

No.	Responses	Marks
1. (a)	Burette (1) / <u>Pipette</u> / <u>Syringe</u> / <u>Graduated test pipette (dropper)</u> ✓ ₁	3 marks
(b)	Deflagrating spoon (1) / <u>A pair of tongs</u> / <u>Metallic test tube holder</u> ✓ ₁ / <u>Forceps</u> / <u>Tweezer</u>	
(c)	Desiccator (1) ✓ ₁	
2. (a)	The alpha particles have a <u>high charge</u> $\frac{1}{2}$ so high <u>ability to pull electrons</u> // The alpha particles have <u>high mass</u> $\frac{1}{2}$ leading to <u>slow speed and more contact</u> $\frac{1}{2}$ time with substances. ✓ ₂	3 marks
(b)	Alpha particles have <u>low penetrating</u> $\frac{1}{2}$ power and are <u>stopped by paper</u> // while Beta $\frac{1}{2}$ particles have <u>higher penetrating power</u> and <u>pass through paper</u> but are <u>stopped by aluminium</u> $\frac{1}{2}$ foil. ✓ ₂	
3.	React a sample of the nitrate with sodium sulphate, if a white precipitate forms, the salt is lead(II) nitrate (1) ✓ ₁ React a sample of the nitrate with aqueous ammonia, if it forms a precipitate that dissolves in excess, the salt is zinc nitrate (1) ✓ ₁ React a sample of the nitrate with aqueous ammonia, if a precipitate is formed and persists even after adding excess ammonia then it is aluminium nitrate (1) ✓ ₁	3 marks
4. (a)	The reaction involves <u>bond formation</u> which is exothermic (1) ✓ ₁	3 marks
(b)	Observation: <u>Yellow colour intensifies</u> (1) / <u>More yellow</u> / <u>Brown colour changes to yellow</u> / <u>Brown colour diminishes/decreases</u> . ✓ ₁ Explanation: The equilibrium <u>shifts to the right</u> the direction with few molecules of gas (1) / <u>Forward rxn is favoured</u> / <u>Fewer molecules formed</u> . ✓ ₁	

Alt. An 3.

- Add aq. NH_3 dropwise until in excess, $\text{Zn}(\text{NO}_3)_2$ forms a white ppt that is soluble

- To the remaining $(\text{Al}(\text{NO}_3)_3 \text{ \& } \text{Pb}(\text{NO}_3)_2)$ add aq. Na_2SO_4 ;
 $\text{Pb}(\text{NO}_3)_2$ forms a white ppt, $\text{Al}(\text{NO}_3)_3$ does not.

