MOKASA 1
CHEMISTRY PAPER 1
MARKING SCHEME

1. (a) The flame below is obtained when the air hole of the Bunsen burner is fully closed. State and explain the colour of the region marked A. (1 mk)

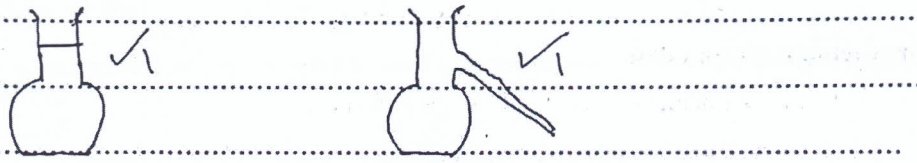
Bright yellow ½
Due to hot unburnt tiny carbon particles ½

b) (i) Give a reason for the following safety rule in the laboratory -:

Use a separate dropper for each of the stock solutions in reagent bottles (½ mks)

to avoid contamination ½

(ii) Using diagrams differentiate between a volumetric flask and a retort flask. (2mks)



2. Element W whose RAM is 79.99 has two isotopes W – 79 and W-81. Determine the percentage relative abundance of the least abundant isotope. (3 mks)

Let x be r. abundance of W-79
(100-x) " " of W-81

$79.99 = \frac{(79 \times x)}{100} + \frac{81(100-x)}{100}$ ½

$79.99 = 79x + 8100 - 81x$ ½
$101 = 2x$ ½; $x = 50.5\%$ ½
$\therefore 100 - x = 100 - 50.5 = 49.5\%$ ✓1

3. Describe how to obtain eliant to cooking oil from corn grains. (2mks)

Crush the nuts in a mortar using a pestle while adding Propanone ½. Decant the resulting solution into an evaporating dish ½. Leave the solution in the sun for sometime to evaporate ½ the Propanone ½

4. In an attempt to prepare nitrogen gas in the laboratory, a student mixed 7g of sodium nitrite and 5.5g of solid X, added some water to the mixture heated, then collected the gas in a test tube.

a) Identify solid X (1 mk)

Ammonium chloride ✓1

b) i) A burning splint was inserted into a test tube containing the gas collected. State the observation made (1 mk)

Extinguishes a burning splint ✓1

ii) State one use of nitrogen gas (½ mk)

- Mnf of Ammonia - In light bulbs @ ½ mk
- As a refrigerant

5. a) Define an acid according to Lewis (1 mk)

An acceptor of the unshared / lone pair of electrons ✓1

b) Identify the acid in the reaction below.

$NH_{3(aq)} + AlCl_{3(aq)} \longrightarrow H_3N{:}AlCl_{3(aq)}$ (1mk)

$AlCl_{3(aq)}$ ✓1

6. Fatuma measured the pH of some commonly used substances and recorded them in the table below.

Substance	pH value
A	2.0
B	5.0
C	7.0
D	8.0
E	13.0

i) Which of the pH values represents a weak base? ..... (1mk)

8.0 ✓1

ii) What would be the colour of litmus solution in substance E? ..... (1mk)

iii) What is the advantage of the universal indicator over the other acid-base indicators (1mk)

Blue ✓1

7. Elements Q, R, S and T not their actual chemical symbols have atomic numbers 3,7, 11 and 12 respectively.

a) Write the formula of -: (2mks)

i) The ion of R. ..... R^{3-} ✓1 .....

ii) The compound formed when S burns in excess oxygen gas.

S_2O_2 ✓1

b) How do the ionization energies of Q and S compare (1mk)

- Q has higher I.E than S ✓½
- Cos outer electrons are close to the nucleus hence firmly held ✓½

8 a) State the Graham's law diffusion of gases. (1mk)

✓1 Under the same conditions of temp and pressure, the rate of diff. of a gas is inversely proportional to the sq. root of its density

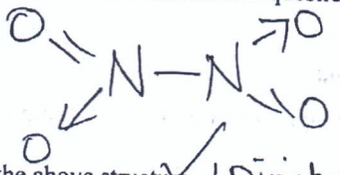
b) Nitrogen gas diffuses through a porous plug at a rate of 10 cm^3/ min and a gas P diffuses through the same plug at a rate of 5.9 cm^3/ min.

