2024 SEED MSCE MOCK PROVISIONAL MARKING KEY
CHEMISTRY PAPER I

SOUTH EAST EDUCATION DIVISION

2024 MALAWI SCHOOL CERTIFICATE OF EDUCATION MOCK EXAMINATION

CHEMISTRY

PAPER I

(PROVISIONAL MARKING KEY)

SECTION A (70 marks)

Answer **all** questions in this section in the spaces provided.

1. a. State any two ways of determining the purity of a substance.

i. *Melting point of a substance*
ii. *Boiling point of a substance*
iii. *Paper chromatography*
iv. *Density of a substance* ***(any 2 points, one mark each)***

b. Sample A was analyzed in the laboratory and the results were recorded as shown in Figure 1 below:

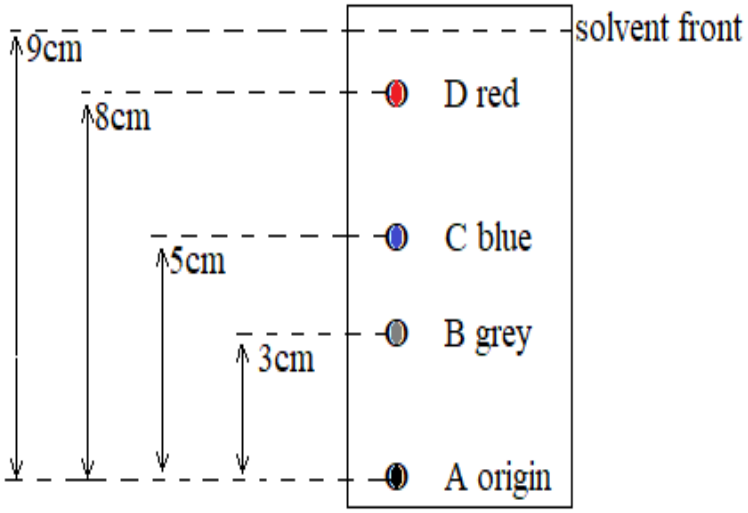


Figure 1

i. State whether sample A is a pure substance or not.

✓ *Sample **A** is not a pure substance* **(1 mark)**

ii. Explain your answer in 1. b) i. above.

✓ *Because the sample has more than one pigment as shown on the chromatogram.* **(1 mark)**

Continued/…

1. **(Continued)…**

iii. Calculate the relative flow value of component B.

$$relative\ flow\ value = \frac{distance\ moved\ by\ component}{distance\ moved\ by\ solvent} \quad \textbf{1}$$

$$= \frac{3cm}{9cm} \quad \textbf{1}$$

$$= 0.33 \quad \textbf{1}$$

2. a. State any two ways of determining the rate of a chemical reaction.

By measuring the;

i. Change in mass of reactants or products

ii. volume of a gas produced

iii. concentration of reactants or products

iv. time taken for a given mass or reactant to disappear completely

v. *time taken for a certain amount of product to form*

(any 2 points, one mark each)

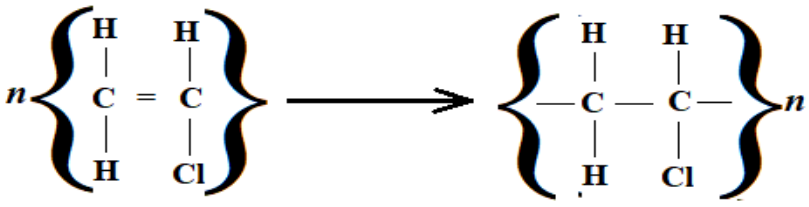
b. Explain how temperature affects the rate of chemical reaction?

✓ *When temperature of the reactants increases, it increases the kinetic energy of the particles of the reactants**(1)** hence increasing the number of successful collisions/**1**. This makes the reaction to take place faster/**1**.*

Or

✓ *Increase in temperature increases the movement of reactant particles/**1** and number of successful collisions/**1**. Hence rate of reaction also increases/**1**.*

3. a. Polymerization of chloroethene can be represented by the equation below:



i. Name the polymer formed.

✓ *Polychloroethene or polyvinylchloride* ***(1 mark)***

Continued/…

3. **(Continued)...**

ii. What kind of polymerization is represented in the equation above?

✓ *Addition polymerization* **(1 mark)**

b. i. State any two examples of artificial polymers.

✓ *Polythene*

✓ *Polyvinylchloride*

✓ *Nylon*

✓ *Perspex*

✓ *Terylene*

✓ *polystylene*

(any 2 points, one mark each)

ii. Explain why thermosoftening plastics melt when subjected to heat.

