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MARKING SCHEME

1. (a) Atoms of the same element that differ in mass numbers, same number of protons but different number of neutrons

(b) $^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e$ or $^{14}_{6}C - {}^{14}_{7}N \rightarrow {}^{0}_{i}e$

(c) Carbon dating ‖ Isotope tracers ‖ tracing of biological processes

2. Experiment II. At a high temperature the particles have more energy, hence rate of high energy collisions increase.

3. (a) (i) B ‖ Magnesium ‖ 2.8.2

(ii) C ‖ Sodium ‖ 2.8.1

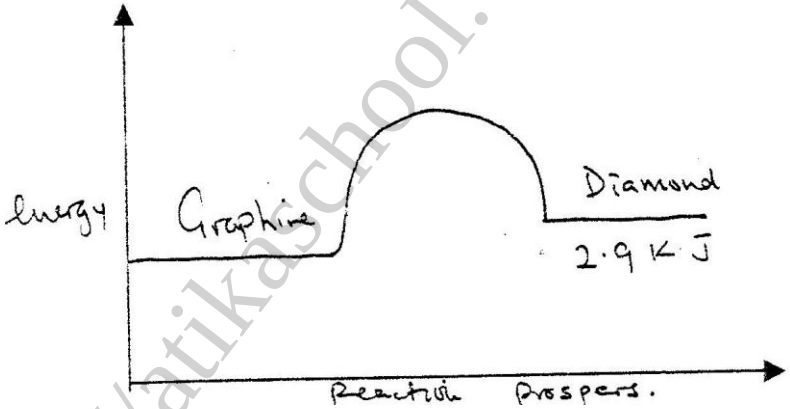
(b) D ‖ Argon ‖ 2.8.8.2

4. (a) Any suitable ammonium salt $(NH4)_2\ SO_4$ NH_4CI e.t.c

(b) $Al^{3+}(aq) + 3OH^-(aq) \rightarrow Al(OH)_3(s)$

5. To keep away air/ oxygen which would react with it

6.



7. Heat the mixture iodine sublimes and can be collected from the cool part of the test tube.

8. (a) Effervescence due to production of carbon dioxide ‖ Hissing ‖ fizzing ‖ bubble
(b) No change observable. Copper is below hydrogen in the activity series therefore cannot displace hydrogen

9. (a) Potassium chloride ‖ KCI
(b) Calcium chloride ‖ $caCI_2$
(c) Lead (II) nitrate ‖ $Pb(NO_3)_2$

10. R.m.m of $H_2O = 2 + 16 = 18$
R.m.m of $Na_2CO_3 = 46 + 12 + 48 = 106$
Moles $H_2O = \frac{14.5}{18} = 0.805$
Moles of $Na_2CO_3 = \frac{85.5}{100} = 0.866$
Mole ration $Na_2CO_3 : H_2O$
1: 1

$16 + 18 = 100\%$
$\frac{18n}{106 + 18n} = \frac{14.5}{100}$

$18n \times (-100) = 14.5 (106 + 18n)$

$1800n = 1537 + 261n$
$1539n = 1537$
$1537 = 09987$
1539

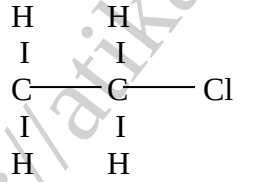
11. SO_2 which is poisonous is released in the air. Acid rain which may cause corrosion will be formed
12. Add dilute acid (e.g. HCI or H_2SO_4) to each substances separately. If Na_2S, colourless gas, smell of rotten eggs
13. G3, because it has the smallest atomic radius. Its outer most electron is tightly held by the nucleus or it requires a lot of energy to remove it.
14. (a) Electrolysis of fused or molten oxide
(b) JCH ‖ J, carbon, H

15. (a) Hygroscopy
(b) Drying of gases ‖ drying agent

16. Magnesium is above iron in the activity series. It supplies electrons to the iron bar Hence prevent it from rusting

17 (a) Presence of Ca (HCO_3) or mg $(HCO_3)_2$
(b) Water vaporizes and distils off leaving behind ions that cause hardness

18 (a) The idea of being replaced by a halogen ‖ reaction where one hydrogen atom of an alkane is replaced.

