

Name: KASSU CHEMISTRY 2023 JUNE PPI Index No.....ADM.....
School: MARKING Class SCHEME Date:.....

CHEMISTRY THEORY

233/1

PAPER 1

TIME: 2 HOURS

KASSU JET EXAMINATIONS JUNE 2023

Instructions to Candidates

- (a) Write your name admission and index number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided above
- (c) Answer **ALL** the questions in the spaces provided in the question paper
- (d) KNEC Mathematical tables and electronic calculators may be used for calculations
- (e) All working **MUST** be clearly shown where necessary
- (f) This paper consists of 12 printed pages
- (g) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing
- (h) Candidates should answer the questions in English

FOR EXAMINER'S USE ONLY

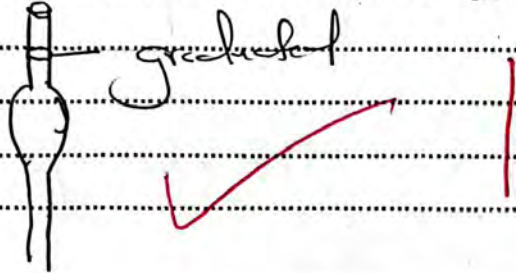
Question	Maximum score	Candidate's score
1 – 28	80	80

This paper consists of 12 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.

1. State TWO reasons why most apparatus are made of glass (2marks)

- (i) Easy to clean ✓
 - (ii) Transparent ✓
 - (iii) Most chemicals do not react with glass ✓
- Any 2 x 1 = 2

2. A pipette is used to measure exact volume of liquids. Draw a pipette. (1 marks)



3. An atom exists as an isotope X-30, X-29 and X-33 has relative atomic mass of 30.30, if X-30 is 10% calculate the percentage abundance of the other two isotopes (2marks)

$$(30 \times 10) + 29(x) + 33(90-x) = 30.30 \times 100$$

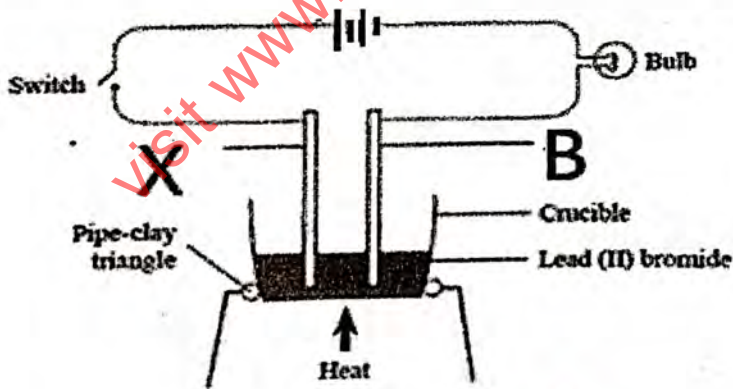
$$300 + 29x + 2970 - 33x = 3030$$

$$-4x = 30$$

$$x = 60$$

29 - 60%
33 - 30%

4. The diagram below shows electrolysis of lead (II) bromide



a) Name electrode B

Cathode ✓

(1 mark)

06

b) Explain the observation made in electrode X

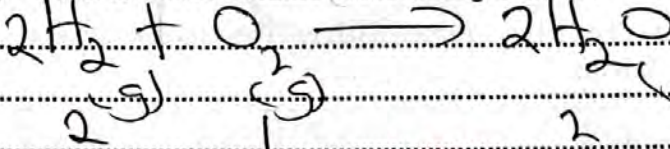
(1 mark)

Brown gas fumes, Br⁻ oxidised to Br₂

5. About 40cm³ of oxygen gas were reacted with 100cm³ of hydrogen gas.

(a) Determine the volume of residual gas at 105°C

(3 marks)

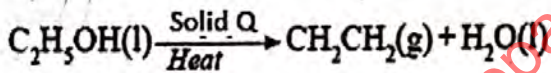


Ex: 100cm³ H₂ + 40cm³ O₂ → 100cm³ H₂O
20cm³ O₂ left

(b) What volume of oxygen was used during the reaction?

