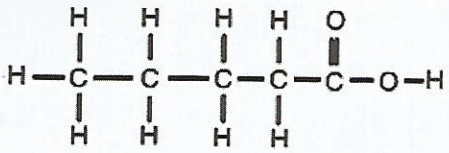
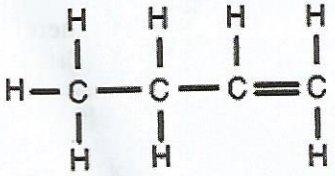
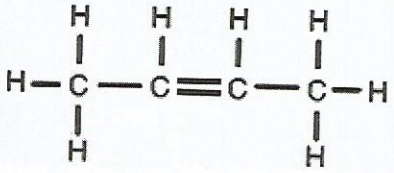
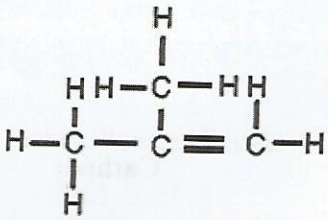
5.5 CHEMISTRY (233)

5.5.1 Chemistry Paper 1 (233/1)

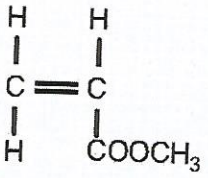
<table>
<tr><th>No.</th><th></th><th>Responses</th><th>Marks</th></tr>
<tr><td>1.</td><td>(a)</td><td>Charge - Proton has positive charge while neutron has no charge. (1)
OR
Mass - Neutron is slightly heavier than a proton</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td>(i) 2.8.8 (1 mark)
(ii) - Group II (½)
- Period 4 (½)</td><td>2
3 marks</td></tr>
<tr><td>2.</td><td>(a)</td><td><table><tr><td>Element</td><td>Sodium</td><td>Magnesium</td><td>Silicon</td><td>Phosphorus</td></tr><tr><td>Formula of chloride</td><td>NaCl</td><td>$MgCl_2$</td><td>$SiCl_4$</td><td>PCl_3
PCl_5</td></tr><tr><td>Structure of chloride</td><td>Giant ionic</td><td>Giant ionic</td><td>Simple molecular</td><td>Simple molecular</td></tr></table>• Award 1 mark for 4 correct formulae
• Award 1 mark for 4 correct structures (2)</td><td>2</td></tr>
<tr><td></td><td>(b)</td><td>$PCl_3(l) + 3H_2O(l) \rightarrow H_3PO_3(aq) + 3HCl(aq)$
OR
$PCl_5(l) + 4H_2O(l) \rightarrow H_3PO_4(aq) + 5HCl(aq)$ (1)
OR
$SiCl_4(l) + 2H_2O(l) \rightarrow SiO_2(s) + 4HCl(aq)$</td><td>1
3 marks</td></tr>
<tr><td>3.</td><td>(a)</td><td>$C(s) + ½O_2(g) \rightarrow CO(g)$; $\Delta H^{\theta}f$ (1)</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td>(i) $-110\ kJmol^{-1}$ (1)
(ii) - 400 - (-110) = -290 kJ (1)</td><td>2
3 marks</td></tr>
</table>

