BSJE JOINT EXAMINATION - 2024 -

Kenya Certificate of Secondary Education

233/2	**CHEMISTRY**	**PAPER 2**
	June, 2024	**TIME: 2½ Hrs**

Name: …………………………….….…….…… Admission No: ……………

Stream: ……………….……….. Signature: ………..........

CODE - SUBJECT
Monday, 3rd June, 2024
Afternoon
2.00-4.30pm

Instructions

(a) Write your **name**, **admission number, date, stream and signature** in the spaces provided above.

(b) *Non programmable silent electronic calculators may be used.*

(c) *All answers must be written in the spaces provided in the booklet.*

(d) **This paper consists of 9 printed pages with 7 questions. Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing**

(e) *Candidate should answer the questions in **English***

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FOR EXAMINERS'USE ONLY

Question	Maximum Score	Candidate's Score
1	12	
2	12	
3	12	
4	12	
5	12	
6	10	
7	10	

Total Score	80	

1. The grid below represents a section of the periodic table. Study it and answer the questions that follow

								Q
A				C	N	H	J	
B	X		R		E	P	D	
M							F	

(a) Give the formula of the compound formed between X and N   (1 mark)

………………………………………………………………………………………………

(b) Which element forms a stable trivalent cation?   (1 mark)

………………………………………………………………………………………………

(c) Identify the least reactive element   (1 mark)

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(d) Explain how the melting point of D and F compare   (2 marks)

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(e) Explain the difference in atomic and ionic radius of F   (2 marks)

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(f) How do atomic radii of X and D compare? Explain   (2 marks)

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(g) Write the electron arrangement of X^{2+} (1 mark)

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(h) What would be the pH of aqueous solution of chloride of M? (1 mark)

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(i) Identify an element which;

(I)   is the strongest reducing (½ mark)

……………………………………………………………………………………………………

(II)   is the most electronegative (½ mark)

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2.   (a). What is meant by rate of reaction? (1 mark)

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 (b) Define activation energy (E_A) (1 mark)

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(c) An experiment was carried out to measure the volume of hydrogen gas produced when 1.0 g of

Zinc chippings (excess) is reacted with $25cm^3$ of dilute sulphuric (VI) acid. Give two other ways

of speeding up the reaction apart from addition of catalyst. (2 marks)

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(d) The decomposition of a compound M carried out at 30^0C was monitored by measuring the concentration of the compound remaining at different time intervals and recorded as shown below.

Time (min)	0	1.0	2.0	3.0	4.0	5.0
Concentration (mol|litre)	1.20	0.54	0.36	0.26	0.17	0.10