(b)

or. CH_3CH_2Cl Chloroethane ‖ Ethylchloride

19. The burning magnesium produces more heat energy that the burning splint. The heat energy from magnesium is enough to break the sulphur oxygen bond setting free oxygen magnesium uses freed oxygen to continue burning.
20. (a) A black solid formed
(b) $Zn(NO_3)_2 (aq) + H_2S (g) \rightarrow ZnS + 2HNO_3 (aq)$

Or $Zn^{2+}(aq) + S^{2-}(g) \rightarrow ZnS(s)$
Or $Zn^{2+}(aq) + HS(g) \rightarrow ZnS(s) + H^+ (aq)$

21. (a) Reddish brown // Brown solid formed
(b) $CuO_{(s)} + CO(g) \rightarrow Cu(s) + CO_2(g)$
(c) it is poisonus // harmful // dangerous// toxic // pollutant

22. It has one electron in its outermost energy level, which it can loose to form H^+ showing oxidation sate of $^{+1}$ or gain an electron to form H^- showing and oxidation state^{-1}

23. (a) Copper metal M
(b) Magnesium chloride K

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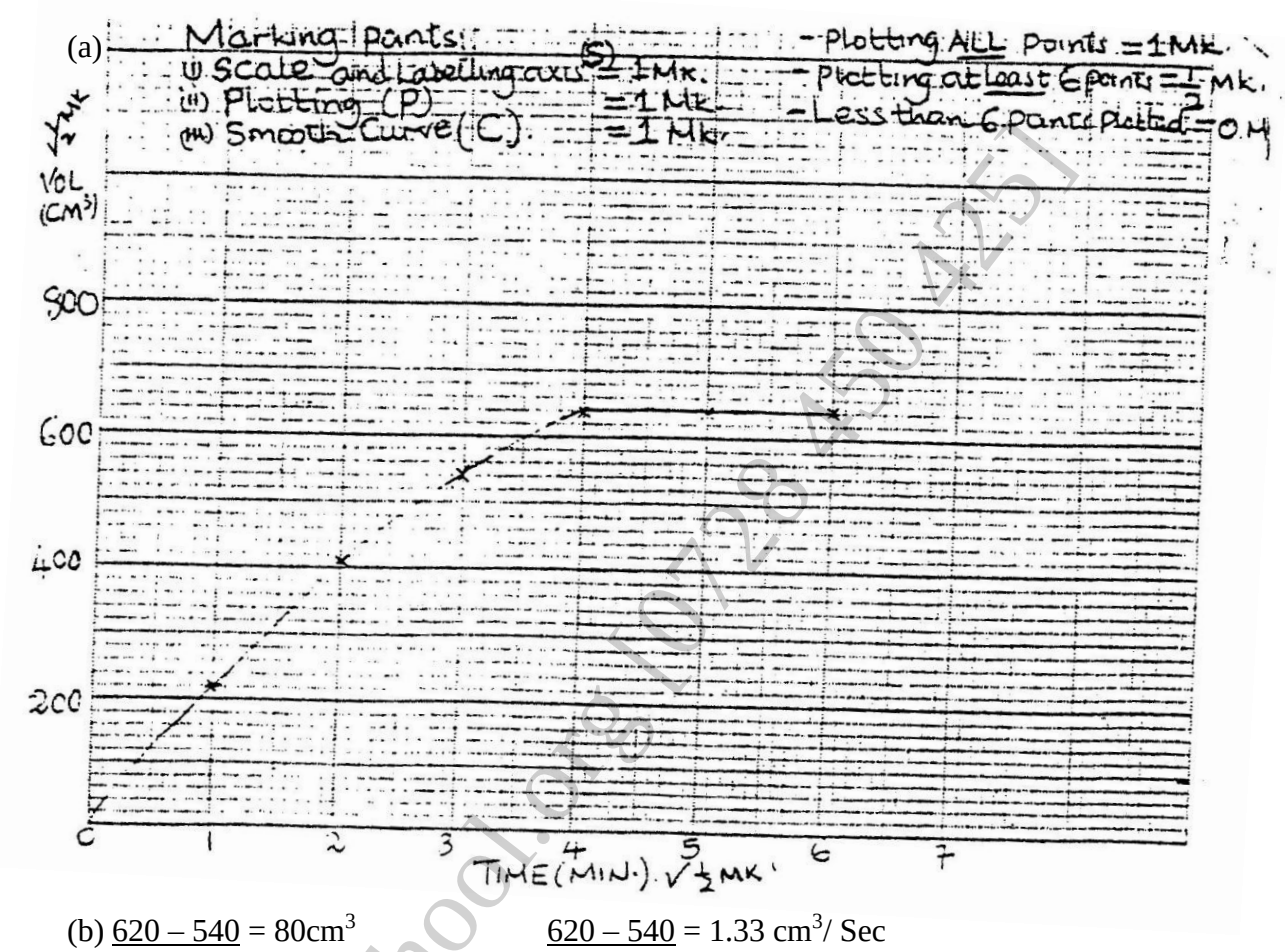
MARKING SCHEME

