1. a)(i) Concentrated sulphuric(VI)acid/ $H_2SO_{4(l)}$

(ii) $H_2SO_{4(l)} + NaCl_{(s)}K \rightarrow NaHSO_{4(s)} + HCl_{(g)}$

(iii) Displacement

(iv) $Fe_{(s)} + HCl_{(g)} \rightarrow FeCl_{2(s)} + HCl_{(g)}$

(v) Potassium hydroxide solution is a strong base with a pH of 13 (1mk) It is neutralized by excess HCl which is acidic and solution becomes acidic hence low pH (1mk)

b) Potassium maganate(VII) // $KMnO_4$

Calcium hypochlorite // $CaOCl_2$

Lead(IV)oxide // PbO_2

c) $2Al_{(s)} + 3Cl_{2(g)} \rightarrow 2AlCl_{3(s)}$ (1mk)

Moles of $Al = \frac{0.42}{27}\left(\frac{1}{2}mk\right) = 0.001481$

Moles of $Cl_2 = \frac{0.001481 \times 3}{2}^{(\frac{1}{2}mk)} = 0.00222$

Vol. Of $Cl_2 = 0.0022 \times 24$ (½)

= 0.05333dm^2(½mk)

d) Chlorine reacts with water to form chloric(I)acid $(HOCl)$ (½mk). The dye in the litmus paper combines with oxygen from $HOCl$ and becomes white (½mk)

2. (a) (i) An element is a pure substance which cannot be split into simpler substances (1mk). A molecule is the smallest part of an element that can exist in a free and separate state. (1mk)
NB: Both must be mentioned to score. If both not mentioned award zero(0mk)

b) (i) J (1mk)

- It has the highest number of delocalized electrons//It has 3 delocalized electrons(1mk)

(ii) $3E_s + G_2 \rightarrow E_3G_{2(s)} // 3Mg_{(s)} + N_{2(g)} \rightarrow Mg_3N_{2(s)}$

(iii) – Ionization energy of C is higher than D.(1mk) OR Ionization energy of D is lower than C(1mk)

- C has a smaller atomic radius hence the electrons are more attracted (1mk)/ OR D has a larger atomic radius and hence the electrons weakly attracted by nucleus (1mk)

(iv) E forms a glant metallic structure (½mk) consisting of strong metallic bonds (½mk). K forms molecular structure(½mk) consisting of weak Vander Waals force(½mk) which are easy to break

(v) Shown on the grid

								F
C					G		H	
D	E		J		L		K	

(vi) $2J_{(s)} + 3H_2SO_{4(aq)} \rightarrow J_2(SO_4)_{3(aq)} + 3H_{2(g)}$ =(1mk)

Moles of $H_2 gas = \frac{0.4}{24}$ $^{(½mk)}$ $= 0.01666$

Moles of $J = \frac{0.01666 \times 2}{3}$ $^{(½mk)}$ $= 0.01110$

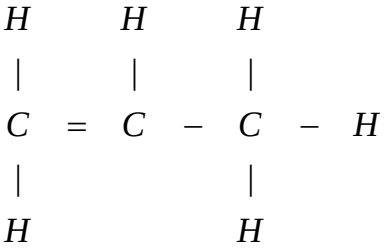
Moles of J = 0.01110x27(½mk)

= 0.2997g(½mk)

3. (a) (i) Alkynes

(ii) Esters

b) (i)

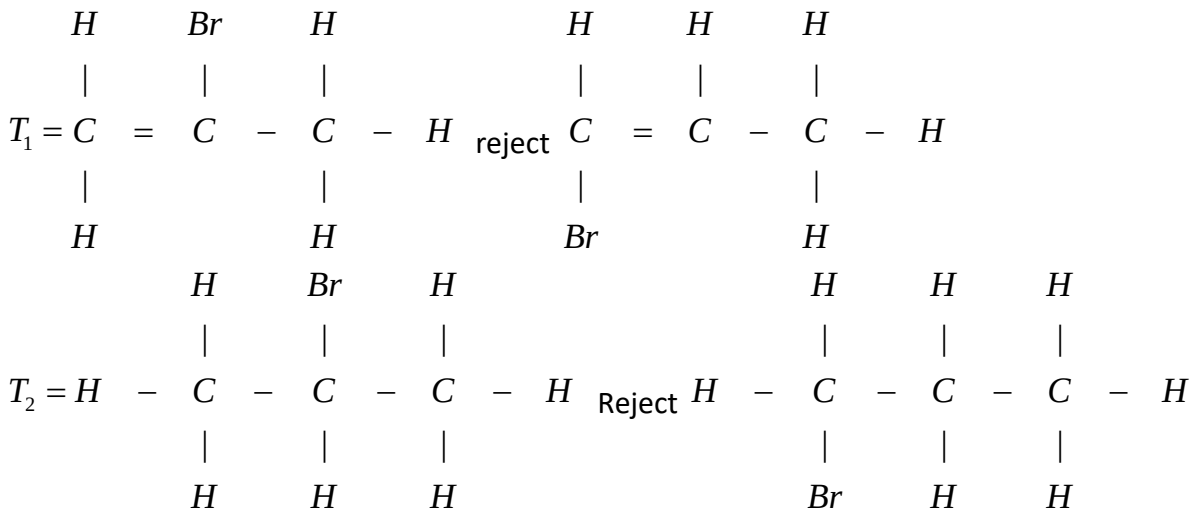


(ii) Add bromine water to C_3H_6 and C_3H_8 in separate test-tubes (1mk)

