KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

PHYSICAL SCIENCES P2 (CHEMISTRY)

FINAL EXAMINATION

NOVEMBER 2025

Stanmorephysics.com

GRADE 11

These marking guidelines consist of 10 pages.

Copyright reserved/*Kopiereg voorbehou*

QUESTION 1

1.1 C ✓✓ (2)

1.2 D ✓✓ (2)

1.3 D ✓✓ (2)

1.4 C ✓✓ (2)

1.5 B ✓✓ (2)

1.6 D ✓✓ (2)

1.7 C ✓✓ (2)

1.8 A ✓✓ (2)

1.9 D ✓✓ (2)

1.10 A ✓✓ (2)

[2 x 10 = 20]



Copyright reserved

QUESTION 2

2.1. The force of attraction between oppositely charged ions,✓ formed as a result of the transfer of electrons.✓ (2)

2.2 ΔEN = 3.5 – 1 = 2.5 } Any one ✓
ΔEN > 2.1 ✓ (2)

2.3 lithium nitrate ✓ (1)

2.4.1 2 ✓ (Accept: -2) (1)

2.4.2 

Marking criteria/*Nasienriglyne*
✓ Correct number of electrons surrounding each atom.
✓ Single bond between O and each of the two H atoms.
✓ Whole structure correct (3)

2.4.3 Bent / Angular ✓ (1)

2.4.4 hydronium ✓ (1)

2.5 Increases. ✓ There is a (net) release of energy / the reaction is exothermic. ✓ (2)

2.6 The average distance between the nuclei of two bonded atoms. ✓✓ (2 or 0) (2)

2.7.1 (b) ✓
Nitrogen atoms are larger than hydrogen atoms. ✓
The nuclei will be further apart. ✓ (3)

2.7.2 (c) ✓
The bond length in (c) is shorter OR there is a stronger force of attraction wih the double bond ✓ (2)

[20]

Copyright reserved

QUESTION 3

3.1 The minimum energy needed for a reaction to take place. ✓✓ (2)

3.2.1 $E_{absorbed}$ = (4 x C–H) + (2 x O = O)
= (4 x 413) ✓+ (2 x 498) ✓
= 2648 kJ·mol^{-1} ✓
(3)

3.2.2 **POSITIVE MARKING FROM Q3.2.1:**

$E_{released}$ = (2 x C = O) + (4 x O – H)
= (2 x 804) ✓+ (4 x 463) ✓
= 3460 kJ·mol^{-1}

$\Delta H = \sum E_{absorbed} - \sum E_{released}$ (4)
= 2648 – 3460 ✓
= –812 kJ·mol^{-1} ✓

3.3 REMAINS THE SAME ✓
A catalyst has no effect on energy of reactants or products✓ OR A catalyst only affects activation energy. (2)

3.4.1 Net release. ✓ (1)

3.4.2 **POSITIVE MARKING FROM Q3.2.2**

$n = \frac{m}{M}$

$= \frac{24}{16}$ ✓

= 1,5 mol

Energy released = 1,5 x 812 kJ ✓ = 1218 kJ ✓ (3)

3.4.3 **POSITIVE MARKING FROM Q3.4.2**

n_{O2} that reacted = 2 x n_{CH4} that reacted = 2 x 1,5 = 3 mol✓

n_{CO2} that formed = 1 x n_{CH4} that reacted = 1 x 1,5 = 1,5 mol✓

n_{H2O} that formed = 2 x n_{CH4} that reacted = 2 x 1,5 = 3 mol✓

n_{O2} in excess = 5,5 – (1,5 + 3) = 1 mol✓

Initial n_{O2} = 3 + 1 = 4 mol✓ (5)
[20]

Copyright reserved

QUESTION 4

4.1 The temperature at which the vapour pressure of a liquid equals atmospheric pressure. ✓✓ (2)

4.2.1 80 kPa ✓ (1)

4.2.2 60°C ✓ [Accept answers between 60°C and 62°C] (1)

4.2.3 Gas ✓ (1)

4.2.4 75°C✓✓ (2)

4.3 H_2O has a higher boiling point than CCl_4✓
Intermolecular forces between H_2O molecules is hydrogen bonding, while intermolecular forces between CCl_4 molecules is London/Dispersion forces.✓
Intermolecular forces in H_2O are stronger / Intermolecular forces in CCl_4 are weaker. ✓
More energy is required to overcome the intermolecular forces in H_2O. ✓ (4)

4.4 No. ✓
OPTION 1: CCl_4 molecules are polar ✓while H_2O molecules are non-polar✓

OPTION 2: the imtermolecular forces in H_2O are stronger than in CCl_4 ✓ so they are not of comparable strength. ✓ (3)
[14]

Stanmorephysics.com

QUESTION 5

5.1. **Marking guidelines**
If any of the underlined key words/phrases are omitted: minus 1 mark.