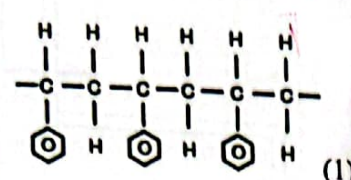
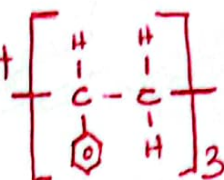
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5.	<p>(a) $(\text{NH}_4)_2\text{SO}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow \text{Na}_2\text{SO}_4(\text{aq}) + 2\text{NH}_3(\text{g}) + 2\text{H}_2\text{O}(\text{l})$ (1)</p> <p>(s) (s) (s) (g) (l) (aq)</p> <p>Ammonium sulphate + Sodium hydroxide</p> <p>Heat</p> <p>Ammonium gas</p> <p>Calcium oxide (drying agent)</p> <p>(2)</p>	<p>Accept the use of syringe collection method $\frac{1}{2}$</p> <p>Workability $\frac{1}{2}$</p> <p>3 marks</p>																								
6.	<p>(a) C, B, A, D (1)</p> <p>decreasing reactivity</p> <p>(i) Colour changes from <u>black</u> to <u>brown</u> (1) // Brown solid formed.</p> <p>(ii) No colour change // solid remains white (1)</p>	<p>Accept: D, A, B, C</p> <p>Increasing reactivity</p> <p>D, A, B, C without an arrow $\frac{1}{2}$</p> <p>3 marks</p>																								
7.	<p>(a) Mass of dry salt after heating = $(67.00 - 57.20) = 9.8 \text{ g}$ ($\frac{1}{2}$)</p> <p>(b) Mass of water = $(78.60 - 67.00) = 11.6 \text{ g}$ ($\frac{1}{2}$)</p> <p>(c) R.F.M of $\text{Na}_2\text{CO}_3 = 106 \text{ g}$</p> <p>R.F.M of $\text{H}_2\text{O} = 18 \text{ g}$</p> <p>Moles of $\text{Na}_2\text{CO}_3 = \frac{9.8}{106} = 0.09$ ($\frac{1}{2}$)</p> <p>Moles of water = $\frac{11.6}{18} = 0.64$ ($\frac{1}{2}$)</p> <p>$X = \frac{0.64}{0.09}$ ($\frac{1}{2}$)</p> <table border="1"> <thead> <tr> <th></th> <th>Na_2CO_3</th> <th>H_2O</th> </tr> </thead> <tbody> <tr> <td>RFM</td> <td>106</td> <td>18</td> </tr> <tr> <td>Mass of Na_2CO_3</td> <td>9.8</td> <td>11.6</td> </tr> <tr> <td>No. of moles</td> <td>$\frac{9.8}{106}$</td> <td>$\frac{11.6}{18}$</td> </tr> <tr> <td>Moles</td> <td>0.09</td> <td>0.64</td> </tr> <tr> <td>Mole ratio</td> <td>$\frac{0.09}{0.09}$</td> <td>$\frac{0.64}{0.09}$</td> </tr> <tr> <td></td> <td>1</td> <td>7.11</td> </tr> <tr> <td></td> <td>1</td> <td>7</td> </tr> </tbody> </table>		Na_2CO_3	H_2O	RFM	106	18	Mass of Na_2CO_3	9.8	11.6	No. of moles	$\frac{9.8}{106}$	$\frac{11.6}{18}$	Moles	0.09	0.64	Mole ratio	$\frac{0.09}{0.09}$	$\frac{0.64}{0.09}$		1	7.11		1	7	<p>Accept without work $\frac{1}{2}$</p> <p>Alternatively:</p> <p>$\frac{0.64}{0.0925} = 6.97$</p> <p>$\frac{0.64}{0.09} = 7.11$</p> <p>Accept Any value for RFM used correctly. Penalize $X = 7$ $\frac{1}{2}$ mark for $X = 7$ (Max = 1)</p> <p>3 marks</p>
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$$X \approx 7.11$$

$$X \approx 7$$

3

Accept Any value for RFM used correctly. Penalize $X = 7$ $\frac{1}{2}$ mark for $X = 7$ (Max = 1)

No.	Responses	Marks
	= 7.11 ≈ 7 (½)	3 marks
8.	<p>(a) Phenylethene (1) // styrene ✓₁</p> <p>(b)  (1) ✓₁ Accept </p> <p>(c) - Strong (1) - Easily be moulded into various shapes. ✓₁ - Durable ✓₁ - Attractive ✓₁ - Resistant to chemical attack. (Acid, base, Air, etc.) Any 1 for 1mk. ✓₁</p>	<p>Penalise if 3 is written on the left.</p> <p>3 marks</p>
9.	<p>(a) (i) Observation: ✓₂ Colour of anhydrous cobalt(II) chloride changes from <u>blue</u> to <u>pink</u> (½). // Changes to pink.</p> <p>Explanation: ✓₂ Anhydrous cobalt(II) chloride which is blue <u>absorbs water</u> to form <u>hydrated cobalt(II) chloride</u> which is pink (½).</p> <p>(ii) pH decreases (½) because carbon(IV) oxide dissolves to form carbonic acid (½). // acidic soln. ✓₂</p> <p>(b) To pull / <u>suck the gases</u> through the apparatus (1). // Suction pump. ✓₁</p>	<p>Rej: pH 1, 2, 3</p> <p>3 marks</p>
10.	<p>(a) (i) Heat change, $\Delta H = m \times c \times \Delta T$ $\Delta T = 6.1^\circ\text{C}$ $\Delta H = 6.1 \times 4.2 \times 200$ (½) ✓₂ $= 5124 \text{ J}$ ✓₂ $= 5.1 \text{ kJ}$ (½)</p> <p>(b) (ii) Moles of hydrochloric acid = $\frac{1.0 \times 100}{1000}$ (½) $= 0.1 \text{ moles}$ ✓₂ $\Delta H_{\text{neut}} = \frac{5.1}{0.1} \times 1$ $= -51.0 \text{ kJmol}^{-1}$ (½) ✓₂</p> <p>(b) ✓₂ Ammonia is a weak base // Ammonia does <u>not ionize completely</u> and some energy is used to ionize it before neutralization can take place. (1) ✓₂</p>	<p>accept + sign included</p> <p>- Negative sign must be included otherwise, penalise ½ mk</p> <p>- Ignore units</p> <p>3 marks</p>