✓ *Thermosoftening plastics have weak intermolecular forces/**1** and there are no crosslinks or branches between the polymer chains. /**1***

(2 marks)

4. a. Figure 2 is a structure of an element that is composed of 4 atoms to make a molecule.

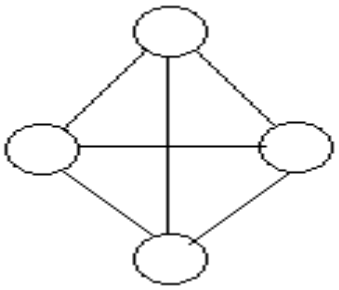


Figure 2

i. Identify the element with the structure above.

✓ *Phosphorus* ***(1 mark)***

ii. State two allotropes of the element.

✓ *White phosphorus*

✓ *Red phosphorus* ***(one mark each)***

Continued/…

4. **(Continued)…**

iii. Mention one agricultural importance of the element.

✓ *Phosphorus is used to manufacture phosphoric fertilisers* **(1 mark)**

b. State two methods of removing permanent water hardness.

*i. Ion exchange method **1***

ii. *Distillation* **1** **(2 marks)**

c. Explain how the car manufacturing industry contributes to global warming.

✓ *Car manufacturing involves the use of heavy machines which use fuels/**1** to be driven. Burning of these fuels releases carbon dioxide, a greenhouse gas /**1**, burning causes global warming.*

Or

✓ *When cars are manufactured, they use fuels such as petrol or diesel to move/**1**, burning of these fuels releases greenhouse gases such as carbon dioxide/**1** whose accumulation in the atmosphere results in global warming.*

(2 marks)

5. a. Define molarity.

✓ *Molarity is the concentration of a solution which is expressed in moles of solute per litre (dm^3) of the solution.* **(1 mark)**

b. A 0.9g tablet of a drug with a molecular formula C_9H_8O was completely dissolved in 10ml of water. Calculate the concentration of the solution in moles per litre. (RAM: C = 12, H = 1, O = 16).

RFM of C_9H_8OH = 12 x 9 + 1 x 8 + 16 x 4 = 180 ***1***

$$Concentration = \frac{mass}{RFM \ x \ Volume}$$ ***1***

$$= \frac{0.9g}{180 \ x \ 0.01}$$ ***1***

$$= 0.5$$ ***1***

(4 marks)

Continued/…

5. **(Continued)…**

c. Work out the molecular formula of a hydrocarbon which has a carbon to hydrogen ratio of 1:1 and its relative formula mass is 78. (RAM: C = 12, H = 1)

$$Molecular\ formula = \frac{Molecular\ mass}{RFM\ of\ empirical\ formula}\ (empirical\ formula) \quad \textbf{1}$$