(1 mark)

6. Ethene gas can be prepared as follows



i) Name solid Q

(1 mark)

Alumina Oxide

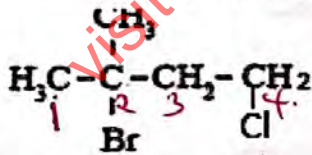
ii) Give two functions of solid Q in the process.

(1 mark)

Dehydrating agent
Catalyst

iii) Name the following organic compound

(1 mark)



2-Bromo, 4-chloro, 2-methylbutane

7 (a) Define the term fractional crystallisation

(1 mark)

Process of separating salts with different solubilities

(b) A salt solution has a mass of 65g containing 5g of solute. The solubility of this salt is 25g per 100g water at 20°C. 60g of the salt are added to the solution at 20°C. Calculate the mass of the solute that remain undissolved (2 marks)

Alt (A)

$65 - 25 = 40$
 $(60 - 25) = 35$
 $40 + 5 = 45$
 $65 - 60 = 5$

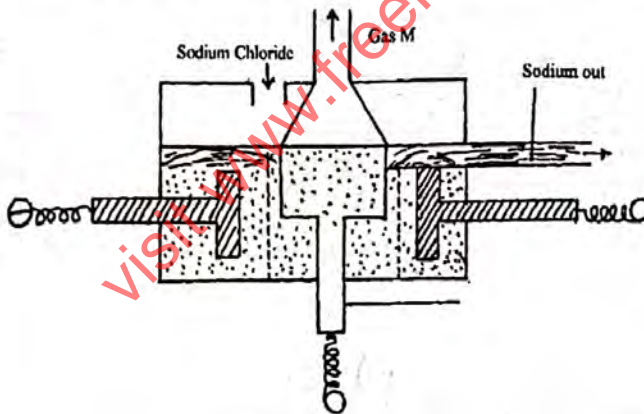
8. A sample of river water was divided into three portions. The table below shows the test carried out on the portions and the observations made.

Test	Observation	Inference
To the first portion, 1 cm ³ of soap solution was added	No lather formed.	Permanent water hard
The second portion was boiled, cooled and 1 cm ³ of soap solution was added.	No lather formed.	Permanent water hard
To the third portion, 3 cm ³ of aqueous sodium carbonate was added, the mixture filtered and 1 cm ³ of soap solution added to filtrate	Lather formed immediately.	Temporary water hard

Complete the table by filling in the inferences

(3 marks)

9. The following diagram represents extraction of sodium by the Down's cell



(a) What is the function of heat resistant wall

Maintain high temperature and contain heat

5

(b) Why is the anode made of graphite?

(1 mark)

Carbon doesn't react with chlorine ✓

(c) How are the electrolytic products separated from reacting?

(1 mark)

Using steel diaphragm ✓

(d) Explain why it is possible to separate components at the cathode

(1 mark)

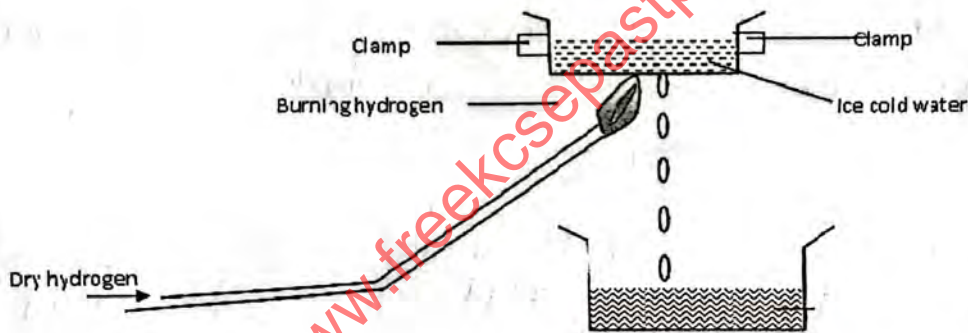
Ca²⁺ ion is denser and easily reduced
leaves behind H₂ in molten salt ✓