What is the molar mass of gas P. (N = 14). (2mk)

$\frac{R_1}{R_2} = \sqrt{\frac{M_2}{M_1}}$ ✓½ | $\left(\frac{10}{5.9}\right)^2 \times 28 = \frac{M_2}{28} \times 28$ ✓½

$\frac{10}{5.9} = \sqrt{\frac{M_2}{28}}$ ✓ | $80.43 = M_2$ ✓½

9. Study the structure below and answer questions that follow.



a) Name the above structure. ✓1 Dinitrogen tetraoxide / Nitrogen(IV) oxide dimer (1mk)

b) Identify the bonds marked -: (1mk)

X Dative Covalent ✓½ Y Covalent ✓½

10. A hydrated copper salt has a formula $CuSO_4 .XH_2O$. 50g of a sample was heated until all the . water evaporated. Its new mass was 32g. Find the value of X in the formula (Cu = 64, S = 32, 0 =16, H =1) (3mks)

Compound	$CuSO_4$	H_2O
Mass	32	18
RMM	160 ½	18 ½
Mols	0.2 ½	1 ½
M.R	1	5

E.F = $CuSO_4 \cdot 5H_2O$ ✓1

11. Chlorine gas was bubbled through cold dilute sodium hydroxide solution, to the resulting solution coloured flower petals was dipped in.

i) Write the chemical equation of reaction between the gas and the hydroxide. (1mk)

$2NaOH_{(aq)} + Cl_{2(g)} \longrightarrow NaCl_{(aq)} + NaOCl_{(aq)} + H_2O$ ✓1

ii) Explain what happens to the flower petals at the end of the experiment. (1mk)

Coloured flower petals bleached ✓½

NaOCl has bleaching properties → adds nascent oxygen atom to the dye ✓½

12. Hydrogen chloride gas was bubbled through water and the resulting solution reacted with a 2cm long magnesium ribbon.

a) State and explain the observations made. (1 ½ mks)

Effervescence ✓½ of a colourless gas

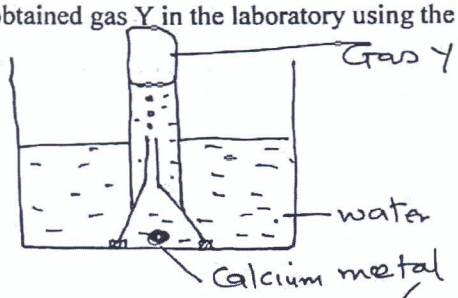
HCl ionises ✓½ in water to give $H^+_{(aq)}$ ✓½ that are displaced by Mg ions to give $H_{2(g)}$

b) Explain what happens if methyl benzene is used in the above experiment in place of water. (1 ½ mks)

No bubbles | No effervescence ✓½

Methylbenzene is non-polar ✓½ hence doesn't ionize to H^+_{aq} ✓½ remains as molecules

13. A student obtained gas Y in the laboratory using the set up below.



a) i) Name gas Y ..... Hydrogen ✓1 ..... (1 mk)

ii) Give one industrial source of gas Y. (1 mk)

Coal mines | Cracking of alkanes | Electrolysis of acidified water ✓1

b i) Dry gas Y was passed over heated lead (ii) oxide in a combustion tube. Write the equation for this reaction. (1mk)

$PbO_{(s)} + H_{2(g)} \xrightarrow{heat} Pb_{(s)} + H_2O_{(l)}$ ✓1

ii) State and explain the observations that could be made if potassium oxide was used in place of lead (II) oxide in reaction b (i) above. (1mk)