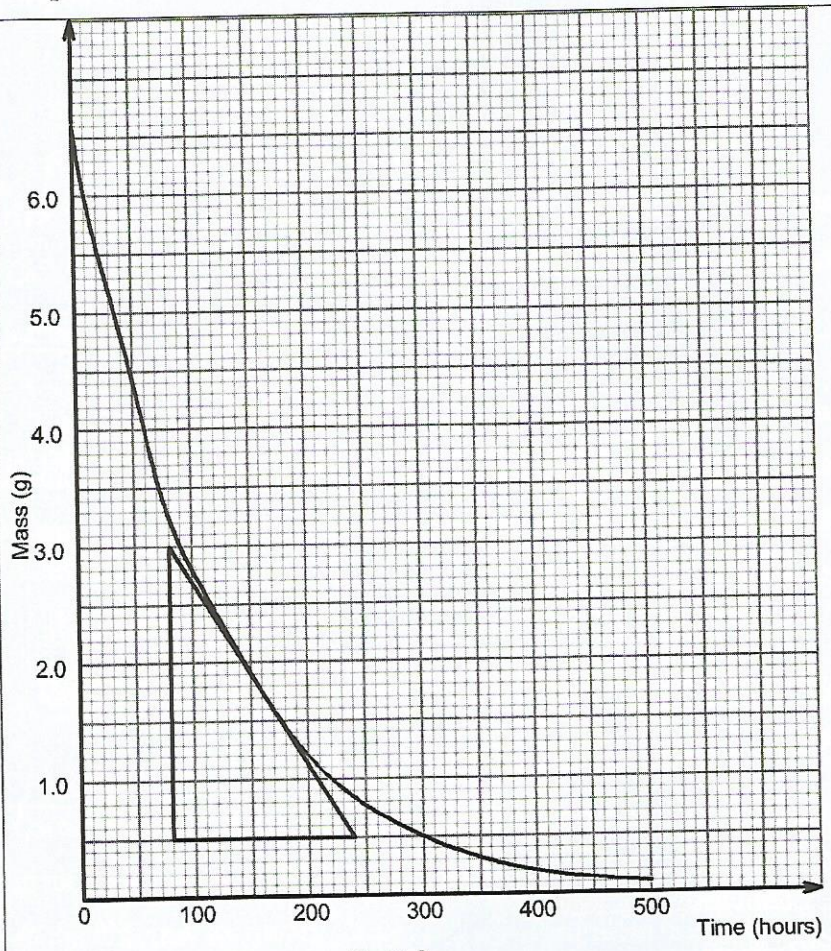
No.		Responses	Marks
4.	(a)	Both methods provide coating that keeps iron away from oxygen and water (1)	1
	(b)	In galvanizing zinc acts as a sacrificial (1) metal since it is more reactive than iron thus prevents rusting; in painting rusting will take place if the coat is broken. (1)	2
			3 marks
5.	(a)	(i) Decane (1)	2
		(ii) C_5H_{11} (1)	
	(b)	 (1)	1
			3 marks
6.		**Condition I** Increase temperature (½). The forward reaction is endothermic. Formation of NO_2**(g)** is favoured by increase in temperature (1).	1½
		Condition II Reduction in pressure (½). Forward reaction proceeds with increase in number of molecules or pressure (1). Production of NO_2**(g)** is therefore favoured by low pressure.	1½
			3 marks

No.		Responses	Marks
7.	(a)	(i) O.N of CaH_2 = +2 + 2H = 0 (½) 2H = -2 O.No. of H = -1 (½)	2
		(ii) O.No. of OF_2 = O + 2(-1) (½) O = +2 (½)	
	(b)	$CH_3COOH(aq) + HCO_3^-(aq) \rightarrow CH_3COO^-(aq) + CO_2(g) + H_2O(l)$ (1)	1
		OR	**3 marks**
		$H^+(aq) + HCO_3^-(aq) \longrightarrow CO_2(g) + H_2O(l)$	
8.	(a)	(i) $9.33 \times 10^{-23} \times 6.0 \times 10^{23}(\frac{1}{2}) = 55.58$ $\approx 56g$ (½)	2
		(ii) (CH)n = 56 13n = 56 (½)	
		n = 4	1
		∴ MF = C_4H_8 (½)	
		OR	
		C_4H_8 (1)	
	(b)	 (1)	
		OR	