C_3H_6 - decolourises bromine water(½mk) while C_3H_8 does not(½mk)

- Add acidified $KMnO_4$ solution to C_3H_6 and C_3H_8 separately(1mk) OR
- C_3H_6 decolourises $KMnO_4$ (½mk) and C_3H_8 does not (½mk) OR
- Burn the two gases separately(1mk)
- C_3H_6 burns with a sooty flame(½mk)
- C_3H_8 burns with a non-sooty flame(½ mk) OR
- React both with bromines gas(1mk)
- C_3H_6 decolourises bromine gas(½mk)
- C_3H_8 does not decolourise(½mk)

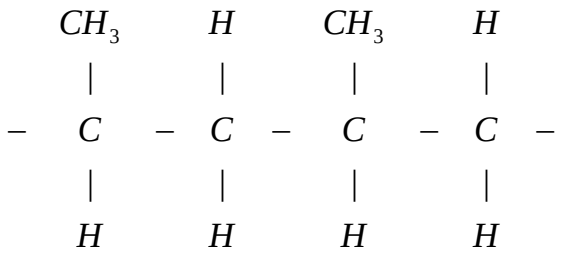
c)



d) (i) Propan-I-ol // $CH_3CH_2CH_2OH$

(ii) It is insoluble in water

e) (i)



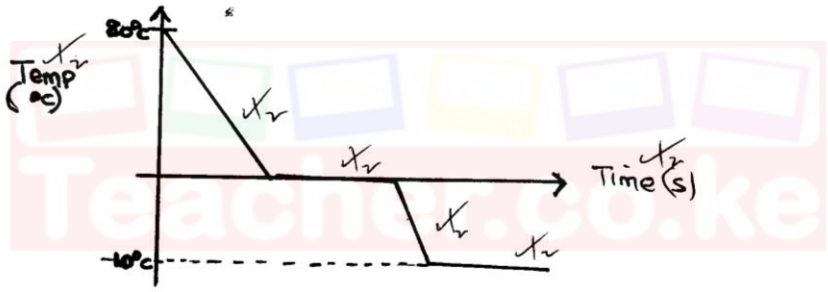
(ii) – Making ropes
Packaging
Plastic chairs
Buckets

4. a)

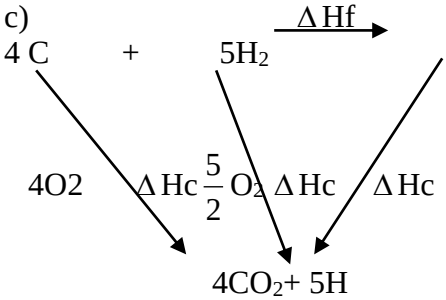
Bond breaking	Bond formation
6C – H 413x 6 = 2478	5C- H = 2065
Br – Br = 193	C – Br= 280
+ 2671	H – Br = 365
	2710

ΔH = + 2671 – 2710
= -39KJ

b)



c)



C_4H_{10} ΔHf = 4(-393)+5(-286)-(-2877)
= -3002 + 2877
= -125KJ mole^{-1}

ii) ΔHf = 4(-393) + 5 (-286) – (-28nn)
= -3002 + 28nn
= -125 KJ mol^{-1}

d) ΔHsoln = ΔH half + ΔH hydr
690 + (-322 – 364)
690 + - 686
= -4 KJmol^{-1}

5. a) (i) Anhydrous calcium chloride// anhydrous $CaCl_2$
(ii) Absorb carbon(IV)oxide gas
(iii) The mass increases

(iv) – The volume would decrease (1mk)
- nitrogen will react with magnesium (½mk) and hence volume decreases
- magnesium more reactive than copper (½mk)

b) (i) $S \rightarrow Air$ (½mk)
U = Nitrogen (½mk)
V = Ammonium sulphate (½mk)

(ii) Electrolysis

(iii) Catalyst – Platinum – rhodium (½mk)
Reagent – air/oxygen (½mk)
- Water (½mk)

(iv) $3CuO_{(s)} + 2NH_{3(g)} \rightarrow 3Cu_{(s)} + 3H_2O_{(l)} + N_{2(g)}$

c) – brown fumes(½mk)
- sulphur dissolves (½mk)
- HNO_3 acid reduces by sulphur to NO_2 (½mk)
- sulphur oxidized to SO_2 or H_2SO_4 (½mk)

6. (a) This is the maximum mass of a solute required to saturate 100g of the solvent at a particular temperature.

(b) (i) in graph paper

ii) I 16g √1 mk
II 25g √1 mk

(iii) 25 – 16 = 9g/100g water

(iv) - Extraction of Na_2CO_3 from Lake Magadi
- Extraction of NaCl from sea water

7. a) (i) Cl^-

(ii) $MgCO_3$
- $ZnCl_2$

b) $Mg^{2+}_{(aq)} + CO_{3(aq)}{}^{2-} \rightarrow MgCO_{3(s)}$

c) Tetraamine Zinc(II) ions

d) (i) – Add 50cm^3 of $1M$ HNO_3 to 50cm^3 $1M$ KOH and stir (1mk)
- heat | evaporate to saturation (1mk)
- Allow the solution to cool for crystals to form (1mk)

NB: If candidate does not mention $1M$ KOH and 50cm^3 =0mk

(ii) $2KNO_{3(s)} \rightarrow 2KNO_2 + O_{2(g)}$ (1mk)

(iii) – As a fertilizer
- Gum powder
Accept any other correct use