No observable change ✓½

K is more reactive than $H_{2(g)}$ ✓½

14. Burning magnesium metal continues to burn in a gas jar of carbon (Iv) oxide gas.

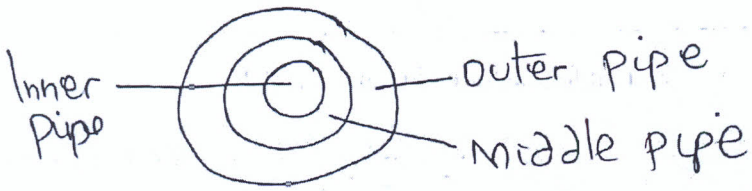
i) Write a balanced equation of reaction for this experiment. (1mk)

$2Mg_{(s)} + CO_{2(g)} \longrightarrow 2MgO_{(s)} + C_{(s)}$

ii) Explain how the mixture of the products formed in 14(i) above can be separated (2 mks)

- Add dilute HCl | HNO_3 | H_2SO_4 ✓½
- Filter to obtain C as residue ✓½
- Wash residue with distilled water ✓½
- Crystalize the salt formed ✓½

15. The diagram below represents a cross – section of the extraction of Sulphur by the Frasch process. Study it and answer questions that follow.



a) i) Name the substance that passes through the outer pipe. (1mk)

Super heated water ✓1

ii) The middle pipe is centrally placed between the inner and outer pipe. Give a reason for this placement. (1mk)

Avoid/prevent S from solidifying since it is in the hot substances

b) Give

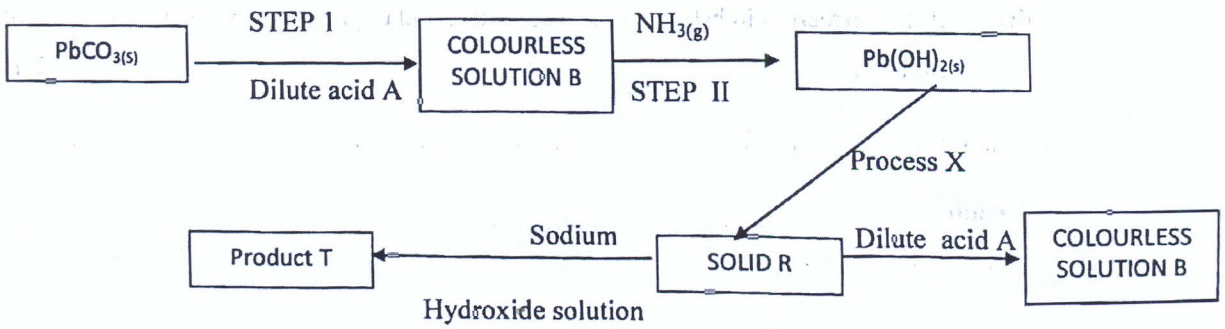
(i) another source of Sulphur apart from the naturally occurring deposits. (1 mk)

Metal sulphide / pyrites ✓1

(ii) One use of Sulphur. (1mk)

- Vulcanisation, - fungicide @ 1mk.
- Mnf H_2SO_4 - bleaching wood pulp fireworks

16. Study the flow chart below and answer questions that follow.



a) Identify. (1 ½ mks)

i) The colourless solution B ---Lead(ii) nitrate--- @ ½mk

ii) Process X ---Heating / thermal decomposition---

(iii) Solid R ---Lead(ii) oxide---

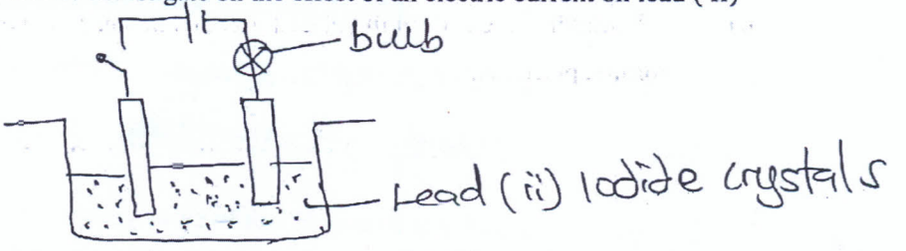
b) Write the equation of reaction for the formation of product T. (1mk)

