

# 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) |

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| 1.2 | B ✓✓ |  | (2) |

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| 1.3 | C ✓✓ |  | (2) |

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| 1.4 | C ✓✓ |  | (2) |

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| 1.5 | D ✓✓ |  | (2) |

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| 1.6 | D ✓✓ |  | (2) |

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| 1.7 | A ✓✓  |  | (2) |

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| 1.8 | B ✓✓ |  | (2) |

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| 1.9 | D ✓✓ |  | (2) |

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| 1.10 | B ✓✓ |  | (2) |
|  |  |  | **[20]** |

**QUESTION 2/*VRAAG* 2**

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| 2.1 | A series of compounds that have the same general formula and where each member differs from the next by –CH2✓✓*'n Reeks verbindings wat dieselfde algemene formule het en waar elke lid van die volgende met –CH2 verskil* ✓✓ |  | (2) |

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| 2.2 |  |  |  |

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| 2.2.1 | Ketone/*Ketoon* ✓ |  | (1) |

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

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| 2.2.3 | Alkanes ✓/*Alkane* ✓  |  | (1) |
| 2.2.4 | Alcohol ✓/*Alkohol* ✓  |  | (1) |

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| 2.3 |  |  |  |

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| 2.3.1 | D ✓ |  | (1) |

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| 2.3.2 | C ✓ |  | (1) |

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| 2.3.3 | E ✓ |  | (1) |

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| 2.4 |  |  |  |

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| 2.4.1 | C5H12 ✓✓ |  | (2) |

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| 2.4.2 |  |  | (3) |

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| **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.* | **🗸** |

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| 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) |

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| 2.4.4 O || ─ C ─ H ✓✓ |    |  | (2) |
|  |  |  | **[19]** |

**QUESTION 3/*VRAAG* 3**

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| 3.1 |  |  |  |

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| 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) |

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

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| 3.2 |  |  |  |

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| 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) |

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| 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.
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|  | * *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) |

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| --- | --- | --- | --- |
|  | **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.*
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| 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.
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|  | * *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**

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| 4.1 | C3H8 + 5O2 🡒 3CO2 + 4H2O +Energy/*Energie*

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| **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.*)

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| 4.2 |  |  |  |

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

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

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

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| 4.2.4 | Sodium hydroxide/Potassium hydroxide 🗸/ *Natriumhidroksied/Kaliumhidroksied*✓(Penalise if chemical formula is written./*Penaliseer indien chemiese formule geskryf is*). |  | (1) |

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| 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**

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

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| 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) |

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| 5.3 |  |  |  |

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| 5.3.1 | Ce4+ 🗸 (Accept/*Aanvaar*: cesium(IV) ions/-*ione*). |  | (1) |

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| 5.3.2 | Cathode✓/*Katode* 🗸 |  | (1) |

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| 5.3.3 | Ce4+ will readily gain electrons (e– )/undergo reduction/is reduced 🗸🗸*Ce4+ sal elektrone wen/ondergaan reduksie/word gereduseer.* ✓✓*(*Accept/*Aanvaar:* Reduction takes place at the cathode./*Reduksie vind by die katode plaas*.) |  | (2) |

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| 5.3.4 | 2I– + 2Fe 3+ → I2 + 2Fe2+ reagents✓/*reagense* 🗸; products✓/*produkte* 🗸; balancing✓/*balansering* 🗸  |  | (3) |

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| 5.4 |  |  |  |

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

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

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| 5.4.3 | Oxidation✓/*Oksidasie*  🗸 |  | (1) |

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| 5.4.4 | Cu2+ (aq) + 2e– 🗸→ Cu(s) 🗸 |  | (2) |

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| 5.4.5 | Copper sulphate/Copper nitrate 🗸*Kopersulfaat/Kopernitraat* ✓(Accept/*Aanvaar*: CuCl2, CuSO4, Cu(NO3)2.) |  | (1) |
|  |  |  | **[17]** |

**QUESTION 6/*VRAAG* 6**

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| 6.1 |  |  |  |

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| 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) |

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| 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) |

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| 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) |

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| 6.1.5 | BaSO4 will form a precipitate🗸 and prevent the movement of ions🗸 between the two half-cells.BaSO4 *vorm 'n neerslag*🗸 *en voorkom die beweging van ione*🗸 *tussen die twee halfselle.* |  | (2) |

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| 6.2 |  |  |  |

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| 6.2.1 | Zn + Cu2+ 🗸 → Zn2+ + Cu 🗸 |  | (2) |

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| 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) ⎸ Zn2+(1mol.dm-3)(aq) ✓ ǁ✓Cu2+(1mol.dm-3)(aq) ⎸Cu (s) ✓(Accept/*Aanvaar:* Zn (s) ⎸ Zn2+(aq) ✓ ǁ✓Cu2+(aq) ⎸Cu (s) ✓(Do not penalise if phases are not included./*Moenie penaliseer indien fases nie ingesluit is nie.*) |  | (3) |

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| 6.3 |  |  |  |

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| 6.3.1 | CO2, CO, NO, NO2, SO2 (ANY 2 gases/*ENIGE 2 gasse)*  ✓✓ |  | (2) |

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

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| 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**

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| 7.1 | Reflection/*Refleksie* 🗸 |  | (1) |

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| 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) |

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

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| 7.5 |  |  |  |

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

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

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| 7.6 |  |  |  |

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

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| 7.6.2 | Red✓/*Rooi* 🗸 |  | (1) |

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| 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**

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| 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) |

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

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| 8.3 |  |  |  |

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| 8.3.1 | Surface A✓/*Oppervlak A* 🗸 |  | (1) |

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| 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) |

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| 8.4 |  |  |  |

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

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| 8.4.2 | It is the diagram where the incident angle has an angle of refraction of 900 🗸🗸*Dit is die diagram waar die invalshoek 'n refraksiehoek van 900 het*. ✓✓ |  | (2) |

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| 8.5 |  |  |  |

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| 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) |

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| 8.5.2 | Telecommunication✓/*Telekommunikasie*  🗸Medicine✓/*Medisyne* 🗸  |  | (2) |
|  |  |  |  |
| 8.6 |  |  |  |



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| **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) |

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|  |  | **[18]** |

**QUESTION 9/*VRAAG* 9**

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| 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) |

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| 9.2 |  |  |  |

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| 9.2.1

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

|  |  |
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| **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) |

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| 9.2.2 | Gamma rays✓/*Gammast*rale 🗸 |  | (1) |

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| --- | --- | --- | --- |
| 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) |

|  |  |  |  |
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| 9.3 | **OPTION 2/*OPSIE 2***E = 🗸 ==4,23 × 10-19 J 🗸**OPTION 1/*OPSIE 1***c =f 3 × 108🗸 = 470 × 10-9 🗸f = 6,38 × 1014 Hz E =hf=6,63 × 10-34 . 6,38 × 1014 🗸= 4,23× 10-19J 🗸 For both/ *vir beide*🗸🗸🗸🗸 |  | (5) |

|  |  |  |  |
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| 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** |