10. Describe how a mixture of sodium chloride and lead chloride can be separated in the laboratory.

(3 marks)

Add cold water to NaCl & PbCl₂ mixture
Filter to obtain PbCl₂ residue
Heat NaCl solution to separate ✓

11. Study the diagram below and answer the following questions.



(i) Write equation that produce the flame in the experiment.

(1 mark)

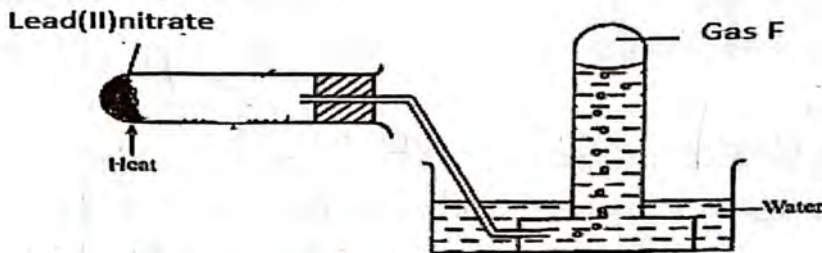
$2H_2 + O_2 \rightarrow 2H_2O$ ✓

(ii) What is the aim of the experiment?

(1 mark)

Steam condense to water which is collected
Condensation of gas to liquid, Any ✓

12. Form 2 students arranged the set up below to study some properties of heating Lead(II) nitrate strongly.

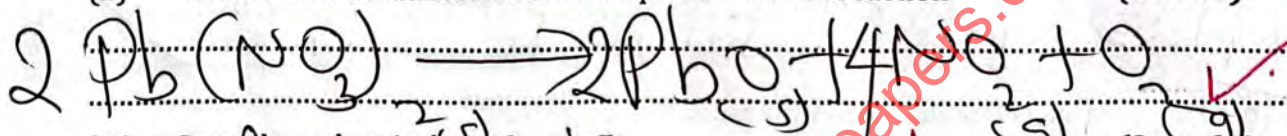


Any 1x1

(i) State the observation during the experiment. (1 mark)

Dark brown / Orange residue

(ii) Write down a balanced chemical equation for the reaction (1 mark)



(iii) Describe a chemical test for gas F (2 marks)

Introduce the glowing splint, the gas relights the glowing splint.

13. Distinguish a dry salt from anhydrous salt. (1 mark)

A dry salt is a salt with no water while anhydrous salt is a salt that has lost water.

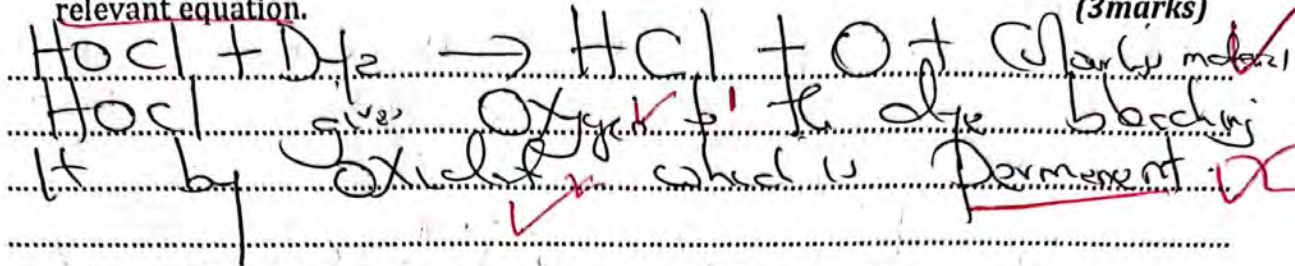
14. 2.56g of hydrocarbon contains carbon to hydrogen in the ratio of 5:1. If the molecular mass is 128. Calculate the molecular formula of the hydrocarbon (3 marks)

