CHEMISTRY MARKING SCHEME K.C.S.E. 1995
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1. a) x-2, 8, 3 , √ (1mks)
   Y- 2, 8 6 √ (1mks)
   b) X_2Y_3 √ OR $Al_2 S_3$ (1mk)

2. The mixture would turn brown due to excess $Br_{2\,(g)}$ / H+ ions removes OH- ions from the mixture / equilibrium shifts to the left/observation not there BUT equilibrium shift to the left/ more Br□ formed for observation (2mks)

3. 1 mole CaCO3 2 moles of HCL
   Therefore 0.1($^1/_2$) mole CaO3 0.2 Mole (½)
   CaCO3 = 40 + 12 + 48 = 100g (½)
   Therefore 15g Ca CO3 = 15 / 100g = 0.15Moles
   Excess moles 0.15 – 0.05 (½)
   Excess mass= (0.05) x 100 (½) = 5g (3mks)

4. a) II because it requires little soap to lather (2mks)
   b) III has temporary (½) hardness, which is removed by boiling (½) (1mk)

5 a) sisal/ Cotton/ wool/ silk /jule/hemp/fur/hair (1mk)
   b) They are stronger than natural fibres/OR are not easily affected by chemicals/lasts longer /durable/ can be produced easily in a large scale therefore cheaper (Reject. Strong bonds) (1mk)

6. a) Pass the mixture through H2SO4 which absorbs D then collect by downward delivery/pass the mixture though NaoH(aq) which absorb D and then collect by downward delivery (upward displacement) (2mks)
   b) Ammonia (½) – Gas- D reacts with the acid (½) / basic/ is less denser / lighter than air. (1 mk)

7 II Because pure substances have sharp MP and BP as shown by the flat regions of curve II. (accept systematic) (2mks)

8. a) $2H_2sO_4$
   b) Insoluble in water/slightly soluble in water (1 mk)
   To ensure that the air that occupied the apparatus initially is expected (reject impurities) (1 mk)

9. When circuit is completed bulb lights (½) brown substance (½) formed grey (½)substance formed on cathode; because PbBr2 acts as an electrolyte (½) /free /mobile (½) ions; lead ions gain electrons to form pb(½) (Lead) and loses electrons to form (½) Bromine (Br)
   (Equations show ions current flow) (3mks)

10. a) To remove oxide coating which could inhibit reaction (1 mk)
    b) ORP

11. a) addition (1mk)
    b) $CH_3CH = CH_2(g) + Cl_2(g) \longrightarrow$ CH3 CHCICH2 CL (g)
    OR
    $C_3H_6 + Cl_2$ (1 mk)

12. Hydrogen forms compounds by losing one electron like group I elements or by gaining one electron like group VII element /Hydrogen has one electron in outermost shell. (2mks)

Al(s) + 6H+ (aq) 2A13+ (aq) + 3□(g)

A1(s) +6OH-(aq)⟶A1 (OH)□(aq) + 2H□O (g)

13. a) Wood ash is basic/ alkaline and would therefore react with aluminium Utensils/amphoteric/ 2A(s) + 6H + (aq) 2A13 + (aq)) + 3 H_2 (g) (2mks)

b) It is strong ($^1/_2$) and not easily corroded ($^1/_2$) / Does not rust (1mk)

14. a) (C3H6O)n = 116

(3 x 12 + 6 + 16)n =116 ($^1/_2$) Molecular formulae = 2(C□H□O)

58n = 116 ($^1/_2$) = $C_3H_{12}O_{2(1/2)}$

N = 116 = 2($^1/_2$) (2mks)

58

b)Percentage of Carbon = $\frac{12x6x}{116}$ 1000($^1/_2$) = 62.07 ($^1/_2$) Range (62.05 – 62)

OR

$\frac{3 \times 12}{58}$ x 100 (1/2) = 62.07 (1/2) (mark consequently)

15. Cool the mixture to a temperature below – 196°C to form a liquid then start warming, Nitrogen distils off a gas at – 196O (cool first) (2mks)

16.a)

Alkaline	Formula	Heat of combustion (△Hc)kjmol^{-1}
Methane	CH_4	- 890
Ethane	C_2H	- 1560
Propane	C_3H_8	- 2220
Butane	C_4H_{10}	- 2870 – 2880($^1/_2$)

(Correct answer only –ve sign)
(award full mark if figure is not ±)
2220 - 1560 = 660
1560 – 890 = 670
2220 + 650 = 2870
(Accept any value 2870)Any calculation (1mk)

b) △Hc is an exothermic reaction. (1mk)

