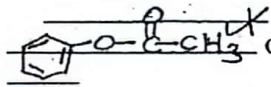
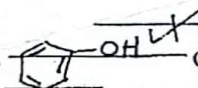
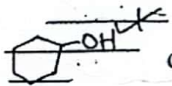

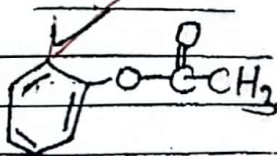




Coordinated guide

Res. All unbalanced eqns  
Deduct 1/2 for missing state symbols

1.(a)(i)	<p>% of oxygen = <math>100 - (70.59 + 5.88)</math> = 23.53</p> <p>Percentages      C                      H                      O 70.59                      5.88                      23.53</p> <p>Moles                      <math>\frac{70.59}{12}</math>                      <math>\frac{5.88}{1}</math>                      <math>\frac{23.53}{16}</math></p> <p>5.8825                      5.88                      1.470625</p> <p>Mole ratio                      <math>\frac{5.8825}{1.470625}</math>                      <math>\frac{5.88}{1.470625}</math>                      <math>\frac{1.470625}{1.470625}</math></p> <p>4                      4                      1</p> <p>Empirical formula of W is <math>C_4H_4O</math></p>	03
ii)	<p>R.F.M of W = <math>68.04 \times 2</math> = 136.08 (<math>C_nH_nO</math>) n = 136.08 (<math>12 \times 4</math>) + <math>1 \times 4</math> + 16) n = 136.08 <math>68n = 136.08</math> n = 2 Molecular formula of W is <math>C_8H_8O_2</math></p>	02
b)(i)	<p>W is  or phenylethanoate</p> <p>X is  or phenol.</p> <p>Y is <math>CH_3COOH</math> or ethanoic acid</p> <p>Z is  or cyclohexanol.</p>	02
(ii)	<p> + <math>CH_3COCl \xrightarrow{NaOH(aq)}</math> </p>	

	Mechanism	<p> </p> <p>04</p>	04
(c)(i)		<p> </p> <p>2 1/2</p>	2 1/2
(ii)	Mechanism	<p> </p> <p>3 1/2</p>	3 1/2
(d)	Neutral Iron (III) chloride solution	<p> </p> <p>Forms violet (purple) coloration</p> <p>No observable change.</p>	03
		20 marks	

2(a)	(i) Solubility product is the product of the molar concentration of the ions of a sparingly soluble electrolyte (salt) raised to appropriate powers when the aqueous solution is saturated at given temperatures.	01
	(ii) Common ion effect is the precipitation of a sparingly soluble electrolyte (salt) when a more soluble compound with one ion common to both is added to its saturated solution to a given temperature.	01
(b)	<p>Excess of solid strontium chromate is mixed with a known volume of distilled water in a flask and the flask is stoppered and the mixture shaken vigorously for some time until equilibrium is attained at a given temperature.</p> <p>The mixture is filtered to obtain the filtrate which is a saturated solution of strontium chromate at that temperature.</p> <p>Known volumes of the filtrate were pipetted and mixed with excess acidified potassium iodide solution and the liberated iodine titrated with a standard solution of sodium thiosulphate using starch indicator.</p> $2\text{CrO}_4^{2-}{}_{(aq)} + 6\text{I}^-{}_{(aq)} + 16\text{H}^+{}_{(aq)} \rightarrow 2\text{Cr}^{3+}{}_{(aq)} + 3\text{I}_2{}_{(aq)} + 8\text{H}_2\text{O}_{(l)}$ $\text{I}_2{}_{(aq)} + 2\text{S}_2\text{O}_3^{2-}{}_{(aq)} \rightarrow 2\text{I}^-{}_{(aq)} + \text{S}_4\text{O}_6^{2-}{}_{(aq)}$ <p>using mole ratios, the concentration of chromate ions and strontium chromate is determined.</p> <p>If <math>C \text{ mol dm}^{-3}</math> is the solubility (molar concentration of strontium chromate) in the saturated solution then the solubility product can be determined.</p> $\text{SrCrO}_4{}_{(aq)} + aq \rightleftharpoons \text{Sr}^{2+}{}_{(aq)} + \text{CrO}_4^{2-}{}_{(aq)}$ $\begin{array}{ccc} C & & C \\ \text{KSP} = [\text{Sr}^{2+}] [\text{CrO}_4^{2-}] & & \\ = C \cdot C & & \\ = C^2 \text{ mol}^2 \text{ dm}^{-6} & & \end{array}$	02
(c)(i)	$\text{SrCrO}_4{}_{(s)} + aq \rightleftharpoons \text{Sr}^{2+}{}_{(aq)} + \text{CrO}_4^{2-}{}_{(aq)}$ $\begin{array}{ccc} x & & x \\ [\text{Sr}^{2+}] = x \text{ mol dm}^{-3} & & \\ [\text{CrO}_4^{2-}] = x \text{ mol dm}^{-3} & & \\ \text{KSP} = [\text{Sr}^{2+}] [\text{CrO}_4^{2-}] & & \\ 3.6 \times 10^{-5} = x \cdot x & & \\ x^2 = 3.6 \times 10^{-5} & & \\ x = \sqrt{3.6 \times 10^{-5}} & & \end{array}$	02



