

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

PHYSICAL SCIENCES: CHEMISTRY(P2)

PRE-TRIAL EXAMINATION

24 AUGUST 2026

MARKING GUIDELINES

MARKS : 150

These marking guidelines consist of 18 pages.

QUESTION 1

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

QUESTION 2

- 2.1 A compound that contains a double bond/multiple bond/does NOT contain only single bonds (between C atoms). ✓✓ **(2 or 0)** (2)
- 2.2 B / E ✓ (1)
- 2.2.1
- 2.2.2 Carbonyl (group bonded to two C atoms) ✓
- ACCEPT**
 Ketone
- (1)
- 2.2.3 F ✓✓ (2)
- 2.2.4 2,5-dichloro-3-methylhexane

Marking criteria:

- Correct stem i.e. hexane. ✓
- All substituents (dichloro and methyl) correctly identified. ✓
- IUPAC name completely correct including numbering, sequence, hyphens and commas. ✓

(3)

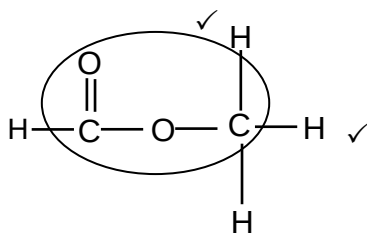
2.2.5 C_nH_{2n} ✓ (1)

2.3 Compounds with the same molecular formula, ✓ but different functional groups/homologous series. ✓ (2)

2.4 Carboxylic acids ✓ (1)

2.4.1

2.4.2



Marking criteria:

•Whole structure correct/ 2/2

•Only functional group correct Max: 1/2

IF

More than one functional group: 0/2

IF

• Molecular formula 0/2

• Condensed structural formula 1/2

(2)

2.5

2.5.1 Ethanol ✓ (1)

2.5.2 E ✓ **ACCEPT:** C_2H_4 (1)

2.5.3 (Concentrated) sulphuric acid/ H_2SO_4 /(concentrated) phosphoric acid/ H_3PO_4 ✓ (1)

[18]

QUESTION 3

3.1

Marking criteria:

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

The temperature at which solid and liquid phases are in equilibrium. ✓✓

(2)

3.2

Marking criteria

- Identification of independent variable. ✓
- Stating the relationship between dependent and independent variable. ✓

- As the chain length/number of C atoms/molecular mass/surface area/strength of the intermolecular forces ✓ increases, the melting points increase. ✓

OR

- As the chain length/ number of C atoms/molecular mass/surface area/strength of the intermolecular forces ✓ decreases, the melting points decrease. ✓

(2)

3.3 London forces ✓

ACCEPT:

Dispersion forces/induced dipole forces

(1)

3.4

3.4.1 Liquid ✓

(1)

3.4.2 Solid ✓

(1)

3.5

3.5.1 Equal to ✓

Same molecular formula/isomers/same number and types of atoms/same number of C and H atoms ✓

(2)

3.5.2 Lower than ✓

(1)

3.5.3

Marking criteria:

- Compare structures. ✓
- Compare the strength of intermolecular forces. ✓
- Compare the energy required to overcome intermolecular forces. ✓

2,2-dimethylbutane:

- **Structure:**
More branched/more compact/more spherical/smaller surface area (over which intermolecular forces act). ✓
- **Intermolecular forces:**
Weaker/less intermolecular forces/Van der Waals forces/London forces/dispersion forces. ✓
- **Energy:**
Lesser energy needed to overcome or break intermolecular forces/Van der Waals forces. ✓

OR

Hexane

- **Structure:**
Longer chain length/unbranched/less compact/less spherical/larger surface area (over which intermolecular forces act). ✓
- **Intermolecular forces:**
Stronger/more intermolecular forces/Van der Waals forces/London forces/dispersion forces. ✓
- **Energy:**
More energy needed to overcome or break intermolecular forces/Van der Waals forces. ✓

(3)

[13]

QUESTION 4

4.1

Marking criteria

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

The chemical process/reaction in which longer chain hydrocarbon/alkane molecules/are broken down to shorter (more useful) molecules. ✓✓

(2)

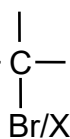
Primary ✓

4.2

The halogen/bromine/functional group (-X) is bonded to a C atom that is bonded to one other C atom. ✓

OR

The functional group ($\begin{array}{c} | \\ -\text{C}- \\ | \\ \text{Br/X} \end{array}$) is bonded to one other C atom.



