LIMPOPO

PROVINCIAL GOVERNMENT

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF EDUCATION

NATIONAL
SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES (PHYSICS)
PAPER 2: MAY - JUNE 2025
MEMO

MARKS: 150

TIME: 3 Hours

This Marking Guidelines consist of 8 pages including the cover page

QUESTION 1

1.1	A✓✓	(2)
1.2	C✓✓	(2)
1.3	C✓✓	(2)
1.4	C✓✓	(2)
1.5	B✓✓	(2)
1.6	B✓✓	(2)
1.7	C✓✓	(2)
1.8	C✓✓	(2)
1.9	A✓✓	(2)
1.10	B✓✓	(2)
		[20]

QUESTION 2

2.1

2.1.1	F✓	(1)
2.1.2	C✓	(1)
2.1.3	A✓	(1)
2.1.4	F✓	(1)
2.1.5	A✓ and H✓	(2)
2.1.6	G✓	(1)
2.1.7	E✓	(1)

2.2

2.2.1 2-methyl✓butane✓ (2)

2.2.2 methyl✓propan-2-ol✓✓ (3)

Notes:

1. Methyl identified✓
2. Propanol✓
3. Whole structure correct✓

2.2.3 2-bromo✓butanal✓ (2)

2.2.4 3,3-dimethyl✓pent-1-yne✓✓

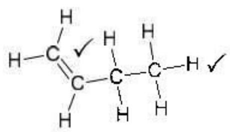
Notes:

1. dimethyl identified✓
2. Pentyne✓
3. Whole structure correct✓

(3)

2.3

2.3.1

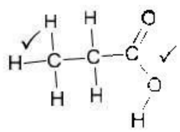


Notes:

1. Correct functional group✓
2. Whole structure correct✓

(2)

2.3.2



Notes:

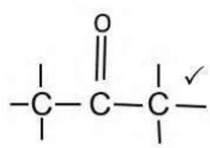
1. Correct functional group✓
2. Whole structure correct✓

(2)

2.4

2.4.1 $C_3H_6O_2$✓ (1)

2.4.2



(1)

2.4.3 CH_3COOH✓✓/(Accept: CH_3 - COOH) (2)

2.4.4 Methanol✓ (1)

2.4.5 Formyl✓ (group)/Accept: carbonyl (1)

2.4.6 Alkyne✓ (1)

[29]

QUESTION 3

3.1

3.1.1 The temperature at which the vapour pressure is equal to the atmospheric pressure.✓✓ (2 or 0) (2)

3.1.2 Thermometer✓/Accept: Bunsen burner/heat source/flame (1)

3.2

3.2.1 Molar mass✓/molecular size/chain length/number of C atoms/surface area (1)

3.2.2 Boiling point✓ (1)

3.2.3 Relationship between dependant and independent variables:

As molar mass/molecular size/chain length increases✓ the boiling point also increases. ✓

OR

As molar mass/molecular size/chain length decreases✓ the boiling point also decreases. ✓

(**DIRECTLY PROPORTIONAL NOT ACCEPTED**) (2)

3.3 London forces✓✓ (2)

3.4 E✓ (1)

3.5 E has a smaller surface area/shorter chain length/more spherical✓ than D therefore the intermolecular forces in E are weaker✓ and need less energy to overcome than those in D. ✓ (3)

[13]

QUESTION 4

4.1 Secondary.✓The carbon atom bonded to the halogen/chlorine, is bonded to two other carbon atoms.✓✓ (3)

4.2 Substitution/hydrolysis ✓✓ (2)

4.3 $CH_3CH(OH)CH_2CH_3$✓ → $CH_3CHCHCH_3$ + H_2O✓ (✓ balancing) (3)

4.4 Dilute strong base/Dilute NaOH✓✓/Excess water/moderate heat/ethanol as solvent (2)

4.5 Sulphuric acid✓

H_2SO_4✓ (2)

4.6 Hydrohalogenation/hydrochlorination✓ (1)

[13]

QUESTION 5

5.1 Reactant that is totally consumed when a chemical reaction is completed.✓✓ (2 or 0) (2)

5.2 $CaCO_3$ is the limiting reagent✓ (1)

5.3 $n_{(CaCO_3)} = \frac{m}{M}$✓

$= \frac{0,4}{100}$✓

$= 0,004 mol$✓ (3)

5.4 $\mathbf{0,004 mol}$✓ (1)

5.5

$Rate = \frac{n}{\Delta t}$✓

$= \frac{0,004}{10}$✓

$= 0,0004 mol/s$✓

(3)

5.6 $n_{(CO_2)} formed = n_{(CaCO_3)} reacted = 0,004 mol$✓

$n = \frac{V}{V_m}$✓

$0,004 = \frac{V}{22,4}$✓

$V = 0,896 dm^3$✓

REMOVE the question for all schools due to late errata not received by all in time

(0)

5.7 When concentration is increased, there are more reactant particles✓ in the same volume, the number of effective collisions per unit time increase,✓✓ increase in the rate of reaction. (3)