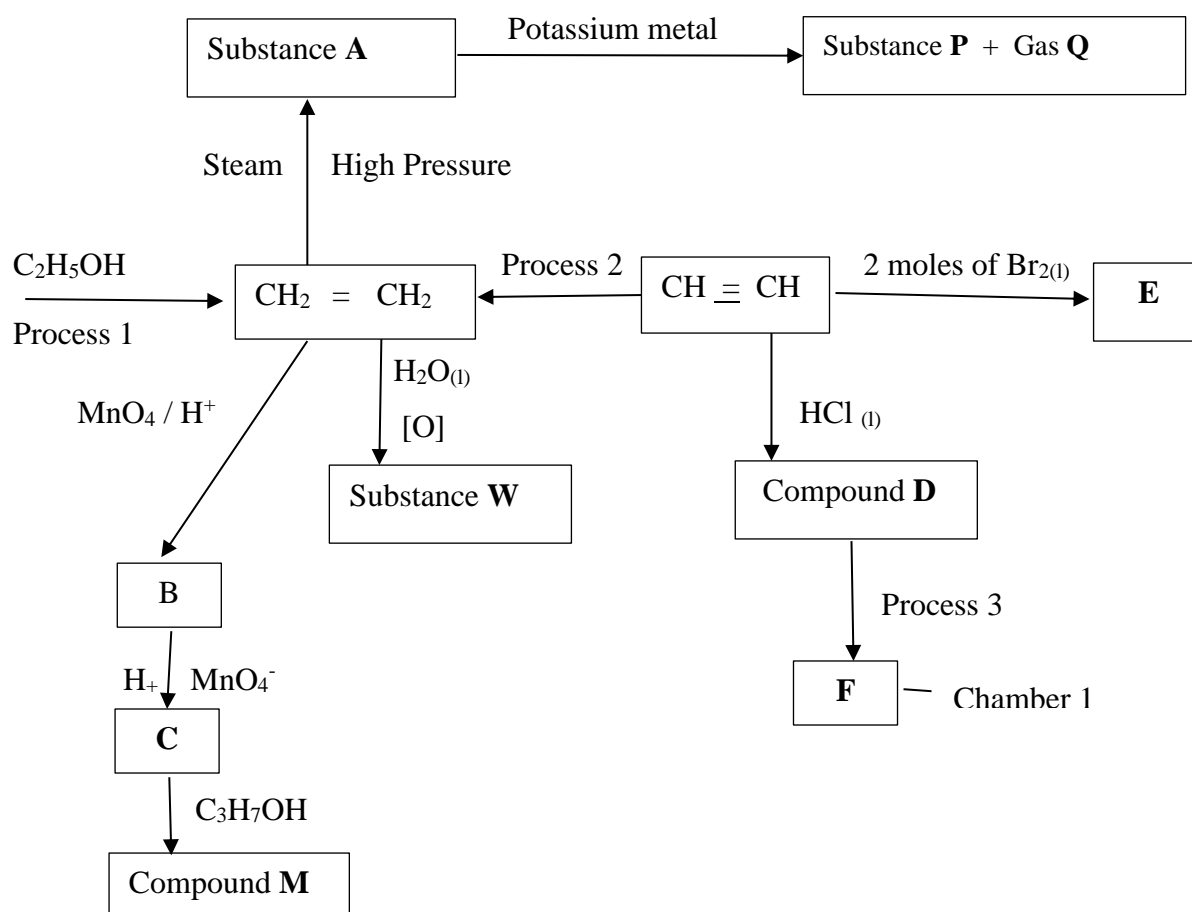(i) Plot a graph of the concentration of compound M (vertical axis) against time (3 marks)
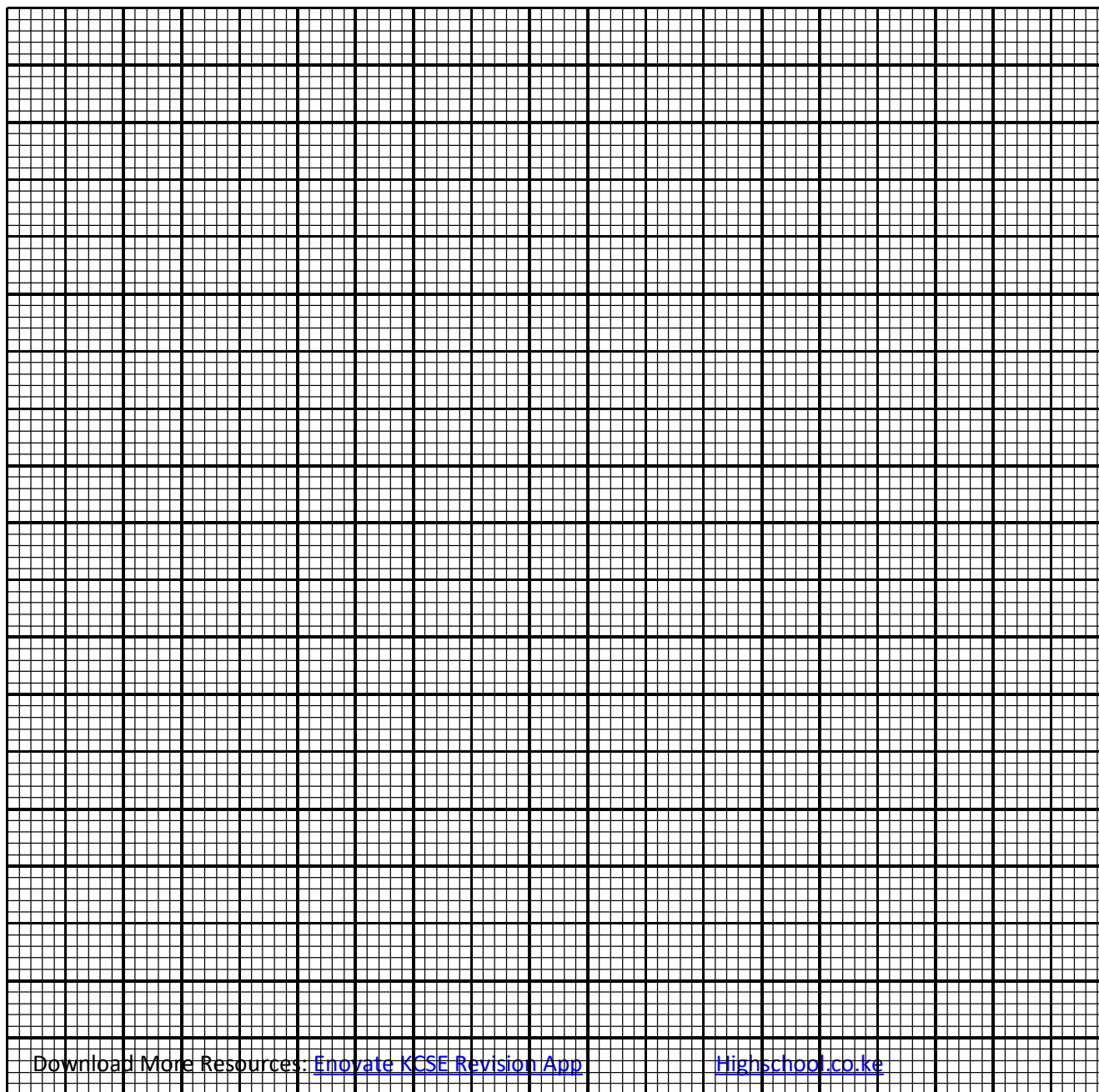
(ii) From the graph, determine the rate of decomposition of M at 2.5 minutes   (2 marks)