	$= 0.006$ R.F.M of $\text{SrCrO}_4 = 87.6 + 52 + 16 \times 4$ $= 203.6$ Solubility of $\text{SrCrO}_4 = 203.6 \times 0.006$ $= 1.2216 \text{ g dm}^{-3}$ <i>Rel is units are missing.</i>							
(ii)	<p>Let the solubility of <math>\text{SrCrO}_4</math> in 0.15M sodium chromate be y.</p> $\text{SrCrO}_{4(s)} + aq \rightleftharpoons \text{Sr}^{2+}_{(aq)} + \text{CrO}_4^{2-}$ <table> <tr> <td>y</td> <td>y</td> <td>y</td> </tr> </table> $\text{Na}_2\text{CrO}_{4(aq)} \rightarrow 2\text{Na}^+_{(aq)} + \text{CrO}_4^{2-}_{(aq)}$ <table> <tr> <td>0.15</td> <td>0.30</td> <td>0.15</td> </tr> </table> $[\text{Sr}^{2+}] = y \text{ mol dm}^{-3}$ $[\text{CrO}_4^{2-}] = y + 0.15$ Since $y \ll 0.15$ $y + 0.15 \approx 0.15$ $\therefore [\text{CrO}_4^{2-}] = 0.15 \text{ M}$ $K_{sp} = [\text{Sr}^{2+}][\text{CrO}_4^{2-}]$ $3.6 \times 10^{-5} = y \times 0.15$ $y = 0.00024$ $\therefore$ Solubility of $\text{SrCrO}_4$ in 0.15M $\text{Na}_2\text{CrO}_4$ $= 0.00024 \times 203.6$ $= 0.048864 \text{ g dm}^{-3}$ <i>Resect with units</i>	y	y	y	0.15	0.30	0.15	03
y	y	y						
0.15	0.30	0.15						
(d) (i)	<p>Molar conductivity is the conductance of a given volume containing one mole of an electrolyte enclosed between electrodes unit distance apart and with unit cross sectional area.</p>	03						
(ii)	$K_{Ag_3PO_4} = K_{\text{solution}} - K_{\text{water}}$ $= 2.7336 \times 10^{-6} - 1.5916 \times 10^{-6}$ $= 1.142 \times 10^{-6} \Omega \text{ cm}^{-1}$ $\Lambda_{\infty} \text{Ag}_3\text{PO}_4 = 3\Lambda_{\infty} \text{Ag}^+ + \Lambda_{\infty} \text{PO}_4^{3-}$ $= 3 \times 61.9 + 240$ $= 425.7 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$ $\Lambda = \frac{K}{C}$ $425.7 = \frac{1.142 \times 10^{-6} \times 10^3}{C}$ $C = 2.683 \times 10^{-6} \text{ M}$ $\text{Ag}_3\text{PO}_{4(s)} + aq \rightleftharpoons 3\text{Ag}^+_{(aq)} + \text{PO}_4^{3-}_{(aq)}$ <table> <tr> <td>x</td> <td>3x</td> <td>x</td> </tr> </table>	x	3x	x	4 1/2			
x	3x	x						