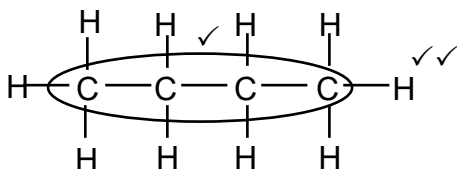
Accept:

The Br/bromine (atom)/X/halogen is bonded to first /last/ terminal C-atom.

(2)

4.3

4.3.1



Marking criteria:

- Correct stem, i.e. 4 C atoms. ✓
 - Whole structural formula correct. ✓
- ✓✓

(3)

POSITIVE MARKING FROM QUESTION 4.3.1

4.3.2

C₈H₁₈ ✓

(1)

4.4

4.4.1

Br₂/Bromine ✓

(1)

4.4.2

Substitution ✓

(1)

4.4.3

UV/(Sun)light/Heat✓

(1)

4.5 Dehydrohalogenation/Dehydrobromination ✓

(1)

4.6

4.6.1

Marking criteria:Reaction IV

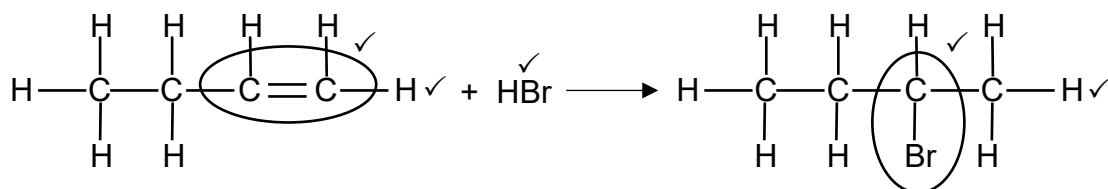
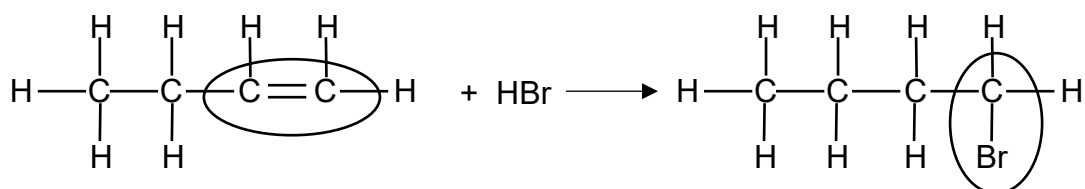
- Functional group of alkene on first C atom. ✓
- Whole structural formula of alkene correct. ✓
- HBr. ✓
- Functional group of haloalkane correct. ✓
- Whole structural formula of haloalkane correct (halogen on second/first C-atom). ✓

IF

- Condensed, semi structural or molecular formula Max: $\frac{1}{5}$
- Marking rule 6.3.10

Note:

For extra product or reactant, deduct 1 mark.

**OR**

(5)

4.6.2

Marking criteria:

- NaOH. ✓
- Whole structural formula of alkene correct (functional group on second/first C atom). ✓
- NaBr + H₂O ✓