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(iii) On the same axis, sketch the curve that would be obtained if the decomposition was carried out

at 15^0C, label the curve A and give a reason for your answer.   (3 marks)

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3. Study the flow chart and use it to answer the questions that follow

| Substance **A** | Potassium metal | Substance **P** + Gas **Q** |

Steam | High Pressure

C_2H_5OH

Process 1

$CH_2 = CH_2$ ← Process 2 → $CH \equiv CH$ → 2 moles of $Br_{2(l)}$ → **E**

MnO_4 / H^+

$H_2O_{(l)}$

[O]

$HCl_{(l)}$

Substance **W**

Compound **D**

B

H_+ | MnO_4^-

C

C_3H_7OH

Compound **M**

Process 3

F — Chamber 1

(a) Identify substances: (3 marks)

A……………………………………………………………………….

W………………………………………………………………….

P…………………………………………………………………….

E……………………………………………………………………

D…………………………………………………………………….

Gas Q………………………………………………………………

(b) State the conditions and reagents that are required for processes:

     1:     Reagent……………………………………………   (½ mark)

           Condition………………………………………….   (½ mark)

     2:     Reagent………………………………………….   (½ mark)

           Condition……………………………………………   (½ mark)

     3:     Reagent……………………………………………   (½ mark)

           Condition………………………………………….   (½ mark)

(c) (i) Write the formula and the name of the compound formed in chamber 1.   (2marks)

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………………………………………………………………………………………………

 (ii) Give the uses of the compound in **c (i)** above   (2 marks)

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………………………………………………………………………………………………

(d) State the physical property of compound M and write its structural formula   (2 marks)

…………………………………………………………………………………………………

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4. The diagram below represents a blast furnace used for extraction of iron.

