MARKING GUIDELINES

EXAMINATION	NATIONAL SENIOR CERTIFICATE
GRADE	12
DATE	MAY/JUNE 2025
SUBJECT	PHYSICAL SCIENCES
PAPER	2
MARK TOTAL	150
DURATION (HOURS)	3
NUMBER OF PAGES	13

SOUTH AFRICAN COMPREHENSIVE ASSESSMENT INSTITUTE

SUID-AFRIKAANSE KOMPREHENSIEWE ASSESSERINGSINSTITUUT

FINAL APPROVED MARKING GUIDELINES	
DATE OF MEETING	
UMALUSI MODERATOR	
CHIEF MARKER	
INTERNAL MODERATOR	

QUESTION 1

1.1 B ✓✓ (2)

1.2 C ✓✓ (2)

1.3 A ✓✓ (2)

1.4 B ✓✓ (2)

1.5 D ✓✓ (2)

1.6 D ✓✓ (2)

1.7 B ✓✓ (2)

1.8 D ✓✓ (2)

1.9 B ✓✓ (2)

1.10 A ✓✓ (2)

[20]

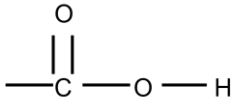
QUESTION 2

2.1 A bond or an atom or a group of atoms ✓that determine(s) the physical and chemical properties of a group of organic compounds. ✓ (2)

2.2

2.2.1 Double bond ✓ (1)

2.2.2



✓ (1)

2.3 A series of organic compounds ✓ that can be described by the same general formula ✓

OR

A series of organic compounds ✓in which one member differs from the next with a CH_2 group. ✓ (2)

2.4

2.4.1 Alkanes ✓ (1)

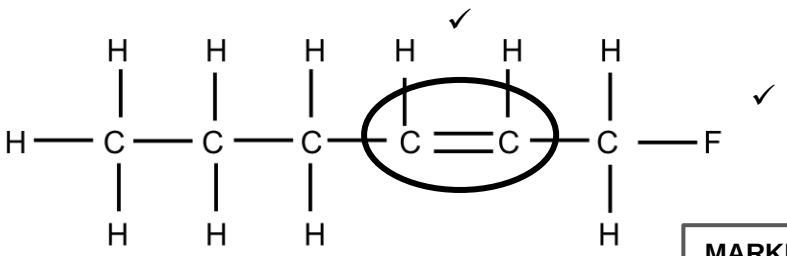
2.4.2 **2** C_8H_{18} + **25** O_2 ✓→ **16** CO_2 + **18** H_2O ✓✓

MARKING GUIDELINES:
✓Reactants
✓Products
✓Balancing

(3)

2.5

2.5.1



✓ ✓

MARKING GUIDELINES:
✓Functional group
✓Correct structure

(2)

2.5.2 1-fluoro✓hex-2✓- ene✓

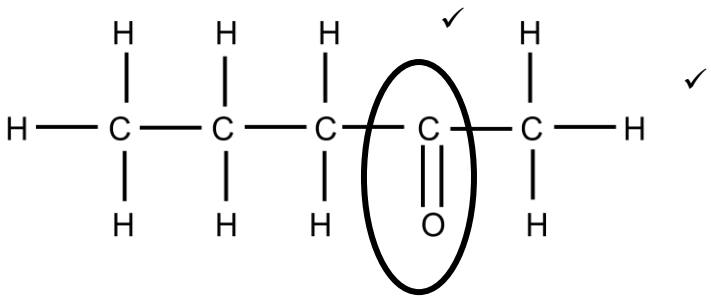
MARKING GUIDELINES:
✓1-fluoro
✓hex-2-
✓ene

(3)

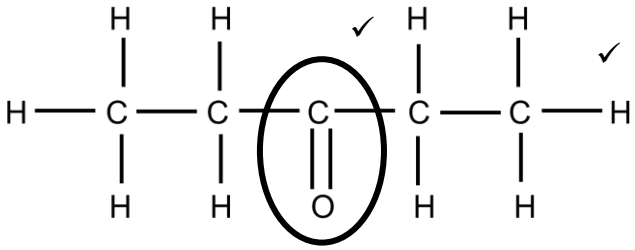
2.6

2.6.1 Butane ✓✓ (2)

2.6.2



OR



MARKING GUIDELINES:
✓Functional group
✓Correct structure

(2)

