basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

TECHNICAL SCIENCES: P2
TEGNIESE WETENSKAPPE: V2

EXEMPLAR/*MODEL* 2018

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 11 pages.
Hierdie nasienriglyne bestaan uit 11 bladsye.

QUESTION 1/*VRAAG* 1

1.1 A ✓✓ (2)

1.2 B ✓✓ (2)

1.3 C ✓✓ (2)

1.4 C ✓✓ (2)

1.5 D ✓✓ (2)

1.6 D ✓✓ (2)

1.7 A ✓✓ (2)

1.8 B ✓✓ (2)

1.9 D ✓✓ (2)

1.10 B ✓✓ (2)
[20]

QUESTION 2/*VRAAG* 2

2.1 A series of compounds that have the same general formula and where each member differs from the next by $–CH_2$✓✓
'n Reeks verbindings wat dieselfde algemene formule het en waar elke lid van die volgende met $–CH_2$ verskil ✓✓ (2)

2.2
2.2.1 Ketone/*Ketoon* ✓ (1)

2.2.2 Haloalkane (Alkyl halide) ✓/*Haloalkaan (Alkielhalied)* ✓ (1)

2.2.3 Alkanes ✓/*Alkane* ✓ (1)

2.2.4 Alcohol ✓/*Alkohol* ✓ (1)

2.3
2.3.1 D ✓ (1)

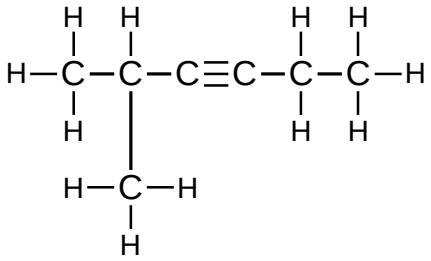
2.3.2 C ✓ (1)

2.3.3 E ✓ (1)

2.4

2.4.1 C_5H_{12} ✓✓ (2)

2.4.2

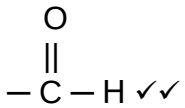


(3)

Marking criteria/*Nasienriglyne*	
Methyl on second carbon/*Metiel op tweede koolstof*	✓
Correct functional group/*Korrekte funksionele groep*	✓
The whole structure is correct./*Die hele struktuur korrek.*	✓

2.4.3 2-bromo✓-1-chloro✓ propane ✓ (If hyphens omitted, max $\frac{2}{3}$)
2-bromo✓-1-chloro✓propaan✓ (Indien koppelteken uitgelaat is, maks $\frac{2}{3}$) (3)

2.4.4



(2)
[19]

QUESTION 3/*VRAAG* 3

3.1

3.1.1 Long chains of monomers covalently bonded together (in a repeating pattern) ✓✓
Lang kettings van monomere wat kovalent gebonde is (in 'n herhalende patroon) ✓✓ (2)

3.1.2 Manufacturing of plastic bags/squeeze bottles/cling wrap/bullet-proof vests. ✓
Vervaardiging van plastieksakke, drukbottels, kleefplastiek, koeëlvaste baadjies.✓ (1)

3.2

3.2.1 London forces (induced dipole) in alkanes ✓/*London-kragte (geïnduseerde dipool*) in alkane✓
London forces✓ and hydrogen bonds in alcohols✓/*London-kragte*✓ en waterstofbindings in alkohole ✓ (3)

3.2.2 **OPTION 1/*OPSIE 1***

- Molar mass/chain length increases from pentane to heptane. ✓
- The strength of intermolecular force increases with an increase in chain length/molar mass ✓
- More energy is required to overcome the intermolecular forces to allow molecules to evaporate, thus fewer molecules evaporate. ✓

OR

- The stronger the intermolecular force, the lower the vapour pressure.