Charge
Mixture

J

K

L

Tuyeres

A

B
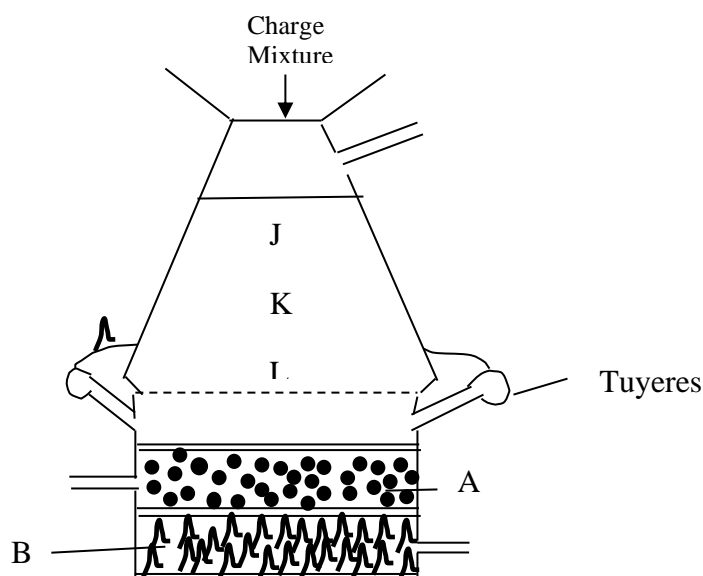
(a) Name three substance contained in the charge mixture (3 marks)

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………………………………………………………………………………………………………

…………………………………………………………………………………………………..

(b) Name substances labelled A and B (2 marks)

………………………………………………………………………………………………………

………………………………………………………………………………………………………

(c) Arrange regions J, K and L in order of decreasing temperature (1 mark)

………………………………………………………………………………………………………

………………………………………………………………………………………………………

(d) Write an equation for the reaction that occurs in region L (1 mark)

………………………………………………………………………………………………………

(e) What is the function of the tuyeres? (1 mark)

………………………………………………………………………………………………………

………………………………………………………………………………………………………

(f) Distinguish between cast iron and wrought iron (1 mark)

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(g) Write an equation for the reaction between heated iron and chlorine   (1 mark)

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(h) Iron -60 is a radio isotope of iron (half - life 2.6 x 10^6 years). Its ultimate decay product is nickel -60. Write a nuclear equation for this process. (Atomic numbers Fe=26, Ni=28)
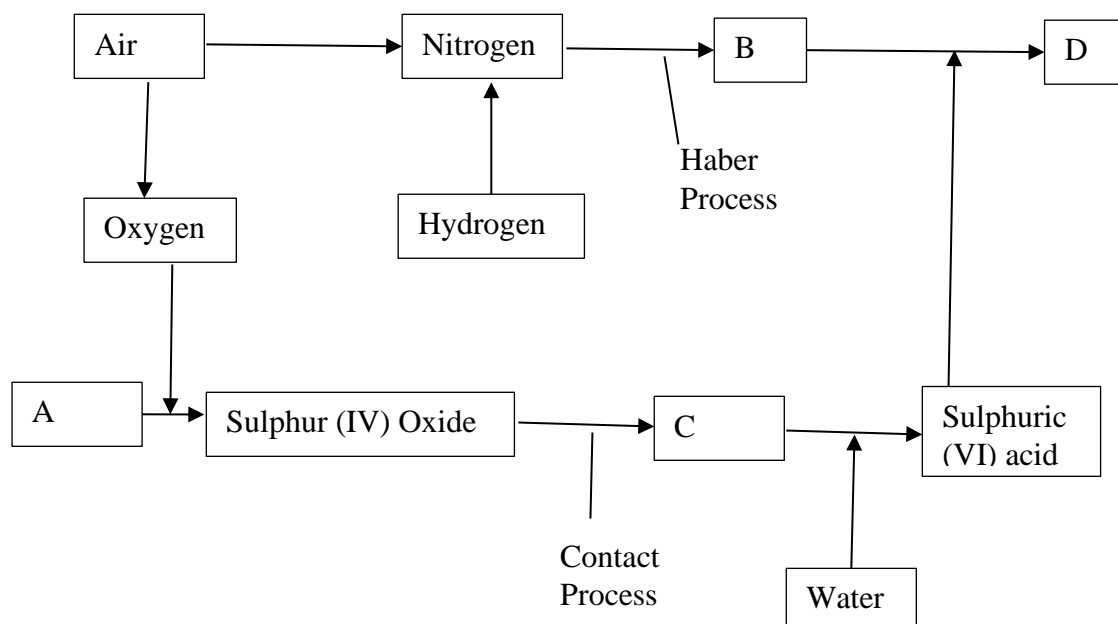
(1 mark)