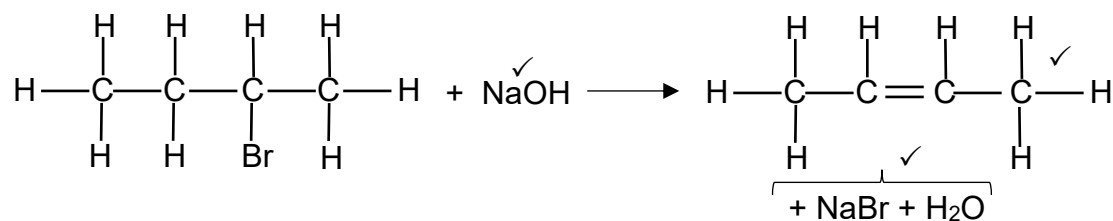
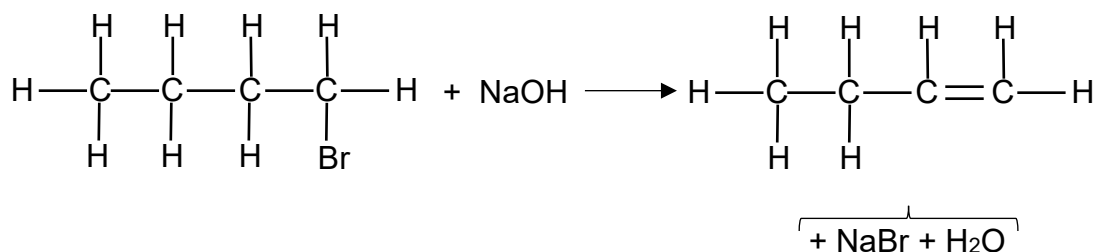
•

IF

- Condensed, semi structural or molecular formula.
- Max: 1/5
- Marking rule 6.3.10

Note:

For extra product or reactant, deduct 1 mark.

**OR**

(3)

4.6.3 But-2-ene/2-butene/but-1-ene/1-butene ✓✓

Butene: deduct 1 mark

(2)

[22]

QUESTION 5

5.1

Marking criteria

If any of the underlined key words/phrases in the **correct context** are omitted: - 1 mark per word/phrase.

ANY ONE

Change in concentration ✓ of reactant or product per (unit) time. ✓

Change in amount/number of moles/volume/mass of products or reactants per (unit) time.

Change in amount/number of moles/volume/mass of products formed or reactants used reactants per (unit) time.

OR/OF

The rate of change in concentration / amount of moles / number of moles / volume / mass. **(2 or 0)** ✓✓ (2)

5.2 Stopwatch ✓/Timer/ Measuring cylinder (1)

5.3 Reaction is exothermic / reaction releases heat ✓ (1)

5.4 SHORTER ✓ (1)

NSC – Marking Guidelines

5.5 For Exp. 2

- Higher concentration results in more particles colliding with correct orientation ✓
- The number of effective collision per unit time increases / frequency of the effective collisions increases ✓

OR / OF

For Exp. 1

- Low concentration results in fewer particles colliding with correct orientation ✓
- The number of effective collision per unit time decreases / frequency of effective collisions decreases ✓ (2)

5.6.1

$$\begin{aligned}
 \text{Rate} &= \frac{\Delta c}{\Delta t} \\
 &= \frac{250-0}{5,28-0} \checkmark \\
 &= 0,95 \checkmark (\text{cm}^3 \cdot \text{min}^{-1})
 \end{aligned}$$

Accept $\frac{250}{5,28}$ (3)

5.6.2 **Marking criteria**

- $V_{\text{CO}_2 \text{ remaining}} = 150 \text{ cm}^3$
- Substitution into $n = V/V_m$
- Subst. into $n = m/M$
- Final answer

$$V(\text{CO}_2) \text{ remaining} = 250 - 100 = 150 \text{ cm}^3 \checkmark \quad n = V/V_m =$$

$$150/25\,000 \checkmark$$

$$\begin{aligned}
 &= 6 \times 10^{-3} \text{ mol} \\
 n(\text{CO}_2) &= m/M \\
 6 \times 10^{-3} &= m / 44 \checkmark \\
 m &= 0,264 \text{ g} \checkmark / 0,26 \text{ g}
 \end{aligned}$$

(4)

NSC – Marking Guidelines

5.7.1 P ✓ (1)

5.7.2 C₂H₄O₂ is a weaker acid ✓ (than HCl) which will result in a LOWER reaction rate ✓ (for Expt. 3) / Lower gradient/Longer reaction time

- - -

OR / OF

HCl is stronger acid ✓ (than C₂H₄O₂) which will result in a HIGHER reaction rate ✓ for Expt. 1/ Higher gradient/Shorter reaction time (2)

5.7.3 EQUAL TO ✓
Final amount of CO₂ is the same ✓ (in both experiments) (2)

[19]