1. (a)



(b) $\frac{620 - 540}{1} = 80 cm^3$ $\frac{620 - 540}{60} = 1.33\ cm^3/\ Sec$

(c) Solid is due to presence of copper which had NOT reacted (1 mk) as it is below hydrogen in the activity series (1 mk) Don't accept does not displace hydrogen from the acid. (Candidate should state the reason why copper does not displace hydrogen).

(d) Vol of $H_2O = 640 - 2.5\ cm^3$ - Mass of Al = $\frac{637.5}{24000} \times \frac{2}{3} \times 27$

$= \frac{637.5\ cm^3}{24000}$ $= 0.47g$

- Moles of $H_2 = 637.5\ cm^3$
- Mole ration of AL: H2 = 2:3
- Moles of AL(s) = $637.5 \times \frac{2}{24000} \times \frac{}{3}$ 1 mk
- % Mass of AL = $\frac{0.478}{0.5} \times \frac{100}{2}$ (Range 95.55 – 95.64%)

(e) *- It is stronger than pure aluminium (1 mk)*
- It is harder than aluminium (1 mk)

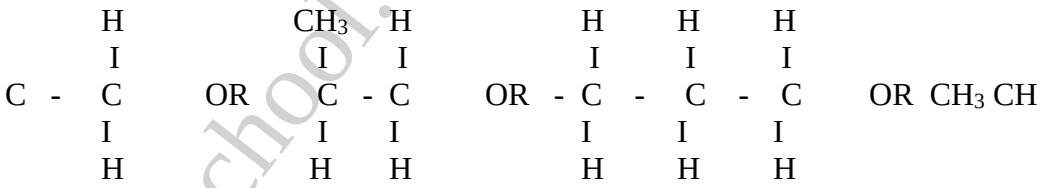
- *It is not easily corroded/ rusting (1 mk)*
- *It is more durable / higher ensile strength (1 mk)*
  (-Any correct two = 2 mks)

2. (a) (i) *Alkyline*
   (ii) *Carboxylic acid or Alkanoic acid*
   (b) (i) *Vulcanisation*
   (ii) *- To harden rubber*
   - To make it tougher/ stronger
   - To make it durable
   - To last longer
   (any answer cancels the correct)

