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**SA EXAM  
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**KWAZULU-NATAL PROVINCE**

**EDUCATION**  
REPUBLIC OF SOUTH AFRICA

**PROVINCIAL STANDARDISED  
ASSESSMENT**

**GRADE 12**

**PHYSICAL SCIENCES P2 (CHEMISTRY)**

**MARKING GUIDELINES**

**JUNE 2026**

**MARKS: 150**

**These marking guidelines consist of 10 pages.**



**SA EXAM PAPERS**

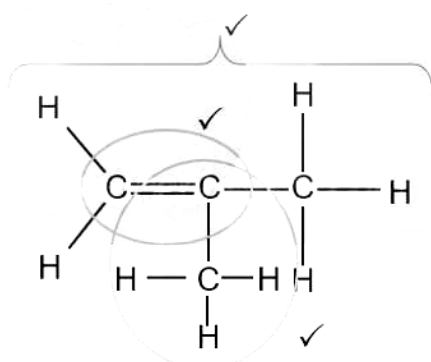
Proudly South African

**QUESTION 1**

- 1.1 C ✓✓ (2)  
 1.2 A ✓✓ (2)  
 1.3 D ✓✓ (2)  
 1.4 C ✓✓ (2)  
 1.5 C ✓✓ (2)  
 1.6 B ✓✓ (2)  
 1.7 C ✓✓ (2)  
 1.8 A ✓✓ (2)  
 1.9 A ✓✓ (2)  
 1.10 B ✓✓ (2)

**[20]****QUESTION 2**

- 2.1.1 Compounds with the same molecular formula, but different structural formula. ✓✓ (2/0) (2)  
 2.1.2 Unsaturated. ✓  
 It has a double bond between carbon ✓ atoms.  
 (Accept: It has a general formula  $C_nH_{2n}$ ) (2)  
 2.1.3 But-2-ene ✓✓ (2 or 0) (2)  
 2.1.4

**Marking criteria**

- Functional group (double bond): ✓
- Side chain (methyl) on carbon 2: ✓
- Whole structure correct: ✓

(3)

- 2.2.1 Haloalkanes ✓ (1)





2.2.2

3-ethyl-4-fluorohexane ✓

**Note:**

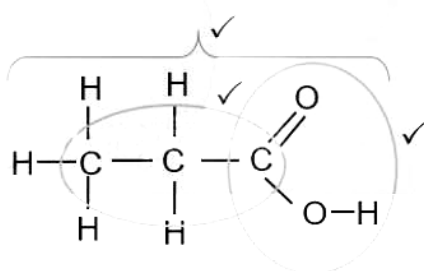
If: 4-fluoro-3-ethylhexane: 2/3

(3)

2.2.3 General formula for carboxylic acid:  $C_nH_{2n}O_2$ . $(12 \times n) + (1 \times 2n) + (16 \times 2) = 74$  ✓ $n = 3$  $\therefore X = 3$  ✓ $Y = 6$  ✓ $Z = 2$  ✓

(5)

2.2.4

**Positive marking from 2.2.3****Marking criteria**

- Functional group: ✓
- Chain of 3 carbon atoms: ✓
- Whole structure correct: ✓

(3)

**[21]****QUESTION 3**

3.1 The greater the molecular mass/chain length the higher the boiling point. ✓✓ (2/0)

(Boiling point increases with an increase in molecular mass)

(2)

3.2.1 An organic compound made of Carbon and Hydrogen atoms only. ✓✓ (2/0)

(2)

3.2.2  $C_5H_{12}$  ✓ (Accept: Pentane)

Its boiling point is higher than the room temperature. ✓

(2)

3.2.3  $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$  ✓ Bal. ✓

(3)

3.3.1 An alcohol in which the carbon bonded to OH is directly bonded to one carbon ✓✓ (2/0)

(2)

3.3.2 • Alcohols have Hydrogen bonds, dipole-dipole and London forces ✓ between their molecules.• London forces in  $C_4H_{10}O$  are the strongest ✓ compared to the other compounds.• More energy is required to overcome the intermolecular forces in  $C_4H_{10}O$  ✓ than the other alcohols.

(3)





- 3.4
- $C_5H_{12}$  (Alkanes) have London forces ✓ between their molecules.
  - $C_4H_{10}O$  (Alcohols) have Hydrogen bonds, ✓ dipole-dipole, and London forces between their molecules.
  - Intermolecular forces of  $C_4H_{10}O$  are stronger than that of  $C_5H_{12}$ . ✓
  - More energy is required to overcome Intermolecular forces of  $C_4H_{10}O$  ✓

(4)

**[18]****QUESTION 4**

- 4.1.1 A concentrated base contains a large amount of base in proportion to the volume of water. ✓  
A dilute base contains a small amount of base in proportion to the volume of water. ✓

(2)

- 4.1.2 Substitution ✓ (Hydrolysis).

