basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE/*SENIOR SERTIFIKAAT*
NATIONAL SENIOR CERTIFICATE/
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

TECHNICAL SCIENCES P2/
TEGNIESE WETENSKAPPE V2

NOVEMBER 2020

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 17 pages.
Hierdie nasienriglyne bestaan uit 17 bladsye.

QUESTION/*VRAAG* 1

1.1 B ✓✓ (2)

1.2 C ✓✓ (2)

1.3 D ✓✓ (2)

1.4 A ✓✓ (2)

1.5 A ✓✓ (2)

1.6 D ✓✓ (2)

1.7 B ✓✓ (2)

1.8 C ✓✓ (2)

1.9 C ✓✓ (2)

1.10 D ✓✓ (2)

[20]

QUESTION/*VRAAG* 2

2.1 An atom or a group of atoms (bond) that determine the chemistry of a molecule. ✓✓
OR
An atom or a group of atoms (bond) that determine(s) the physical and chemical properties of a group of organic compounds.

'n Atoom of groep atome (binding) wat die chemie van 'n molekule bepaal.
OF
'n Atoom of groep atome (binding) wat die fisiese en chemiese eienskappe van 'n groep organiese verbindings bepaal. (2)

2.2.1 Alkenes ✓/*Alkene* (1)

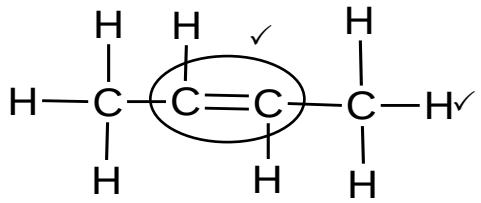
2.2.2 Aldehydes ✓/*Aldehiede* (1)

2.2.3 Carboxylic acids ✓/*Karboksielsure* (1)

2.3.1 Hexanal✓/*Heksanal* (2)

2.3.2 Propanoic acid✓/*Propanoësuur* (2)

2.4.1



Marking criteria/*Nasienriglyne*:
- Double bond ✓
- Whole structure correct. ✓

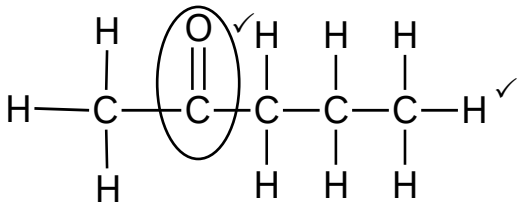
Note: Any hydrogen atom or bond missing or added Max: 1/2

- *Dubbelbinding*
- *Hele struktuur korrek.*

***Let wel**: Enige waterstofatoom of binding uitgelaat of bygevoeg Maks: 1/2*

(2)

2.4.2



Marking criteria/ *Nasienriglyne*:
- Functional group ✓
- Whole structure correct. ✓

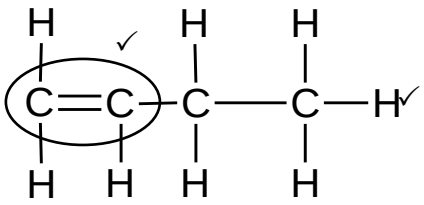
Note: Any hydrogen atom or bond missing or added Max 1/2

- *Funksionele groep.*
- *Hele struktuur korrek.*

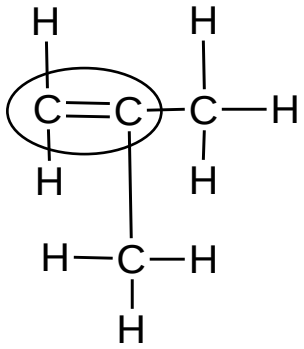
***Let wel:** Enige waterstofatoom of binding uitgelaat of bygevoeg Maks: 1/2*

(2)

