education

Department of Education
FREE STATE PROVINCE

EXAMINATION/*EKSAMEN*

GRADE/*GRAAD* 10

PHYSICAL SCIENCES/ *FISIESE WETENSKAPPE*

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JUNE/*JUNIE* 2026

MARKING GUIDELINE/ *NASIENRIGLYNE*

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MARKS/*PUNTE*: 150

This marking guideline consists of 13 pages.

Hierdie nasienriglyn beslaan 13 bladsye.

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QUESTION 1: MULTIPLE-CHOICE QUESTIONS
VRAAG 1: VEELVULDIGE KEUSEVRAE

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

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QUESTION 2

2.1 Transverse (wave) / *Transversale (golf)*✓ (1)

2.2 The particles of the medium vibrate at right angles to the direction of motion of the wave ✓/ *Die deeltjies van die medium vibreer loodreg op die bewegingsrigting van die golf.*
Accept/*Aanvaar:*
The disturbance is at right angles to the direction of propagation (motion) of the wave. / *Die versteuring is loodreg op die rigting van voortplanting (beweging) van die golf.* (1)

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2.3 5 cm ✓
It has the highest frequency/smallest period ✓ and shortest wavelength ✓/ *Dit het die hoogste frekwensie/kleinste periode* ✓ *en kortste golflengte* ✓

OR/*OF*

5cm ✓, $f \propto \frac{1}{\lambda}$ ✓✓ (3)

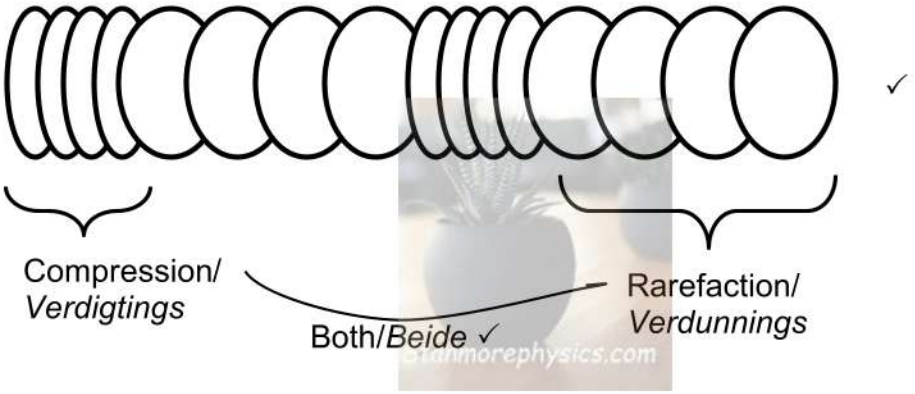
2.4

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$v = f\lambda$ ✓ $= 6(0,1)$ ✓ $= 0,6\ m{\cdot}s^{-1}$ ✓ **IF:** $c = f\lambda$ is used, max. $^2/_3$	$T = \frac{1}{f}$ $= \frac{1}{6}$ $= 0,167\ s$ speed = $\frac{\text{distance}}{\text{time}}$ ✓ / spoed = $\frac{\text{afstand}}{\text{tyd}}$ $= \frac{0,1}{0,167}$ ✓ $= 0,6\ m{\cdot}s^{-1}$ ✓

(3)

2.5

MARKING CRITERIA/ *MERKRIGLYNE*
✓ correct shape/ *korrekte vorm*
(**Accept:** straight lines in the drawing. / ***Aanvaar:*** *reguitlynskets.*)
✓ correct labelling/ *korrekte ettiketering*



✓

(2)
[10]

QUESTION/*VRAAG* 3

3.1 $v = \frac{\Delta x}{\Delta t}$ ✓ **OR/*OF*** speed = $\frac{\text{distance}}{\text{time}}$ / spoed = $\frac{\text{afstand}}{\text{tyd}}$