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3

3

pH changes to 6, 5, 4

3

3
Reduce Fe_2O_3 ✓

No.	Responses	Marks								
11.	<p>(a) (i) Limestone: Produces calcium oxide which helps remove impurities from the ore (1). // CaO forms slag // Production of CO_2 that is reduced by C to form CO for reduction of the ore.</p> <p>(ii) Coke: - burns in air to produce carbon(II) oxide which reduces the iron ore to iron metal (1) // - coke produces heat which is a requirement in the blast furnace.</p> <p>(b) The iron produced is brittle ($\frac{1}{2}$) hence breaks easily ($\frac{1}{2}$) since it contains impurities $\frac{1}{2}$ collapse.</p>	3 marks								
12.	<table border="1"> <thead> <tr> <th>Type of forces</th> <th>Structure</th> </tr> </thead> <tbody> <tr> <td>Van der waals forces ($\frac{1}{2}$)</td> <td>Simple molecular ($\frac{1}{2}$) // Molecular</td> </tr> <tr> <td>Electrostatic forces ($\frac{1}{2}$) // Metallic bond</td> <td>Giant metallic ($\frac{1}{2}$) // Metallic</td> </tr> <tr> <td>Electrostatic forces ($\frac{1}{2}$) // Ionic bond</td> <td>Giant ionic ($\frac{1}{2}$) // Ionic</td> </tr> </tbody> </table> <p>X Intermolecular // Y Electrostatic forces ($\frac{1}{2}$) // Metallic bond Z Electrostatic forces ($\frac{1}{2}$) // Ionic bond</p> <p>Electrovalent</p>	Type of forces	Structure	Van der waals forces ($\frac{1}{2}$)	Simple molecular ($\frac{1}{2}$) // Molecular	Electrostatic forces ($\frac{1}{2}$) // Metallic bond	Giant metallic ($\frac{1}{2}$) // Metallic	Electrostatic forces ($\frac{1}{2}$) // Ionic bond	Giant ionic ($\frac{1}{2}$) // Ionic	<p>3 marks</p> <p>Award even without mention of simple / Giant.</p>
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13.	<p>(a) Add barium nitrate solution to a sample of aqueous sodium sulphite (1). The two salts react and a white precipitate of barium sulphite is formed. The precipitate dissolves when dilute acid nitric(V) acid is added (1). // bubble of a gas.</p> <p>(b) Add acidified potassium dichromate(VI) to a sample of aqueous sodium sulphite ($\frac{1}{2}$). The colour of potassium dichromate changes from orange to green ($\frac{1}{2}$).</p>	<p>3 marks</p> <p>Penalize $\frac{1}{2}$ mark for wrong commitment of initial colour of $H^+ / K_2Cr_2O_7$</p>								
14.	$\begin{array}{c} H & H \\ & \\ C & = & C \\ & \\ H & H \end{array} + 3(O = O) \rightarrow 2(O = C = O) + 2(H - O - H)$ <p>Enthalpy of reactants = + 612 + (496 x 4) + 3 (412) ($\frac{1}{2}$) ✓</p> <p>= 612 + 1984 + 1236</p> <p>= + 3832 kJ ($\frac{1}{2}$) ✓ Ignore any +/- sign.</p> <p>Enthalpy of products = (- 743 x 4) + (- 463 x 4) ($\frac{1}{2}$) ✓</p> <p>= - 2972 + - 1852</p> <p>= - 4824 kJ ($\frac{1}{2}$) ✓ Ignore any +/- sign</p> <p>ΔH = Enthalpy of reactants + Enthalpy of products</p> <p>= +3832 + - 4824 ($\frac{1}{2}$) ✓</p> <p>= - 992 kJmol⁻¹ ($\frac{1}{2}$) ✓</p> <p>Ignore units</p>	3 marks								