Boyle's Law ✓
Pressure of an enclosed gas is inversely proportional to the volume it occupies at constant temperature. ✓✓ (3)

5.2 **OPTION 1**:

$$V = \frac{1}{5,5 \times 10^{-3}} \checkmark$$

$$p_1V_1 = p_2V_2 \checkmark$$

$$(115,5)(181,82) = (101,3)V_2 \checkmark$$

$$V_2 = 207,31\ dm^3 \checkmark$$

OPTION 2:

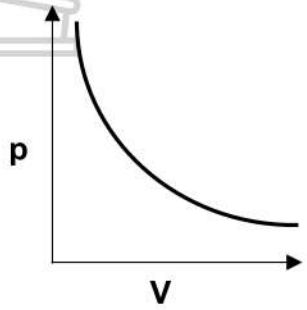
$$\frac{115 - 101,3 \checkmark}{5,5 - \frac{1}{V} \checkmark} = \frac{115}{5,5} \checkmark$$

$V = 207,45\ dm^3$✓ (4)

Copyright reserved

5.3 High✓
The volume of the gas particles is no longer negligible ✓ **OR** Intermolecular forces become significant.
Increasing the pressure does not decrease the volume as predicted by Boyle's Law✓ (3)

5.4



Marking criteria
Correct shape (hyperbola) ✓✓

(2)

5.5 A ✓
The gradient is proportional to the number of moles.
A has a larger gradient, ✓ and hence a larger number of moles of gas✓. (3)
[15]

QUESTION 6

6.1.1 The smallest whole number ratio of elements in a compound. ✓✓ (2 OR 0) (2)

6.1.2 Mass of C = $\frac{12}{44}$ x 1,74 ✓ = 0,475 g

Mass of H = $\frac{2}{18}$ x 0,70 ✓ = 0,078 g

Mass of O = 1,5 – (0,475 + 0,078) ✓ = 0,947 g

C:	H:	O:
$n = \frac{m}{M}$	$n = \frac{m}{M}$	$n = \frac{m}{M}$
$= \frac{0,475}{12}$ ✓	$= \frac{0,078}{1}$ ✓	$= \frac{0,947}{16}$ ✓
= 0,04	= 0,078	= 0,059

C : H : O
0,04 : 0,078 : 0.059
2 : 4 : 3

Molecular formula: $C_2H_4O_3$ ✓ (7)

6.1.3 $(C_2H_4O_3)_3$✓
Molecular formula is $C_6H_{12}O_9$ ✓ (2)

Copyright reserved

6.2.1 +3 ✓ (1)

6.2.2 Mass of $Fe_2O_3 = \frac{30}{100} \times 150$ ✓

$= 45g$

Mass of Fe $= \frac{112}{160}$ ✓ x 45 ✓

$= 31,5$ g ✓ (4)

6.3.1 Limiting reagent is the reactant that is used up completely in a reaction. ✓✓
OR Limiting reagent determines the maximum amount of product formed in a reaction. (2)

6.3.2 H_2SO_4 ✓
Lithium was left over after the reaction OR All the H_2SO_4 was used up during the reaction. ✓ (2)

6.3.3

Marking criteria:

(a) Use of formula $c = \frac{n}{V}$ ✓
(b) Substitution into formula $c = \frac{n}{V}$ to calculate no fo mol of H_2SO_4 ✓
(c) Apply ratio (2:1) to calculate no of mol of Li used. ✓
(d) Substitution into formula $n = \frac{m}{M}$ to calculate mass of Li used / initial mass of Li. ✓
(e) Addition of mass of Li used to final mass of Li OR Addition of moles of Li used to final moles of Li. ✓✓
(f) Final answer. ✓

$c = \frac{n}{V}$ ✓(a)

$0,43 = \frac{n}{1,51}$ ✓(b)

$n_{H2SO4} = 0,65$ mol H_2SO_4

n_{Li} used = 2 x n_{H2SO4} used
= 2 x 0,65 ✓(c)
= 1,3 mol

$n = \frac{m}{M}$	$n = \frac{m}{M}$
$1,3 = \frac{m}{7}$ ✓(d)	$n = \frac{1,24}{7}$
m = 9,1 g Li used	m = 0,18 mol Li used
Initial mass of Li = 9,1 + 1,24 ✓✓(e)	Initial moles of Li = 0,18 + 1,3 ✓✓(e)
Y = 10,34 g ✓(f)	= 1,48 mol
	$n = \frac{m}{M}$
	$1,48 = \frac{m}{7}$ ✓(d)
	Y = m = 10,33 g ✓(f)

(7)
[27]