$340 = \frac{\Delta x}{1,6}$ ✓

$\Delta x = 544$ m ✓ (3)

3.2 HIGHER THAN ✓/ *HOËR AS* (1)

3.3 20 kHz ✓**OR/*OF*** 20 000 Hz (1)

3.4 (**Accept any ONE relevant application)/ *(Aanvaar enige EEN toepassing.)***
Sonar image of an unborn baby. / *Sonar van 'n ongebore baba.*✓
To measure the rate of blood flow./ *Om bleodvloei te meet.*
To break down gallstones and kidney stones. / *Om galstene en nierstene te breek.*
Used by dentists to clean teeth./ *Word deur tandartse gebruik om tande skoon te maak.* (1)
[6]

QUESTION/ *VRAAG* 4

4.1 Behaves as both particle ✓ and wave ✓
Dit het deeltjie sowel as golfgeaardheid. (2)

4.2 X-ray/ *X-straal* ✓ (1)

4.3 According to/ *Volgens:* $E = hf$
$E \propto f$ ✓✓ **OR/*OF***
The higher the frequency, the higher the energy.✓✓
Hoe hoër die frekwensie, hoe hoër die energie (2)

4.4 $c = f\lambda$ ✓
$3\times10^{8} = 2,5\times10^{18}\lambda$ ✓
$\lambda = 1,2\times10^{-10}$ m for x-ray (0,12 nm)

Adjustment/ *Verstelling*:
$= 550 \times 10^{-9} - 1,2 \times 10^{-10}$ ✓ **OR/OF** 550 nm – 0,12 nm
$= 549,88 \times 10^{-9}$ m ✓ **OR/OF** = 549,88 nm (4)

4.5 EQUAL TO/ *GELYK AAN* ✓ (1)

4.6 X-ray/ *X-strale*. ✓
It could cause severe skin/ tissue damage ✓/
Dit kan erge vel/weefsel skade aanrig. (2)
[12]

QUESTION/*VRAAG* 5

5.1 Added / *By gevoeg* ✓ (1)

5.2
$$n = \frac{Q}{q_e} \checkmark$$
$$= \frac{1,95 \times 10^{-6}}{1,6 \times 10^{-19}} \checkmark$$
$$= 1,22 \times 10^{13}\ e^- \checkmark$$ (3)

5.3 The net charge of an isolated system remains constant during any physical process. ✓✓ (**2 or 0**)
ACCEPT:
Charge cannot be created or destroyed but can only be transferred from one object to another.

Die nettolading in 'n geïsoleerde sisteem bly konstant tydens enige fisiese proses.
AANVAAR:
Lading kan nie geskep of vernietig word nie, maar slegs van een voorwerp na 'n ander oorgedra word. (2)

5.4
$$Q_{new} = \frac{Q_1 + Q_2}{2} \checkmark$$
$$1,53 \times 10^{-6} \checkmark = \frac{-1,95 \times 10^{-6} + Q_N}{2} \checkmark$$
$$Q_N = 5,01 \times 10^{-6}\ C \checkmark \quad (\textbf{Accept}\ 5,01\ \mu C)$$

AFRIKAANS VERSION:
$$Q_{new} = \frac{Q_1 + Q_2}{2} \checkmark$$
$$1,53 \times 10^{-6} \checkmark = \frac{-1 \times 10^{-6} + Q_N}{2} \checkmark$$
$$Q_N = 4,06 \times 10^{-6}\ C \checkmark \quad (\textbf{Accept}\ 4,06\ \mu C)$$ (4)

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5.5 **POSITIVE MARKING FROM QUESTION 5.4 /**
POSITIEWE NASIEN VANAF VRAAG 5.4