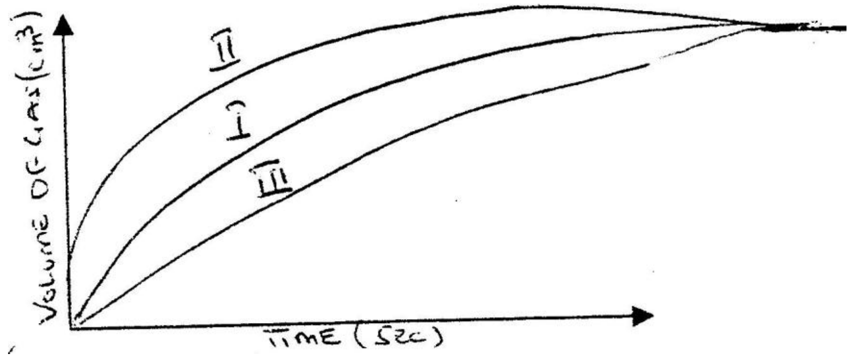
17. a) I – Molten sulphur

b) II – Superheated water / water.

18. a) 2HCl (aq) + Zncl □(aq) + H2 (g) ($^{-1}/_2$) states)

b) $2H_2$ (g) + O_2 (g ⟶ $2H_2O$ (g) (Not L) ($^{-1}/_2$ state)

19. Hydrogen, because it is lighter/ less denser / diffuses faster (2mks)

20. 

21. W because its solubility decreases with increase in temperature

22. a) i) NO^{-3} : O_3- = -6

. . N = + 5 (+5) (don't mark formula) (1mk)

ii) NO

O = 02 . . N = + 2 (1mk)

b) Reduction ($^1/_2$) because the nitrogen ion in NO□ gains 3 electrons ($^1/_2$) to form the nitrogen in NO. (1mks)

23. The chloride form ions in water which conduct electric current. NO ions are formed in methylbenzene /chloride exists in methylbenzene as molecules. (2mks)

24. A gas with a smell of rotten eggs is formed H_2S gas is formed / A greenish solution is formed? Effervescence / A gas is produced / Black solid dissolves. (1mk)

25. Dissolve the potassium sulphate ($^1/_2$) in water, dissolve ($^1/_2$) the lead carbonate in the nitric acid, mix the two solutions ($^1/_2$) and filter ($^1/_2$) off the lead sulphate precipitate// Dissolve lead carbonate in nitric acid add solid $pbSO_4$ and filter off (max^1 ½)// Dissolve this in HNO_3 and add solid $pbCO_3$ and filter off the precipitate.

26. Enthalpy of neutralization between CH_3 CaOH $_{(aq)}$ and NaOH $_{(aq)}$ is lower than that between HCl $_{(aq)}$ and NaOH because CH_3 CaOH $_{(aq)}$ is a weak acid which does not dissociate fully in water thus some of heat produced is used for dissociation fully dissociated and partially dissociated. (2mks)

27. Ca (OH) 2 (aq) forms white precipitate (1/2) with CO2 Can be observed NaOH(1/2)(aq) does not form a precipitate. (1mk)

28. a) Structural formula

```
    H     H     H     H
    |     |     |     |
H — C  —  C  —  C  —  C — OH (1/2)
    |     |     |     |
    H     H     H     H
```

Butan – 1 01 But – 2- 01

Butan-2-01($^1/_2$)

Butanol

But-01-01

b) $2CH_3\,CH_2\,CH_2\,OH_{(l)} + 2K_{(S)} \longrightarrow 2CH_3CH_2CH_2CH_2OK^+(l) + H_2(g)$

$2S_9H9OH + 2K \longrightarrow 2C_4H_9OK + H_2$ (1mk)

29. **a)** Yield would increase (1/2) since △ H us position/ thus increase in temperature shift the equilibrium to the right .Since △ H is positive ($^1/_2$) (1mk)

No effect (1/2) volume on the left (1/2) is the same as on the right//moles on left same as moles on the right.(1mk)

30. a) 100g of Pa ⟶ 50g if Pa ⟶ 25g Pa ⟶ 12.5 (g)

.

. . 3t ½ = 81(1/2) t=1/2 = 27 days (1/2) (2mks)

b) Mass number – 233 (1/2)

Atomic number – 92(1/2) (1mk)

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1. a) K and N because they are in the same group OR loses 2 electrons/same number or electrons sins the outer energy level (2mk)
   b) L_2O_2 OR L_2O (1mk)
   c) L, because it has 7 electrons in its outermost energy level (2mk)
   d) M, Because its ionic radius is bigger than atomic radius so its tendency to donate its electrons is high
   (e) M and N arc in the same period. Across the period ionic radius decrease due to increase in nuclear charge OR nuclear charge of N is greater than M. L gains electrons to form L. There's increase in repulsion of electrons (2mks)

