 2 + 3 × 1 + 79 × 3 Mr of C ₂ H ₃ Br ₃ = 12 × 2 + 3 × 1 + 81 × 3 Mr of C ₂ H ₃ Br ₃ = 12 × 2 + 3 × 1 + 79 × 2 + 81 Mr of C ₂ H ₃ Br ₃ = 12 × 2 + 3 × 1 + 79 × 1 + 81 × 2																				
7	D	silver chloride is insoluble in water and exist as solid at rtp. Hence, cannot conduct electricity as there is no free-moving ions when in water or at rtp.																				
8	A	Diamond and silicon dioxide have similar tetrahedral structure.																				
9	A	A The molecule contains a total of 10 electrons.																				

		B W and X are both non-metals: Covalent bonding happens between non-metals C W is in Group 15 of the Periodic Table: W has 5 valence electrons, hence is from Group 15 D X is hydrogen: correct												
10	C	Copper is a metal which conducts electricity due to the delocalised electrons.												
11	B	A $0.2 \text{ mol of magnesium metal, } \text{Mg} = 0.2 \times 6.02 \times 10^{23} = 1.204 \times 10^{23}$ B $0.3 \text{ mol of ammonia gas, } \text{NH}_3 = 4 \times 0.3 \times 6.02 \times 10^{23} = 7.224 \times 10^{23}$ C $0.4 \text{ mol of hydrogen chloride, } \text{HCl} = 2 \times 0.4 \times 6.02 \times 10^{23} = 4.816 \times 10^{23}$ D $1.2 \text{ mol of carbon dioxide gas, } \text{CO}_2 = 3 \times 1.2 \times 6.02 \times 10^{23} = 2.1672 \times 10^{24}$												
12	A	<table border="1"> <tr> <td></td><td>SO_2</td><td>H_2SO_4</td></tr> <tr> <td>percentage of sulfur by mass</td><td>$\frac{32}{32+2(16)} \times 100\% = 50\%$</td><td>$\frac{32}{2 \times 1 + 32 + 4(16)} \times 100\% = 32.65\%$</td></tr> </table> <table border="1"> <tr> <td></td><td>Na_2S</td><td>PbS_2</td></tr> <tr> <td>percentage of sulfur by mass</td><td>$\frac{32}{2 \times 23 + 32} \times 100\% = 41.03\%$</td><td>$\frac{32 \times 2}{207 + 2(32)} \times 100\% = 23.62\%$</td></tr> </table>		SO_2	H_2SO_4	percentage of sulfur by mass	$\frac{32}{32+2(16)} \times 100\% = 50\%$	$\frac{32}{2 \times 1 + 32 + 4(16)} \times 100\% = 32.65\%$		Na_2S	PbS_2	percentage of sulfur by mass	$\frac{32}{2 \times 23 + 32} \times 100\% = 41.03\%$	$\frac{32 \times 2}{207 + 2(32)} \times 100\% = 23.62\%$
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13	B	no of mole of CN = $\frac{600}{24\,000} = 0.025 \text{ mol}$ $\text{Mr} = \frac{1.3}{0.025} = 52$ Mr of CN = $12 + 14 = 26$ $n = \frac{52}{26} = 2$, $\therefore$ molecular formula is B												
14	B	At rtp, no of mole of any gases and no of molecules are the same. mass of 1mole of any gasses is different												
15	C	mol of = $0.025 \times 1.00 = 0.025 \text{ mol}$ $\text{Na}_2\text{SO}_4 : \text{BaSO}_4$ 1 : 1 0.025 mol : 0.025 mol theoretical mass = $0.025 \times (137 + 32 + 4 \times 16) = 5.825$ % yield = $\frac{5.36}{5.825} \times 100\% = 92.0\%$												
16	A	the ionic equation between zinc metal and acid. H^+ ions will react with Zn to form hydrogen gas.												
17	A	Aluminium ions forms white precipitate, insoluble in excess aqueous ammonia Copper (II) ions forms blue precipitate, soluble in excess forming a dark blue solution zinc ions forms white precipitate, soluble in excess forming a colourless solution												
18	C	calcium sulfate, lead(II) sulfate, silver chloride are all insoluble salts. Method of preparation is precipitation												
19	C	initial pH – hydrochloric acid (low pH) end of experiment – excess sodium hydroxide (high pH)												
20	D	A adding more iron catalyst to the reaction mixture – metals are expensive B decreasing the volumes of nitrogen and hydrogen gases added – the yield will be low and the reaction may not move forward												

