education

Department of
Education
FREE STATE PROVINCE

EXAMINATION

GRADE 10

PHYSICAL SCIENCES

JUNE 2025

MARKS: 150

TIME: 3 HOURS

This paper consists of 12 pages and two information sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of NINE questions. Answer ALL questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave one line between two sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable pocket calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEETS.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your FINAL numerical answers to a minimum of TWO decimal places where applicable.
11. Give brief motivations, discussions, et cetera where required.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write down only the letter A, B, C or D next to the question number (1.1–1.10) in your ANSWER BOOK.

1.1 Time taken for one complete wave cycle to pass a point is known as … of a wave.

A wavelength.

B frequency.

C amplitude.

D period. (2)

1.2 When the period of a wave increases, the frequency …

A increases.

B decreases.

C becomes zero.

D stays the same. (2)

1.3 How does the SPEED of a wave of a red light compare to that of an ultraviolet light in a vacuum?

A Equal to.

B Greater than.

C Smaller than.

D both are less than 3×10^8 m·s^{-1}. (2)

1.4 A positively charged object has …

A gained electron.

B gained protons.

C lost electrons.

D lost protons. (2)

1.5 Which **one** of the following is the equivalent unit for potential difference?

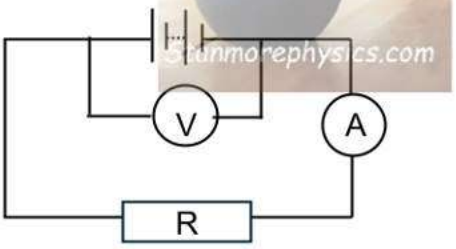
A W.h

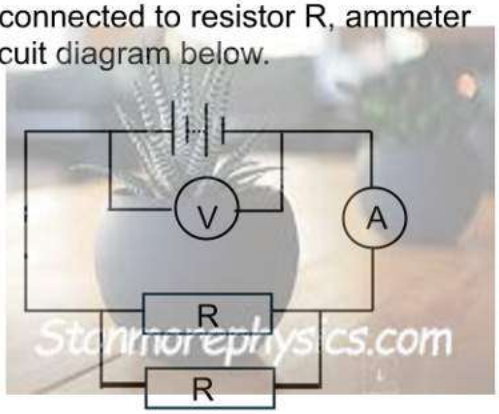
B J·C

C $J \cdot C^{-1}$

D $C \cdot J^{-1}$ (2)

1.6 A battery with a potential difference V is connected to resistor R, ammeter connected in series as shown in the circuit diagram below.





A second resistor of the SAME RESISTANCE is now connected in parallel with resistor R. (See the diagram on the right.)
How will the voltmeter and ammeter readings change when the second resistor is connected in the circuit?

	VOLTMETER READING	AMMETER READING
A	Decreases	Increases
B	Increases	Increases
C	Stay the same	Decreases
D	Stay the same	Increases

(2)

1.7 What happens to the average kinetic energy of particles when the temperature of the substance increases?

A Increases

B Decreases

C Becomes zero

D Remains constant (2)

1.8 The atomic number of an element is determined by the number of...

A neutrons.

B electrons.

C nucleons.

D protons. (2)

1.9 When a metal atom bonds with a non-metal, the non-metal atom will …

A lose electrons and decrease in size.

B gain electrons and decrease in size.

C lose electrons and increase in size.

D gain electrons and increase in size. (2)

1.10 Which ONE of the following is a physical change ?

A Iron and sulphur are melted together.

B A piece of magnesium burns in air.

C Wood turns into ash.

D Gold melts. (2)
[20]

QUESTION 2

The frequencies and the corresponding energy of electromagnetic waves are given in the table below.

TYPE OF WAVE	FREQUENCY (Hz)	ENERGY (J)
Microwaves	3×10^{10}	$1,33\times10^{-23}$
Infrared	$3,5\times10^{12}$	$1,75\times10^{-21}$
Visible light	f	$2,11\times10^{-20}$
Ultraviolet	$2,01\times10^{15}$	$1,33\times10^{-18}$
X- rays	$1,8\times10^{17}$	$2,97\times10^{-14}$