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15.	<p>(a) To <u>increase the concentration of hydrogen ions</u> hence <u>increases the conductivity</u> (1). // To ionize water // To add H⁺ ions // % electrolyze it ✓</p> <p>(b) $2H^+_{(aq)} + 2e^- \rightarrow H_{2(g)}$ Q = $12 \times 2 \times 3600$ = 86,400 C ✓ (1) 1 Faraday = 96,500 2F = $2 \times 96,500$ = 193,000 C Moles of oxygen = $\frac{86400}{193000}$ Hydrogen = 0.4477 moles (½) ✓ 1 mole = 24 dm³ $0.4477 = \frac{0.4477 \times 24}{1}$ = 10.7448 dm³ (½) ✓</p> <p style="text-align: right;">Accept Formula Volume = $\frac{I \times t \times M.G.V}{n^{\circ} \text{ of ions} \times 96,500}$ = $\frac{12 \times 2 \times 60 \times 60 \times 24}{2 \times 96,500}$ ✓ 1½ = 10.744 dm³ // 10,744.04 ✓ $\frac{0.4477 \times 24,000}{1}$ 10,744.8 cm³.</p>	3marks
16.	<p>(a) High temperature will <u>denature</u> the yeast which is used as a catalyst (1). ✓ destroy/Kill ✓</p> <p>(b) By <u>distillation</u> / <u>fractional distillation</u> / <u>redistillation</u> to remove water (1). ✓</p> <p>(c) <u>Uses of ethanol in hospital</u> • Sedative • As a sanitizer (1) • Antiseptic ✓ • Disinfectant ✓ Any 1 • Solvent for some drugs • Sterilizer</p>	3 marks
17.	<p>(a) Pencil does not dissolve in the solvent, hence <u>does not contaminate the sample</u> (1). // To avoid impurities in the solvent ✓</p> <p>(b) The baseline should not come into contact with the solvent to <u>prevent the dye from dissolving</u> in the solvent (1). ✓</p> <p>(c) To prevent the solvent from <u>evaporating</u> (1). ✓</p>	3 marks
18.	(a) Manganese(IV) oxide (MnO ₂) (1)	