2.5.1



OR/OF



Marking criteria/*Nasienriglyne*:
- Double bond ✓
- Whole structure correct. ✓

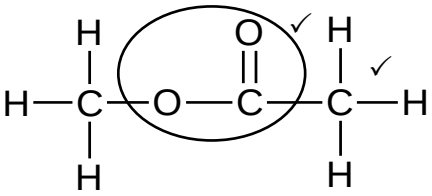
Note: Any hydrogen atom or bond missing or too many bonds Max ½
If compound A is drawn 0/2

- *Dubbelbinding.*
- *Hele struktuur korrek.*

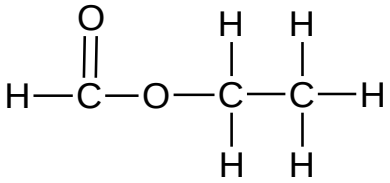
Let wel: *Enige waterstofatoom of binding uitgelaat of teveel binding Maks: ½*
Indien verbinding A geteken 0/2

(2)

2.5.2



OR/OF



Marking criteria/ *Nasienriglyne*:
- Correct functional group ✓
- Whole structure correct. ✓

Note: Any hydrogen atom or bond missing or added Max ½
- *Korrekte funksionele groep.*
- *Hele struktuur korrek.*

Let wel: *Enige waterstofatoom of binding uitgelaat of bygevoeg Maks: ½*

(2)

2.6.1 **Negative marking from 2.5.1/*Negatiewe nasien van 2.5.1*.**

Positional ✓ *(*if but-1-ene is given in 2.5.1).
Posisioneel (indien but – 1-een gegee is in 2.5.1)
OR/OF
Chain/positional isomer (if 2-methyl prop-1-ene is given in 2.5.1)
Ketting/posisionele isomeer (indien 2-metielprop-1-een gegee is) (1)

2.6.2 Functional ✓/*Funksioneel* (1)

2.7.1 Unsaturated ✓/*Onversadig* (1)

2.7.2 **Negative marking from 2.7.1/*Negatiewe nasien van 2.7.1*.**

It contains carbon - carbon double/multiple bond ✓
Bevat koolstof-koolstof dubbelbindinge/meervoudige bindinge (1)

[21]

QUESTION/*VRAAG* 3

3.1 The pressure exerted by a gas in equilibrium with a (solid or) liquid ✓ in a closed container/closed system (at a given temperature). ✓

Die druk wat deur 'n gas in ewewig met 'n (vaste stof) of vloeistof in 'n geslote houer/geslote stelsel (by 'n bepaalde temperatuur), uitgeoefen word. (2)

3.2.1 Vapour pressure decreases with an increase in molar mass/molecular mass/number of C-atoms/chain length.✓
OR
Vapour pressure increases with a decrease in molar mass/molecular mass/number of C-atoms/chain length.

OR

Vapour pressure decreases from 1-propanol to 1-pentanol.
OR
Vapour pressure increases from 1-pentanol to 1-propanol.

Dampdruk verlaag met 'n toename in mol massa/molekulêre massa/aantal C-atome/kettinglengte.
OF
Dampdruk verhoog met 'n afname in mol massa/molekulêre massa/aantal C-atome/kettinglengte.

OF

Dampdruk verlaag van 1-propanol na 1-pentanol.
OF
Dampdruk verhoog van 1-pentanol na 1-propanol (1)

3.2.2
- Chain length/molar mass increases from 1-propanol to 1-pentanol. ✓
- The strength of intermolecular forces increases from 1-propanol to 1-pentanol/with increase in chain length/molar mass✓
- More energy is needed to overcome strong intermolecular forces from 1-pentanol to 1-propanol. ✓

OR

- Chain length/molar mass decreases from 1-pentanol to 1-propanol.
- The strength of intermolecular forces decreases from 1-pentanol to 1-propanol/with decrease in chain length/molar mass area.
- Less energy is needed to overcome weak intermolecular forces from 1-propanol to 1-pentanol.