- *Molêre massa/kettinglengte neem toe van pentaan na heptaan.* ✓
- *Die sterkte van die intermolekulêre krag vergroot met 'n toename in kettinglengte/molêre massa.* ✓
- *Meer energie word benodig om die intermolekulêre kragte te oorkom om die molekule te laat verdamp, dus verdamp minder molekule.* ✓

OF

- *Hoe sterker die intermolekulêre krag, hoe laer die dampdruk.* (3)

OPTION 2/*OPSIE 2*

- Molar mass/chain length decreases from heptane to pentane. ✓
- The strength of intermolecular force decreases with an decrease in chain length/molar mass ✓
- Less energy is required to overcome the intermolecular forces to allow molecules to evaporate, thus more molecules evaporate. ✓

OR

- The weaker the intermolecular forces, the higher the vapour pressure.

- *Molêre massa/kettinglengte neem af van heptaan na pentaan.* ✓
- *Die sterkte van die intermolekulêre krag verklein met 'n afname in kettinglengte/molêre massa.* ✓
- *Minder energie word benodig om die intermolekulêre kragte te oorkom om die molekule te laat verdamp, dus verdamp meer molekule.* ✓

OF

- *Hoe swakker die intermolekulêre kragte, hoe hoër die dampdruk.*

3.2.3 Ethanoic acid ✓/*Etanoësuur* (1)

3.2.4
- Ethanoic acid has a lower vapour pressure than propan-1-ol thus stronger intermolecular forces ✓; thus more energy will be required to overcome intermolecular forces in ethanoic acid than propan-1-ol. ✓
- The lower the vapour pressure, the higher the boiling point. ✓

OR

- The stronger the intermolecular forces, the higher the boiling point.

OR

- Ethanoic acid has two sides to form hydrogen bonds while propan-1-ol has one, thus stronger intermolecular forces than propan-1-ol.

- *Etanoësuur het 'n laer dampdruk as propan-1-ol, dus sterker intermolekulêre kragte ✓, dus is meer energie nodig om die intermolekulêre kragte te oorkom in etanoësuur as in propan-1-ol.* ✓
- *Hoe laer die dampdruk, hoe hoër die kookpunt.* ✓

OF

- *Hoe sterker die intermolekulêre kragte, hoe hoër die kookpunt.*

OF

- *Etanoësuur het twee kante om waterstofbindinge te vorm terwyl propan-1-ol een kant het, dus sterker intermolekulêre kragte as in propan-1-ol.* (3)

[13]

QUESTION 4/*VRAAG* 4

4.1 $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$ +Energy/*Energie*

Marking criteria/*Nasienriglyne*	
Correct reactants/*Korrekte reaktanse*	✓
Correct products/*Korrekte produkte*	✓
Correct balancing/*Korrekte balansering*	✓

(3)

(Do not penalise correct products if the energy is not written./*Moenie korrekte produkte penaliseer indien die energie nie neergeskryf is nie.*)

4.2

4.2.1 Addition (Hydration) ✓✓/*Addisie (Hidrasie)* ✓✓ (2)

4.2.2 Substitution (Halogenation/Chlorination) ✓✓
Substitusie (Halogenering/Chlorering) ✓✓ (2)

4.2.3 Addition (Hydrogenation) ✓✓/*Addisie (Hidrogenering)* ✓✓ (2)

4.2.4 Sodium hydroxide/Potassium hydroxide ✓/
Natriumhidroksied/Kaliumhidroksied✓

(Penalise if chemical formula is written./*Penaliseer indien chemiese formule geskryf is*). (1)

4.2.5 A dilute strong base ✓ and mild heat ✓
'n Verdunde sterk basis ✓ *en matige hitte* ✓

(Penalise if only heat is written./Penaliseer indien slegs hitte geskryf is.) (2)

[12]

QUESTION 5/*VRAAG* 5

5.1 To protect a buried iron pipe from <u>corrosion (rust)</u>. ✓
Om 'n ysterpyp wat begrawe is, teen korrosie (roes) te beskerm. ✓ (1)

5.2
- Zinc is a stronger reducing agent than iron and it will be oxidised easier than iron. ✓✓

(Accept: Zinc loses electrons more readily than iron, thus preventing the iron from oxidising.)

OR

- Iron ions are stronger oxidising agent than zinc ions, and it will be reduced easier than zinc ions.