OPTION 1	**OPTION 2**
$\Delta Q = Q_f - Q_i$ $= 1,53 \times 10^{-6} - 5,01 \times 10^{-6}$ ✓ $= -3,48 \times 10^{-6}$ C ✓ **Accept:** -3,48 µC	$\Delta Q = Q_f - Q_i$ $= 1,53 \times 10^{-6} - (-1,95 \times 10^{-6})$ ✓ $= 3,48 \times 10^{-6}$ C ✓ **Accept:** 3,48 µC
AFRIKAANS VERSION $\Delta Q = Q_f - Q_i$ $= 1,53 \times 10^{-6} - 4,06 \times 10^{-6}$ ✓ $= -2,53 \times 10^{-6}$ C ✓ **Accept:** -2,53 µC	$\Delta Q = Q_f - Q_i$ $= 1,53 \times 10^{-6} - (-1 \times 10^{-6})$ ✓ $= 2,53 \times 10^{-6}$ C ✓ **Accept:** 2,53 µC

(2)
[12]

QUESTION/*VRAAG* 6

6.1 The (total) work done per unit charge (by the battery).✓✓ (**2 or 0**)
Die (totale) arbeid verrig per eenheid lading (deur die battery). (2)

6.2 24 V ÷ 3 ✓ = 8 V ✓ (2)

6.3 $V_{R_2} = \underline{24 - V_2}$ ✓ (1)

6.4 V = IR ✓
= 3 (2) ✓
= 6 V ✓ (3)

6.5 **POSITIVE MARKING FROM QUESTION 6.4 /**
POSITIEWE NASIEN VANAF VRAAG 6.4

OPTION/ *OPSIE* 1	**OPTION/ *OPSIE 2***
$Q = I\Delta t$ $= 3 (4 \times 60)$ ✓ $= 720$ C $W = VQ$ ✓ $= 6 (720)$ ✓ $= 4\ 320$ J ✓	$W = VI\Delta t$ ✓ $= 6 (3)$ ✓ $(4 \times 60$ ✓$)$ $= 4\ 320$ J ✓

(4)

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6.6 **POSITIVE MARKING FROM QUESTION 6.3 & 6.4 /**
POSITIEWE NASIEN VANAF 6.3 & 6.4

OPTION/ *OPSIE* 1	**OPTION/ *OPSIE 2***
$R_{tot} = \frac{V_{tot}}{I}$ ✓ $= \frac{24}{3}$ ✓ $= 8\ \Omega$ $R_{tot} = R_{bulb} + R_2$ $8 = 2 + R_2$ ✓ $R_2 = 6\ \Omega$ ✓	$V_{R_2} = V_{tot} - V_2$ $= 24 - 6$ ✓ $= 18\ V$ $R_2 = \frac{V}{I}$ ✓ $= \frac{18}{3}$ ✓ $= 6\ \Omega$ ✓

(4)

6.7 Increases / *Toeneem* ✓
Total resistance decreases, ✓ the EMF remains the same ✓ so total current therefore increases.
Totale weerstand neem af, EMK verander nie, totale stroom neem toe. (3)

6.8 **POSITIVE MARKING FROM QUESTION 6.6 /**
POSITIEWE NASIEN VANAF VRAAG 6.6

$$\frac{1}{Rp} = \frac{1}{R_1} + \frac{1}{R_2}$$ ✓

$$\frac{1}{Rp} = \frac{1}{6} + \frac{1}{6}$$ ✓

$Rp = 3\ \Omega$

$R_{tot} = 3 + 2$ ✓
$= 5\ \Omega$ ✓

(4)

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6.9 Series:

$$I_1 = \frac{V}{R} \checkmark$$

$$= \frac{12}{2x} \checkmark$$

$$= \frac{6}{x}$$

Parallel:

$R_p = ½ x$

$$I_2 = \frac{12}{1/2\ x} \checkmark$$

$$= \frac{24}{x}$$

Ratio/Verhouding: $I_{series} : I_{Parallel}$

$$\frac{6}{x} : \frac{24}{x}$$

1 : 4 ✓ (4)

[27]