5.8 Decreases.✓When granules are used, the surface area decreases✓ and therefore the number of effective collisions per unit time decreases.✓ (3)

5.9 The reaction is complete/$CaCO_3$ has been used up.✓ (1)

5.10

5.10.1 C✓ (1)

5.10.2 D✓ (1)

5.10.3 The average kinetic energy is the same✓ as for graph A showing that the temperature is the same. The area under the graph D is double/larger✓ showing that the quantity of nitrogen gas is larger. ✓ (3)

[26]
- 4

QUESTION 6

6.1

OPTION 1	$2SO_2$	O_2	$2SO_3$	
Initial amount(mol)	x	1,25✓	0	✓(ratio)
Change	1,0	0,5	1,0	
Equilibrium amount	x - 1,0	0,75	1,0	✓
Equilibrium conc.	$\frac{x-1,0}{0,5}$	1,5	2	✓(÷ 0,5)

OPTION 2

	$2SO_2$	O_2	$2SO_3$	
Initial amount(mol)	$\frac{x}{0,5}$	2,5✓	0	✓(÷ 0,5)
Change	-2	-1	+2	✓(ratio)
Equilibrium amount	$\frac{x}{0,5}-2$	1,5	2	✓

$K_c = \frac{[SO_3]^2}{[SO_2]^2[O_2]}$✓

$42,67$✓ $= \frac{(2)^2}{\left(\frac{x-1,0}{0,5}\right)^2(1,5)}$✓

$x = 1,125(\text{mol})$✓ (8)

6.2

6.2.1 Concentration of O_2 increased.✓✓ (2)

6.2.2 Pressure was increased.✓✓ (2)

6.2.3 Increase in pressure favours the reaction that produces less number of moles.✓ The forward reaction was favoured.✓ As the concentrations of the reactants decrease,✓ the concentration of the products increases.✓

(4)

6.3

6.3.1 System that is isolated from its surroundings.✓✓/ A system that does not constantly interact with the environment / A system that does not exchange energy and matter with the environment (2)

6.3.2 Turns yellow.✓ (1)

6.3.3 Sodium hydroxide reacts with H^+ and reduces their concentration.✓ The forward reaction is favoured.✓ The concentration of chromate ions increases.✓/the product/H^+ increases (3)

[22]

QUESTION 7

7.1 An acid is a proton (H^+ ion) donor.✓✓ (2)

7.2

7.2.1 $HC\ell$ and $C\ell^-$✓

H_3O^+ and H_2O ✓ (2)

7.2.2 Substance that can either act as acid or base.✓✓ (2)

7.2.3 H_2O✓ (1)

7.2.4 H_3O^+✓ (1)

7.2.5 **OPTION 1**

$C = \frac{m}{MV}$✓

$= \frac{3,65}{(36,5)(0,2)}$✓

$= \mathbf{0,5\ mol.dm^{-3}}$✓

OPTION 2

$n = \frac{3.65}{36.5}$

$= 0.1$ mol

$c = \frac{n}{v}$

$= \frac{0.1}{0.2}$ (3)

$= 0.5\ mol.dm^{-3}$

7.2.6 $p^H = -\log[H_3O^+]$ ✓
$= -\log(0,5)$ ✓
$= 0,3$ ✓

Remove Question 7.2.6 due to late errata not received in time by all schools

(0)

7.3

7.3.1 **NaOH + HNO_3✓ → $NaNO_3$ + H_2O✓✓ (reactants, products, balancing)** (3)

7.3.2 Number of moles of $MgCO_3$

Remove Question 7.3.2 due to typing error in the information on the Question paper

$n = \frac{m}{M}$
$= \frac{1,68}{84}$✓
$= 0,02mol$
Number of moles of HNO_3 which reacted with $MgCO_3$
$n = 2(0,02)$✓
$= 0,04mol$
Let the initial concentration of the acid be x
$c = \frac{n}{V}$✓
$x = \frac{n}{0,039}$✓
$\therefore n = 0,039x$
$n(HNO)_3\ in\ 12cm^3 = 0,012x$✓
Ratio HNO_3:NaOH = 1 : 1
$\therefore n(NaOH)\ in\ 15cm^3 = 0,012x$✓
$[NaOH] = \frac{0,012x}{0,015}$✓
$= 0,8x$
$n(NaOH)\ in\ 25cm^3 = cV$
$= (0,8x)(0,025)$✓
$= 0,02x$
$n(HNO_3)\ in\ excess = 0,02x$
Number of moles of HNO_3 which reacted with $MgCO_3$
$n(MgCO_3) = 0,039x - 0,02x$✓
$= 0,019x$
$0,019x = 0,04$
$x = 2,11$
$[HNO_3] = 2,11moldm^{-3}$✓

(0)

[27]
– 13

GRAND TOTAL = [150] – [17] = [133].

REWORK THE RAW TOTAL OF 133 BACK TO 150 using the formula

$$\frac{mark\ obtained}{133} \times 150$$