Iron (III) chloride, $FeCl_3$

Potassium iodide, KI

Lead (IV) oxide, PbO_2

Copper (I) oxide, Cu_2O

Chromium (III) oxide, Cr_2O_3

18 (a) Manganese (IV) oxide; MnO_2 ✓

Any 1

No.	Responses	Marks
(b)	<p>(i) Moles of $H_2O_2 = \frac{6.12\text{ g}}{34\text{ g}} (\frac{1}{2}) \checkmark_2$ $= 0.18\text{ moles} \checkmark_2$</p> <p>(ii) Moles of oxygen $= \frac{0.18}{2} (\frac{1}{2}) \checkmark_2$ $= 0.09 \checkmark_2 \rightarrow$ Consequential marking.</p> <p>Volume of oxygen $= 0.09 \times 24000 (\frac{1}{2})$ $= 2,160\text{ cm}^3 (\frac{1}{2}) \checkmark_2$</p>	3 marks
19.	<ul style="list-style-type: none"> - NH_3 is oxidized to nitrogen(II) oxide in the presence of iron (Fe) (Platinum) / Pt-Phospor / Copper wire ✓ catalyst at high temperatures (1). - Nitrogen(II) oxide is further oxidized to nitrogen(IV) oxide to form nitric(V) acid (1). \checkmark_2 Dissolve NO_2 in water to form $HNO_3 \checkmark_2$ - The remaining ammonia reacted with nitric(V) acid to form ammonium nitrate (1). ✓ 	3 marks
20.	<p>(a) \checkmark_2 X - Concentrated sulphuric(VI) acid ($\frac{1}{2}$) / sulphuric (VI) acid \checkmark_2 To dehydrate (remove water) ($\frac{1}{2}$) / Dehydration.</p> <p>\checkmark_2 (ii) Y - Calcium hydroxide / any aqueous hydroxide ($\frac{1}{2}$) / NaOH / KOH \checkmark_2 To remove carbon(IV) oxide ($\frac{1}{2}$)</p> <p>(b) Carbon(II) oxide is soluble in cold water. (1) / Insoluble in warm water / slightly soluble in warm water. Reject: Insoluble in water</p>	<p>Rej. Dil H_2SO_4 Accept correct formula</p> <p>3 marks</p>

No.	Responses	Consequential	Marks	
21.	<p>(a) $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ ($\frac{1}{2}$) // Mole ratio $2\text{H}_2 : 1\text{O}_2$ ✓₂</p> <p>2g 2g</p> <p>Moles = $\frac{2\text{g}}{2}$ $\frac{2\text{g}}{32}$</p> <p>1 0.0625 ($\frac{1}{2}$) ✓₂</p> <p>Moles of water = $0.0625 \times 2 = 0.125$ ($\frac{1}{2}$) ✓₂</p> <p>Mass = moles \times molar mass $= 0.125 \times 18 \text{ gmol}^{-1}$ $= 2.25 \text{ g}$ ($\frac{1}{2}$) ✓₂</p> <p>(b) Moles of H_2 that reacted = moles of water produced = 0.125 $0.0625 \times 2 \rightarrow$</p> <p>(b) Mass of H_2 that reacted = 0.125×2 $= 0.25 \text{ g}$ ($\frac{1}{2}$) ✓₂</p> <p>Unreacted hydrogen = $2 - 0.25$ $= 1.75 \text{ g}$ ($\frac{1}{2}$) ✓₂</p>	<p>Alternative (Using Masses)</p> <p>$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$</p> <p>32g of $\text{O}_2 \rightarrow 36\text{g}$ of H_2O</p> <p>2g of $\text{O}_2 \rightarrow \frac{2 \times 36}{32}$ $= 2.25\text{g}$</p> <p>Alternative</p> <p>Moles of $\text{H}_2 = 2 \times 0.0625$ $= 0.125$</p> <p>Unused moles = $1 - 0.125$ $= 0.875$</p> <p>Mass of $\text{H}_2 = 0.875 \times 2$ $= 1.75\text{g}$</p>		
			3 marks = 1.75g	
22.	<p>(a) This is because different reactants have <u>different bond energies</u> and require different energies for the bonds to be broken (1).</p> <p>(b)</p> <p>Energy</p> <p>Reactants</p> <p>Products</p> <p>Progress of reaction (1)</p>			