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(i) State one use of stainless steel   (1 mark)

………

………

5. The flow chart below illustrates two industrial processes, Haber and Contact processes, each with air as one of the starting materials and other chemical reactions

(a) (i) Give the name of the process by which air is separated into oxygen and nitrogen

(1 mark)

……………………………………………………………………………………………………

(ii) Apart from oxygen and nitrogen gases produced in **a(i)** above , name any other gas

produced in the process above. (1 mark)

…………………………………………………………………………………………………

(b) Name the substances which are represented by the letter (2 marks)

A…………………………………………………………………….

B…………………………………………………………………….

C……………………………………………………………………

D……………………………………………………………………

(c) Name the catalyst used in

(i) Haber process (1 mark)

……………………………………………………………………………………………………

(ii) Contact process (1 mark)

……………………………………………………………………………………………………

(iii) Explain the role of the catalyst in both the Haber and Contact processes. (2 marks)

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(d) (i) Write a balanced equation for the formation of compound D (1 mark)

……………………………………………………….……………………………………………

(ii) Calculate the percentage by mass of nitrogen present in compound D

(N=14, H=1, S=32, O=16)   (2marks)

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

(iii) .Give one use of compound D   (1 mark)

…………………………………………………………………………………………………

6. The following are reduction potential of some element , study them and answer the questions that follow.

Half Reaction	Electrode Potential (Volts)
$R^{2+}_{(aq)} + 2e \longrightarrow R_{(S)}$	-0.34
$G^{2+}_{(aq)} + 2e \longrightarrow R_{(S)}$	+1.32
$\frac{1}{2}L_{2 \,(aq)} + e \longrightarrow L_{(aq)}$	+2.07
$J^{+}_{(aq)} + e \longrightarrow \frac{1}{2}J_{2\,(g)}$	0.00
$Q^{2+}_{(aq)} + 2e \longrightarrow Q_{(S)}$	-2.70
$S^{2+}_{(aq)} + 2e \longrightarrow S_{(S)}$	-1.20

(a) What is the reduction potential of the strongest reducing agent?   (1 mark)

…………………………………………………………………………………………………

(b) Which element is most likely to be substance J? Explain your answer (1 mark)

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(c) (i) Draw a well labeled diagram for the electrochemical cell that would be formed when elements G and S are combined (3marks)

(c) Calculate the electromotive force of cell formed above (1 mark)

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(d) During electrolysis of dilute sodium chloride solution using graphite electrodes, a current of 0.8 amperes was passed through the cell for two and a half hours.

(i) Write an ionic equation for the reaction that occurred at the cathode (1 mark)

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(ii) Calculate the volume of the gas produced at the anode in cm^3. (Faraday=96500C, 1 mole of gas at r.t.p = 24dm^3) (3 marks)

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7. The following results were obtained when the molar heat of neutralization between hydrochloric acid and sodium hydroxide was determined. $100cm^3$ of 1.0M hydrochloric acid was reacted with $50cm^3$ of 2M sodium hydroxide solution.

Initial temperature of the base was 25^0C

Initial temperature of the acid was 27^0C

The final stable temperature when the acid and base were mixed was 34^0C

(a) Write an ionic equation for the reaction   (1 mark)

………………………………………………………………………………………………

(b) Calculate the,

(i) Change in temperature   (1 mark)

……………………………………………………………………………………………………

……………………………………………………………………………………………………

(ii) Heat change for the reaction (specific heat capacity= 4.2KJ|g|k and density of solution=$1.0g|cm^3$).   (1 mark)

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……………………………………………………………………………………………………

(iii) Molar heat of neutralization of hydrochloric acid   (2 marks)

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(c) Draw an energy level diagram for the reaction   (2 marks)

(d) Account for the heat loss (1 mark)

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(e) How can the heat loss be minimized? (1 mark)

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(f) Write the thermochemical equation for the reaction (1 mark)

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