(Accept: Iron ions gain electrons more readily than zinc ions, thus preventing the zinc ions from reducing.)

- *Sink is 'n sterker reduseermiddel as yster en sal makliker as yster geoksideer word.* ✓✓

(Aanvaar: Sink verloor elektrone makliker as yster, dus verhinder sink die yster om te oksideer.)

OF

- *Yster is 'n sterker oksideermiddel as sink en sal makliker as sink gereduseer word.*

(Aanvaar: Yster wen makliker elektrone as sink, dus verhinder yster die sink om te oksideer.)

(2)

5.3

5.3.1 Ce^{4+} ✓ (Accept/*Aanvaar*: cesium(IV) ions/-*ione*). (1)

5.3.2 Cathode✓/*Katode* ✓ (1)

5.3.3 Ce^{4+} will readily gain electrons (e^-)/undergo reduction/is reduced ✓✓
Ce^{4+} sal elektrone wen/ondergaan reduksie/word gereduseer. ✓✓

*(*Accept/*Aanvaar:* Reduction takes place at the cathode./*Reduksie vind by die katode plaas*.) (2)

5.3.4 $2I^- + 2Fe^{3+} \rightarrow I_2 + 2Fe^{2+}$ reagents✓/*reagense* ✓; products✓/*produkte* ✓; balancing✓/*balansering* ✓ (3)

5.4

5.4.1 Is a cell that converts electrical energy into chemical energy. ✓✓
Is 'n sel wat elektriese energie na chemiese energie omskakel. ✓✓ (2)

5.4.2 Impure copper✓/*Onsuiwer koper* ✓ (1)

5.4.3 Oxidation✓/*Oksidasie* ✓ (1)

5.4.4 $Cu^{2+}(aq) + 2e^- \checkmark \rightarrow Cu(s)$ ✓ (2)

5.4.5 Copper sulphate/Copper nitrate ✓
Kopersulfaat/Kopernitraat ✓

(Accept/*Aanvaar*: $CuCl_2$, $CuSO_4$, $Cu(NO_3)_2$.) (1)
[17]

QUESTION 6/*VRAAG* 6

6.1

6.1.1 Galvanic/Voltaic cell ✓/*Galvaniese/Voltaïese sel* ✓ (1)

6.1.2 From chemical energy to electrical energy ✓✓/*Van chemiese energie na elektriese energie*✓✓ (2)

6.1.3
- Provides medium to allow for mobility of charge, i.e. allows charge to move through the cell effectively. ✓
- Maintains electrical neutrality in the cell. ✓
- It completes the circuit ✓

- *Verskaf medium om elektriese ladings te gelei, m.a.w. om ladings effektief deur sel te laat beweeg.* ✓
- *Handhaaf elektriese neutraliteit in die sel.* ✓
- *Dit voltooi stroombaan*✓ (Any two/*Enige twee)* (2)

6.1.4 From the zinc (electrode) ✓ to the copper (electrode) ✓/*Van sink (elektrode)* ✓*na koper (elektrode)* ✓

OR/*OF*
From anode ✓ to cathode ✓/*Van anode*✓ *na katode.* ✓

(Accept/*Aanvaar*: From negative to positive electrode/*Van negatiewe na positiewe elektrode.*) (2)

6.1.5 $BaSO_4$ will form a precipitate✓ and prevent the movement of ions✓ between the two half-cells.

$BaSO_4$ *vorm 'n neerslag*✓ *en voorkom die beweging van ione*✓ *tussen die twee halfselle.* (2)

6.2

6.2.1 $Zn + Cu^{2+}$ ✓ → $Zn^{2+} + Cu$ ✓ (2)

6.2.2 Concentration (of electrolyte) = 1 mol·dm^{-3} ✓
Temperature = 25° C/298 K ✓

Konsentrasie (van elektroliet) = 1 mol·dm^{-3}✓
Temperatuur = 25° C/298 K✓ (2)