$= \frac{78}{13}(CH)$ **1**

$= 6(CH)$ **1**

$= C_6H_6$ **1**

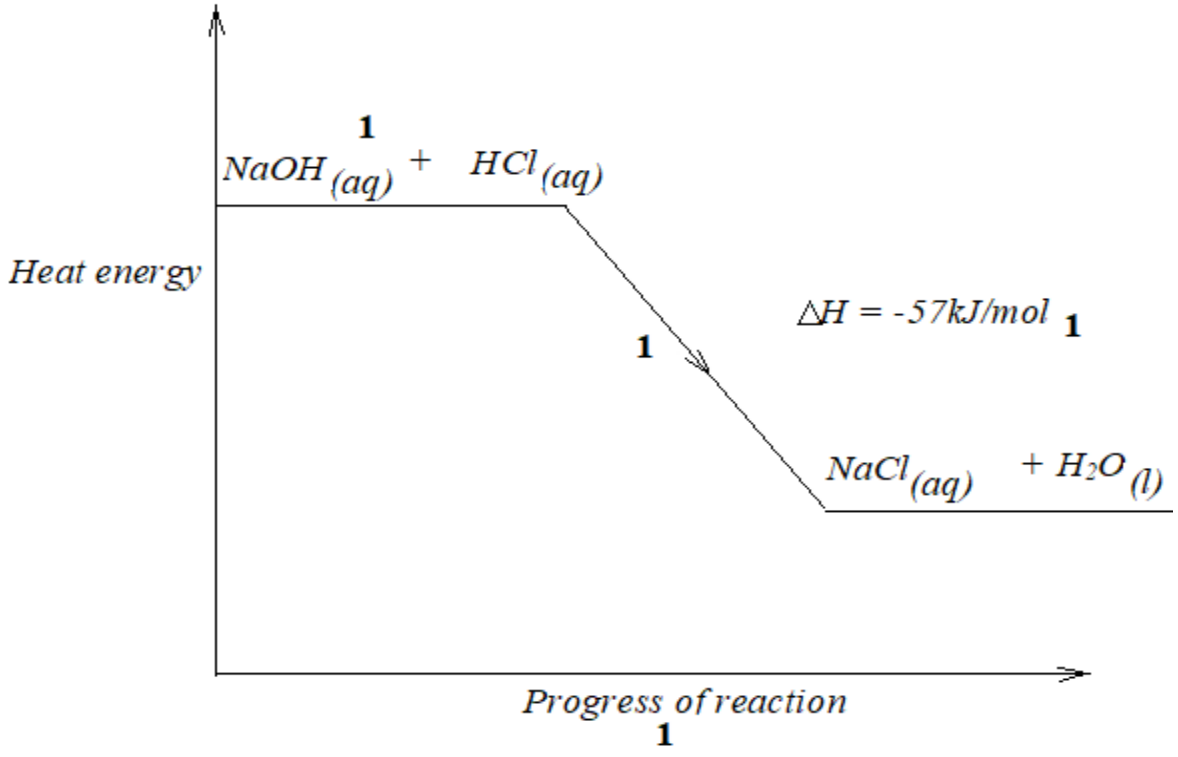
6. a. Define enthalpy change.

✓ *Enthalpy change is the amount of heat energy lost or gained during a chemical reaction.* ***1***

b. Draw an energy level diagram for the following equation.

$NaOH(aq) + HCl(aq) \longrightarrow NaCl(aq) + H_2O(l) \quad \Delta H = -57kJ/mol$

Energy level diagram



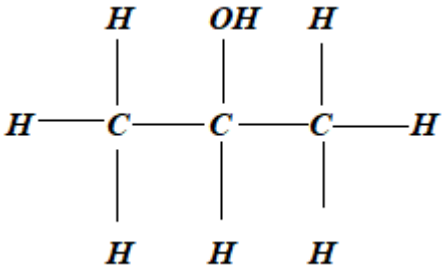
(4 marks)

Continued/…

7. a. Give any two sources of alkanoates.

i. Fats
ii. Oils
iii. Fruits
iv. Flowers
v. Esterification of alkanols and alkanoic acids ***(any 2 points, one mark each)***

b. Draw the structure of a secondary alkanol with 3 carbon atoms.



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c. Figure 3 shows a flow diagram of soap making process.

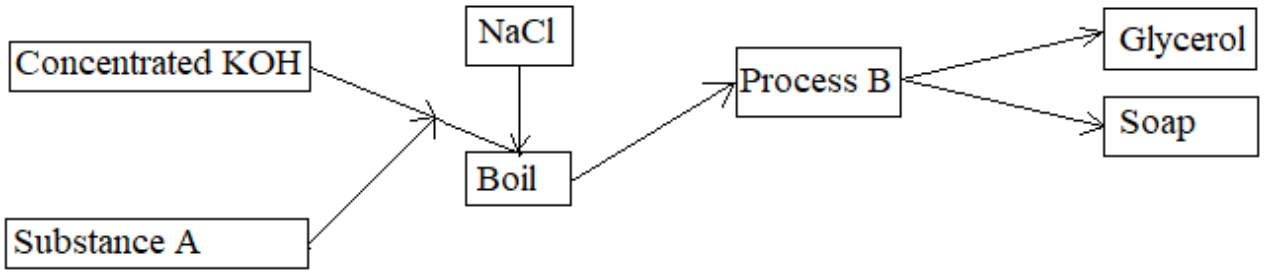


Figure 3

i. Name the homologous series of substance A.

✓ *Alkanoate/ Ester* ***1***

ii. Why is process B necessary in soap making?

✓ *To separate the resisdue (soap) from the filtrate (glycerol)* ***1***

d. Write the condensed formulae of any two isomers of an alkanol with a molecular formula C_4H_9OH.

✓ $CH_3(CH_2)_3OH$
✓ $CH_3CH(CH_3)CH_2OH$
✓ $CH_3C(CH_3)OHCH_3$

(any 2 points, one mark each)

Continued/…

8. a. Give two examples of acidic oxides.