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QUESTION 7

7.1.1 The temperature at which a solid, given sufficient heat, becomes a liquid. ✓✓ / *Die temperatuur waarteen 'n vaste stof, met voldoende hitte, 'n vloeistof word.*
OR
The temperature at which the solid and liquid phases of a substance are at equilibrium./ *Die temperatuur waarteen die vastestof en vloeistoffases van 'n stof in ewewig is.* (2)

7.1.2 (a) Solid/ *Vatstestof* ✓ (1)

(b) Liquid/ *Vloeistof*✓ (1)

7.2.1 90 (°C) ✓ (1)

7.2.2 (a) INCREASES/ *TOENEEM* ✓ (1)

(b) REMAINS THE SAME/ *BLY DIESELFDE*✓ (1)

7.2.3 As a substance is heated, its <u>particles absorb energy</u>. ✓
The <u>particles move faster</u>. ✓
The <u>forces of attraction</u> between the particles become <u>weaker</u>. ✓

Soos wat 'n stof verwarm word, <u>absorber deeltjies energie.</u>
Die <u>deeltjeis beweeg vinniger.</u>
Die <u>aantrekkingskragte tussen deeltjies verswak.</u> (3)
[10]

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QUESTION/*VRAAG* 8

8.1 Number of protons in an atom of an element. ✓✓ (**2 or 0**)
Die aantal protone in 'n atom van 'n element. (2)

8.2.1 Silicon/ Si ✓ (1)

8.2.2

MARKING CRITERIA/ *MERKRIGLYNE*

- Correct labelling of energy levels: 1s 2s 2p 3s 3p ✓
  Korrekte benoeming van energievlakke: 1s 2s 2p 3s 3p
- Correct filling of 1st and 2nd energy levels ✓
  Korrekte opvul ban 2ste en 2de energievlakke.
- Correct filling of 3rd energy level ✓
  Korrektev ul van 3de energievlak

IF: Not using opposite spins (1↓) when filling electrons: deduct 1 mark
Indien teenoorgestelde spinrigtings nie in orbitale sigbaar is nie: trek 1 punt af.

3p	1	1	
3s	1↓		
2p	1↓	1↓	1↓
2s	1↓		
1s	1↓		

(3)

8.3 (Atomic) orbital/ *(Atoom-)orbitaal* ✓ (1)

8.4 6 ✓✓ (2)

8.5 1 ✓
Element X/sodium is in group/groep 1(I) **OR/*OF***
has the atomic number of 11/ het atoomgetal 11 **OR/*OF***
has 11 protons/ het 11 protone ✓✓ (3)

8.6 Na_2S **OR/*OF*** X_2Z ✓✓ (2)

8.7 Relative atomic mass/ *Relatiewe atoommassa:*

$$= \frac{(23\times78,9)+(24\times21,1)}{100} \checkmark\checkmark$$

= 23,21 (amu)✓ (3)

[17]

QUESTION/*VRAAG* 9

9.1 Energy needed per mole to remove an electron(s) from (a neutral) atom in the gaseous phase. ✓✓ (**2 or 0**)
Energie wat per mol benodig word om 'n elektron(e) uit ('n neutrale) atoom in die gasfase te verwyder. (2)

9.2 B ✓ (1)

9.3 **Explanation based on diagram B/ *Verduideliking gebaseer op diagram B***

- B/nitrogen has a smaller atomic radius/ the valence electrons are closer to the nucleus.✓ */Stikstof het 'n kleiner atoomradius/ die valenselektrone is nader aan die kern*
- More energy is required to remove (valence) electrons of B/nitrogen. ✓*/Meer energie is nodig om (valens) elektrone van B/stikstof te verwyder.*

OR/*OF*

Explanation based on diagram A/ *Verduideliking gebaseer op diagram B*

- A/phosphorus has a larger atomic radius/ the valence electrons further from the nucleus. / *Fosfor het 'n groter atoomradius/ die valenselektrone verder van die kern af.*
- Less energy is required to remove (valence) electrons of A/phosphorus. / *Less energy is required to remove (valence) electrons of A/phosphorus.* (2)