6.2.3 Zn (s) | Zn^{2+}(1mol.dm^{-3})(aq) ✓ ‖✓Cu^{2+} (1mol.dm^{-3})(aq) | Cu (s) ✓
(Accept/*Aanvaar:* Zn (s) | Zn^{2+}(aq) ✓ ‖✓Cu^{2+} (aq) | Cu (s) ✓
(Do not penalise if phases are not included./*Moenie penaliseer indien fases nie ingesluit is nie.*) (3)

6.3
6.3.1 CO_2, CO, NO, NO_2, SO_2 (ANY 2 gases/*ENIGE 2 gasse)* ✓✓ (2)

6.3.2 It does not produce harmful substances✓./*Dit lewer geen skadelike verbindings nie*. ✓ (1)

6.3.3 *A car can travel a maximum of 250 km (before refilling).* ✓/'n Motor kan 'n maksimum van 250 km reis (voordat hervulling plaasvind). ✓ (1)
[20]

QUESTION 7/*VRAAG* 7

7.1 Reflection/*Refleksie* ✓ (1)

7.2 The surface is made up of an opaque substance✓✓./*Die oppervlak is gemaak uit 'n ondeursigtige stof.* ✓✓ (2)

7.3
- Angle of incidence must be equal to angle of reflection ✓
- Normal, incidence and reflected rays must lie in the same plane ✓

- *Invalshoek moet gelyk aan die weerkaatsingshoek wees.* ✓
- *Normaal, invals- en weerkaatste strale moet in dieselfde vlak wees.* ✓ (2)

7.4 A: Incidence ray✓/*Invallende straal* ✓
B: Reflected ray✓/*Weerkaatste straal* ✓
C: Normal✓/*Normaal* ✓ (3)

7.5
7.5.1 Angle of incidence✓/*Invalshoek* ✓; 70º✓ (2)

7.5.2 Angle of reflection✓/*Weerkaatsingshoek* ✓; 70º✓ (2)

7.6
7.6.1 Dispersion (of light) ✓/*Dispersie* (van lig) ✓ (1)

7.6.2 Red✓/*Rooi* ✓ (1)

7.6.3 It has the longest wavelength ✓; The longer the wavelength, the more the degree of refraction ✓
Dit het die langste golflengte✓; hoe langer die golflengte, hoe groter die mate van refraksie/breking✓. (2)
[16]

QUESTION 8/*VRAAG* 8

8.1 The bending of light when it moves from one medium to another ✓✓
(of different optical density)
Wanneer lig gebuig word wanneer dit van een medium na ander beweeg ✓✓
(van 'n ander optiese digtheid) (2)

8.2 Total internal reflection.✓/*Totale interne weerkaatsing.* ✓ (1)

8.3

8.3.1 Surface A✓/*Oppervlak A* ✓ (1)

8.3.2 When light moves from a more dense optical medium to a less dense optical medium, it is reflected away from the normal ✓✓
Wanneer lig van 'n meer digte optiese medium na 'n minder digte optiese medium beweeg, word dit weg van die normale gebuig. ✓✓ (2)

8.4

8.4.1 At Diagram 2✓/B*y Diagram* 2 ✓ (1)

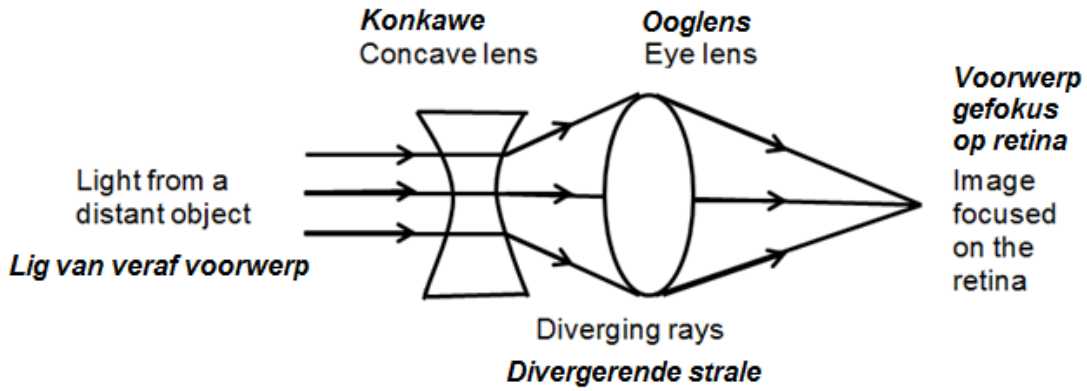
8.4.2 It is the diagram where the incident angle has an angle of refraction of 90^0 ✓✓
Dit is die diagram waar die invalshoek 'n refraksiehoek van 90^0 het. ✓✓ (2)