Stanmorephysics.com

Copyright reserved

QUESTION 7

7.1.1 An acid is a substance that produces hydrogen ions (H+)/hydronium ions (H_3O^+) when it dissolves in water. ✓✓ (2)

7.1.2 CH_3COOH ✓ and H_3O^+ ✓ (2)

7.1.2 Weak acid. ✓ It ionises incompletely/partially in water to form a low concentration of H_3O^+ ions. ✓ (2)

7.2.1

OPTION 1

$$\frac{C_BV_B}{C_AV_A} = \frac{n_B}{n_A} \checkmark$$

$$\frac{C_B(24,5)\checkmark}{(0,15)(31,3)\checkmark} = \frac{1}{2} \checkmark$$

$$C_B = 0,1 \text{ mol·dm}^{-3} \checkmark$$

OPTION 2

$$C = \frac{n}{V} \checkmark$$

$$0,15 = \frac{n}{0,0313} \checkmark$$

$$n = 4,7 \times 10^{-3} \text{ mol } HNO_3$$

$$HNO_3 : Ca(OH)_2$$

$$2 : 1 \checkmark$$

$$4,7 \times 10^{-3} : 2,35 \times 10^{-3} \text{ mol } Ca(OH)_2$$

$$C = \frac{n}{V}$$

$$C = \frac{2,35 \times 10^{-3}}{0,0313} \checkmark$$

$$C = 0,1 \text{ mol·dm}^{-3} \checkmark$$

(5)

Stanmorephysics.com

Copyright reserved

7.2.2

Marking criteria:
(a) Substitution into formula n = cV to calculate initial concentration of HNO_3.
(b) Substitution of pH value (2,174) in pH formula.
(c) Substitution into formula n = cV to calculate final concentration of H_3O^+.
(d) Apply ratio $n_{final}(H_3O^+)$: $n_{final}(HNO_3)$ =1:1 to calculate final moles of HNO_3.
(e) Subtraction: $n_{reacted}$ (HNO_3) = n_{final} (HNO_3) - $n_{rnitial}$ (HNO_3).
(f) Apply ratio $n_{reacted}$ (Zn) = ½ $n_{reacted}$ (HNO_3) to calculate $n_{reacted}$ (Zn).
(g) Substitute in formula m = nM to calculate mass of Zn that reactd.
(h) Final answer.

$n_{initial}(HNO_3) = cV$

$= \underline{0,15 \times 0,25}$ ✓(a) = 0,0375 mol

$pH = -\log[H_3O^+]$

$\underline{2,174 = -\log[H_3O^+]}$ ✓(b)

$[H_3O^+] = 6,7 \times 10^{-3}$ mol·dm^{-3}

$n_{final}(H_3O^+) = cV$

$= \underline{6,7 \times 10^{-3} \times 0,25}$ ✓(c) $= 1,675 \times 10^{-3}$ mol

$n_{final}(HNO_3) = 1,675 \times 10^{-3}$ mol ✓(d)

$n_{reacted}(HNO_3) = \underline{0,0375 - 1,675 \times 10^{-3}}$ ✓(e)

$= 0,0358$ mol

$n_{reacted}$ (Zn) = ½ (0,0358) ✓(f)

$= 0,018$ mol

$m = nM$

$= \underline{0,018 \times 65}$ ✓(g)

$= 1,16$ g ✓(h)

(8)

7.2.3

$n_{produced}$ (H_2) = ½ $n_{reacted}$ (HNO_3) OR 1 x $n_{reacted}$ (Zn)

= ½ (0,0358) ✓ OR 1(0,018)

= 0,018 mol

$V = nV_m$

= 0,018 x 24 000 ✓

= 429,6 cm^3 ✓ (0,4296 dm^3)

(3)
[22]

Copyright reserved

QUESTION 8

8.1.1 A reaction in which <u>electrons are transferred</u>. ✓✓ (2)

8.1.2 Al ✓ (1)

8.1.3 NO_3^- ions do not undergo oxidation nor reduction ✓
OR
The oxidation numbers stay the same. (1)

8.1.4 The net charge on the left-hand side / for the reactants is not equal to the net charge on the right-hand side / for the products. ✓✓ (2)

8.2.1 +6 ✓ (1)

8.2.2 $Cr_2O_7^{2-} + 14H^+ + 6e^- \checkmark \rightarrow 2Cr^{3+} + 7H_2O$ ✓ (2)

8.2.3 $3Sn^{2+} \rightarrow 3Sn^{4+} + 6e^-$
$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$
$\underline{Cr_2O_7^{2-} + 14H^+ + 3Sn^{2+}} \checkmark \rightarrow \underline{2Cr^{3+} + 3Sn^{4+} + 7H_2O}$ ✓ Balancing✓
(3)
[12]

TOTAL:150

Stanmorephysics.com

Copyright reserved