NSC – Marking Guidelines

QUESTION 6

6.1 6.1.1 Concentration of N₂ increases✓ (1)

6.1.2 Pressure increased✓ (1)

6.1.3 Temperature increased✓ (1)

6.2 When equilibrium in a closed system is disturbed, the system will reinstate a new equilibrium by favouring the reaction that will oppose the disturbance. ✓✓ **(2 or 0)** (2)

6.3

6.3.1 Decreases ✓ (1)

6.3.2

- The pressure will decrease. ✓
- The system will favour the reaction that increases the number of gas molecules or number of particles. ✓
- Hence, the reverse reaction will be favoured. ✓

(3)

6.4 **CALCULATION USING NUMBER OF MOLES**

Mark allocation:

- a. Use of $n = \frac{m}{M}$ ✓
- b. n(NH₃) at equilibrium = 1,2 mol ✓
- c. Using ratio n(N₂): n(H₂) : n(NH₃) = 1:3:2 ✓
- d. n(N₂) at equilibrium (initial – change) ✓
- e. n(H₂) at equilibrium (initial – change) ✓
- f. Divide by volume ✓
- g. K_c expression ✓
- h. Substitution into K_c expression ✓
- i. Final answer : 0,25 ✓

$$n(\text{NH}_3) = \frac{m}{M}$$

$$= \frac{20,4}{17} \checkmark \text{ a}$$

$$= 1,2 \text{ mol} \checkmark \text{ b}$$

OR

give two marks in table for 1,2 mol

	N ₂	H ₂	NH ₃	
Molar ratio	1	3	2	
Initial moles	5	5	0	
Change in moles	0,6	1,8	1,2	✓ Ratio c
Equilibrium moles	4,4 ✓ d	3,2 ✓ e	1,2	
Concentration at equilibrium	0,88	0,64	0,24	✓ Divide by 5 f

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3} \checkmark \text{ g}$$

$$= \frac{(0,24)^2}{(0,88)(0,64)^3} \checkmark \text{ h}$$

$$= 0,25 \checkmark \text{ i}$$

carry over

CALCULATIONS USING NUMBER OF CONCENTRATIONS**Mark allocation:**

- a. Use of $c = \frac{m}{MV}$ ✓
- b. (NH₃) at equilibrium = 0,24 mol·dm⁻³ ✓
- c. Using concentration ratio
[N₂] : [H₂] : [NH₃] = 1:3:2 ✓
- d. Divide by volume ✓
- e. Equilibrium concentration of N₂ (initial – change) ✓
- f. Equilibrium concentration of H₂ (initial – change) ✓
- g. K_c expression ✓
- h. Substitution into K_c expression ✓
- i. Final answer: 0,25 ✓

	N ₂	H ₂	NH ₃	
Molar ratio	1	3	2	
Initial concentration	1	1	0	
Change in concentration/	0,6	1,8	1,2	✓ Divide by 5 d
Equilibrium concentration	0,12	0,36	0,24 ✓ b	
Concentration at equilibrium	0,88 ✓ e	0,64 ✓ f	0,24 ✓ a	✓ Ratio/ c

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3} \checkmark \text{ g}$$

$$= \frac{(0,24)^2}{(0,88)(0,64)^3} \checkmark \text{ h}$$

$$= 0,25 \checkmark \text{ i}$$

$$c = \frac{m}{MV}$$

$$= \frac{20,4}{17 \times 5}$$

$$= 0,24$$

6.5 Decrease ✓✓

(9)

(2)

[20]

QUESTION 7/VRAAG 7

7.1 Strong (acid) ✓

Large/ $K_a > 1$ / (HBr) ionises completely ✓ H_2O ✓

(2)

7.2 Br^- ✓

(2)

7.3

7.3.1

Marking guidelines

- Formula: $c = \frac{n}{V} / n = cV / \frac{c_a \times V_a}{c_b \times V_b} = \frac{n_a}{n_b}$ ✓
- Substitution of: (0,5)(0,0165)/(0,5)(16,5) ✓
- Use mol ratio: 1:1/n(HBr) = n(NaOH) ✓
- Substitute: $V = 0,09 \text{ dm}^3 / 90 \text{ cm}^3$ ✓
- Formula: $pH = -\log[H_3O^+]$ ✓
- Substitute $[H_3O^+]$ in pH formula. ✓
- Final answer: $pH = 1,04$ (range: 1,036 – 1,05) ✓