8.5

8.5.1
- Light must travel from a more dense optical medium to a less dense optical medium. ✓
- Incident angle must be greater than critical angle. ✓
- *Lig moet van 'n medium beweeg wat opties meer dig is na 'n medium wat opties minder dig is.* ✓
- *Invalshoek moet groter as die grenshoek wees.* ✓ (2)

8.5.2 Telecommunication✓/*Telekommunikasie* ✓
Medicine✓/*Medisyne* ✓ (2)

8.6



Marking criteria/*Nasienriglyne*	
Parallel rays from a distant object./*Parallelle strale van 'n verafgeleë voorwerp.*	✓
Concave lens/*Konkawe lens*	✓
Diverging rays between the concave lens and the eye lens./*Divergerende strale tussen konkawe lens en die ooglens.*	✓
Middle ray going straight through the lens/*Middelste straal beweeg dwarsdeur die lens*	✓
Rays converging on the retina/*Strale konvergeer op die retina*	✓

(5)
[18]

QUESTION 9/*VRAAG* 9

9.1 It is a wave with a changing magnetic and electric field perpendicular to each other in the direction of propagation of the wave.✓✓
Dit is 'n golf met 'n verandering in magnetiese en elektriese velde wat loodreg op mekaar in die voortplantingsrigting van die golf is. ✓✓ (2)

9.2
9.2.1

Radio waves *Radiogolwe*	Micro waves *Mikrogolwe*	Infrared *Infrarooi*	Visible light *Sigbare lig*	Ultra-violet	X-rays *X-strale*	Gamma rays *Gamma-strale*

Marking criteria/*Nasienriglyne*	
Radio waves have the lowest frequency and gamma rays have the highest frequency *Radiogolwe het die laagste frekwensie en gammastrale het die hoogste frekwensie*	✓
Middle five radiations in the correct order of increasing frequency *Middelste vyf frekwensies in die korrekte volgorde van toenemende frekwensie*	✓

(2)

9.2.2 Gamma rays✓/*Gammast*rale ✓ (1)

9.2.3 It has the highest frequency ✓; according to the formula E = hf, the higher the frequency, the higher the energy of a photon ✓
Dit het die hoogste frekwensie✓; volgens die formule E = hf, hoe hoër die frekwensie, hoe hoër die energiewaarde van die foton. ✓ (2)

9.3

OPTION 1/*OPSIE 1*

$c = f\lambda$

3×10^{8}✓ $= 470 \times 10^{-9}$ ✓

$f = 6{,}38 \times 10^{14}$ Hz

$E = hf$

$= 6{,}63 \times 10^{-34} \cdot 6{,}38 \times 10^{14}$ ✓

$= 4{,}23 \times 10^{-19}$ J ✓

OPTION 2/*OPSIE 2*

$E = \frac{hc}{\lambda}$ ✓

$= \frac{6{,}63 \times 10^{-34} \text{ x } 3 \text{ x } 10^{8}}{470 \times 10^{-9}}$ ✓ ✓ ✓

$= 4{,}23 \times 10^{-19}$ J ✓

(5)

9.4 SMALLER THAN. ✓/*KLEINER AS* ✓ (1)

9.5

9.5.1 X-rays✓/*X-strale* ✓ (1)

9.5.2 Ultraviolet light✓/*Ultraviolet lig*✓ (1)

[15]

TOTAL/*TOTAAL*: 150