(1)

- 4.1.3 Alcohols. ✓

(1)

- 4.1.4 Butan-2-ol ✓✓

**Note**

(If: Butanol / Butan-1-ol: 1/2)

(2)

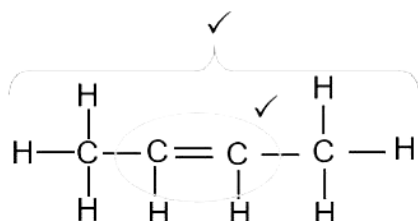
- 4.1.5 Elimination ✓ (Dehydrohalogenation)

(1)

- 4.1.6 Dissolve 2-Bromobutane in Ethanol.(alcohol) ✓

(1)

- 4.1.7

**Marking criteria**

- Functional group (double bond): ✓
- Whole structure correct: ✓

(2)

- 4.1.8 Sodium bromide/NaBr. ✓

(1)

- 4.2.1 Platinum/Pt ✓ (Palladium/Pd/Nickel/Ni)

(3)

- 4.2.2 Q ✓ and R ✓

(2)





- 4.2.3 Propan-1-ol/1 - propanol. ✓✓ (2 or 0) (2)
- 4.2.4 - Heat ✓  
- Concentrated H<sub>2</sub>SO<sub>4</sub> ✓ (2)
- 4.2.5 Ester ✓ (group) (1)
- 4.2.6  $C_3H_8O + C_2H_4O_2 \checkmark \rightarrow C_5H_{10}O_2 + H_2O \checkmark$  Bal. ✓ (3)  
NB: If they use correct structural formulae 2/3
- [22]**

### QUESTION 5

- 5.1.1 The minimum energy required for a reaction to take place. ✓✓ (2)
- 5.1.2 1340 (kJ.mol<sup>-1</sup>). ✓ (1)
- 5.1.3 According to the balanced equation, 197 kJ is released for 2 mol SO<sub>3</sub>.  
Energy released for 1 mol of SO<sub>3</sub>:  
 $\frac{197}{2} \checkmark = 98,5$  kJ per mol  
Energy released to make 24 g of SO<sub>3</sub>:  
 $n = \frac{m}{M} = \frac{24}{80} \checkmark = 0,3$  mol  
Energy = 0,3 x 98,5 ✓ = 29,55 kJ. ✓ (4)
- 5.2.1 What is the relationship between surface area and reaction rate? ✓✓  
(How does the surface area affect the reaction rate?) (2)
- 5.2.2 Experiment 2. ✓  
Aluminium has a greater surface area. ✓ (2)
- 5.2.3 Temperature ✓ (1)
- 5.2.4
- Increase in temperature increases the average kinetic energy of particles. ✓
  - More particles collide with sufficient kinetic energy. ✓
  - More effective collisions per unit time/ Higher frequency of effective collisions. . ✓ (3)





5.3 **Volume of CO<sub>2</sub> formed:**

$$\text{Reaction rate} = \frac{\Delta \text{Volume}}{\Delta \text{time}} : \quad 0,05 \checkmark = \frac{V-0}{180-0} \checkmark$$

$$V = 0,9 \text{ dm}^3$$

**Number of moles of CO<sub>2</sub> formed:**

$$n = \frac{V}{V_m} = \frac{0,9}{24} \checkmark = 0,0375 \text{ mol}$$

**Number of moles of Na<sub>2</sub>CO<sub>3</sub> used (Ratio CO<sub>2</sub>: Na<sub>2</sub>CO<sub>3</sub>):**

$$n(\text{Na}_2\text{CO}_3) = n(\text{CO}_2) = 0,0375 \text{ mol.} \quad \checkmark$$

**Mass of Na<sub>2</sub>CO<sub>3</sub> used:**

$$m = n \times M = 0,0375 \times 106 \checkmark = 3,975 \text{ g}$$

**Percentage purity of Na<sub>2</sub>CO<sub>3</sub>:**

$$\begin{aligned} \% \text{ purity} &= \frac{3,975}{5} \times 100 \checkmark \\ &= 79,5 \% \checkmark \end{aligned}$$

(7)

**[22]**

**QUESTION 6**

6.1 Chemical equilibrium.  $\checkmark$  (1)

6.2 When the equilibrium in a closed system is disturbed, the system will re-instate a new equilibrium by favouring the reaction that will oppose the disturbance.  $\checkmark \checkmark$  (2)

**Marking criteria**

If any one of the underlined key phrases in the **correct context** is omitted, deduct 1 mark.

