



CENTRAL WEST EDUCATION DIVISION

2025 MALAWI SCHOOL CERTIFICATE OF EDUCATION MOCK EXAMINATION

CHEMISTRY

Subject Number: M038/I

PAPER I MARKING KEY

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Section A (70 marks)

1. a. Electroplating is the process of coating a metal on another metal using electricity. **(1 mark)**
- b. All carbonates are insoluble in water **(1)** except ammonium/sodium /Potassium carbonates **(1)**
- c. Mass of $\text{MgSO}_4 \cdot 5\text{H}_2\text{O} = 24 + 32 + (4 \times 16) + (10 \times 1) + (5 \times 16)$
 $= 24 + 32 + 64 + 10 + 80$
 $= 210 \text{ g}$ **(1)**

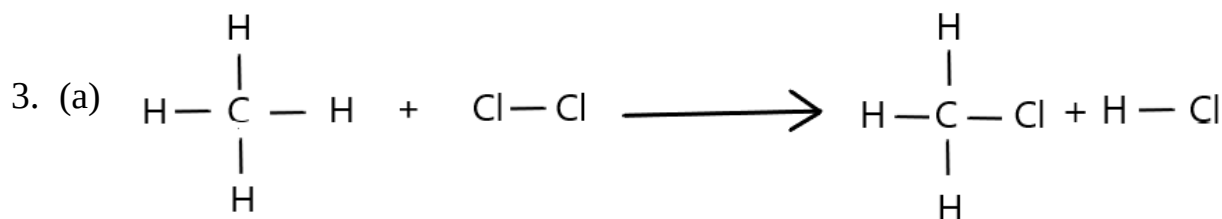
$$\begin{aligned}\text{Mass of } 5\text{H}_2\text{O} &= 5(2 + 16) \\ &= 90\end{aligned}$$

$$\% \text{ of water} = \frac{\text{mass of water only}}{\text{mass of hydrated compound}} \times 100\% \text{ (1)}$$

$$= \frac{90 \text{ g}}{210 \text{ g}} \times 100\%$$

$$= 42.86\% \text{ (1)}$$

2. used to make sulphuric acid, matches, explosive or gunpowder, plaster of Paris, to make rubber tough**(1)**
(any two for 2 marks)
- b. steel
- c. It is the hardest material**(1)** hence does not wear out easily**(1)**
- d. (i) hydrogen bonding**(1)** because hydrogen is bonded to a high electronegative atom **(1)**



$$\begin{array}{ccccccc} (4 \times 414) & + & (244) & \rightarrow & 3(414) & + & 326 & + & 431 \\ 1656 \text{ KJ/mol} & + & 244 \text{ KJ/mol} & & 1242 \text{ KJ/mol} & + & 326 \text{ KJ/mol} & + & 431 \\ & & 1900 \text{ KJ/mol (1 mark)} & & 1999 \text{ KJ/mol (1 mark)} & & & & \\ & & \text{Bond breaking} & & \text{bond breaking} & & & & \end{array}$$

$$\begin{aligned}\text{Enthalpy change} &= 1900 \text{ KJ/mol} - 1999 \text{ KJ/mol} \\ &= \underline{-99 \text{ KJ/mol}} \text{ (1 mark)}\end{aligned}$$



- b. Incineration (1) burning wastes to ashes.
Solid wastes are subject to combustion (1)
Sanitary land fills (1) wastes are deposited into pits in a land set aside (1)
- c. Polythene, PVC (polyvinylchloride), nylon, Terylene (any two)(2)
4. a. In aqueous form they release ions (1) which are able to move and conduct electricity. (1)
- b. (i) measuring the volume of carbon dioxide produced per unit time (1)
- (ii) concentration of sugar is high (1) at the beginning of the reaction which increases the rate at which atoms collide(1)
5. a. - reacts with alkanols to form alkanoates(1)
- reacts with bases to form salts(1)
- reacts with metals to form salts and hydrogen gas (any **two**)
- b. $C_1V_1 = C_2V_2$ (1)
 $250 \text{ ml} \times 0.1\text{M} = 2\text{M} \times V_2$
 $V_2 = \frac{250\text{ml} \times 0.1\text{M}}{2\text{M}}$ (1)
 $= \underline{12 \text{ ml}}$ (1)
6. a. biodegradable wastes are wastes that can be decomposed into harmless substances by action of living things(1)
- b. different wastes require different treatment(1) since they affect the environment in different way (1)
- c. carbon dioxide accumulates in upper atmosphere(1) since plants that absorb carbon dioxide are destroyed (1)
- d. Allotropes are substances that exist in two or more forms in the same physical state.
7. a. (i) $\text{C}_2\text{H}_4 + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_5\text{OH}$ (1)
- (ii) hydration(1)
- (iii) it is a catalyst to speed up the rate of reaction (1)



b.