- *Kettinglengte/molekulêre massa verhoog van 1-propanol na 1-pentanol.*
- *Die sterkte van die intermolekulêre kragte verhoog van 1-propanol na 1-pentanol/met toename in kettinglengte/molekulêre massa*
- *Meer energie is nodig om die sterk intermolekulêre kragte in 1-pentanol te oorkom as in 1-propanol.*

OF

- *Kettinglengte/mol massa verlaag van 1-pentanol na1-propanol.*
- *Die sterkte van die intermolekulêre kragte verlaag van 1-pentanol na 1-propanol/ met afname in kettinglengte/molekulêre massa.*
- *Minder energie is nodig om die swak intermolekulêre kragte in 1-propanol te oorkom as in 1-pentanol.* (3)

3.3.1 **A** : Aldehydes ✓/**A***: Aldehiede*
B : Alkanes ✓/***B****: Alkane* (2)

3.3.2

- **A**/Aldehydes have (London forces) and dipole-dipole forces. **B**/Alkanes contain London forces only. ✓

- Dipole-dipole forces/forces in **A/**aldehydes are stronger than London forces/forces in **B/** alkanes. ✓

OR

- London forces/Forces in **B/**alkanes are weaker than dipole-dipole forces /forces in **A/**aldehydes**.**

OR

- The intermolecular forces in **A** are stronger than the intermolecular forces in **B**.

OF

- The intermolecular forces in **B** are weaker than the intermolecular forces in **A**.

- Aldehydes need more energy to overcome the intermolecular forces and therefore have higher boiling points. ✓

OR

- Aldehydes have higher boiling points than alkanes.

OR

- Alkanes have lower boiling points than aldehydes.

Marking criteria/*Nasienriglyne*:
- **A/B** or forces is only accepted if 3.3.1 is correctly identified.
- ***A/B*** *of kragte word slegs aanvaar indien 3.3.1 korrek is.*

- ***A****/Aldehiede het (London-kragte) en dipool-dipool-kragte.*
  B*/Alkane het slegs London-kragte.*

- *Dipool-dipool-kragte/Kragte in **A/**aldehiede is sterker as London-kragte/Kragte in **B**.*

OF

- *London-kragte/Kragte in **B/**alkane is swakker as dipool-dipool-kragte/Kragte in **A**.*

OF

- *Die intermolekulêre kragte in **A** is sterker as die intermolekulêre kragte in **B**.*

OF

- *Die intermolekulêre kragte in **B** is sterker as die intermolekulêre kragte in **A**.*

- *Aldehiede benodig meer energie om die intermolekulere kragte te oorkom en het dus hoër kookpunte*.

OF

- *Aldehiede het hoër kookpunte as alkane.*

OF

- *Alkane het laer kookpunte as aldehiede.*

(3)
[11]

QUESTION/*VRAAG* 4

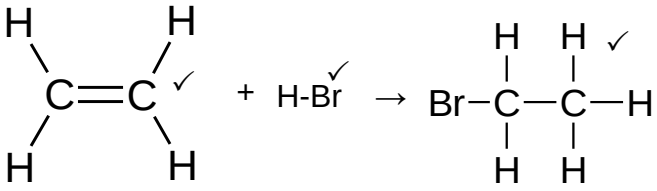
4.1.1 Addition/hydration ✓
Addisie/hidrasie (1)

4.1.2 Addition/hydrohalogenation/hydrobromination ✓
Addisie/hidrohalogenering/hidrobrominering (1)

4.1.3 Substitution/Halogenation ✓
Substitusie/Halogenasie (1)

4.2.1 Water/H_2O ✓ (1)

4.2.2 (Dilute) sulphuric acid/H_2SO_4 **OR** (Dilute) phosphoric acid/H_3PO_4 ✓
(Verdunde) swaelsuur/H_2SO_4 ***OF*** *(Verdunde) fosforsuur/H_3PO_4* (1)

4.3 

(3)