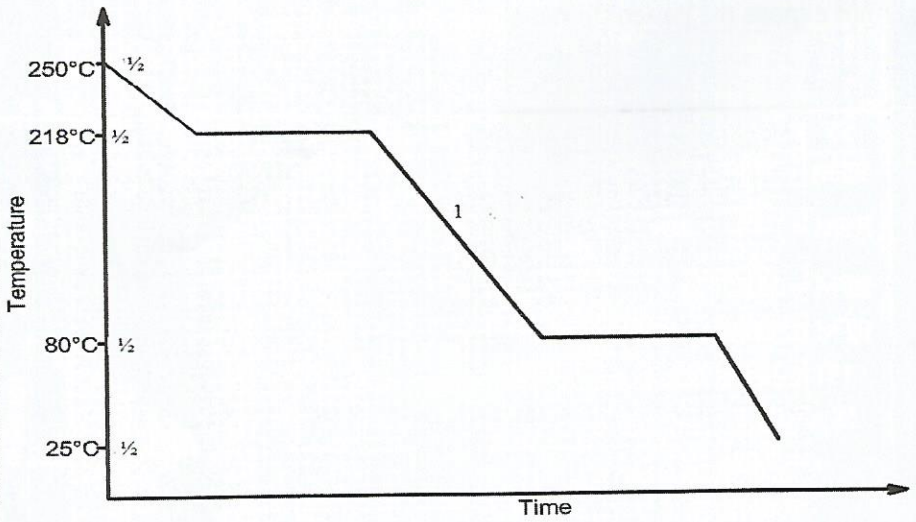
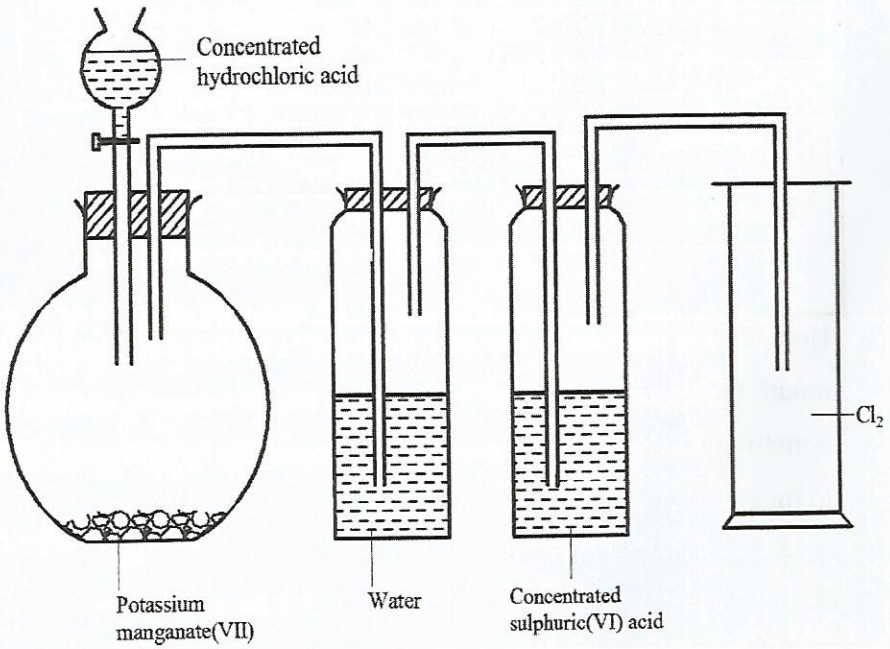
No.		Responses	Marks
		 **OR**  **(Accept any correct isomer of C_4H_8)**	**3 marks**
9.	(a)	(i) H_3O^+ (½)	
		(iii) Dative bond /coordinate bond (½)	1
	(b)	Iodine has larger molecular mass /bigger size (1) thus stronger Van der (1) Waals forces of attraction than chlorine which has small mass.	2
			3 marks
10.	(a)	$2NH_4Br(s) + Ba(OH)_2(s) \rightarrow BaBr_2(aq) + 2NH_3(g) + 2H_2O(l)$ (1)	1
	(b)	Ammonia reacts with calcium chloride to form $CaCl_2 \bullet 2NH_3$ which is a complex salt. (1)	1
	(c)	CaO(s)/Calcium oxide (1)	1
			3 marks