- ✓ *Sulphur dioxide (SO_2)*
- ✓ *Phosphorus pentoxide (P_2O_5)*
- ✓ *Carbon dioxide (CO_2)*
- ✓ *Nitrogen dioxide (NO_2)* ***(any 2 points, one mark each)***

b. Below are conjugate acid – base pairs for a chemical reaction between an acid and a base.

H_2CO_3 / HCO_3^- and NH_4^+ / NH_3

Write an equation for the reaction using the conjugate acid – base pairs above.

$$H_2CO_{3(aq)} + NH_{3(l)} \longrightarrow HCO_3^-{}_{(aq)} + NH_4^+{}_{(aq)}$$

1 ***1***

c. State any two benefits of recycling wastes.

i. It saves energy.

ii. It creates job as most people are involved in the process of collecting, sorting and cleaning the materials.

iii. It reduces emissions of greenhouse gases which cause air pollution

iv. It saves money since recycled materials are cheaper.

(any 2 points, one mark each)

9. Table 1 shows boiling points of some chlorides which are represented by letters A, B, C, D and E. Use it to answer questions 9 a (i) and (ii).

Table 1

Chloride	Boiling point
A	**898**
B	**-80**
C	**50**
D	**1380**
E	**98**

Continued/…

9. **(Continued/…**

a. i. Which two chlorides are ionic compounds.

✓ *A and D*

ii. Which of the compounds is hydrogen chloride gas?

✓ *B*

b. Explain why preparation of composite manure is one way of solid waste disposal.

✓ *Composite manure is made from biodegradable wastes./**1**. This reduces air pollution as well as other health hazards / **1** hence it is a solid disposal method.*

c. i. Define allotropy.

✓ *Allotropy is the existence of an element in more than one form without change of state. **1***

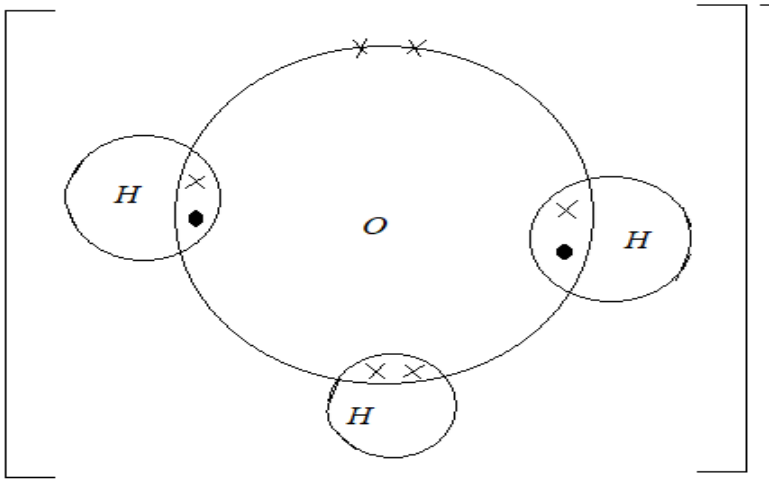
ii. State **two** allotropes of oxygen.

✓ *Oxygen **1***

✓ *Ozone **1***

10. a. With the aid of an electron dot and cross diagrams, explain the difference between pure and dative covalent bonding.

✓ *In a pure covalent bond both of the elements involved contribute an electron to the shared pair of electrons**1**/ while in dative covalent bonding the shared pair of electrons are contributed by one element**1**/. The sharing is as in the dot and cross diagrams below;*



Continued/…

b. With the aid of relevant chemical equations, describe preparation of ethanoic acid by oxidation of ethanol.

Ethanoic acid can be prepared by oxidation of ethanol.

- ✓ *A mixture of ethanol and acidified potassium dichromate (VI) or potassium permanganate (VII) / **1** is warmed to form ethanal / **1** as in the equation below;*
- ✓ $C_2H_5OH_{(aq)} + [O] \xrightarrow[KMnO_4/H^+]{K_2Cr_2O_7/H^+} CH_3CHO_{(aq)} + H_2O_{(l)}$ ***1***
- ✓ *Then the ethanal is further oxidized to form ethanoic acid / **1** as in the equation below;*
- ✓ $CH_3CHO_{(aq)} + [O] \xrightarrow[KMnO_4/H^+]{K_2Cr_2O_7/H^+} CH_3COOH_{(aq)}$ ***1***

SECTION B (30 marks)

Answer all the questions in this section in the spaces provided.