(C=12, H=1)

C	H	(C H)	
$\frac{5}{6} \times 2.56$	$\frac{1}{6} \times 2.56$	(1 2.4)	$n = \frac{128}{70} = 1.8 = 2$
2.1333	0.4266	C ₅ H ₁₀	
$\frac{0.4266}{12}$	$\frac{0.4266}{1}$		
0.0355	0.4266		
$\frac{0.0355}{0.0355}$	$\frac{0.4266}{0.0355} = 12$		
1	12		
			3

08

15. Chlorine water is a bleaching agent. Describe the bleaching action of chlorine using relevant equation. (3 marks)



16. During electrolysis of dilute Magnesium Sulphate, using inert electrode. Explain

(i) The effect on concentration of the electrolyte during electrolysis. (2 marks)

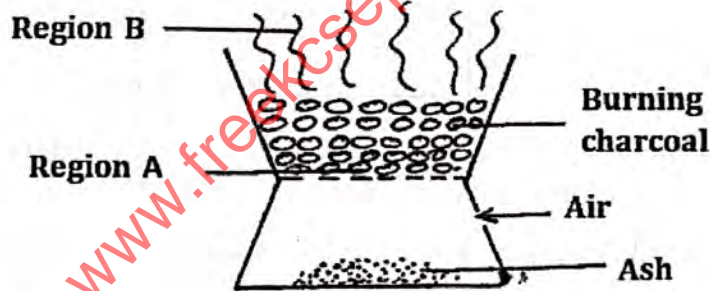
Mg^{2+} SO_4^{2-} Concentration increases as water is lost during discharge of H^+ and OH^-

(ii) The difference in volume of the gasses produced at each electrode. (2 marks)

Volume of H_2 is twice volume of O_2

(Cathode) (Anode)

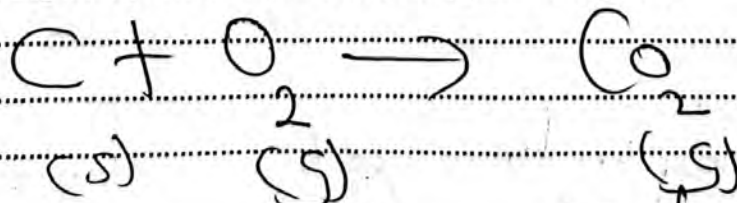
17. The diagram below shows a 'jiko' when in use. Study it and answer the questions that follow



(a) Identify the gas formed at region B (1 mark)

Carbon (IV) oxide

(b) Using an equation, explain what happens at region A (2 marks)



Carbon undergoes full combustion forming CO_2

18. (a) What is half-life? (1 mark)

Time taken for a given mass of a substance to decay to half its original mass

(b) The half-life of protactinium - 234 is 1.17 minutes. Determine the mass that decays in 5.85 minutes starting with 100 g of the sample. (2 marks)

S: 8.5
T: 1.17
100 → 50 → 25 → 12.5 → 6.25 → 3.125g

Half-life

19. Given the following substances: sodium carbonate, orange juice and sodium bromide.

(a) Name one commercial indicator that can be used to show whether sodium carbonate, orange juice and sodium bromide are acidic, basic or neutral. (1 mark)

Methyl Orange, Phosphotungstic acid

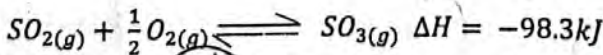
(b) Classify the substances in 15 (a) above as acids, bases or neutral. (2 marks)

Acid	Orange juice
Base	Sodium carbonate
Neutral	Sodium bromide

20. A reaction is described as "having reached equilibrium". What does this statement mean regarding the amounts of the reactants and products? (1 mark)

Rate of the amount of reactant being converted to product is the same as rate of product being converted back to reactant