Note: Do not penalise HBr
Let wel: *Moenie* HBr *penaliseer nie.*
No arrow max 2/3
Geen pyl *maks 2/3*

4.4 Moderate/warm temperature ✓/Mild heat. *(**Accept**: UV light).*
No water✓ (**Accept:** concentrated H_2SO_4 + NaBr/HBr).
Warm/Matige temperatuur/Matige warmte/hitte (**Aanvaar**: UV lig).
*Geen water (**Aanvaar**: gekonsentreerde* H_2SO_4 + NaBr/HBr). (2)

4.5 $C_2H_4 + 3O_2$ ✓ → $2CO_2 + 2H_2O$ (+ energy)✓ (balancing/*balansering*) ✓

Marking criteria/*Nasienriglyne*:
- Reactants/*reagense* ✓
- Products/*produkte* ✓
- Balancing/*balansering* ✓

Note: Do not penalise if energy is omitted.
Let wel: *Moenie penaliseer indien energie uitgelaat is*

(3)

4.6 Ethene✓/*Eteen* (1)

Note: Penalise if molecular formula is written
Let wel: *Penaliseer indien molekulêre formule geskryf is*

[14]

QUESTION/*VRAAG* 5

5.1 (A process) in which electrical energy is converted into chemical energy ✓✓
OR
The decomposition of a (ionic) substance when an electric current is passed through it.

('n Proses) waar elektriese energie omgeskakel word in chemiese energie.
OF
Die ontbinding van 'n (ioniese) stof/verbinding wanneer elektriese stroom daardeur gestuur word. (2)

5.2 Non spontaneous ✓/*Nie-spontane* (1)

5.3 **Apply negative marking from 5.2./*Negatiewe nasien van 5.2.*** (1)

It requires electrical energy ✓
OR
It is an endothermic reaction

Dit vereis elektriese energie
OF
Dit is 'n endotermiese reaksie.

5.4 $CuC\ell_2$ ✓ (1)

Note: Penalise if name is written.
Let wel: *Penaliseer indien naam geskryf is.*

5.5.1 Anode ✓ (1)

5.5.2 Cathode ✓/*Katode* (1)

5.6 Reducing agent – a substance that is oxidised/loses electrons. ✓✓
OR
Reducing agent – A substance that undergoes oxidation.

Reduseermiddel – 'n Stof wat geoksideer word/verlies van elektrone.
OF
Reduseermiddel – 'n Stof wat oksidasie ondergaan. (2)

5.7.1 $2C\ell^- \rightarrow C\ell_2 + 2e^-$ ✓✓ (2)

Note:
Penalise once if charge if left out on chloride ion
Penaliseer eenmalig indien lading op chloorioon uitgelaat is

Marking criteria*:/Nasienriglyne:*

$2C\ell^- \rightarrow C\ell_2 + 2e^-$	2/2
$2C\ell^- \rightleftharpoons C\ell_2 + 2e^-$	1/2
$2C\ell^- \leftarrow C\ell_2 + 2e^-$	0/2
$C\ell_2 + 2e^- \rightleftharpoons 2C\ell^{--}$	0/2

5.7.2 $Cu^{2+} + 2e^- \rightarrow Cu$ ✓✓ (2)

Note:
Penalise once if charge if left out on copper ion
Penaliseer eenmalig indien lading op koperioon uitgelaat is

Marking criteria*:/Nasienriglyne:*	
$Cu^{2+} + 2e^- \rightarrow Cu$	2/2
$Cu^{2+} + 2e^- \rightleftharpoons Cu$	1/2
$Cu \rightleftharpoons Cu^{2+} + 2e^-$	0/2
$Cu^{2+} + 2e \leftarrow Cu$	0/2