   (c) (i) $2CH_3CH_2CH_2OH(I) + 2K(I) \rightarrow 2CH_3CH_2CH_2OK(s) + H_2(g)$
   (State symbols not necessary in equations involving organic)
   (ii) *I Dehydration*
   II Hydrogenation
   (iii) *A 1,2 – dibromopropane or formula,* $CH_2Br - CHBrC + \frac{1}{3}$
   B Ethene or formula C_4H_4

   (iv) *Nickel/ Palladium/ Platinum*

   (v)



   (d) *- Production of hydrogen*
   - Production of carbon tetrachloric
   - Production of acetylene or ethane
   - Production of carbon black used for making printers ink
   - Preparation of methanol
   - Preparation of chloroform

3. (a) (i) *- G2 OR G (do not accept* G^-*)*
   - It has highest positive electrode potential (1 mk) or it has the highest reduction potential (1 mk)

   (ii) *-G and N or (1mk)*
   + 1.36 and -2.92 or (1mk)
   Cell (i) and (iv) (1 mk)

   (iii) $2N^+(aq) + M(s) \rightarrow 2N(s) + M^{2+}(aq)$

- *it cannot take place (1 mk) misbelow N in activity series (1mk) and cannot displace N from its solution (1 mk) Or*
- *It cannot take place from left to right.*
  E Cell = 2.92 + 0.44 = -2.48
  E value is negative (1mk) reaction cannot take place spontaneously.

(e) (i) $4OH\ (aq) \rightarrow 2\ (g) + 2H_2O(I) + 4\ e^-$
(1 mk for state symbols missing Eq'n not balanced = 0 mk; joining the chemicals symbols in an equation = 0 mk)

(ii) *Insert a burning splint in a gas K. (1mk) the gas should burn with a pop sound to show it is hydrogen (½ mk) (observation and the lest are tied together) (½ mk)*

(iii) I. *Hydrogen is monovalent (1 mk) and oxygen is divalent or (½ mk)*
$4OH^-(aq) \rightarrow 2H_2O + O_2(g) + 4e^-; 2H^+(aq) + 2e \rightarrow H_2(g)$ *(½ mk)*

The vol of $H_2(g)$ is twice O_2 because to produce 1 mole of $H_2(g)$2 moles of electrons required and produce 1 mole of $O_2(g)$ -4moles of electrons are given out.

II. *The bulb is brighter with sulphuric acid. Sulphuric is a strong acid hence its degree of ionization is higher sulphuric acid is a strong acid, ethanoic acid is a weak acid*
(accept words dim, dimmer, less brighter or w.t.t.e)

4. (a) (i) *KOH or NaOH or chemical names or common nodes (any contradiction = 0 mk)*

(ii) *(Boiling points Nitrogen = -196° C, Oxygen = -183°C)*
- *Heat/ boil the liquid air/warm/ raise the temp of liquid air*
- *Nitrogen comes out first because it has a lower boiling point than oxygen*
  (if word heating/ boiling/ raising the temp or warming not mentioned the candidate score 0mk)

(b) (i) *Hydrogen or H_2*

(ii) *- So that all ammonia gas can be converted to Q or NO(g) (1mk) or*
- To increase the yield of gas Q or NO (g) (1 mk) OR
- For complete oxidation of ammonia or reduce the cost of Production

(iii) *- NO(g) or nitrogen monoxide or nitrogen (II) oxide (1mk)*

(iv) $NH_3(g) + HNO_3(aq) \rightarrow NH_4NO_3\ (aq)$
(½ mk for state symbols; Equation not balanced or chemical symbol joining or use of capital letters for small letter or vice versa in chemical symbols = 0 mk)

(i) - Fertilizer (don't accept manufacture of fertilizers)
- Explosives
(wrong use cancels the correct use therefore = 0mk)

(c) - Brown gas formed (½ mk) and sulphuric or disappears
- The brown gas is NO_2, HNO_3 acid reduced by sulphur
- Sulphur is oxidized to SO_2, or H_2SO_4 or H_2SO_3acid.