	$K_{sp} = [Ag^+]^3 [PO_4^{3-}]$ $K_{sp} = (3x)^3 (x)$ $= 27x^4$ $27 \times (2.683 \times 10^{-6})^4$ $= 1.398 \times 10^{-21} \text{ mol}^4 \text{ dm}^{-12}$	
(e)	<ul style="list-style-type: none"> <li>- Salting out of soap</li> <li>- Purification of common salt</li> <li>- Qualitative analysis</li> <li>- Precipitation titration.</li> </ul>	01
3(a)(i)	20 marks	
(ii)	<p>A d-block element is one in which the outer electrons or last electrons are in d-sub energy level. <b>OR</b> It is an element in which the d-subshell is in the process of filling up with electrons.</p> <p> <math>24Cr: 1S^2 2S^2 2P^6 3S^2 3P^6 3d^5 4S^1</math>  <math>25Mn: 1S^2 2S^2 2P^6 3S^2 3P^6 3d^5 4S^2</math>  <math>29Cu: 1S^2 2S^2 2P^6 3S^2 3P^6 3d^{10} 4S^1</math>  <math>30Zn: 1S^2 2S^2 2P^6 3S^2 3P^6 3d^{10} 4S^2</math> </p>	02
b(i)	<ul style="list-style-type: none"> <li>- It forms complexes</li> <li>- It acts as a catalyst</li> <li>- It forms interstitial compounds.</li> </ul>	01
(ii)	<ul style="list-style-type: none"> <li>- It forms colourless compounds</li> <li>- It has only one oxidation state</li> <li>- It is non-paramagnetic.</li> </ul>	01
(c)(i)	<p>Zinc reduces copper (ii) ions to copper metal and zinc itself is oxidized to zinc ions.</p> <p><math>Zn_{(s)} + Cu_{(aq)}^{2+} \rightarrow Zn_{(aq)}^{2+} + Cu_{(s)}</math></p>	03
(ii)	<p>Chromium (III) ions have small ionic radii and high charge and thus high charge density and high polarizing power.</p> <p>In aqueous solution, chromium (iii) ions undergo hydrolysis to form insoluble chromium (iii) hydroxide and hydrogen ions which react with carbonate ions from sodium carbonate solution to form carbon dioxide gas. <b>OR</b> In aqueous solution, it polarizes water molecules which lead to breakage of O-H bond in water and release of <math>H^+</math> form carbon dioxide gas, the remaining <math>OH^-</math> from the water combines with <math>Cr^{3+}</math> ions to form insoluble chromium III hydroxide.</p> <p> <math>Cr_{(aq)}^{3+} + 3H_2O_{(l)} \rightleftharpoons Cr(OH)_{3(s)} + 3H_{(aq)}^+</math>  <b>OR</b>  <math>[Cr(H_2O)_6]^{3+} + 3H_2O_{(l)} \rightleftharpoons Cr(H_2O)_3(OH)_3 + 3H_3O_{(aq)}^+</math>  <math>CO_3^{2-}_{(aq)} + 2H^+_{(aq)} \rightarrow CO_{2(g)} + H_2O_{(l)}</math>  <b>OR</b>  <math>CO_3^{2-}_{(aq)} + 2H_3O^+_{(aq)} \rightarrow CO_{2(g)} + 3H_2O_{(l)}</math> </p>	04