11. a. Describe how ammonia is produced in industries by the Harber process.

i. *Nitrogen and hydrogen are pumped into the machine were they are purified, dried and mixed in the ratio of 1:3 respectively.* ***1***

ii. *The mixture is pumped into the compressor where it is squeezed at about 300atm pressure and a temperature of 450°C.* ***1***

iii. *The compressed gas is pumped into a converter where some hydrogen and nitrogen react to form ammonia.* ***1***

iv. *The mixture of ammonia and unreacted nitrogen and hydrogen leave the converter into the condenser where ammonia is cooled into liquid.* ***1***

v. *Unreacted hydrogen and nitrogen is pumped back into a converter for another chance to react.* ***1***

vi. *The liquid ammonia is collected in tanks or bottles for storage.* ***1***

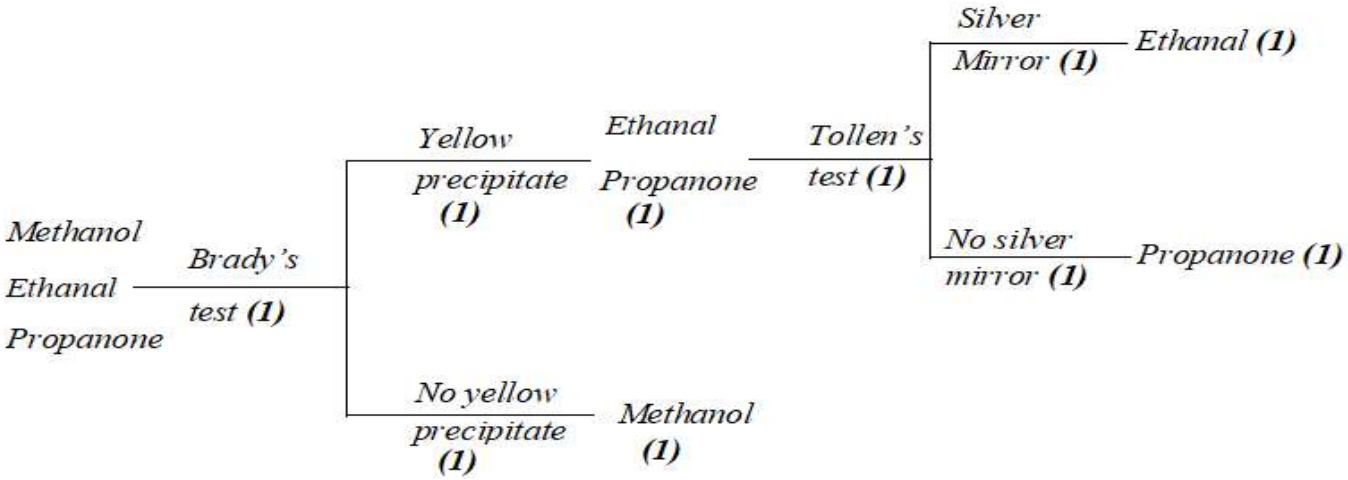
b. Explain how rusting of iron metal can be prevented by galvanizing.

2024 SEED MSCE MOCK PROVISIONAL MARKING KEY
CHEMISTRY PAPER I

*Galvanizing involves dipping iron in molten zinc/**1** Zinc reacts with air forming thin coating of zinc oxide/**1** which creates a barrier /**1** reducing exposure of iron to oxygen and moisture /**1** which are necessary for rusting of iron metal.*

12. With the aid of a flow diagram, describe how methanol, ethanal and propanone could be identified using 2,4 – DNPH and Tollens reagents.

THE FLOW DIAGRAM



(10 marks)

13. Describe how pure and dry crystals of Copper (II) sulphate can be prepared from Copper oxide and dilute Sulphuric acid.

- ✓ *Put the powder of dilute sulphuric acid into a beaker /**1** and warm gently. **1***
- ✓ *Add powedered solid copper II oxide into the beaker containing warm dilutee sulphuric acid while stirring the mixture. / **1***
- ✓ *Stop adding copper II oxide when it becomes saturated (when it no longer dissolves) **1***
- ✓ *Filter off the excess oxide and collect the filtrate in a conical flask. **1***
- ✓ *Evaporate a little of the filtrate in an evaporating dish. **1***
- ✓ *Heat the solution gently / **1** until a thin layer of crystals is formed on the surface. **1***
- ✓ *Cool the saturated solution slowly. **1***
- ✓ *Dry the crystals between sheets of filter papers. **1***
- ✓ *The dried crystals are pure copper sulphate.*

END OF PROVISIONAL MARKING KEY

NB: This paper contains 10 printed pages.