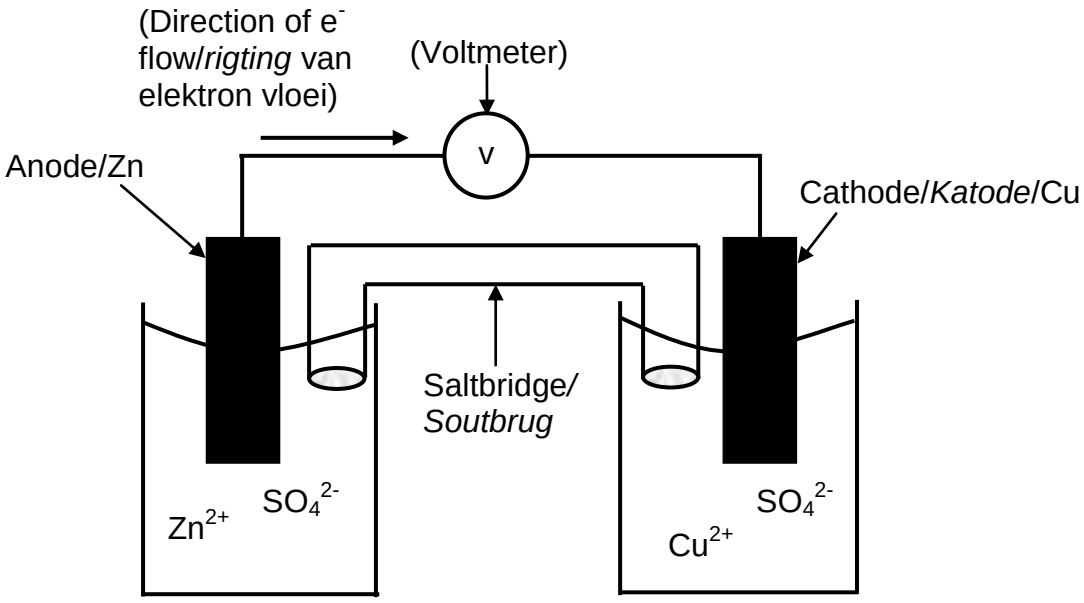
5.7.3 $Cu^{2+} + 2C\ell^- \checkmark\rightarrow C\ell_2 + Cu$ ✓ (2)
Accept/Aanvaar: $CuC\ell_2(aq) \rightarrow C\ell_2 + Cu$

[15]

QUESTION/*VRAAG* 6

6.1.1 An (electrochemical cell) that converts chemical energy to electrical energy.✓✓
'n (Elektrochemiese sel) waar chemiese energie na elektriese energie omgeskakel word. (2)

6.1.2



CRITERIA FOR MARKING/*NASIENRIGLYNE*	
Anode in correct half cell, labelled (Zn electrode in Zn^{2+} /zinc sulphate or zinc nitrate solution) *Anode in korrekte halfsel, benoem (Zn elektrode in Zn^{2+} /sinksulfaat of sinknitraatoplossing)*	✓
Cathode in correct half cell, labelled (Cu electrode in Cu^{2+} /copper sulphate or copper nitrate solution) *Katode in korrekte halfsel, benoem (Cu elektrode in Cu^{2+} /kopersulfaat of kopernitraatoplossing)*	✓
Voltmeter included and labelled/*Voltmeter ingesluit en benoem* ***Accept**:* galvanometer/multimeter/lightbulb/*gloeilamp*	✓
Salt bridge included and labeled	✓
Correct direction of the flow electrons in the external circuit *Korrekte rigting van elektron vloei in eksterne stroombaan.* ***Note**:* if not labelled, do not penalise/*indien geen byskrif gegee nie, moenie penaliseer nie*	✓

(5)

Note: Credit the saltbridge and voltmeter only if separate containers.
Krediteer soutbrug en voltmeter slegs indien verskillende houers.