21. Suggest two ways in which the equilibrium concentration of $SO_3(g)$ can be increased in a closed container, if the only chemical equilibrium is; (2 marks)



Increase Pressure

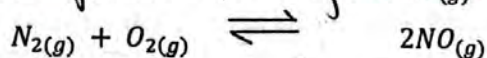
Decrease temperature

O₂

0.8/1

Product of NO is Endothermic decrease in temperature favors Backward reaction

22. Industrial process of production of $\text{NO}_{(g)}$ is represented by reaction:

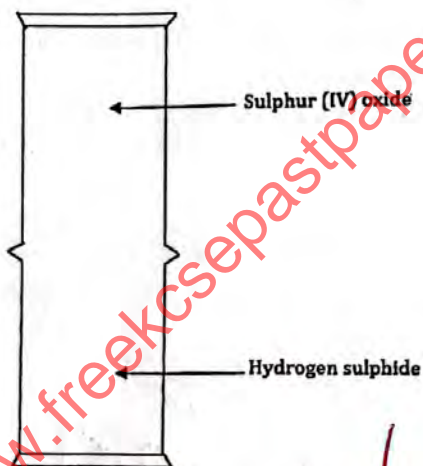


The reaction is carried out at elevated temperatures to drive the reaction towards the formation of the product. After sufficient products has formed the reaction mixture is quickly cooled. Explain. (2 marks)

To decrease temperature

To increase pressure

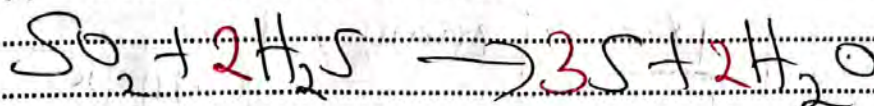
23. The Diagram below may be used to react hydrogen sulphide and Sulphur (IV) oxide. Study it and answer the questions that follow.



(a) What is observed in the jars? (1 mark)

Yellow deposit

(b) Write an equation for the reaction. (1 mark)



(c) What is the role of Sulphur (IV) oxide in the reaction? (1 mark)

Oxidising agent $\text{H}_2\text{S} \rightarrow \text{S}$

24. Element A atomic no. 6 and element B atomic no. 13 react to form a compound.

(i) Using dots (•) and crosses (x) show bond formed in the above compound.



(ii) Explain why the compound above has very high melting point.

(1 mark)

Strong ionic bond and giant ionic structure

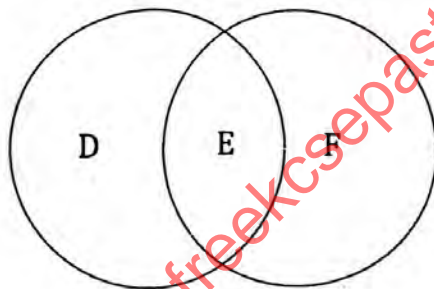
(iii) Explain how the compound above will conduct electricity.

(1 mark)

Molten state - free mobile ions

(iv) The diagram below shows relationship of basic and acidic oxides. In which region will compound of A and B fall? Explain.

(1 mark)



Amphoteric Oxide both basic and acidic properties

25. 100cm^3 of gas X takes 30 seconds to diffuse through a porous plug, whereas 300cm^3 of oxygen gas takes 120 seconds. Calculate the relative molecular mass of gas X (O=16)