2.6.3 Pentan-2-one ✓✓

OR

Pentan-3-one ✓✓ (2)

[21]

QUESTION 3

3.1 The pressure exerted by a vapour at equilibrium ✓ with its liquid in a closed system. ✓ (2)

3.2 A ✓ (1)

3.3

3.3.1 Dipole-dipole forces ✓ (1)

3.3.2
- Compound A is a carboxylic acid and has hydrogen bonds✓ between its molecules.
- Compound D is an ester and has dipole-dipole forces ✓ between its molecules.
- Hydrogen bonds are stronger ✓than dipole-dipole forces.
- More energy needed to overcome the intermolecular forces ✓in compound A. (4)

3.4 B ✓ (1)

3.5
- Both **B** and **F** (are alkanes and) possess London forces ✓
- **F** is a longer chain / less branched therefore stronger forces than B ✓
- More energy needed to overcome the intermolecular forces in F than in B✓ (3)

[12]

QUESTION 4

4.1

4.1.1 Dehydrohalogenation/Elimination ✓ (1)

4.1.2 Heat ✓
Concentrated NaOH/KOH in ethanol ✓ (2)

4.2

4.2.1 Pent-1-ene ✓✓ (2)

4.2.2 $CH_3(CH_2)_2CHCH_2$ ✓+ H_2 ✓→ $CH_3(CH_2)_3CH_3$ ✓

$CH_3CH_2CH_2CHCH_2$ ✓ + H_2 ✓→$CH_3CH_2CH_2CH_2CH_3$ ✓

MARKING GUIDELINES:
✓✓Reactants
✓ Product

(3)

4.3 Substitution/Hydrolysis ✓ (1)

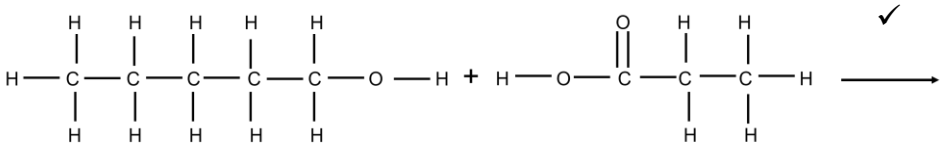
4.4 Addition/Hydration ✓ (1)

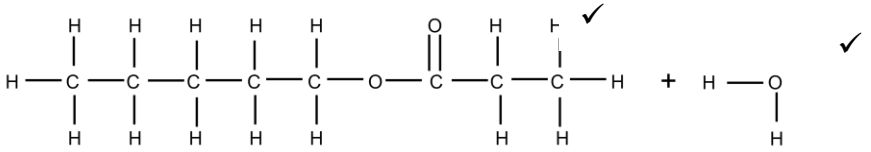
4.5

4.5.1 Sulphuric acid✓ (1)

4.5.2 Dehydrating agent✓
Catalyst ✓ (2)

4.5.3





MARKING GUIDELINES:
✓ Reactants
✓✓Both products

(3)

4.5.4 Pentyl propanoate ✓✓ (2)

[18]

QUESTION 5

5.1 The change in concentration of reactants or products ✓per unit time. ✓ (2)

5.2 Average reaction rate $= -\frac{\Delta c}{\Delta t}$ ✓

$= \frac{1,45-1,9}{15-0}$ ✓

= (-) 0,03 mol·dm^{-3}·min^{-1} ✓ (3)

MARKING GUIDELINES:
✓Formula
✓Substitution
✓Answer in unit

5.3
- [HCℓ] decreases. ✓
- Fewer particles per unit volume. ✓
- Fewer collisions per unit time.
- Fewer effective collisions per unit time. ✓
- *Fewer effective collisions per unit time* $E_k > E_A$.
- Slower/lower rate of reaction. (3)