6.1.3 Temperature/*Temperatuur*: 25°C/298 K ✓
Concentration of electrolytes / Konsentrasie van elektroliete: 1 mol·dm^{-3} ✓ (2)

6.1.4 Towards the zinc (half cell)/anode. ✓/*Na sink(halfsel)/anode*
Accept/*Aanvaar*: *Zn/Zn^{2+}(aq)* (1)

6.1.5 To maintain electrical neutrality, ✓ because the Zinc half-cell becomes more positive as zinc is oxidised to form zinc ions/Zn^{2+}.✓.
Handhaaf elektriese neutraliteit, omdat die sinkhalfsel meer positief word soos wat die sink na sinkione/Zn^{2+} geoksideer word. (2)

6.2.1

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$E^{\theta}_{cell} = E^{\theta}_{cathode} - E^{\theta}_{anode}$ ✓ 2,00✓= 0,34 - E^{θ}_{x} ✓ E^{θ}_{x} = - 1,66 V ✓ Electrode **X** is aluminium/Aℓ ✓ *Elektrode* **X** *is aluminium/*Aℓ	**X** → $\mathbf{X}^{n+}$ + ne^- (**y**) ✓ $Cu^{2+} + 2e^- \rightarrow Cu$ -(0,34) ✓ **X** + $Cu^{2+} \rightarrow \mathbf{X}^{n+} + Cu$ ✓ 2,00V ✓ E^{θ}_{x} = - 1,66 V ✓ Electrode **X** is aluminium/Aℓ ✓ *Elektrode* **X** *is aluminium/Aℓ*

(5)

Note:
Positive marking of answer obtained in 6.2.1 for 6.2.2, 6.2.3. and 6.2.4.
Positiewe nasien van antwoord in 6.2.1 in 6.2.2, 6.2.3 en 6.2.4

6.2.2 Aℓ → $Aℓ^{3+}$ + $3e^-$ ✓✓ (2)

Marking criteria*:/Nasienriglyne:*	
Aℓ → $Aℓ^{3+}$ + $3e^-$	2/2
Aℓ ⇌ $Aℓ^{3+}$ + $3e^-$	1/2
$Aℓ^{3+}$ + $3e^-$ ⇌ Aℓ	0/2
Aℓ ← $Aℓ^{3+}$ + $3e^-$	0/2

6.2.3 X/Aluminium/ A*ℓ*/ anode/negative electrode ✓ / *negatiewe elektrode* (1)

6.2.4 X/Aluminium/A*ℓ* will be oxidised. ✓✓
OR
X/Aluminium/A*ℓ* will lose electrons.

*X/Aluminium/A*ℓ *word geoksideer.*
OF
*X/Aluminium/A*ℓ *verloor elektrone.* (2)
[22]

QUESTION/*VRAAG* 7

7.1.1 The change in direction ✓ of a wave upon striking the interface ✓ between two materials.
OR
The change in direction of a wave front at the interface (boundary) between two media, bouncing back into the original medium.

Die verandering in bewegingsrigting van 'n golf wanneer dit die grens tussen die twee media tref.
OF
Die verandering in bewegingsrigting van 'n golffront by die grens tussen twee media, en dit terugweerkaats word in die oorspronklike medium. (2)

7.1.2 Incident (ray) ✓/*Invallende (straal)* (1)

7.1.3 Reflected (ray) ✓/*Weerkaatste (straal)* (1)

7.1.4 Normal ✓/*Normaal* (1)

7.1.5 (Angle) of incidence ✓/*invals(hoek)* (1)

7.1.6 (Angle) of reflection ✓/*weerkaatsings(hoek)* (1)

7.2 30° ✓ (1)

7.3 The speed will decrease. ✓/*Die spoed sal afneem.* (1)

7.4.1 Water ✓ (1)

7.4.2 It will bent towards the normal/It will be refracted towards the normal ✓
Dit sal na die normaal gebuig word./Dit sal na die normaal gebreek word.
Accept/*Aanvaar*: change direction/*verander rigting* (1)

7.4.3 Refraction ✓/*Refraksie* (1)

7.5.1 (Critical angle) is the angle of incidence in the denser medium ✓ such that the refracted ray just passes through the surface of separation of the two media. ✓
OR
An angle of incidence in the denser medium whose angle of refraction is 90º (a right angle).