5. (a) Potassium permanganate, Manganese (IV) oxide, Lead (IV) oxide
KM_nO_4 or MnO_2 or PbO_2

(b) I. to remove all oxygen or air which would form iron (III) oxide
II. CaO absorbs both $Cl_2(g)$ and moisture. $CaCl_2$ can only absorb Moisture

(c) It sublimes or changes directly from solid to gas

(d) $CaO(s) + H_2O(g) \rightarrow Ca(OHO_2$ or
$CaO(s) + Cl_2(g) \rightarrow CaOCl+2(s)$ or
$Ca(OH) + Cl(g) \rightarrow CaOCl_2H_2O$

(e) (Fe = 56.0,Cl = 35.5 and molar gas volume at 298K is 24,000cm^3)
$2fe(s) + 3Cl_2(g)$ $2FeCl_3(s)$ or mole ratio 2:3
- R.F.M of Fe = $\frac{0.5}{162.5} = 0.003$
- Moles of $Cl_2 = \frac{3}{2} \times 0.003 = 0.0045$
Vol of gas = 0.0045 x 24000
= 110.76cm^3 – 111cm^3
Alternative method
$2Fe(s) + 3Cl_2(g)$ $2FeCl_3(s)$
$\frac{3 \times 24000 \times 05}{162.5 \times 2} = 3$
= 110.76cm^3 >111cm^3

(f) - $Fe^{3+}(aq)$ is reduced to $Fe^{2+}(aq)$ or Fe^{2+} (aq) ions formed
- $H_2S(g)$ is oxidized to sulphur or sulphur is formed
- (contradiction of the process subtract (½ mk)

(g) - Turns red thin white/ decolourised/ bleached. ½ mk
- Chlorine is acid and also a bleaching agent or
- Litmus paper is bleached
- Chlorine is a bleaching agent
Equation:$Cl_2(g) + H_2O(l) \rightarrow HOCl(aq) + HCl$ (aq); then
$HOCl(aq) + Dye \rightarrow Dye$ (o) + HCl

6. (a) (i) Alkali metals

(ii) - Enthalpy change when 1 mole of e-5 is removed from 1 mole of gases atom or
- Energy required to remove radius therefore the outermost electron is MOST STRONGLY attracted to the nucleus, hence more energy is required to removed it.
(most strongly or very strongly in the attraction must be mentioned for a candidate to score 1 mk)

(b) - Melts because of the heat produced or reaction is exothermic
- Hissing sound due to the production of H1 gas during reaction
- Moves on the surface due to its being propelled by the hydrogen gas

(c) $2q\ (s) + 2H_2O(L) \rightarrow 2QOH\ (aq) + H_2\ (g)$
$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$

(d) - A strong base produced a high concentration of OH e.g. NaOH, KOH, Na_2O or K_2O, woodash, Li_2O or LiOH

- A weak base products a low concentration of OH^- ions e.g. $NH_3(g)$, $Ca(OH)_2$ Ca), $Mg(OH)_2$ or MgO or

- Strong base has more OH^- ions or PH of 12 - 14
- Weak bas has few OH^- ions or PH of 8-11

(e) (i) – Reaction between 1 mole of H^+ and 1 mole of OH- to form 1 mole of H_2O
- $H^+\ (aq) + OH^-\ (aq)\ H_2O(l)$
- Reaction between an acid and base to form a salt and water only

(ii) – Add $200cm^3$ of 2M HNO_3 to the $200cm^3$ of 2 M NaOH
- Allow the mixture to cool for crystals to appear
- Filter/ decant to obtain crystals or
- Filtrate with a suitable indicator. Get the end point
Repeat without an indicator. Then follow the other step.
NB: candidate must mention $200cm^3$ or 2MHNO for other steps to be correct

(iii) $2NaNo_3(s)\ \ 2NaNo_2(s) + O_2\ (g)$