5.4 Amount of HCℓ used = 1,9 – 0,6 ✓

= 1,3 mol·dm^{-3}

n(HCℓ) = c.V ✓

= (1,3)(0,06) ✓

= 0,078 mol

m = n.M

= 0,078 x 50,5 ✓

= 3,94 g ✓ (5)

MARKING GUIDELINES:
✓Subtracting to calculate c *HCℓ used up*
✓Formula
✓Substitution
✓Substitution
✓Answer with unit

5.5

5.5.1 Steeper ✓✓ (2)

5.5.2 Less steep ✓✓ (2)

[17]

QUESTION 6

6.1

6.1.1 The rate of the forward reaction equals ✓the rate of the reverse reaction. ✓ (2)

6.1.2 Solution turned blue ✓ (1)

6.1.3
- Adding HCℓ increases the $C\ell^-$ ion concentration.
- Reverse reaction is favoured to use up the $C\ell^-$ ions.✓
- Rate of the reverse reaction is greater than the rate of the forward reaction.✓ (2)

6.1.4 Negative ✓ (1)

6.1.5 According to Le Chatelier's Principle, when temperature is decreased, the exothermic reaction is favoured ✓
Colour changes to pink shows that forward reaction is favoured ✓
Therefore, forward reaction is exothermic ✓
ΔH for exothermic reaction is NEGATIVE (3)

6.2. **OPTION 1:**

	NO	**O_2**	**NO_2**
Initial moles (mol)	3,375	2,063	0
Change in moles (mol)	-1,125	-0,5625	+1,125 ✓ratio
Moles at equilibrium (mol)	2,25	1,5	1,125 ✓
Concentration ($mol.dm^{-3}$)	3	2	1,5

$Kc = \frac{[NO2]2}{[NO]2.[O2]}$

$0,125 = \frac{(1,5)2}{(3)2.[O2]}$ ✓

$[O_2] = 2\ mol.dm^{-3}$

O_2 : O-atoms
1 : 2
2,063 : 4,126] ✓

$N = n.N_A$ ✓
$= 4,126 \times 6,02 \times 10^{23}$ ✓
$= 2,483 \times 10^{24}$ O-atoms ✓

MARKING GUIDELINES:
✓n of NO_2 and n O_2 at equilibrium
✓Change in n (use of ratio)
✓Substitution in Kc expression
✓Use of ratio – O_2 : O-atoms
✓Formula: $N = n.N_A$
✓Substitution
✓Answer

OPTION 2:

	NO	O_2	NO_2
Initial moles (mol)	3,375	x	0
Change in moles (mol)	-1,125	-0,5625	+1,125 ✓ratio
Moles at equilibrium (mol)	2,25	x - 0,5625	1,125 ✓
Concentration ($mol.dm^{-3}$)	3	$\frac{(x - 0,5625)}{0,75}$	1,5

$$K_c = \frac{[NO2]2}{[NO]2.[O2]}$$

$$0,125 = \frac{(1,5)^2}{(3)^2.[O2]} \checkmark$$

$$\frac{(x - 0,5625)}{0,75} = 2 \text{ mol·dm}^{-3}$$

$$x = 2,063 \text{ mol}$$

O_2 : O-atoms
1 : 2
2,063 : 4,126 ✓

$N = n.N_A$ ✓
$= 4,126 \times 6,02 \times 10^{23}$ ✓
$= 2,483 \times 10^{24}$ O-atoms ✓

MARKING GUIDELINES:
✓n of NO_2 and n O_2 at equilibrium
✓Change in n (use of ratio)
✓Substitution in Kc expression
✓Use of ratio – O_2 : O-atoms
✓Formula: $N = n.N_A$
✓Substitution
✓Answer

(7)

[16]

QUESTION 7

7.1

7.1.1 A substance that can act as either an acid or a base ✓✓ (2)

7.1.2 HSO_4^- ✓and H_2O ✓ (2)

7.1.3 That it is a weak acid,✓ it ionises incompletely/partially in water. ✓ (2)

7.1.4 $[H_3O^+][OH^-] = 1 \times 10^{-14}$ ✓

$[OH^-] = \frac{1 \times 10-14}{1,8 \times 10-4}$ ✓

$= 5,56 \times 10^{-11}$ mol·dm^{-3}✓

MARKING GUIDELINES:
✓Formula
✓Substitution
✓Answer with unit

(3)

