

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:

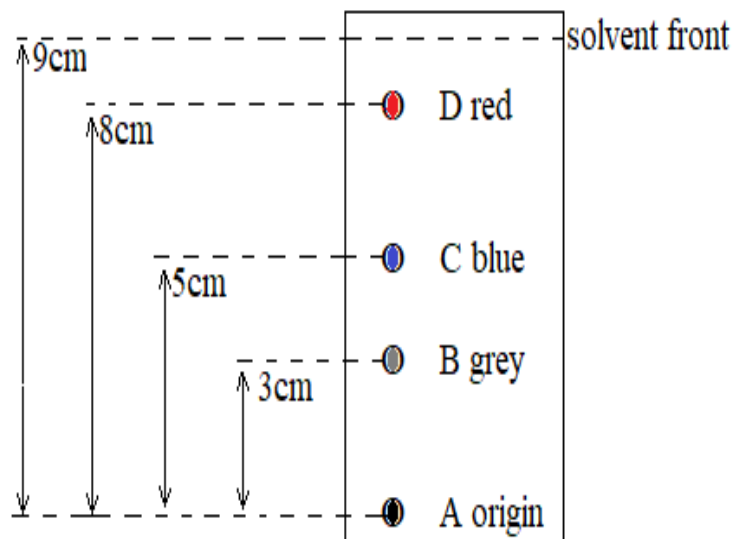


Figure 1

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)

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1. (Continued)...

iii. Calculate the relative flow value of component B.

$$\begin{aligned}\text{relative flow value} &= \frac{\text{distance moved by component}}{\text{distance moved by solvent}} && 1 \\ &= \frac{3\text{cm}}{9\text{cm}} && 1 \\ &= 0.33 && 1\end{aligned}$$

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)

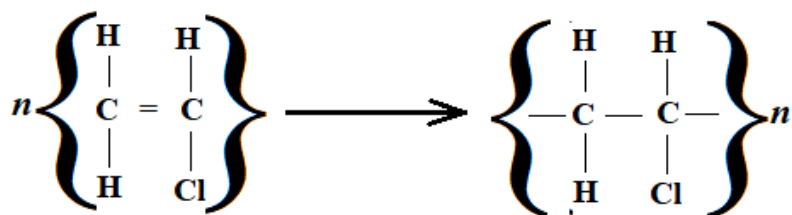
b. Explain how temperature affects the rate of chemical reaction?

- ✓ 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/...



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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*

✓ *polystyrene*

(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.

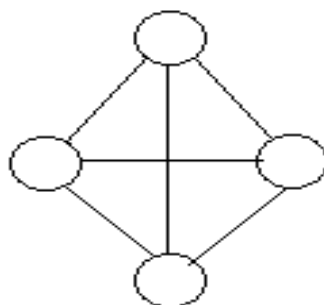


Figure 2

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/...

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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 $\text{C}_9\text{H}_8\text{O}$ was completely dissolved in 10ml of water. Calculate the concentration of the solution in moles per litre. (RAM: C = 12, H = 1, O = 16).

$$\text{RFM of } \text{C}_9\text{H}_8\text{OH} = 12 \times 9 + 1 \times 8 + 16 \times 4 = 180 \quad 1$$

$$\text{Concentration} = \frac{\text{mass}}{\text{RFM} \times \text{Volume}} \quad 1$$

$$= \frac{0.9\text{g}}{180 \times 0.01} \quad 1$$

$$= 0.5 \quad 1$$

(4 marks)

Continued/...



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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)