(iii)	Hydrogen peroxide oxidizes hexahydroxochromate (iii) ions to chromate (VI) ions. <b>OR</b> Hydrogen peroxide oxidizes the $\text{Cr}^{3+}$ in hexahydroxochromate III ion to chromate VI ions which are yellow.	03
(d)(i)	Yellow precipitate $\text{Ba}^{2+}_{(\text{aq})} + \text{CrO}_4^{2-}_{(\text{aq})} \rightarrow \text{BaCrO}_4(\text{s})$	02
(ii)	Green solution turns purple and black / brown precipitate formed, $3\text{MnO}_4^{2-}_{(\text{aq})} + 4\text{H}^+_{(\text{aq})} \rightarrow 2\text{MnO}_4^{-}_{(\text{aq})} + \text{MnO}_2(\text{s}) + 2\text{H}_2\text{O}(\text{l})$	03
4(a)	A weak base is one which partially ionizes in aqueous solution to form fewer hydroxide ions as the only negatively charged ions.	20 marks 01
(b)(i)	$(\text{CH}_3)_2\text{NH}_{(\text{aq})} + \text{H}_2\text{O}(\text{l}) \rightleftharpoons (\text{CH}_3)_2\text{NH}^+_{(\text{aq})} + \text{OH}^-_{(\text{aq})}$ $K_b = \frac{\alpha^2 C}{1-\alpha}$ $5.9 \times 10^{-4} = \frac{\alpha^2 \times 0.025}{1-\alpha}$ $0.025\alpha^2 + 5.9 \times 10^{-4}\alpha - 5.9 \times 10^{-4} = 0$ $\therefore \alpha = 0.14228$ $\alpha = \frac{K_b}{K_b + C} = \frac{5.9 \times 10^{-4}}{5.9 \times 10^{-4} + 0.025} = 0.152$	03
(ii)	$[\text{OH}] = \alpha C$ $= 0.14228 \times 0.025$ $= 3.557 \times 10^{-3}$ $\text{POH} = -\log_{10} [\text{OH}]$ $= -\log_{10} 3.557 \times 10^{-3}$ $= 2.4489$ $\text{PH} = 14 - 2.4489$ $= 11.551$	02
(c)(i)	Number of moles of dimethylammonium chloride = $\frac{500 \times 0.025}{1000}$ $= 0.0125$ moles Number of moles dimethylamine = $\frac{500 \times 0.025}{1000}$ $= 0.0125$ Total volume of solution = 500 + 500 $= 1000 \text{ cm}^3$ $\left[ (\text{CH}_3)_2\text{NH}_2^+ \text{Cl}^- \right] = 0.05 \text{ M}$ $\left[ (\text{CH}_3)_2\text{NH} \right] = 0.0125 \text{ M}$ $\text{PH} = \text{p}K_b + \left( \text{p}K_b + \log_{10} \left[ \frac{[\text{salt}]}{[\text{Base}]} \right] \right)$ $= -\log_{10} 1.0 \times 10^{-14} - \left( -\log_{10} 5.9 \times 10^{-4} + \log_{10} \left( \frac{0.05}{0.0125} \right) \right)$ $= 14 - (3.2291 + 0.60206)$ $= 10.1688$	4