Die (grenshoek) is die invalshoek in die digter medium sodanig dat die gebreekte straal al langs die skeidingsoppervlak van die twee media beweeg.
OF
Die invalshoek in die digter medium waar die refraksiehoek 90º (regtehoek) is. (2)

7.5.2 Light ray will travel from water and pass into the air. ✓ It will be refracted away/move away from the normal✓/*Ligstraal sal vanaf water na die lug beweeg. Dit sal weg van die normaal breek.* (2)

7.5.3 When the angle of incidence is greater than the critical angle ✓ the ray of light reflects (back) into the original medium ✓

W*anneer die invalshoek groter is as die grenshoek, sal die ligstraal (terug) weerkaats word in die oorspronklike medium.* (2)

7.5.4 Greater than ✓/*Groter as* (1)
[19]

QUESTION/*VRAAG* 8

8.1 (The phenomenon) whereby white light breaks up (spreads out) ✓ into its component colours. ✓

(Die verskynsel) wanneer witlig in sy saamgestelde kleure opbreek. (2)

8.2 The different colours of visible light include:/*Die verskillende kleure van sigbare lig is:*

- Red ✓ *Rooi*
- Orange ✓ *Oranje*
- Yellow ✓ *Geel*
- Green ✓ *Groen*
- Blue *Blou*
- Indigo *Indigo*
- Violet *Violet*

(Any FOUR)/(*Enige VIER*) (4)

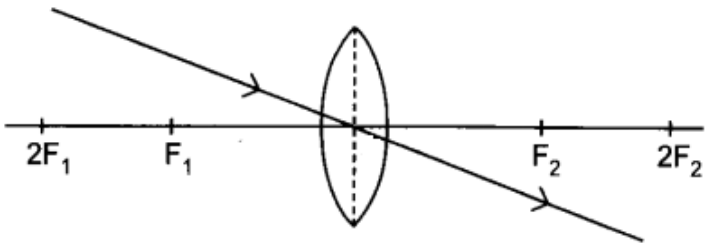
8.3.
- It is always virtual. ✓
- Erect/upright. ✓
- Its size is equal to that of the object. ✓
- It is formed at the same distance behind the mirror as the object is in front of the mirror.
- It is laterally inverted.

(Any THREE)

- *Dit is 'n skynbeeld.*
- *Regop.*
- *Dieselfde grootte as die voorwerp.*
- *Dit is dieselfde afstand agter die spieël as die voorwerp voor die spieël is.*
- *Dit is sywaarts omgekeerd.*

(Enige DRIE) (3)

8.4.1

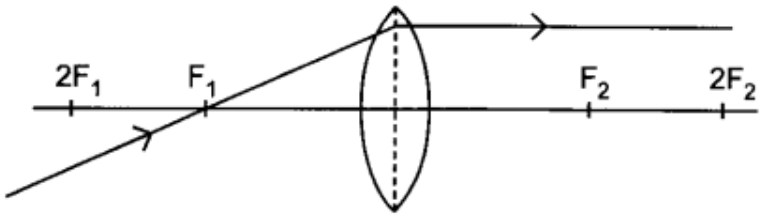


Note:
Penalise once if arrow is missing in answer 8.4.1, 8.4.2 and/or 8.4.3.
Penaliseer slegs eenmalig indien pyl uitgelaat is in 8.4.1, 8.4.2 en/of 8.4.3

Marking criteria/*Nasienriglyne*:
- Ray through the optical centre of the lens continues straight through the lens without deviation. ✓
- *Straal beweeg regdeur die optiese middelpunt van die lens sonder afwyking*

(1)