3x 100cm^3 300s
 1x 300cm^3 120s

Equal volume

$\frac{100}{30} = \sqrt{\frac{M_{O_2}}{M_X}}$

$\frac{300}{120} = \sqrt{\frac{M_X}{M_{O_2}}}$

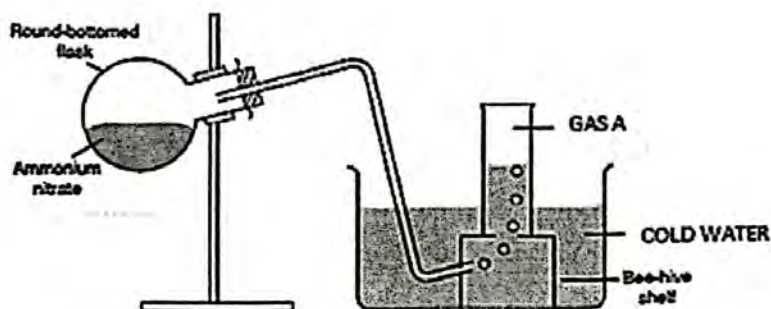
$\frac{3}{4} = \sqrt{\frac{M_X}{32}}$

$\frac{9}{16} = \frac{M_X}{32}$

$M_X = \frac{9 \times 32}{16} = 18$

(3 marks)

26. Ammonium nitrate was heated as shown below



a) Identify gas A (1 mark)

Nitrogen (I) oxide ✓

b) Identify a mistake in the set up and give a reason (2 marks)

- Collecting N_2O over Cold Water - H_2O is soluble ✓
 - Heat is missing - NH_4NO_3 will not decompose in cold water ✓

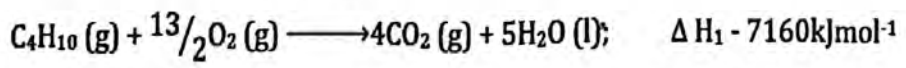
c) Gas A was passed over heated copper in a combustion tube, state the observation made (1 mark)

Brown Copper metal changed to black
 Copper (II) Oxide ✓

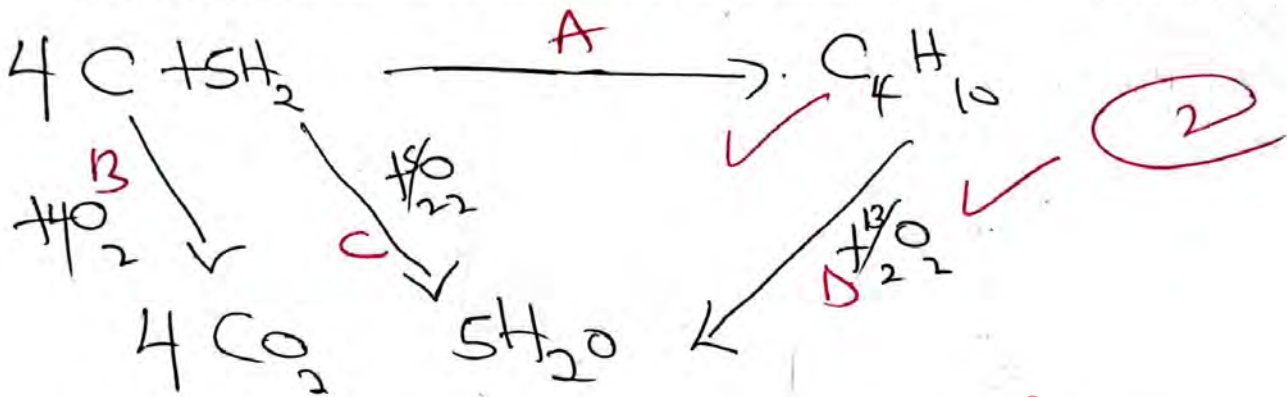
27. State Hess's law (1 mark)

Energy change for converting reactants to products is same regardless of route taken by the chemical change.

b). Given the following energies



Draw energy circle diagram linking of formation of butane to its heat of combustion and heat of combustion of carbon and hydrogen (2 marks)



c) Use the energy circle to calculate the heat of formation of butane (2 marks)

$$A = 4B + 5E - D$$

$$A = 4(-393) + 5(-286) - (-160) = -4158 \text{ kJ/mol}$$

28. a) What is a fuel

A substance that releases useful energy when undergoes combustion

b) State two factors to consider when choosing fuel

- (i) Cost
- (ii) Availability
- (iii) Heating value
- (iv) Ease of combustion

THE END

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