02 mms p h  
at adt

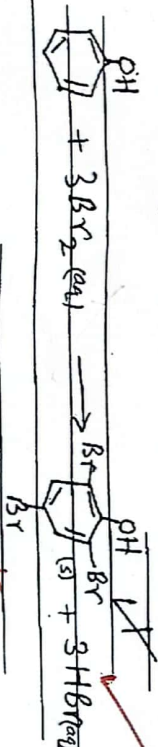

(b)	<p><i>Red heat or 140°C</i></p> $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \xrightarrow{\text{conc. H}_2\text{SO}_4, 170^\circ\text{C}} \text{CH}_3\text{CH}=\text{CH}_2$ $\text{CH}_3\text{CH}=\text{CH}_2 \xrightarrow{\text{KOH/EtOH, heat}} \text{CH}_3\text{CH}=\text{CH}_2$ $\text{CH}_3\text{CH}=\text{CH}_2 \xrightarrow{\text{excess HCl}} \text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$ <p>OR</p> $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \xrightarrow{\text{conc. H}_2\text{SO}_4, 170^\circ\text{C}} \text{CH}_3\text{CH}=\text{CH}_2$ $\text{CH}_3\text{CH}=\text{CH}_2 \xrightarrow{\text{NaOH/EtOH, heat}} \text{CH}_3\text{CH}=\text{CH}_2$ $\text{CH}_3\text{CH}=\text{CH}_2 \xrightarrow{\text{HBr}} \text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$ $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} \xrightarrow{\text{PbO}_2/\text{H}^+} \text{CH}_3\text{CH}=\text{CH}_2$ $\text{CH}_3\text{CH}=\text{CH}_2 \xrightarrow{\text{PbO}_2/\text{H}^+} \text{CH}_3\text{CH}=\text{CH}_2$	05
(c)	$\text{Cyclohexanone} \xrightarrow{\text{H}_2\text{N}^+\text{Cl}^-, 150^\circ\text{C}} \text{Cyclohexylamine}$ $\text{Cyclohexylamine} \xrightarrow{\text{NaOH/EtOH, heat}} \text{Cyclohexene}$	05
(d)	$\text{Cyclohexanone} \xrightarrow{\text{H}_2\text{N}^+\text{Cl}^-, 150^\circ\text{C}} \text{Cyclohexylamine}$ $\text{Cyclohexylamine} \xrightarrow{\text{NaOH/EtOH, heat}} \text{Cyclohexene}$	05

(10)



6(a)	Standard enthalpy at displacement is the enthalpy change that occurs when one mole of a metal is displaced from its salt solution by a more electropositive metal at standard conditions.	01
(b)(i)	Graph (at the back)	
(ii)	<p>Maximum temperature for metal X  <math>50^{\circ}\text{C} \pm 1</math></p> <p>Maximum temperature for metal Y  <math>39^{\circ}\text{C} \pm 1</math></p>	02
(iii)	<p>Temperature change for metal X = <math>50 - 26.5</math>  <math>= 23.5^{\circ}\text{C}</math></p> <p>Mass of solubility = Volume x density  <math>= 50 \times 1</math>  <math>= 50\text{g}</math></p> <p>Heat change = mass x S.H.C x temperature change  <math>= 50 \times 4.2 \times 23.5</math>  <math>= 4935\text{ J}</math></p> <p>Number of moles <math>\text{CuSO}_4 = \frac{50 \times 0.5}{1000}</math>  <math>= 0.025</math></p> <p>0.025 moles of <math>\text{CuSO}_4</math> produced 4935J</p> <p>1 mole of <math>\text{CuSO}_4</math> produced <math>\frac{4935}{0.025}</math></p> <p>Heat of displacement by metal X = <math>-197.4\text{KJmol}^{-1}</math></p> <p>Temperature change for metal Y  <math>= 39 - 26.5</math>  <math>= 12.5^{\circ}\text{C}</math></p> <p>Mass of solution = <math>50 \times 1</math>  <math>= 50\text{g}</math></p> <p>Heat change = mass of solution x S.H.C x DT  <math>= 50 \times 4.2 \times 12.5</math>  <math>= 2625\text{J}</math></p> <p>Number of moles <math>\text{CuSO}_4 = \frac{50 \times 0.5}{1000}</math>  <math>= 0.025</math></p> <p>0.025 moles of <math>\text{CuSO}_4</math> produced 2625J</p> <p>1 mole of <math>\text{CuSO}_4</math> produced <math>\frac{2625}{0.025}</math></p> <p>Heat of displacement by metal Y  <math>= -105.0\text{KJmol}^{-1}</math></p>	
(iv)	$\text{CuSO}_{4(\text{aq})} + \text{X}_{(\text{s})} \rightarrow \text{Cu}_{(\text{s})} + \text{XSO}_{4(\text{aq})}$ $\text{CuSO}_{4(\text{aq})} + \text{Y}_{(\text{s})} \rightarrow \text{Cu}_{(\text{s})} + \text{YSO}_{4(\text{aq})}$	02
(v)	26.5 $^{\circ}\text{C}$ represents the initial temperature of copper (II) sulphate solution.	0 1/2
(vi)	Metal X is more reactive because it produced more heat of displacement.	02