2. (a) (i) Liquid P – concentrated sulphuric acid (1 mk)
   Solid Q- Aluminium (III) chloride OR $AlCl_3$ (1 mk)
   (ii) Anhydrous calcium chloride or fused calcium or lumps of calcium chloride (1 mk)
   (iii) The blue litmus paper turns red because the HCI(g) that does not react with the aluminum dissolves in the water making it acidic. (2mks)

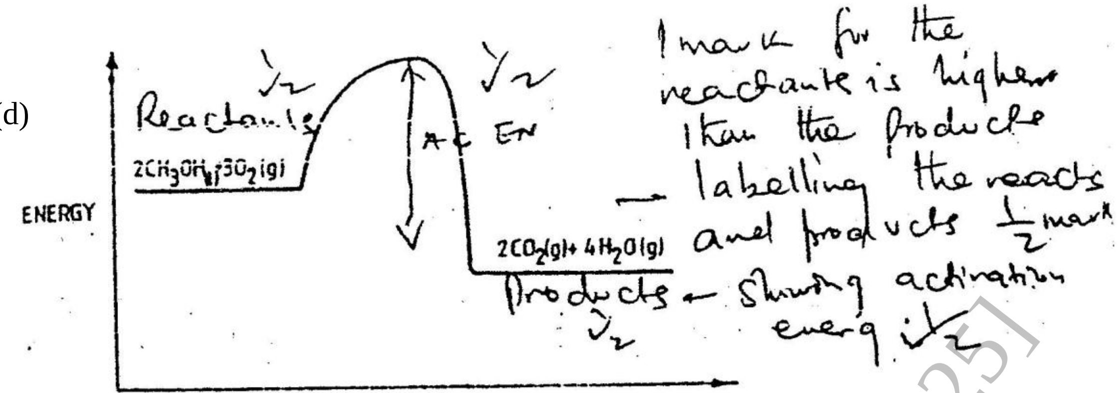
   (b) (i) $NH_4 + HCl\ (g) \rightarrow NH_4Cl(g)$ (1 mk)
   (ii) $HCl\ (g) + NH_4\ (g) \rightarrow NH_4Cl\ (g)$ (½) Penalize ½ for wrong states)
   Moles of HCL = $\frac{200}{24000}$ ½ = 0.00833 ½ moles HCI
   0.00833 moles HCI = 0.00833 moles NH_4Cl
   NH_4Cl = 14 + 4 + 3.35 = 53.5g ½
   (0.00833) (53.5) = 0.446 g (answers must be to 3dp)
   $CH_3OH + 3O \rightarrow CO_2$ + Heat (penalize ½ if wrong unit for answers)
   (3 mks)

3. (a) $2CH_3OH(g) + 3O_2(g) \rightarrow CO_2\ (g) + 4H_2O(g)$
   (b) (i) 22.98 – 22.11 = 0.87 g methanol
   R.F.M CH_3OH = 12 + 3 + 17 = 32 (½)
   0.87 (½) = 0.02718 (½) moles OR 0.02719 moles
   Temp rise = 27 – 20 = 7 (½) (2 mks)
   (ii) Heat change = △H= 500 x 7 (½) x 4.2 = 14700j (½) if unit missing)
   (2 mks)
   (iii) 0.027 moles = 14700J
   $1 \text{ mole} = \frac{[14700]}{[0.027]} \times \frac{[1]}{[1000]} = 544.4\ kjmol^{-1}$

   $\frac{[14700]}{[0.022718]} = 540.7\ kjmol^{-1}$

   (c) This value is lower than the theoretical value because some of the heat is lost to the surrounding because apparatus is not shielded. Some more heat is also lost to the apparatus. Incomplete combustion of methanol (2 mks)

(d)



4 (a) (i) Sulphur dioxide (1mk)

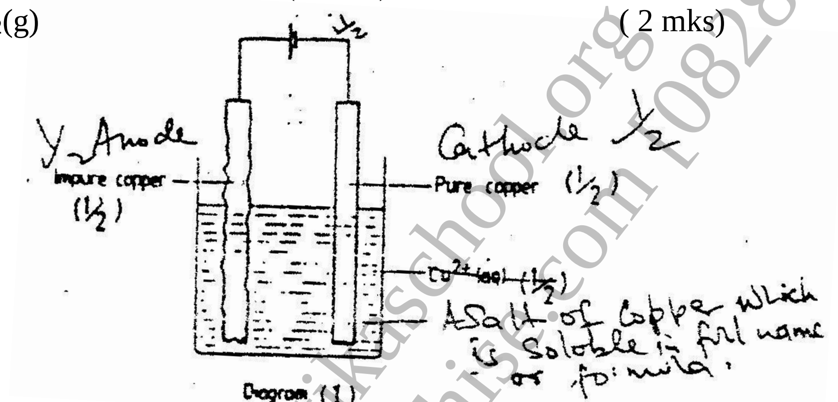
(ii) 2 $cuFeS_2(s) + 4O_2\ (g) \rightarrow 2FeO(s) + Cu_2\ S(s) + 3SO_2(g)$ (1 mk)