2.1 Define *frequency* in words. (2)

2.2 Give one use of the following waves

2.2.1 Infrared (1)

2.2.2 X-rays (1)

2.3 Calculate the:

2.3.1 Frequency of visible light (3)

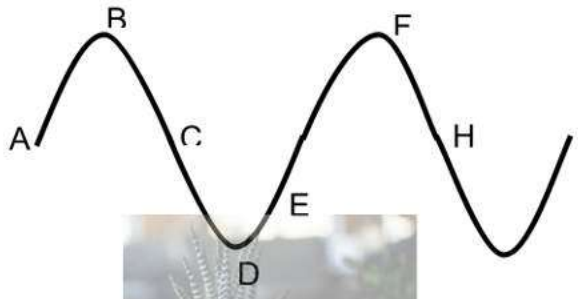
2.3.2 Wavelength of ultraviolet. (3)

2.4 Which type of waves has the lowest penetrating ability?
Refer to the either frequency or the energy to explain your answer. (2)

2.5 Determine the energy of gamma ray with a wavelength of $1,24 \times 10^{-11}$ m. (3)
[15]

QUESTION 3

In the diagram below a wave passes a point every 0,5 seconds. The total length of the waves shown below is 6 m.



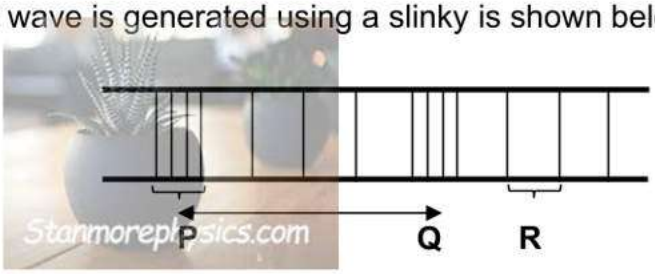
3.1 Define the term *transverse wave*. (2)

3.2 Calculate:

3.2.1 the speed of the wave. (3)

3.2.2 how far is the wave after 3 minutes. (3)

3.3 A wave is generated using a slinky is shown below.



3.3.1 What type of wave is represented in the diagram above? (2)

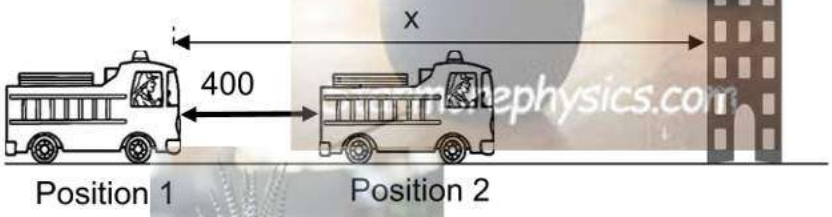
3.3.2 What is represented by the following:

(a) letter P (1)

(b) letter R (1)

(c) distance PQ (1)

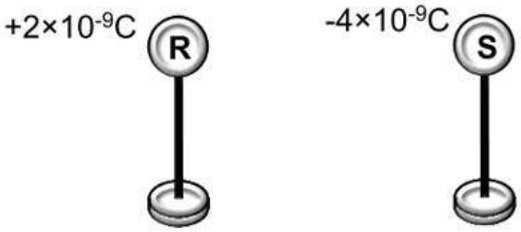
3.4 A truck moves with a constant velocity towards a building. When the truck is at position 1 which is *x*-metres away from the building, the driver sounds the siren and receives the echo 2 seconds later at position 2. Position 1 and 2 are 400 m apart.



Calculate the distance between the truck and the building when the truck is at position 2. The speed of sound in air is 340 m· s^{-1}. (5)
[20]

QUESTION 4

Two small identical spheres **R** and **S** placed on insulated stands, as shown in the sketch below. The spheres carry charges of +2×10^{-9} C and -4×10^{-9} C respectively.



4.1 State the principle of conservation of charge. (2)

4.2 Which sphere has an excess of electrons?
Explain the answer. (2)

4.3 The two spheres are brought into contact.
Calculate:

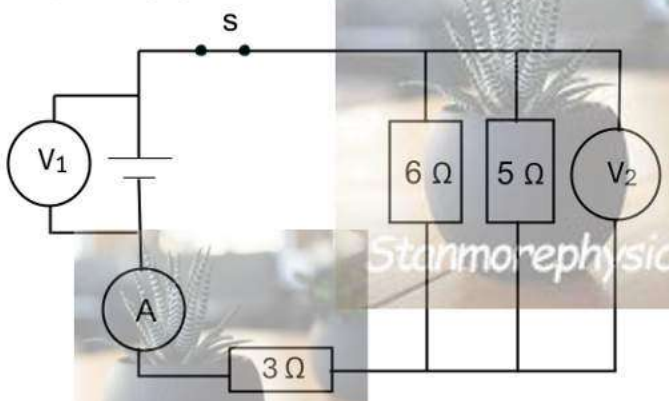
4.3.1 the new charge on sphere R. (3)

4.3.2 the number of electrons transferred. (3)

4.4 It is observed that the spheres move apart after contact. Briefly explain this observation. (3)
[13]

QUESTION 5

The diagram shows the three resistors connected to the battery, the ammeter and high resistance voltmeters, V_1 and V_2. The resistance of the ammeter, conducting wires and the battery is negligible.