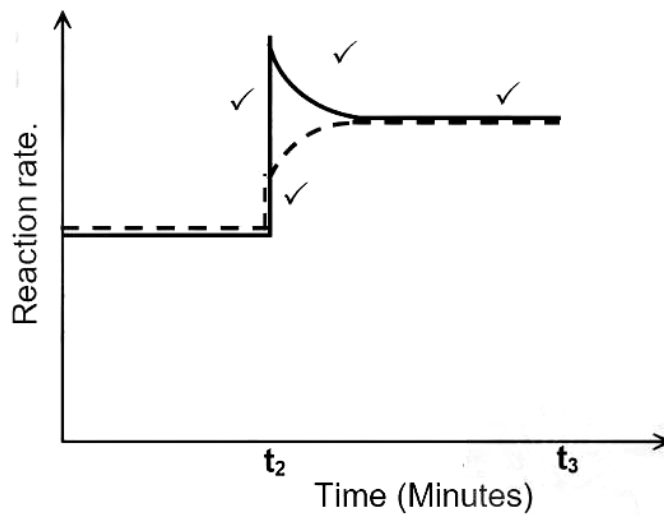
- 6.3
- Temperature was increased.  $\checkmark$
  - Concentrations of N<sub>2</sub> and H<sub>2</sub> increase while concentration of NH<sub>3</sub> decreases.  $\checkmark$
  - Reverse reaction is favoured.  $\checkmark$
  - Endothermic reaction is favoured.  $\checkmark$  (4)





- 6.4.1
- Forward reaction. ✓
  - An increase in pressure favours the reaction that proceeds towards the fewer number of moles. ✓
- (2)

6.4.2

**Marking criteria**

- Both rates increase at  $t_2$ : ✓
- Rate of forward increases more than rate of reverse at  $t_2$ : ✓
- After  $t_2$ , Rate of forward decreases while rate of reverse increases: ✓
- Both rates become equal and remain constant (horizontal) before  $t_3$ : ✓

(4)



6.5 **Marking criteria**

- Percentage O<sub>2</sub>:  $0,65 \times 8 = 5,2$  mol ✓
- Number of moles of O<sub>2</sub> used:  $8 - \sqrt{5,2} = 2,8$  mol
- Ratio n(NO):n(O<sub>2</sub>):n(NO<sub>2</sub>) = 2:1:2 ✓
- Number of moles at equilibrium:  
n<sub>initial</sub>-n<sub>used</sub> for NO and O<sub>2</sub> and n<sub>initial</sub>+n<sub>formed</sub> for NO<sub>2</sub>:  
2,4 (NO): 5,2 (O<sub>2</sub>): 5,6 (NO<sub>2</sub>) ✓
- Concentration at equilibrium: Dividing all number of moles by unknown volume. ✓
- Correct K<sub>c</sub> expression. ✓
- Substitution of K<sub>c</sub> value. ✓
- Substitution of concentration values in terms of unknown volume. ✓
- Correct volume: 3,01 dm<sup>3</sup>. ✓

	NO (g)	O <sub>2</sub> (g)	NO <sub>2</sub> (g)	
Ratio	2	1	2	
Initial n (mol)	8	8	-	
Change (mol)	-5,6	-2,8 ✓	+5,6	✓
Equilibrium (mol)	2,4	5,2 ✓	5,6	✓
$c = \frac{n}{V}$ (mol.dm <sup>-1</sup> )	$\frac{2,4}{x}$	$\frac{5,2}{x}$	$\frac{5,6}{x}$	✓

$$K_c = \frac{[\text{NO}_2]^2}{[\text{NO}]^2 \cdot [\text{O}_2]} \checkmark$$

$$3,15 \checkmark = \frac{\left(\frac{5,6}{x}\right)^2}{\left(\frac{2,4}{x}\right)^2 \cdot \left(\frac{5,2}{x}\right)} \checkmark$$

$$x = 3,01$$

$$V = 3,01 \text{ dm}^3 \checkmark$$

(9)

**[22]**

**QUESTION 7**

7.1.1 Diprotic ✓  
The acid can donate two hydrogen ions. ✓ (2)

7.1.2  $\text{HSO}_4^-$  ✓ (1)