$PbO_{(s)} + 2NaOH_{(aq)} \longrightarrow Na_2PbO_{(aq)} + H_2O_{(l)}$ ✓

17. Electronegativity in halogens decreases down the group. Explain. (2mks)

As atomic radius increases down the gp, the effective ½ force to attract electrons in the outermost energy ½ level also ½ increases

18. The set up below was used to investigate on the effect of an electric current on lead (II) Iodide.



a) When the switch was connected to complete the circuit the bulb did not light. Explain (1mk)

$PbI_{2(s)}$ ions are in fixed ½ positions hence ½ unable to conduct

b) i) What mistake was done on the above set up. (½ mk)

Source of heat ommited ✓½

iii) If the correction in b(I) above is made, state and explain the observation made on the cathode. (2 mks)

Observation. Grey deposits ✓

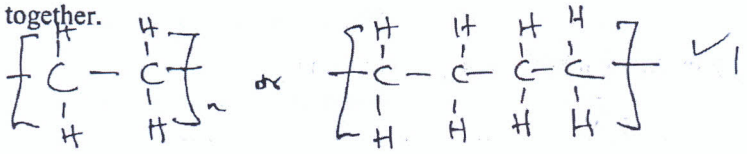
Explanation Pb^{2+} gains $2e^-$ to ✓ form lead metal // accept eqn

19 a. Using Bromine water and the other apparatus found in the laboratory, describe how C_2H_6 $_{(g)}$ can be differentiated from C_2H_4 $_{(g)}$. (2mks)

Bubble each of the gases through bromine water in two separate test tubes ✓1

C_2H_4 decolourises the yellow bromine water while C_2H_6 does not ½

b. Write the formula of the product formed when two molecules of C_2H_4 $_{(g)}$ are added together. (1 mk)

 ✓1

20 a) Define the term molar heat of fusion. (1 mk)

Amount of heat energy required to convert one mole of a solid substance to a liquid at its melting point ✓1

b. Calculate the heating value of fuel X given that 0.84kJ of heat is produced by 0.0087 moles of fuel X. (Molar mass of X =46) (2mks)

0.0087mol → 0.84kJ

1mol → $\frac{1 \times 0.84}{0.0087}$ ½

$= 96.5517$ kJ/mol. ½

Heating value = $\frac{96.5517 \text{ kJ/mol}}{46 \text{ g/mol}}$ ½

$= 2.0989$ kJ/g. ½

units Must be Correct.

21. When concentrated Sulphuric (vi) acid is reacted with common salt, an acidic gas G is formed.

a) What property of concentrated sulphuric (vi) acid in being investigated in this experiment (1mk) Conc. H_2SO_4 as a less volatile acid ✓1

~~$NaCl(s) + H_2SO_4(l) \rightarrow NaHSO_4(s) + HCl(g)$~~ ✓1

b. Write the correct chemical equation-:

i) For the above reaction. (1mk)

$NaCl_{(s)} + H_2SO_{4(l)} \longrightarrow NaHSO_{4(s)} + HCl_{(g)}$ ✓1

ii) When gas G is reacted with ammonia gas. (1mk)

$NH_{3(g)} + HCl_{(g)} \longrightarrow NH_4Cl_{(s)}$

22. An organic compound B has a formula CH_3CH_2COOH.

a) To which homologous series does this compound belong. (1mk)

Alkanoic acid

b. Write the correct name and formula of the organic product formed when compound B reacts with-:

i) Sodium carbonate (1 mk)

CH_3CH_2COONa ½ Sodium Propanoate ½.