OPTION 1

$$\begin{aligned}
 n(\text{NaOH})_{\text{reacted}} &= cV \checkmark \\
 &= 0,5(0,0165) \checkmark \\
 &= 0,00825 \text{ mol} \\
 n(\text{HBr})_{\text{excess}} &= n(\text{NaOH}) = 0,00825 \text{ mol} \checkmark \\
 c(\text{H}_3\text{O}^+) &= \frac{n}{V} \\
 &= \frac{0,00825}{0,09} \checkmark \\
 &= 0,092 \text{ mol} \cdot \text{dm}^{-3} \\
 pH &= -\log[H_3O^+] \checkmark \\
 &= -\log(0,092) \checkmark \\
 &= 1,04 \checkmark
 \end{aligned}$$

OPTION 2

$$\begin{aligned}
 \frac{c_a V_a}{c_b V_b} &= \frac{n_a}{n_b} \checkmark \\
 \frac{c_a (90)}{(0,5)(16,5)} &= \frac{1}{1} \checkmark \\
 c_a &= 0,092 \text{ mol} \cdot \text{dm}^{-3} \\
 pH &= -\log[H_3O^+] \checkmark \\
 &= -\log(0,092) \checkmark \\
 &= 1,04 \checkmark
 \end{aligned}$$

(7)

7.3.2

Marking guidelines

- Calculaten(HBr)_{initial}: substitute(0,45)(0,09) in $n = cV$ ✓
- Subtraction:
 $n(\text{HBr})_{\text{reacte}} = n(\text{HBr})_{\text{initial}} - n(\text{HBr})_{\text{reacted with NaOH}}$ ✓✓
OR/OF: $c(\text{HBr})_{\text{reacted}} = c(\text{HBr})_{\text{initial}} - c(\text{H}_3\text{O}^+)_{\text{excess}}$
- Use mol ratio: $n(\text{Zn}(\text{OH})_2) : n(\text{HBr}) = 1 : 2$ ✓
- Substitution o: $99 \text{ g} \cdot \text{mol}^{-1}$ ✓
- Final answer: 1,5964 g (range: 1,58 – 1,68) ✓

POSITIVE MARKING FROM Q7.3.1**OPTION 1**

$$n(\text{HBr})_{\text{initial}} = cV$$

$$= (0,45)(0,09) \checkmark$$

$$= 0,0405 \text{ mol}$$

$$n(\text{HBr reacted with Zn}(\text{OH})_2) = \underline{0,0405 - 0,00825} \checkmark \quad \checkmark$$

$$= 0,03224 \text{ mol}$$

$$n(\text{Zn}(\text{OH})_2) = \frac{1}{2}n(\text{HBr}) = \frac{1}{2}(0,03224) \checkmark = 0,016125 \text{ mol}$$

$$m(\text{Zn}(\text{OH})_2) = nM$$

$$= (0,016125)(99) \checkmark$$

$$= 1,596 \text{ g} \checkmark$$

OPTION 2

$$c(\text{HBr}) = 0,45 - 0,092 \checkmark \checkmark$$

$$= 0,358 \text{ mol} \cdot \text{dm}^{-3}$$

$$n(\text{HBr reacted}) = cV$$

$$= 0,358 \times 0,09 \checkmark$$

$$= 0,0322 \text{ mol}$$

$$n(\text{Zn}(\text{OH})_2) = \frac{1}{2}n(\text{HBr}) = \frac{1}{2}(0,0322) \checkmark = 0,01611 \text{ mol}$$

$$m(\text{Zn}(\text{OH})_2) = nM$$

$$= 0,01611 \times 99 \checkmark$$

$$= 1,595 \text{ g} \checkmark \quad (1,60 \text{ g})$$

(6)
[17]