		C increasing the pressure exerted on the reaction mixture – increasing the pressure is costly. D pumping unreacted nitrogen and hydrogen gases back for further reaction – recycling unreacted nitrogen and hydrogen will save cost.				
21	B	Since Y is an oxidising agent, Y will react with reducing agents, KI and not with KMnO_4				
22	C	stage 1: $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$ stage 2: $\text{NO}_2 + \text{SO}_2 \rightarrow \text{SO}_3 + \text{NO}$ A NO_2 is reduced to NO . $\therefore$, NO_2 is an oxidising agent. B NO is oxidised to NO_2 C Oxygen is reduced as its oxidation state decreased from 0 in NO_2 to -2 in NO_2 D SO_2 is oxidised to SO_3 . Hence, SO_2 is a reducing agent.				
23	B	Copper is a reactive electrode. During electrolysis, copper electrode oxidised to form copper(II) ions. This will replenishes Cu^{2+} ions which are reduced at the cathode Concentration of Cu^{2+} ions remain unchanged Colour intensity and concentration of copper(II) sulfate solution remains the same				
24	C	For dilute copper(II) chloride solution, cathode/ negative electrode: copper metal will be discharged anode/ positive electrode: oxygen and water will be discharged				
25	B	option C has the highest difference in reactivity between the 2 metal electrodes which will contribute to the biggest potential difference				
26	D	Down a group, charge on the ion – stays the same number of outer shell electrons – same number of protons – increasing total number of inner shell electrons – increasing				
27	A	element X is more reactive than Y, as X displaced Y from a salt of Y chlorine is more reactive than iodine in group 17				
28	A	reactions of group 1 metals in water forming an alkali and hydrogen gas. When the alkali reacts with acid, neutralisation happens forming salt and water.				
29	C	Properties of transition metals: 1 High melting points and high densities. 2 Variable oxidation states 3 Form coloured compounds 4 Good catalysts				
30	D	Sacrificial protection occurs where the more reactive metal has the tendency to oxidise and form metallic ions. <table><tr><td>experiment 1</td><td>experiment 2</td></tr><tr><td>$\text{Fe(s)} \rightarrow \text{Fe}^{2+}(\text{aq}) + 2\text{e}^-$</td><td>$\text{Mg(s)} \rightarrow \text{Mg}^{2+}(\text{aq}) + 2\text{e}^-$</td></tr></table>	experiment 1	experiment 2	$\text{Fe(s)} \rightarrow \text{Fe}^{2+}(\text{aq}) + 2\text{e}^-$	$\text{Mg(s)} \rightarrow \text{Mg}^{2+}(\text{aq}) + 2\text{e}^-$
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31	C	$4\text{NH}_3(\text{g}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{N}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$ Bond breaking (endothermic): $12 \times \text{N-H} + 3 \times \text{O=O}$ $= 12 \times 391 + 3 \times 498$ $= 4692 + 1494$ $= + 6186 \text{ kJ}$				

		Bond forming (exothermic): $2 \times \text{N}\equiv\text{N} + 12 \times \text{O}-\text{H}$ $= 2 \times 945 + 12 \times 467$ $= 1890 + 5604$ $= - 7494 \text{ kJ}$ enthalpy change = - 1308 kJ
32	C	A Activation energy of the forward reaction is given by +50 kJ/mol B Enthalpy change of the forward reaction is given by $20 + 50 = +70 \text{ kJ/mol}$. C Activation energy of the backward reaction is given by +50 kJ/mol. D Enthalpy change of the backward reaction is given by – 70 kJ/mol.
33	B	same concentration of hydrogen peroxide with different particle size
34	D	A At each level in the distillation column, a mixture of hydrocarbons is collected. B The higher up the distillation column, the lower the boiling points of the hydrocarbon collected. C The molecules collected at the bottom of the distillation column are the least flammable. D The molecules reaching the top of the distillation column have the smallest relative molecular masses.
35	B	$\text{C}_{23}\text{H}_{48} \rightarrow \text{C}_3\text{H}_8 + 4\text{C}_2\text{H}_4 + 4\text{C}_3\text{H}_6$
36	C	Option A, B and D are the same structural formulae
37	D	Serine has the carboxylic acid group which will react with sodium carbonate to form salt, water and carbon dioxide. 
38	C	 repeat unit of nylon
39	C	P – respiration (give out energy) → exothermic, Q – photosynthesis (absorb light energy) → endothermic, R – combustion (give out heat) → exothermic
40	C	Characteristics of catalytic converters