<table>
<tr><th>No.</th><th></th><th>Responses</th><th>Marks</th></tr>
<tr><td>11.</td><td>(a)</td><td>(i) Sample 1 (½)
(ii) Sample 4 (½)
(iii) Sample 2 / sample 5 (½)</td><td>1½</td></tr>
<tr><td></td><td>(b)</td><td>Hard water is run (½) into a column containing the ion exchange resin. Ca^{2+}/Mg^{2+} ions are exchanged for Na^{+} (1) ions. Therefore, water coming out from the column is soft.</td><td>1½
3 marks</td></tr>
<tr><td>12.</td><td>(a)</td><td>Position of the ion/element in the reactivity series. (1)</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td><table><tr><th>Electrolyte</th><th>Anode</th><th>Cathode</th></tr><tr><td>Dilute calcium chloride</td><td>Oxygen (½)</td><td>Hydrogen (½)</td></tr><tr><td>Concentrated calcium chloride</td><td>Chloride (½)</td><td>Hydrogen (½)</td></tr></table>(Accept correct formula of the product) (2)</td><td>2
3 marks</td></tr>
<tr><td>13.</td><td>(a)</td><td>Carbon exists in different (½) crystalline forms/allotropes i.e diamond and graphite in the same physical state, hence different boiling points because of the different structures. (½)</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td>$\frac{\text{Time of effusion of } Cl_2}{\text{Timeof effusion of } NO_2} = \sqrt{\frac{\text{RMM of } Cl_2}{\text{RMM of } NO_2}}$
$\text{Time of diffusion of } Cl_2 = 44 \times \sqrt{\frac{\text{RMM of } Cl_2}{\text{RMM of } NO_2}}$ (½)
$RMM(NO_2) = 46$ (½)
$RMM(Cl_2) = 71$ (½)
Time taken by (NO_2) 44 Sec.
Time taken by $(Cl_2) = 44 \times \sqrt{\frac{71}{46}} = 54.66$ S (½)</td><td>2
3 marks</td></tr>
<tr><td>14.</td><td>(a)</td><td>(i) Cotton/sisal/(½)/ sisal/banana fibre
(ii) Rubber (½)</td><td>1</td></tr>
</table>

No.		Responses	Marks
	(b)	(i)  (iii) Transparent (½); strong (½)	2
			3 marks
15.	(a)	Diamond has tetrahedral structure with all atoms forming four strong covalent bonds while in graphite each atom forms three covalent bonds in a (1) layer structure which are far from each other. The layers are held together by weak Van der Waals. **OR** Graphite has a large volume than diamond hence less dense for equal masses.	1
	(b)	(i) Graphite Use: Lubricant/pencil leads (½) Electrode Property: Soft and slippery (½) Conductor of electricity (ii) Diamond Use: Tips of drilling bits (½) Jewel Property: Hard and abrasive (½) Shiny lustre	2
			3 marks

No.		Responses	Marks
16.	(a)	 Figure 2	
		(i) Half-life = 85 hours (1 mark) **(Accept any value between 85 - 90 hours)** (ii) $\frac{3.0 - 0.5}{80 - 240}$ ($\frac{1}{2}$) Rate = $\frac{2.5}{-160}$ = - 0.016 g/hrs ($\frac{1}{2}$) **(Note the negative sign)**	2

<table>
<tr><th>No.</th><th></th><th>Responses</th><th>Marks</th></tr>
<tr><td></td><td>(b)</td><td>A has a shorter half-life than B ($^1/_2$). It will clear from the body faster thus not expose the patient to radiations for a long time ($^1/_2$).</td><td>3 marks</td></tr>
<tr><td>17.</td><td></td><td>$\frac{55}{RFM} \times 100 = 24.7$
$RFM = \frac{55}{24.7} \times 100$
RFM = 222.7 (1)
RFM of $MnSO_4$ = 151 (1)
$\therefore 151 + 18x = 222.7$
$18x = 71.7$
$x = 3.98$
$= 4$ (1)
OR
RFM $MnSO_4$ = 151
<table>
<tr><td></td><td>$MnSO_4$</td><td>H_2O</td></tr>
<tr><td>%</td><td>67.8</td><td>32.2</td></tr>
<tr><td>RFM</td><td>151</td><td>18</td></tr>
<tr><td>No. of moles</td><td>$\frac{67.8}{151} = 0.449$</td><td>$\frac{32.2}{18} = 1.789$</td></tr>
<tr><td>Mole ratio</td><td>1</td><td>4</td></tr>
</table>
</td><td>3
3 marks</td></tr>
<tr><td>18.</td><td></td><td>Hold the test tube with a test tube holder; (½) keep it slanting (1) with the mouth facing away; (½) heat from the top (½) downwards and not from the bottom to the top while rotating(½)/ while shaking /withdrawing from time to time.</td><td>3
3 marks</td></tr>
</table>