7.1.3 Sulphate ion. ✓ (1)

7.2.1 Reaction between salt and water. ✓ ✓ (2)

7.2.2  $\text{HCO}_3^- + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3 + \text{OH}^-$  ✓ Balancing ✓

**Marking criteria**

- Left side correct:  $\text{HCO}_3^- + \text{H}_2\text{O}$  ✓
- Right side correct:  $\text{H}_2\text{CO}_3 + \text{OH}^-$  ✓
- Balancing: ✓

(3)

7.3.1  $[\text{H}_3\text{O}^+] = 2 \times [\text{H}_2\text{SO}_4] = 2 \times 0,12 = 0,24 \text{ mol}\cdot\text{dm}^{-3}$ .

$\text{pH} = -\log [\text{H}_3\text{O}^+]$  ✓

$= -\log (0,24)$  ✓

$= 0,62$  ✓

(4)

7.3.2 - Bromothymol blue ✓  
- Reaction between a strong base and strong acid ✓ (2)





### 7.3.3 Marking criteria

- Number of moles of NaOH in 16 ml. ✓
- Number of moles of H<sup>+</sup> in 20 ml. ✓
- n of H<sup>+</sup> in 500 ml: 0, 00488 x 25 ✓
- Number of moles of H<sub>2</sub>SO<sub>4</sub>: 0, 12 x 0, 3 ✓ = 0, 036 mol.
- Number of moles of H<sup>+</sup> in 0, 036 mol of H<sub>2</sub>SO<sub>4</sub>:  
Ratio: n(H<sup>+</sup>) = 2 x n(H<sub>2</sub>SO<sub>4</sub>) = 2 x 0, 036 ✓ = 0, 072 mol.
- Number of moles of H<sup>+</sup> from HCl:  
Total n<sub>(entire solution)</sub> - n<sub>(H<sub>2</sub>SO<sub>4</sub>)</sub> = 0, 122 - 0, 072 ✓ = 0, 05 mol.
- Number of moles of HCl:  
Ratio HCl:H<sup>+</sup> = 1:1, n<sub>(HCl)</sub> = 0, 05 mol. ✓
- Formula for concentration: c=n/v ✓
- Substitution into formula c = n/v = 0,05/0,2. ✓
- Concentration of HCl: 0, 25 mol.dm<sup>-3</sup>. ✓

#### Number of moles of NaOH in 16 ml.

$$n = c.v = 0, 305 \times 0, 016 \checkmark = 0, 00488 \text{ mol.}$$

#### Number of moles of H<sup>+</sup> in 20 ml of acidic solution.

$$\text{Ratio OH}^-:\text{H}^+ = 1:1$$

$$n_{(\text{H}^+)} = n_{(\text{OH}^-)} = 0, 00488 \text{ mol. } \checkmark$$

#### Number of moles of H<sup>+</sup> in 500 ml

$$n(\text{H}^+) = 0, 00488 \times 25 \checkmark = 0, 122 \text{ mol.}$$

#### Number of moles of H<sub>2</sub>SO<sub>4</sub> in 500 ml.

$$n = c.v = 0, 12 \times 0, 3 \checkmark = 0, 036 \text{ mol.}$$

#### Number of moles of H<sup>+</sup> in 0, 036 mol of H<sub>2</sub>SO<sub>4</sub> present in 500 ml.

$$\text{Ratio H}^+:\text{H}_2\text{SO}_4 = 2:1$$

$$n(\text{H}^+) = 2 \times n(\text{H}_2\text{SO}_4) = 2 \times 0, 036 \checkmark = 0, 072 \text{ mol.}$$

#### Number of moles of H<sup>+</sup> of HCl in 500 ml.

$$n_{(\text{H}^+)} = n_{(\text{total H}^+)} - n_{(\text{H}^+ \text{ of H}_2\text{SO}_4)} = 0, 122 - 0, 072 \checkmark = 0, 05 \text{ mol.}$$

#### Number of moles of HCl in 500 ml.

$$\text{Ratio HCl}:\text{H}^+ = 1:1$$

$$n(\text{HCl}) = n(\text{H}^+) = 0, 05 \text{ mol. } \checkmark$$

#### Concentration of HCl in 200 ml.

$$c = \frac{n}{V} \checkmark = \frac{0, 05}{0, 2} \checkmark$$

$$c = 0, 25 \text{ mol.dm}^{-3}. \checkmark$$

(10)

[25]

TOTAL 150