(p) The uncatalyzed E_a is high // ✓₁
Catalyst lowers activation energy

No.	Responses	Marks																
	The catalyst activation energy is high (1).	3 marks																
23.	<p>(a)</p> <table border="1"> <thead> <tr> <th>Ions</th> <th>No. of electrons</th> <th>No. of protons</th> <th>No. of neutrons</th> </tr> </thead> <tbody> <tr> <td>$^{31}_{15}\text{P}^{3-}$</td> <td>18 ✓</td> <td>15 ✓</td> <td>16 ✓</td> </tr> <tr> <td>$^{56}_{26}\text{Fe}^{2+}$</td> <td>24 ✓</td> <td>26 ✓</td> <td>30</td> </tr> <tr> <td>$^x_y\text{O}^n$</td> <td>10</td> <td>8</td> <td>9</td> </tr> </tbody> </table> <p>$^x_y\text{O}^n \longrightarrow ^{17}_8\text{O}^{2-}$ (1)</p> <p>(b)</p> <p>$x = 17$ ✓ $y = 8$ ✓ $n = 2^-$ ✓</p>	Ions	No. of electrons	No. of protons	No. of neutrons	$^{31}_{15}\text{P}^{3-}$	18 ✓	15 ✓	16 ✓	$^{56}_{26}\text{Fe}^{2+}$	24 ✓	26 ✓	30	$^x_y\text{O}^n$	10	8	9	<p>3 marks</p> <p>All 3 - 1mk. 2 - 1/2 mk. 1 - 0 mk. 0 - 0mk.</p>
Ions	No. of electrons	No. of protons	No. of neutrons															
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$^x_y\text{O}^n$	10	8	9															
24.	<p>(a)</p> <p>Bromine ($\frac{1}{2}$) // $\text{Br}_2(\text{aq})$ ✓</p> <p>Oxidation number reduced from 0 to -1 so it is reduced as it oxidizes Iodine ($\frac{1}{2}$).</p> <p>Iodide ($\frac{1}{2}$) // $\text{I}^-(\text{aq})$ ✓</p> <p>Oxidation number increased from -1 to 0 so it is oxidized as it reduces Bromine ($\frac{1}{2}$).</p> <p>(b)</p> <p>$\text{CaCO}_3(\text{s}) + 2\text{H}^+(\text{aq}) \longrightarrow \text{Ca}^{2+}(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$ (1) ✓</p>	<p>3 marks</p>																
25.	<p>(a)</p> <p>Iron(III) chloride (1) // Ferric chloride // FeCl_3 ✓</p> <p>(b)</p> <p>$\text{Fe}(\text{OH})_2$ (1) ✓</p> <p>(c)</p> <p>$\text{Fe}^{2+}(\text{aq}) + \text{Zn}(\text{s}) \longrightarrow \text{Zn}^{2+}(\text{aq}) + \text{Fe}(\text{s})$ (1) ✓</p>	<p>3 marks</p>																
26.	<p>(2)</p> <div style="text-align: center;"> <pre> graph TD Fuel[Fuel] --> Igniter[Igniter or Heat] Fuel --> Oxidiser[Oxidiser or Oxygen/air] Igniter --- Oxidiser </pre> </div> <p>- Electric sparks ✓ - Open flame ✓ - Hot surface ✓ - Friction ✓ - Static (charges) ✓</p> <p>(2)</p>	<p>2 marks</p>																

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27.	<p>(a) Moles of Helium = $\frac{100 \text{ g}}{4 \text{ g/mol}}$ ✓₂ = 25 moles ✓₂</p> <p>1 mole = 24 dm³</p> <p>Volume of helium = $\frac{25}{1} \times 24,000$ (½) ✓₂ = 600 dm³ (½) ✓₂</p> <p>(b) P₁ = 1 atmosphere</p> <p>V₁ = 600 dm³</p> <p>T₁ = 298 K</p> <p>P₂ = 0.85 atmosphere</p> <p>T₂ = 283 K</p> <p>$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$ ✓₂</p> <p>$\frac{1 \times 600}{298} = \frac{0.85 \times V_2}{283}$ (1) ✓₁</p> <p>169,800 = 253.3 V₂</p> <p>$V_2 = \frac{169800}{253.3}$ (½)</p> <p>V₂ = 670.3 dm³ (½) ✓₂</p>	<p>4g of He → 24 dm³</p> <p>100g of He → $\frac{100 \times 24}{4}$ ✓₂</p> <p>= 600 dm³ ✓₂</p> <p>Att. ✓₂</p> <p>$\frac{25}{1} \times 24,000$ 600,000 cm³</p> <p>Temp in K</p> <p>- Allow consequential marking upto end and down ½ mk.</p> <p>- Correct sub. without formula; Award 1½ mk.</p> <p>3 marks</p>

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