Accept 10mL

(d)	$\text{Cu}^{2+}(\text{aq}) + \text{X}_{(\text{s})} \rightarrow \text{Cu}_{(\text{s})} + \text{X}^{2+}(\text{aq})$ $E_{\text{cell}} = E_{\text{cathode}} - E_{\text{anode}}$ $= +0.34 - 0.76$ $= +1.10\text{V}$ $\Delta G^{\circ} = nFE^{\circ}$ $= -2 \times 96500 \times 1.1$ $= -212300\text{Jmol}^{-1}$ $= -212.3\text{KJmol}^{-1}$ $\text{Cu}^{2+}(\text{aq}) + \text{Y}_{(\text{s})} \rightarrow \text{Cu}_{(\text{s})} + \text{Y}^{2+}(\text{aq})$ $E^{\circ}_{\text{cell}} = E_{\text{cathode}} - E_{\text{anode}}$ $= +0.34 - 0.44$ $= -0.10\text{V}$ $\Delta G^{\circ} = -nFE^{\circ}$ $= -2 \times 96500 \times 0.78$ $= -150.540\text{Jmol}^{-1}$ $= -150.54\text{KJmol}^{-1}$	04
7(a)	<p>The three peaks are due to isotopic combinations.</p> <p>ie <math>^{35}\text{Cl} - ^{35}\text{Cl}</math> gives <math>\frac{M}{e}</math> at 70</p> <p><math>^{35}\text{Cl} - ^{37}\text{Cl}</math> gives <math>\frac{M}{e}</math> at 72</p> <p><math>^{37}\text{Cl} - ^{37}\text{Cl}</math> gives <math>\frac{M}{e}</math> at 74</p> <p>rel of charges as masses</p>	03
(b)	<p>Benzene has delocalized pi electrons and cannot undergo electrophilic substitution without a halogen carrier. However, in the phenol, the hydroxyl functional group has a positive inductive effect and thus increases the electron density in the benzene ring. The activated benzene ring can easily undergo electrophilic substitution without a halogen carrier.</p> <p>OR</p> <p>The OH group in phenol increases the electron density at the ortho and para positions of the benzene ring. This increases the reactivity of phenol at the ortho and para positions and make it under go electrophilic substitution when reacted with bromine water to form 2,4,6-tribromophenol</p>  <p>On the other hand, benzene has delocalized pi electrons and therefore cannot react with bromine water without a halogen carrier to make bromine an electrophile.</p> 	03