iii) Ethanol (1mk)

$CH_3CH_2COOCH_2CH_3$ ½ Ethyl ethanoate ½

23. Use the bond energy values below to answer questions that follow.

N – N 945 kJmol^{-1}

H – H 432 kJmol^{-1}

N – H 391 kJmol^{-1}

a) Calculate the enthalpy change for the formation of Ammonia gas given (3mks)

$N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)}$ ✓1

$\Delta H = BB + BF.$

$= 1(N\equiv N) + 3(H-H) + -[2(N-H)3]$ ½

$= +[945 + 3(432)] + -[2(3\times391)]$ ½

$= 2241 - 2346$ ½

$= -105 kJ/mol$ ½

24. Your laboratory technician forgot a salt labelled sodium carbonate decahydrate in an open petri dish in the laboratory after an experiment. A day later, he found out that the transparent crystalline salt had formed a white powder which your chemistry teacher identified as sodium carbonate monohydrate.

a) Name the process that describes the behavior of the salt above. (1mk)

Efflorescence ✓1

b) Write the correct balanced equation illustrating the above behavior of the salt. (1mk)

$Na_2CO_3 \cdot 10H_2O \xrightarrow{heat} Na_2CO_3 \cdot H_2O_{(s)} + 9H_2O_{(l)}$

25. The diagram below represents one of the allotropes of carbon.

a) What are allotropes? (1mk)

forms of the same element in the same physical state. ✓1

b) i) Identify the allotrope above. (1mk)

Diamond ✓1

ii) State and explain one use of the allotrope above. ✓ /(1mk)

- strong covalent bonds hence hard - used in drilling rocks, glass cutting
- Sparkling brilliance when cut and polished - jewellery ✓1 ball bearings.

26. Calculate the relative molecular mass of 0.8g of gas Q that occupies 560 cm^3 at STP.
(Molar gas volume at STP = 22.4 litre) (2 mks)

If 22400 cm^3 → 1 mole
560 cm^3 → $\frac{560 \times 1}{22400}$
= 0.025 moles

If 0.025 moles → 0.8g
1 mole → $\frac{1 \times 0.8}{0.025}$
= 32

27. Rusting is one of the chemical reactions that is relatively slow. State one importance of this process. (1mk)

- dispose off scrap metal
- Adds iron nutrients to the soil

@ 1mk

28. 25 cm^3 of 0.12M sodium hydroxide was completely neutralized by 30 cm^3 of dibasic acid solution containing 6.3g per litre of solution. Calculate the molarity of the acid (3mks)

Moles of base used $\frac{25}{1000} \times 0.12 = 0.003$ moles

$2NaOH_{(aq)} + H_2X \rightarrow Na_2X_{(aq)} + 2H_2O_{(l)}$

Moles of acid $= \frac{0.003}{2} = 0.0015$ moles

If 30 cm^3 → 0.0015 moles
1000 cm^3 → $\frac{1000 \times 0.0015}{30}$
= 0.05 M

29. Propane is a common fuel used in the school laboratory. With the aid of an energy cycle diagram, Calculate the standard enthalpy of formation of propane

Given $\triangle H_c$ (propane) = - 2220. 1KJ/mole

$\triangle H_c$ (Hydrogen gas) = - 285.8 KJ/mole

$\triangle H_c$ (Graphite) = - 393.5KJ/mole (3mks)

$3C_{(s)} + 4H_{2(g)} \xrightarrow{\Delta H_2} C_3H_8$

ΔH_1: $3O_{2(g)}$ → $3CO_{2(g)}$ + $4H_2O_{(l)}$

ΔH_3: $5O_{2(g)}$

$\Delta H_1 = \Delta H_2 + \Delta H_3$

$\Delta H_2 = \Delta H_1 - \Delta H_3$

$= [(2 \times -393.5) + 4(-285.8)] - [2220.1]$

$= -103.6$ kJ/mole

GOOD LUCK!