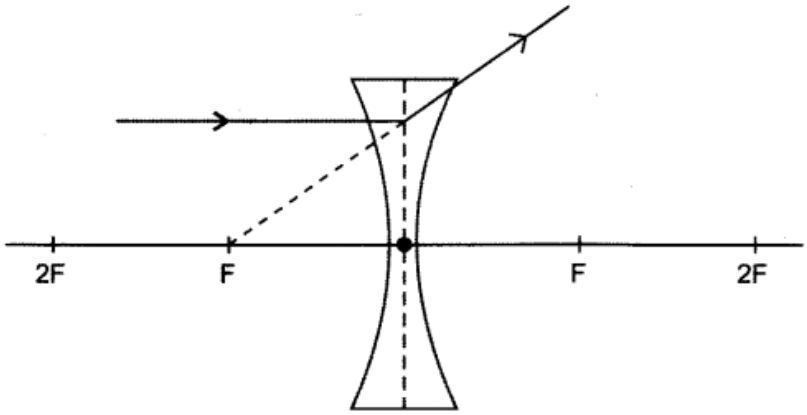
8.4.2



Marking criteria/*Nasienriglyne*:
- Ray parallel to the principal axis on the opposite side of the lens without any refraction ✓
- Correct direction of ray ✓
- *Straal beweeg parallel aan die hoofas, aan die teenoorgestelde kant van die lens sonder enige breeking.*
- *Korrekte rigting van die straal*

(2)

8.4.3



Marking criteria/*Nasienriglyne*:
- Ray refracted and diverges on the opposite side of the lens ✓
- Correct direction of ray ✓

Note: Don't penalise if dotted extrapolated line is omitted or is incorrectly drawn, but angle of refracted ray must be correct

- *Straal gebreek, divergeer aan die teenoorgestelde kant van die lens*
- *Korrekte rigting van die straal*

Let wel: *Moenie penaliseer indien gestippelde ge-ekstrapoleerde straal uitgelaat is of verkeerd geteken is nie, maar hoek van die gerefrakteerde straal moet korrek wees*

(2)
[14]

QUESTION/*VRAAG* 9

9.1 (Electromagnetic wave) is the changing of the magnetic and electric fields mutually perpendicular to each other ✓ and to the direction of propagation of the wave. ✓

(Elektromagnetiese golf) is die verandering in die magneet- en elektriese velde wat onderling loodreg op mekaar is en op die voortplantingsrigting van die golf. (2)

9.2 They have longer wavelengths ✓/*Hulle het langer golflengtes* (1)

9.3 Quantum (packets) of energy✓/*Kwantumenergie (pakkies)* (1)

9.4.1 Ultraviolet ✓ (1)

9.4.2 Infrared ✓/*Infrarooi* (1)
Accept/Aanvaar: radio waves/*radiogolwe*

9.4.3 Radio waves ✓/*Radiogolwe* (1)
Accept/*Aanvaar*: micro waves/*mikrogolwe*

9.5 Wavelength and frequency are inversely proportional. ✓✓
OR
When wavelength becomes longer, frequency decreases.
OR
When wavelength becomes shorter, frequency increases

Golflengte en frekwensie is omgekeerd eweredig.
OF
Wanneer golflengte langer word, word frekwensie korter.
OF
Wanneer golflengte korter word, word frekwensie langer. (2)

9.6

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$c = f\lambda$ $3,0 \times 10^8$ ✓$= f\ (4,06 \times 10^{-11})$ ✓ $f = 7,39 \times 10^{18}$ Hz $E = hf$ ✓ $= (6,63 \times 10^{-34})(7,39 \times 10^{18})$ ✓ $= 4,90 \times 10^{-15}$ J ✓ **Accept/*Aanvaar*** : $4,8990 \times 10^{-15}$ J	$E = h\frac{c}{\lambda}$ ✓ $E = \frac{(6,63 \times 10^{-34})(3,0 \times 10^{8})}{4,06 \times 10^{-11}}$ ✓✓ $E = 4,90 \times 10^{-15}$ J ✓

(5)
[14]

TOTAL/*TOTAAL*: 150