7.2

7.2.1 $n_{(HF)} = c.V$

$= (0,5)(0,025)$ ✓

$= 0,0125$ mol ✓

MARKING GUIDELINES:
✓Substitution
✓Answer with unit

(2)

7.2.2 **OPTION 1:**

HF : NaOH
1 : 1] ✓

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

$= \frac{0,0125}{0,083}$ ✓

$= 0,15$ mol·dm^{-3}✓

MARKING GUIDELINES:
✓Use of ratio
✓Substitution
✓Answer with unit

OPTION 2:

$\frac{ca.Va}{cb.Vb} = \frac{na}{nb}$✓

$\frac{(0,5)(0,025)}{cb.(0,083)} = \frac{1}{1}$✓

$c_b = 0,15$ mol·dm^{-3}✓

MARKING GUIDELINES:
✓Formula
✓Substitution
✓Answer with unit

(3)

7.2.3
- F^- is a strong conjugate base of a weak acid, HF. F^- hydrolyses in water.
- $F^- + H_2O \rightarrow HF + OH^-$ ✓✓
- Excess OH^- ions in solution ✓Basic salt

(3)

7.3 **Using PURE reactant**:

CaF_2 : HF

1 : 2
0,28 : 0,56] ✓

% purity = $\frac{0,28}{0,32}$ x 100✓✓

= 87,5%✓

OR

Using PURE product:

CaF_2 : HF

1 : 2
0,32 : 0,64] ✓

% purity = $\frac{0,56}{0,64}$ x 100✓✓

= 87,5%✓

MARKING GUIDELINES:
✓Use of ratio
✓✓Substitution
✓Answer with unit

(4)

[21]

QUESTION 8

8.1 A : $C\ell_2$ ✓

B : $C\ell^-$ ✓

C : Pt ✓ (3)

8.2 Salt bridge✓ (1)

8.3 Chemical ✓energy → electrical ✓energy (1)

8.4 Pt | Fe^{2+} |Fe^{3+} ✓|| $C\ell^-$ | $C\ell_2$ | Pt✓ (2)

8.5 $E^{\theta}_{cell} = E^{\theta}_{cathode} - E^{\theta}_{anode}$ ✓

E_{cell} = 1,36 ✓– 0,77 ✓

E_{anode} = 0,59 V ✓

MARKING GUIDELINES:
Accept any other correct formula from the data sheet. No mark for any other formula using unconventional abbreviations, e.g. $E^{e}_{cell} = E^{e}_{OA} - E^{e}_{RM}$ followed by correct substitutions.

✓Formula
✓✓Correct substitution
✓Answer with unit

(4)

8.6
- [Fe^{3+}] will increase due to a precipitate/solid ✓being formed.
- Forward reaction will be favoured.✓ To increase [Fe^{3+}].
- Emf will increase.✓ (3)

[14]

QUESTION 9

9.1 A substance of which the aqueous solution ✓contains ions ✓

OR

A substance that dissolves in water ✓to give a solution that conducts electricity ✓ (2)

9.2 W ✓ (1)

9.3 $Cu^{2+} + 2e^- \rightarrow Cu$✓✓ (2)

$Cu \rightleftharpoons Cu^{2+} + 2e^-$ (0/2)
$Cu \leftarrow Cu^{2+} + 2e^-$ (2/2)
$Cu^{2+} + 2e^- \leftarrow Cu$ (0/2)
$Cu^{2+} + 2e^- \rightleftharpoons Cu$ (1/2)

9.4 Pt and Ag are both weaker reducing agents ✓than copper. ✓
Copper will therefore be oxidised. ✓

OR

Copper is a stronger reducing agent ✓than both Pt and Ag. ✓
Copper will therefore be oxidised. ✓ (3)

9.5 $I = \frac{Q}{t}$ ✓
$= \frac{54040}{60 \times 60}$ ✓
= 15,01 A ✓ (3)

MARKING GUIDELINES:
✓Formula
✓Substitution
✓Answer with unit.

[11]

GRAND TOTAL: [150]

End of document