9.4 Group 15/ V ✓ (1)

9.5 P^{3-} / A^{3-} ✓✓ (2)

9.6 Anion/*Anioon* ✓
Electrons were transferred to element A/it gained electrons/
Elektrone is na element A oorgedra/dit het elektrone ontvang ✓. (2)
[10]

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QUESTION/*VRAAG* 10

10.1.1 Ionic/*Ionies* ✓ (1)

10.1.2 Covalent/*Kovalent* ✓ (1)

10.1.3 Metallic/*Metaal(binding)* ✓ (1)

10.2.1 B ✓
(Accept: oxygen, water, H_2O) / (*Aanvaar: suurstof, water, H_2O)* (1)

10.2.2 C ✓
(Accept: cobalt, $Fe_2(SO_4)_3$, Iron(III) sulphate)
(Aanvaar: kobalt, $Fe_2(SO_4)_3$, yster(III)sulfaat) (1)

10.3.1 The sharing of electrons between atoms ✓ (of non-metals) to form molecules ✓
Die deel van elektrone tussen atome ✓(van nie-metale) om molekules te vorm (2)

10.3.2  (Accept angular shape/ *Aanvaar hoekige vorm*)

✓Two bonding pair of electrons between H and O
Twee bindingspaar-elektrone tussen H en O
✓Two lone pair of electrons on oxygen/
Twee alleenpaar-elektrone op suurstof
(2)

10.4.1 Iron(III) sulphate / *yster(III)sulfaat* ✓✓
IF: only iron sulphate (without (III)): Max. $^1/_2$
INDIEN: slegs yster sulfaat (sonder (III)): Maks. $^1/_2$ (2)

10.4.2 Fe – 2 ✓
S – 3 ✓
O – 12 ✓ (3)

10.4.3 Cation/*Katioon*: Fe^{3+} ✓
Anion/*Anioon*: SO_4^{2-} ✓ (2)
[16]

QUESTION 11

11.1.1 (Change in which) new chemical substances are formed. ✓✓
(Verandering waarin) nuwe chemiese stowwe gevorm word
OR/*OF*
Energy changes are much larger than those of physical changes.
Energieveranderinge is baie groter as dié van fisiese veranderinge.
OR/*OF*
Mass of atoms are conserved, but the number of molecules is not./ *Die massa van atome word bewaar, maar die aantal molekules is nie* (2)

11.1.2 **Any ONE** applicable OBSERVATION. / ***Enige EEN*** *toepaslike WAARNEMING.*

- Bubbles ✓/
  Bubbles
- Dissolving of magnesium ribbon/powder /
  Oplosing van magnesiumlint/poeier
- Change in temperature – container getting warm/
  Verandering in temperatuur – houer word warm (1)

11.2. Total mass reactants/ *Totale massa van reaktante:*

$= m[2NH_3)]$
$= 2[(14+3(1)]$ ✓ = 34 g ✓ OR

Total mass products/ *Totale massa van produkte:*

$= m(N_2) + m(3H_2)$
$= 2(14) + 3(2x1)$ ✓ = 34 g

Total mass reactants = total mass products
Totale massa van reaktante = totale massa van produkte (3)

11.3.1 Physical (change)/ *fisiese (verandering)* ✓ (1)

11.3.2 Sublimation / *sublimation* (1)

11.3.3 Less (energy) / *Less (energy)* ✓

- There are no new substances formed ✓/ *Geen nuwe stowwe vorm nie*
- physical change requires less energy than chemical change/ *Fisiese verandering verg minder energie as chemiese verandering/*
- phase change requires less energy than breaking of old bonds and formation of new bonds./ *Faseverandering verg minder energie as die breek van ou bindings en die vorming van nuwe bindings.* (2)

[10]

GRAND TOTAL: [150]

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