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

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

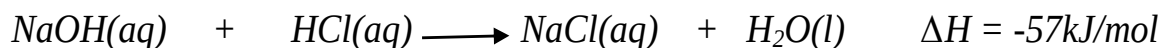
$$= 6(\text{CH}) \quad 1$$

$$= \text{C}_6\text{H}_6 \quad 1$$

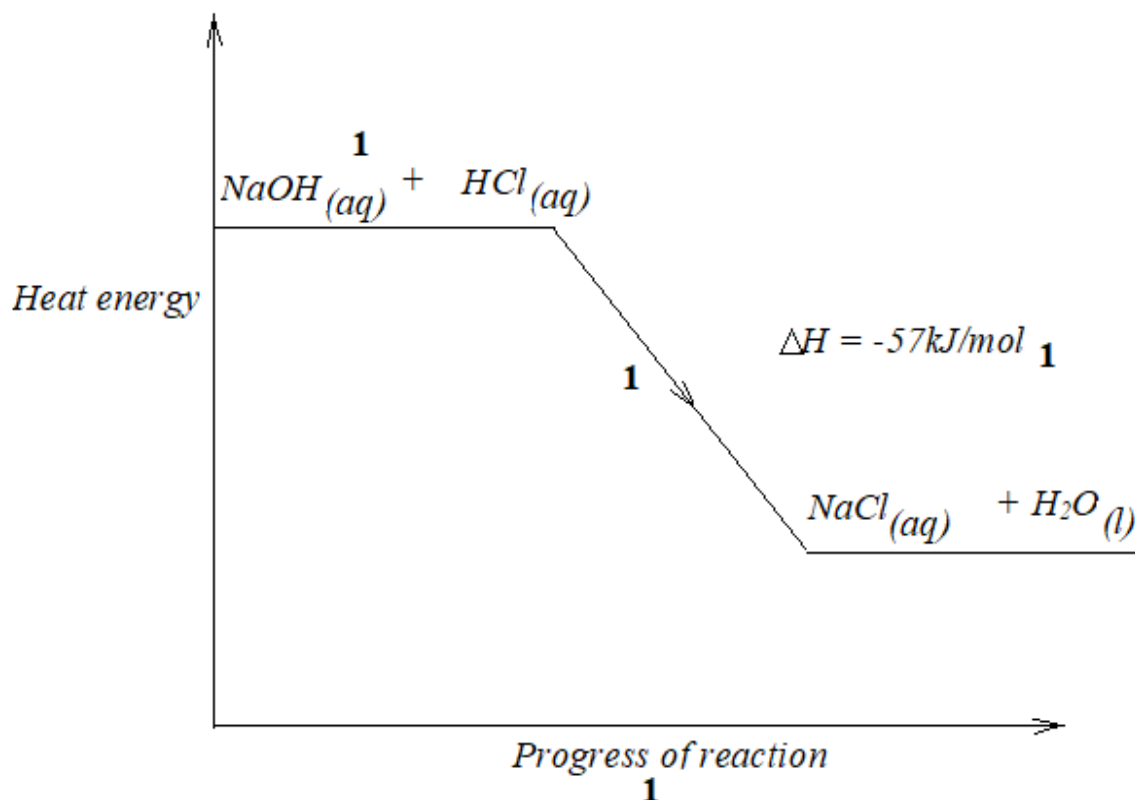
6. a. Define enthalpy change.

✓ 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.



Energy level diagram



(4 marks)

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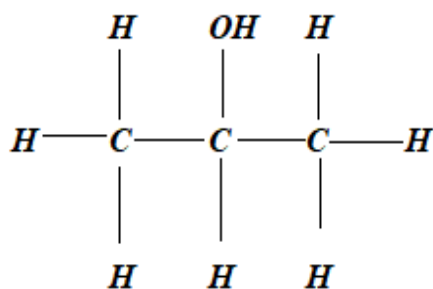


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7. a. Give any two sources of alkanoates.

- 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.

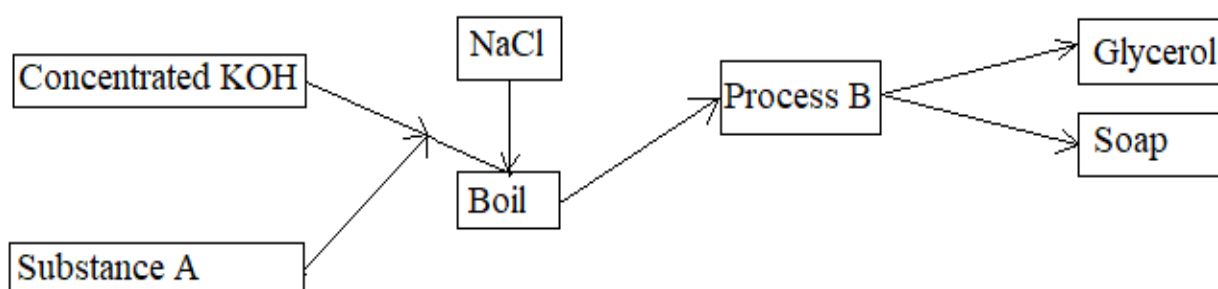


Figure 3

i. Name the homologous series of substance A.

- ✓ *Alkanoate/ Ester* 1

ii. Why is process B necessary in soap making?

- ✓ *To separate the residue (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)

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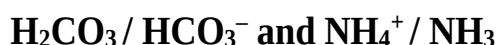


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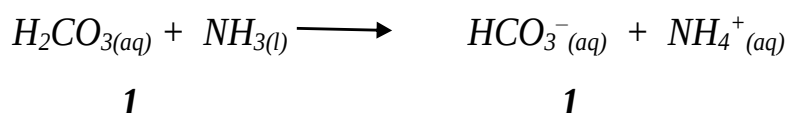
8. a. Give two examples of acidic oxides.

- ✓ 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.



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



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/...