No.		Responses	Marks
19.		 **(Award 1 mark for the shape of the curve)**	3 **3 marks**
20.		 Workability (1) - apparatus Labelling (1) – water (½), drying agent ($^1/_2$) Collection (1)	3 **3 marks**

<table>
<tr><th>No.</th><th></th><th>Responses</th><th>Marks</th></tr>
<tr><td>21.</td><td>(a)

(b)</td><td>Fractional distillation. (½)
Put the two liquids in a fractionating column; heat the mixture gently; hexane will distill at 68.7°C (1) leaving butanol as the residue.

Separating funnel (½)
These are immiscible liquids; hexane will float on water; drain (1) the water from the bottom of the flask. Hexane remains in the funnel</td><td>1½

1½

3 marks</td></tr>
<tr><td>22.</td><td></td><td><table><tr><th>Ions present</th><th>Aqueous ammonia</th><th>Aqueous sodium sulphate</th></tr><tr><td>Ca^{2+}</td><td>White precipitate (½)</td><td>White precipitate (½)</td></tr><tr><td>Al^{3+}</td><td>White precipitate (½)</td><td>No white precipitate (½)</td></tr><tr><td>Fe^{2+}</td><td>Green precipitate (½)</td><td>No green precipitate (½)</td></tr></table></td><td>1
1
1

3 marks</td></tr>
<tr><td>23.</td><td>(a)

(b)</td><td>They react with calcium oxide (1) to form $CaSiO_3$ (½) and $CaAl_2O_4$ (½) which are removed as slag.
(Accept correct equation for formation of slag)
The waste gases are at high temperature. The heat can be recycled to pre-heat the incoming air/ CO is recycled to reduce iron ore. (1)</td><td>2

1

3 marks</td></tr>
<tr><td>24.</td><td>(a)

(b)</td><td>Chlorine reacts partially with water. There is a strong smell due to (1) presence of chlorine molecules / equilibrium lies to the left.

Addition of NaOH neutralizes (1) HCl(aq) and HOCl(aq); equilibrium shifts to the right/ chlorine molecules are consumed (1) hence the smell disappears.</td><td>1

2

3 marks</td></tr>
<tr><td>25.</td><td>(a)
(b)
(c)</td><td>Chamber I (1)
Nitrogen(II) oxide (NO) (1)
$3NO_2(g) + H_2O(l) \rightarrow 2HNO_3(aq) + NO(g)$ (1)
OR
$2NO_2(g) + H_2O(l) \longrightarrow HNO_3(l) + HNO_2(l)$</td><td>

3

3 marks</td></tr>
</table>

No.		Responses	Marks
26.		Oxidation state of zinc is +2 OH^- has a charge of -1 $\therefore +2 + (-1 \times 4) = x$ $\Rightarrow x = -2$ - Get oxidation No. of Zn (½) - Oxidation No. of OH^- (½) - Multiply oxidation No. by 4 - Sum up and equate to x ($^1/_2$)	2 **2marks**
27.	(a)	Hydrogen/ Ammonia/methane gas (1)	3
	(b)	$CuO(s) + CO(g) \rightarrow Cu(s) + CO_2(g)$ Moles CO = moles Cu = $\frac{200\ dm^3}{24\ dm^3}$ Mass Cu = $\frac{200}{24} \times 63.5 = 529.2\ g$ **OR** No. of moles of CO = No. of moles of Cu ($^1/_2$) No. of Cu = $\frac{200}{24} = 8.333$ ($^1/_2$) Mass of Cu = $\frac{200}{24} \times 63.5$ ($^1/_2$) = 529.2g ($^1/_2$)	**3 marks**