Element	% mass/RAM	divide by ratio	mole ratio
C	64.9/12 = 5.41	5.41/1.35	4
H	13.5/1 = 13.5	13.5/1.35	10
O	21.6/16 = 1.35	1.35/1.35	1
	(1)	(1)	(1)

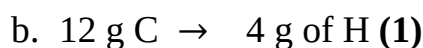
∴ the empirical formula is C₄H₁₀O (1)



correct products(1)

correct reactants(1)

correct balancing(1)



$$\therefore 30\text{ g of C} \rightarrow \frac{30\text{ g}}{12\text{ g}} \times 4\text{ g (1)}$$

$$= 10\text{ g of hydrogen (1)}$$

9. a. T alkene (1)

U: alkanone (1)

b. S and V (1)

c. - Put 3 drops of sodium hydroxide solution into two different test tubes (1)

- Add 2 drops of phenolphthalein indicator (1)

- Pour 2 ml of test solutions in the test tubes and observe colour changes. (1)

- Pink colour remains in U and V turns colourless. (1)

10. a. - provide guidelines of maximum allowable emissions into air(1)

- enact regulations through taxation(1)

- provide best available technics to reduce emissions in industries

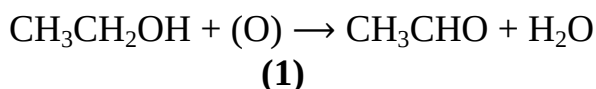
- suggest mitigation measures



- b. it covers the surface of water(1) which prevents entry of air(1) thereby suffocating aquatic animals(1)
- c. (i) galvanisation(1)
- (ii) zinc is more reactive than steel(1) and lose electrons in preference to iron(1) hence iron does not get oxidised(1)

SECTION B (30 marks)

11. a. - put the solution under test into a test tube(1)
- add iron(II) sulphate solution(1)
 - then add concentrated sulphuric acid solution(1)
 - if a brown ring forms at the boundary between iron(II) sulphate and sulphuric acid(1) then the solution contains nitrate ions(1)
- b. - ethanol(1) undergoes oxidation by oxidant such as potassium permanganate(1) to form ethanal and water i.e

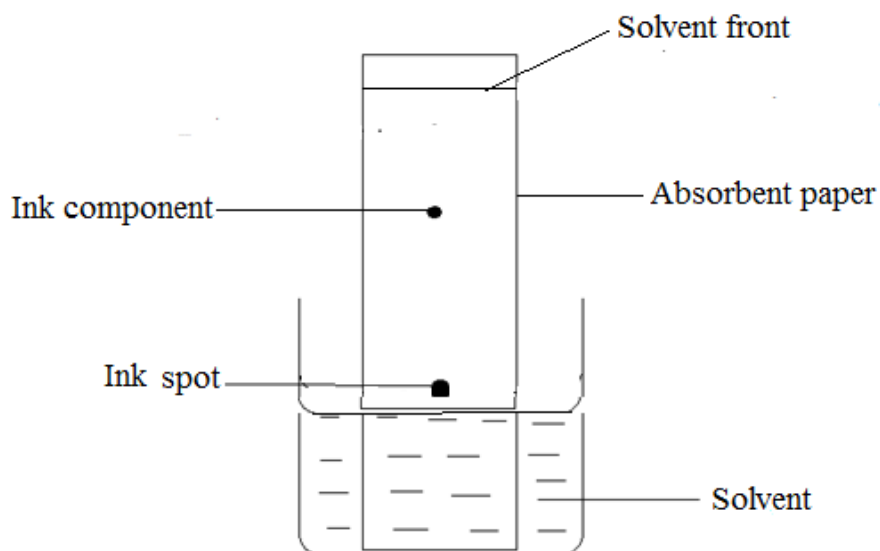


- the ethanal is oxidised further(1) to form ethanoic acid
- $$\text{CH}_3\text{CHO} + (\text{O}) \rightarrow \text{CH}_3\text{COOH}$$
- (1)

12. a. - branching increases distance between adjacent molecules(1)
- this reduces Van der Waal's forces(1)
 - as a result less energy(1) is required to overcome the reduced forces (1) hence melting points decrease(1)
- b. ammonia reacts with phosphoric acid as follows(1)
- $$\text{NH}_3 + \text{H}_3\text{PO}_4 \rightarrow (\text{NH}_4)_3\text{PO}_4$$
- (1 mark each species)



13. - set apparatus as below using the solvent used in the standard chromatogram(1)



Correct diagram (1)

Any pair of correct labels **1 mark** each

- the solvent moves upwards by capillary action (1)
- upon reaching the ink spot, it dissolves it and move upwards with it(1)
- measure the distances moved by the solvent and distance moved by the ink(1)
- calculate the relative flow value using;

$$R_f = \frac{\text{distance travelled the ink spot}}{\text{distance travelled by solvent}} \quad (1)$$

- compare the calculated R_f value with standard R_f value(1)
- if the calculated R_f value matches with the standard R_f value, then the sample of the black ink is pure(1)
- if the R_f values do not match, then the ink is not pure(1)

END OF MARKING KEY