5.1 State *Ohm's law* in words. (2)

When the switch S is closed, the current passing through 6 Ω resistor is 0,8 A.

5.2 Calculate the:

5.2.1 effective resistance of parallel combination. (3)

5.2.2 reading on V_2. (3)

5.2.3 reading on the ammeter. (3)

5.2.4 amount of charge passing through the ammeter in 10 seconds. (3)

5.2.5 reading on V_1. (4)

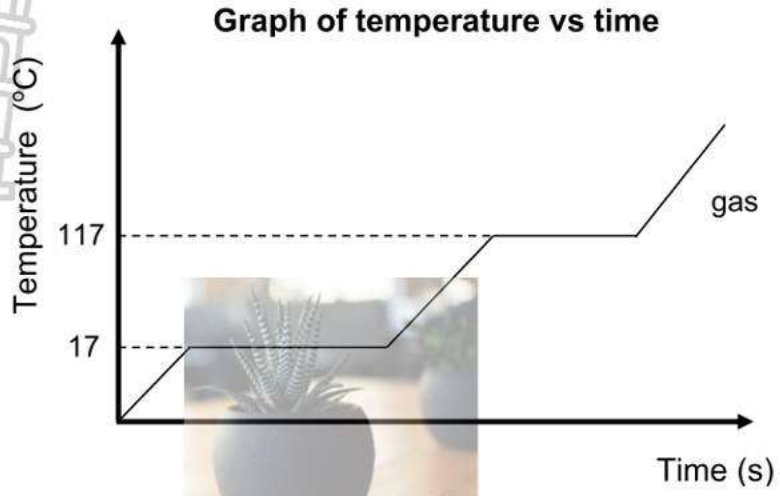
5.3 Define potential difference across the ends of a conductor. (2)

5.4 Calculate work done in moving charge of 9,6 C through the 5 Ω resistor (3)

[23]

QUESTION 6

The graph below shows a heating curve of a pure substance.



6.1 Define the term *boiling point*. (2)

6.2 Using the graph, write down the:

6.2.1 boiling point of the pure substance. (1)

6.2.2 phase of the pure substance at 60 °C. (1)

6.3 How many phase changes are represented on the graph? (1)

6.4 What happens to the temperature while the substance undergoes a **phase change**? Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

6.5 How do we know that this substance is not water? (2)

6.6 In which phase of matter is the average kinetic energy of the particles the highest? (2)

[10]

QUESTION 7

7.1 Consider the electron configuration of the three elements given below:

ELEMENT	ELECTRON CONFIGURATION
P	$1s^2 2s^2 2p^6 3s^2 3p^5$
Q	$1s^2 2s^2 2p^6$
R	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

7.1.1 Define *atomic number*. (2)

7.1.2 Write down a NAME or FORMULA of element represented by electron configuration **R**. (1)

7.1.3 Name of the group to which **Q** belongs. (1)

7.1.4 Which element is in group 17(VII), period 3. (1)

7.1.5 Write down the chemical formula of the compound that is formed when **P** reacts with **R**. (2)

7.2 A certain element, **T**, is in group 18(VIII) and period 2 of the periodic table. For this element, write down the:

7.2.1 name of group 18(VIII) elements. (1)

7.2.2 number of valence electrons. (1)

7.2.3 valency. (1)
[10]

QUESTION 8

The table below shows the first ionisation energies of some elements in group one.

ELEMENT	FIRST IONISATION ENERGIES ($kJ \cdot mol^{-1}$)
Lithium	520
Sodium	496
Potassium	419

8.1 Define the term *ionisation energy*. (2)

8.2 Which one of the three elements will easily lose its outer electron? (1)

8.3 Explain the trend of first ionisation energies down the group. (3)

Naturally occurring elements are a mixture of their isotopes.