(iii) Fe^2 (1 mk)

(iv) P is carbon dioxide/carbon monoxide (1 mk)

(v) Reduction – oxidation (Redox) reaction because Cu_2O is reduced to Cu while coke to $CO_2(g)$ (2 mks)

(b)



(c) 1 mole of CuFeS = 1 mole Cu

210kg Cu = OR $\frac{210}{63.5} \times \frac{183.5}{810} \times 100$ or mass Cu in cores = $\frac{810 \times 63.6}{183.5}$ =

$\%Cu = \frac{210}{280} \times 100 = 74.9\%$

3.3 moles of Cu(s) = 3.3 moles CuFeS2

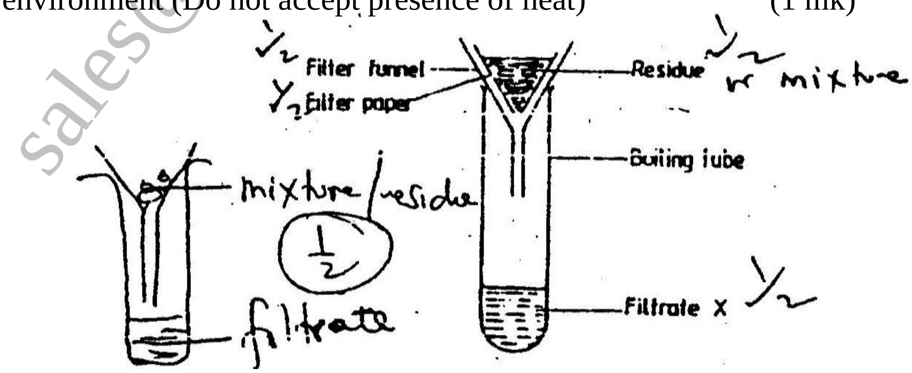
$CuFeS_2 = 63.5 + 56 + 64 = 183.5$ g

$= 183.5 \times 3.3 = 605.6 \times 10^3$g

Purity = $\frac{605.6 \times 1000 \times 100}{810 \times 1000} = 74.75\%$

(d) Acid rain may from due to presence of SO_2 (g) and CO_2 (g) dumping of the waste like the slag prevent vegetation growth large gullies left after the ore is excavated destroys the environment (Do not accept presence of heat) (1 mk)

5. (a)



(iii) Zn^{2+} (aq) + $4NH^3$ (aq) → $[Zn(NH_3)^4$

(iv) Brown coloured gas OR reddish brown (1 mk)

(v) Addition of anhydrous or white $CuSo_4$ copper (II) sulphate which turns blue in presence of water or cobalt chloride paper which turns pink (1 mk)

(b) (i) One of the salts in R is not soluble in water because a residue is formed on addition of water (2 mks)

(ii) CO_3^{2-} because CO_2 (g) is produced on addition of acid (2 mks)

(iii) Pb^{2-}(aq)

(c) Zinc nitrate (1 mk)

Lead carbonate (1mk)

6. (a) (i) Bitumen, it has highest B.P (2 mks)

(ii) Fractional distillation. During the distillation petrol would distil off at 175^0 and diesel could distil at 350^0C (2 mks)

(iii) Each component is mixture of hydrocarbons which have different boiling points

(iv) Methane CH_4(g)

Ethane C_2H_6

Propane C_3H_8

Butane C_4H_{10}

(b) Burning it in limited amount of air will produce carbon monoxide which is poisonous (2mks)

(c) Manufacture of tar used in tarmac/ sealing of roofs (1mk)

7 (a) (i) Liquid L is water

(ii) Black copper (II) oxide changes to reddish brown because it is reduced to copper by ammonia (1mk)

(iii) $2NH_3$ (g) + $3CuO(s)$ → $3Cu(s) + N_2(g) + H_2O(I)$ (1 mk)

(iv) I 2 moles NH_3 ➡ 1mole N2

$320cm^3NH_3$ ➡ $\frac{320}{2} = 160cm^3$

II Moles of NH_3 = $\frac{320}{24000} = 0.133$

2 moles of NH_3 = 3 moles CuO

Moles pf CuO – $\frac{320}{1} \times \frac{½ \times 3}{5} = 0.02$ moles

RFM OF CuO = 63.5 + 16 = 79.5

Mass of CuO= 0.02 x 79.5g = 1.59g (3mks)

(v) The excess ammonia from the reaction dissolves in the water in the beaker to form ammonium hydroxide which is a weak alkali or base of pH about 10. (2 mks)

(b) The burning splint would be extinguished (1 mk)

(c) Because it is cheaper and ammonia is made from nitrogen (1mk)