(c)	<p>Lead (II) ions react with hydroxide ions to form <u>insoluble lead (II) hydroxide</u>.</p> $Pb^{2+}_{(aq)} + 2OH^{-}_{(aq)} \rightarrow Pb(OH)_{2(s)}$ <p>The lead (II) hydroxide being <u>amphoteric</u> reacts with <u>more hydroxide ions</u> to form a <u>soluble complex</u>.</p> $Pb(OH)_{2(s)} + 2OH^{-}_{(aq)} \rightarrow Pb(OH)_{4}^{2-}_{(aq)}$	05
(d)	<p>Form the <math>K_a</math> values; <u>chloroethanoic acid</u> is a <u>stronger acid</u> than <u>ethanoic acid</u>.</p> <p>In <u>chloroethanoic</u>, the <u>chlorine atom</u> is <u>more electro negative</u> than <u>carbon</u> and thus exerts a <u>negative inductive effect</u> which is <u>transmitted</u> throughout the <u>molecule</u>. The <u>oxygen - hydrogen bond</u> is <u>weakened</u> and thus can <u>easily break</u>. The <u>aqueous solution</u> of <u>chloro-ethanoic acid</u> has a <u>relatively higher concentration</u> of <u>hydrogen ions</u> and thus <u>stronger acid</u>.</p> <p>In <u>ethanoic acid</u>, the <u>methyl group</u> has a <u>positive inductive effect</u> and this <u>strengthens the oxygen- hydrogen bond</u> thus <u>cannot easily break</u>.</p> <p>The <u>aqueous solution</u> of <u>ethanoic acid</u> has a <u>relatively lower concentration</u> of <u>hydrogen ions</u> thus a <u>weaker acid</u>.</p>	04
(e)	<p><u>Bromine</u> is a <u>stronger oxidizing agent</u> than <u>iodine</u>.</p> <p>It <u>oxidises thiosulphate</u> to <u>sulphate ions</u> with <u>oxidation state of sulphur</u> increases from <u>+2 to +6</u>. While <u>iodine</u> being a <u>mild oxidizing agent</u> <u>oxidises thiosulphate ions</u> to <u>tetra-thionate ions</u> with <u>oxidation state</u> increases from <u>+2 to 2.5</u></p> $Br_{2(aq)} + S_2O_3^{2-}_{(aq)} + H_2O_{(l)} \rightarrow SO_4^{2-}_{(aq)} + S_{(s)} + 2HBr_{(aq)}$ $I_{2(aq)} + 2S_2O_3^{2-}_{(aq)} \rightarrow S_4O_6^{2-}_{(aq)} + 2I^{-}_{(aq)}$	05
8.(a)	It is converted into iron (III) oxide which can easily be reduced to iron.	20 marks
(b)	<p><math>4FeCO_3(s) + O_{2(g)} \rightarrow 2Fe_2O_3(s) + 4CO_{2(g)}</math></p> <p><u>Silicon (IV) oxide</u> and <u>aluminium oxide</u>.</p> <p>Limestone decomposes to form <u>calcium oxide</u> and <u>carbon dioxide</u>.</p> $CaCO_3(s) \rightarrow CaO(s) + CO_{2(g)}$ <p>The <u>calcium oxide</u> combines with the <u>impurities</u> to form <u>slag</u> which can easily be removed.</p> $CaO(s) + SiO_2(s) \rightarrow CaSiO_3(l)$ $CaO(s) + Al_2O_3(s) \rightarrow Ca(AlO_2)_2(l)$	03
(c)(i)	The blast furnace is made of <u>brick</u> - lining in the inside which is a <u>bad conductor of heat</u> . Therefore <u>heat cannot easily be lost</u> and thus <u>maintaining the temperatures</u> .	02
(ii)	$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$ $CO_{2(g)} + C_{(s)} \rightarrow 2CO_{(g)}$ $3CO_{(g)} + Fe_2O_3(s) \rightarrow 2Fe_{(s)} + 3CO_{2(g)}$	4 1/2
(d)	Pig iron and it is <u>brittle</u> or it has <u>low tensile strength</u> .	01

(e)(i)	Iron reacts with dry oxygen when heated to form tri iron tetra oxide. $3\text{Fe}_{(s)} + 2\text{O}_{2(g)} \rightarrow \text{Fe}_3\text{O}_{4(s)}$	
(ii)	Iron reacts with dilute sulphuric acid to form iron (II) sulphate and hydrogen gas. $\text{Fe}_{(s)} + \text{H}_2\text{SO}_{4(aq)} \rightarrow \text{FeSO}_{4(aq)} + \text{H}_{2(g)}$ It also reacts with hot concentrated sulphuric acid to form Iron (III) sulphate sulphur dioxide and water. $2\text{Fe}_{(s)} + 6\text{H}_2\text{SO}_{4(l)} \rightarrow \text{Fe}_2(\text{SO}_4)_3(aq) + 3\text{SO}_{2(g)} + 6\text{H}_2\text{O}_{(l)}$	05
(iii)	Iron reacts with dry chlorine when heated to form iron (III) chloride. $2\text{Fe}_{(s)} + 3\text{Cl}_{2(g)} \rightarrow 2\text{FeCl}_{3(s)}$	
		20 Marks



A graph of Temperature against time