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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

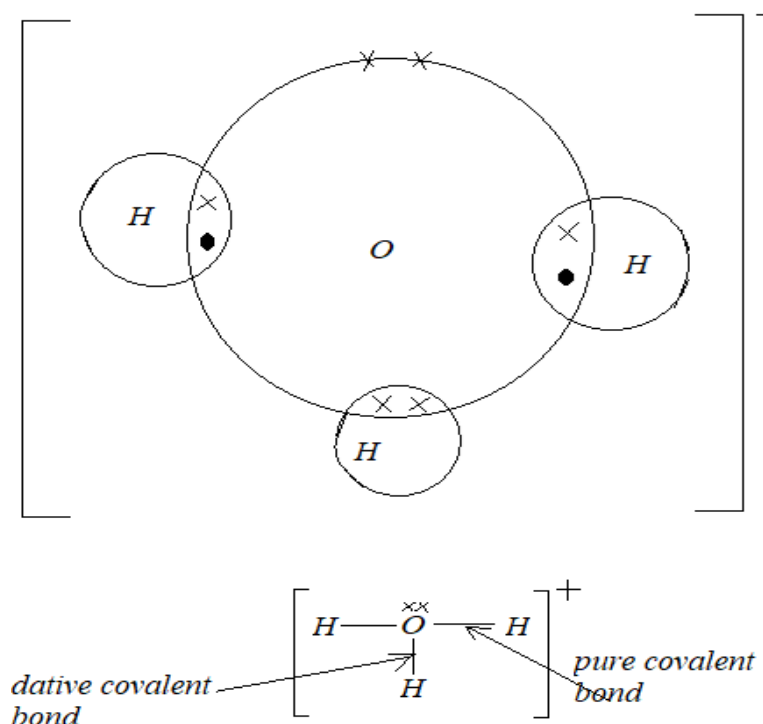
ii. State **two** allotropes of oxygen.

✓ 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 electrons1/ while in dative covalent bonding the shared pair of electrons are contributed by one element1/. The sharing is as in the dot and cross diagrams below;



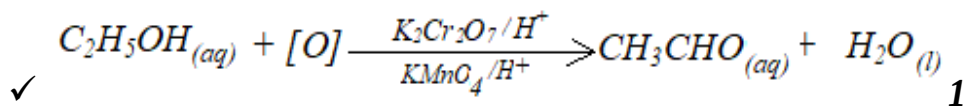
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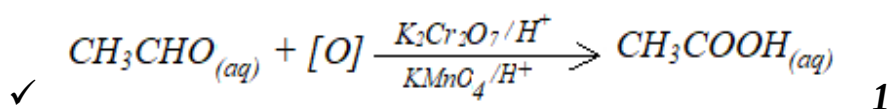
b. With the aid of relevant chemical equations, describe preparation of ethanoic acid by oxidation of ethanol.

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;*



- ✓ *Then the ethanal is further oxidized to form ethanoic acid / 1 as in the equation below;*



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 where 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.

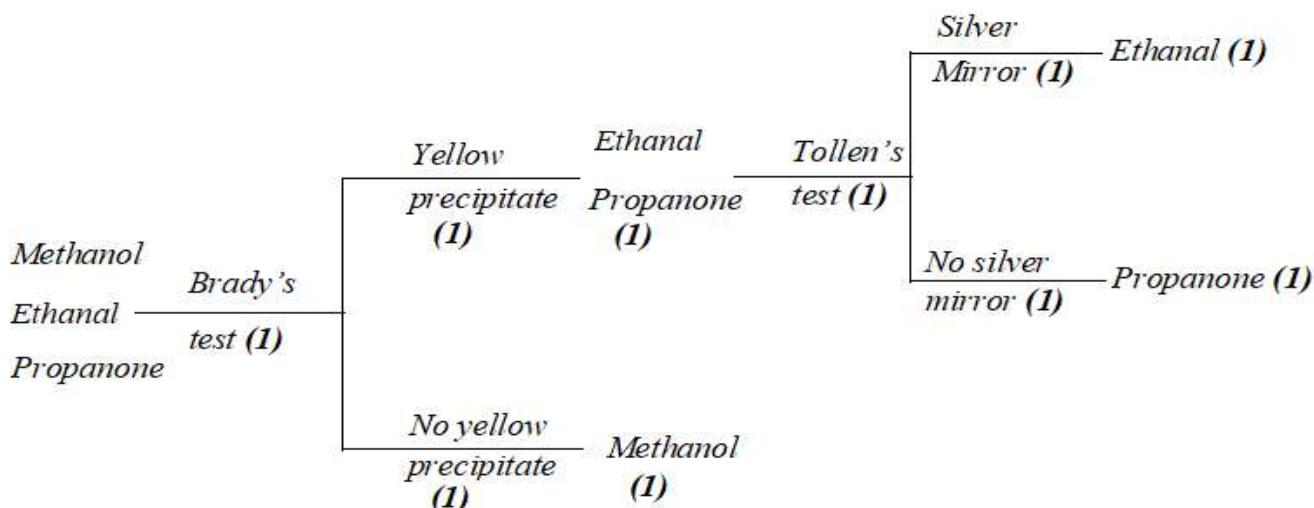


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Galvanizing involves dipping iron in molten zinc/1 Zinc reacts with air forming thin coating of zinc oxide/1 which creates a barrier /1 reducing exposure of iron to oxygen and moisture /1 which are necessary for rusting of iron metal.

- 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 powdered solid copper II oxide into the beaker containing warm dilute 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.