QUESTION 8

8.1 Chemical to electrical ✓ (1)

8.2 Provides path for movement of ions./ Completes the circuit./Ensures electrical neutrality in the cell./Restore charge balance. ✓ (1)

8.3

OPTION 1

$$E_{\text{cell}}^{\theta} = E_{\text{cathode}}^{\theta} - E_{\text{anode}}^{\theta} \quad \checkmark$$

$$1,49 = 1,36 - E_{\text{anode}}^{\theta} \quad \checkmark$$

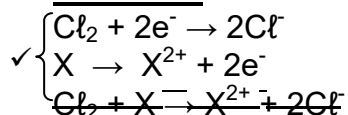
$$E_{\text{anode}}^{\theta} = 1,36 - 1,49$$

$$= -0,13 \text{ (V)} \quad \checkmark$$

X is Pb/Lead ✓

Notes

- Accept any other correct formula from the data sheet.
- Any other formula using unconventional abbreviations, e.g. $E_{\text{cell}}^{\circ} = E_{\text{OA}}^{\circ} - E_{\text{RA}}^{\circ}$ followed by correct substitutions: $\frac{4}{5}$

OPTION 2

$$E^{\theta} = 1,36 \text{ V} \quad \checkmark$$

$$E^{\theta} = 0,13 \text{ V} \quad \checkmark$$

$$E^{\theta} = 1,49 \text{ V} \quad \checkmark$$

X is Pb/Lead/ ✓

(5)

POSITIVE MARKING FROM Q8.3

8.4 X/Pb/Lead ✓ (1)

8.5

8.5.1 Reaction reached equilibrium./ (In each half cell) the rate of oxidation is equal to rate of reduction./ Rate of the forward reaction is equal to the rate of the reverse reaction. ✓ (1)

8.5.2 Increases ✓ (1)

8.5.3

- $[\text{Cl}^-]$ decreases ✓
- Forward reaction is favoured ✓

(2)
[12]

QUESTION 9

9.1

Marking guidelines

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

The chemical process in which electrical energy is converted to chemical energy. ✓✓

OR/OF

The use of electrical energy to produce a chemical change.

OR/OF

The process during which an electrical current passes through a solution/molten ionic compound.

(2)

9.2

9.2.1 $2\text{H}_2\text{O}(\text{l}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g}) + 2\text{OH}^-(\text{aq})$ ✓✓

Ignore phases

Marking guidelines

- $\text{H}_2(\text{g}) + 2\text{OH}^-(\text{aq}) \leftarrow 2\text{H}_2\text{O}(\text{l}) + 2\text{e}^-$ ($\frac{2}{2}$) $2\text{H}_2\text{O}(\text{l}) + 2\text{e}^- \rightleftharpoons \text{H}_2(\text{g}) + 2\text{OH}^-(\text{aq})$ ($\frac{1}{2}$)

$\text{H}_2(\text{g}) + 2\text{OH}^-(\text{aq}) \rightleftharpoons 2\text{H}_2\text{O}(\text{l}) + 2\text{e}^-$ ($\frac{0}{2}$) $2\text{H}_2\text{O}(\text{l}) + 2\text{e}^- \leftarrow \text{H}_2(\text{g}) + 2\text{OH}^-(\text{aq})$ ($\frac{0}{2}$)

- Ignore if charge omitted on electron.
- If charge (-) omitted on OH^-
- Example: $2\text{H}_2\text{O}(\text{l}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g}) + 2\text{OH}(\text{aq})$ ✓

Max./Maks: $\frac{1}{2}$

(2)

9.2.2 Water ✓ H_2O ✓

(2)

9.3 H_2O is a stronger oxidising agent ✓ than Na^+ ✓ and will be reduced ✓ (to H_2).**OR**

Na^+ is a weaker oxidizing agent ✓ than H_2O ✓ and therefore H_2O will be reduced ✓ (to H_2)

OR/OF

The half-reaction that produces $\text{H}_2(\text{g})$ has a more positive reduction potential (-0,83 V) ✓ than the half-reaction that produces Na (-2,71 V). ✓

Therefore water/ H_2O will be reduced ✓ to H_2 ./ Na^+ will not be reduced to Na.

(3)

[8]

TOTAL : 150