8.4 From the above statement, which atomic particle is responsible for the occurrence of isotopes? (1)

8.5 The element neon is found in nature in the form of three isotopes, with their percentages as indicated below:

88,48% - Ne-20
0,27% - Ne-21
11,25% - Ne-22

8.5.1 Which one of the above isotopes is the heaviest? Give a reason for the answer. (2)

8.5.2 Using a suitable calculation determine the relative atomic mass of neon, using the information above. (3)
[12]

QUESTION 9

9.1 Chemical bonding leads to the formation of molecules such as NH_3 and F_2.

9.1.1 Define the term *chemical bonding*. (2)

9.1.2 Draw the Aufbau diagram to represent the element fluorine. (3)

9.1.3 Write down the type of chemical bond found in fluorine molecule (F_2). (1)

9.2 Draw the Lewis structure of NH_3 molecule. (3)

9.3 The UNBALANCED chemical equation below represents chemical change taking place in a container.

$$Na + CuSO_4 \rightarrow Cu + Na_2SO_4$$

9.3.1 Define *chemical change*. (2)

9.3.2 Balance the above equation. (2)

9.3.3 Write word equation for the chemical equation above. (3)

9.3.4 In what phase is Cu ? (1)

9.3.5 Use the relative atomic masses to prove that the mass is conserved in the above chemical equation. (5)

9.4 Consider the change represented below:

$$CO_2(s) \rightarrow CO_2(g)$$

9.4.1 Define *sublimation*. (2)

9.4.2 Is the above an example of chemical or physical change? (1)

9.4.3 Give a reason for the answer in QUESTION 9.4.2. (2)

[27]

GRAND TOTAL: 150

DATA FOR PHYSICAL SCIENCES GRADE 10
JUNIE-EKSAMEN
GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
JUNIE-EKSAMEN

TABLE 1: PHYSICAL CONSTANTS / *TABEL 1: FISIESE KONSTANTES*

NAME / *NAAM*	SYMBOL / *SIMBOOL*	VALUE / *WAARDE*
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10^{8}$ m·s^{-1}
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}$ J·s
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19}$ C
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}$ kg

TABLE 2: FORMULAE / *TABEL 2: FORMULES*

WAVES, SOUND AND LIGHT / *GOLWE, KLANK EN LIG*

$v = f\lambda$	$f = \frac{1}{T}$ of/*or* $T = \frac{1}{f}$
$v = \frac{\Delta x}{\Delta t}$ of/*or* $spoed = \frac{afstand}{tyd}$ of/*or* $speed = \frac{distance}{time}$	$E = hf = \frac{hc}{\lambda}$

ELECTROSTATICS / *ELEKTROSTATIKA*

$Q = nq$	$Q = \frac{Q_1 + Q_2}{2}$

ELECTRIC CIRCUITS/ *ELEKTRIESE STROOMBANE*

$Q = I\Delta t$	$V = IR$
$V = \frac{W}{Q}$	$R_S = R_1 + R_2 + R_3 \ldots$
$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$	

TABLE 3: THE PERIODIC TABLE OF ELEMENTS/*TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE*

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
2,1 H 1																	2 He 4
1,0 Li 7	1,5 Be 9											2,0 B 11	2,5 C 12	3,0 N 14	3,5 O 16	4,0 F 19	10 Ne 20
0,9 Na 23	1,2 Mg 24											1,5 Aℓ 27	1,8 Si 28	2,1 P 31	2,5 S 32	3,0 Cℓ 35,5	18 Ar 40
0,8 K 39	1,0 Ca 40	1,3 Sc 45	1,5 Ti 48	1,6 V 51	1,6 Cr 52	1,5 Mn 55	1,8 Fe 56	1,8 Co 59	1,8 Ni 59	1,9 Cu 63,5	1,6 Zn 65	1,6 Ga 70	1,8 Ge 73	2,0 As 75	2,4 Se 79	2,8 Br 80	36 Kr 84
0,8 Rb 86	1,0 Sr 88	1,2 Y 89	1,4 Zr 91	41 Nb 92	1,8 Mo 96	1,9 Tc	2,2 Ru 101	2,2 Rh 103	2,2 Pd 106	1,9 Ag 108	1,7 Cd 112	1,7 In 115	1,8 Sn 119	1,9 Sb 122	2,1 Te 128	2,5 I 127	54 Xe 131
0,7 Cs 133	0,9 Ba 137	57 La 139	1,6 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	1,8 Tℓ 204	1,8 Pb 207	1,9 Bi 209	2,0 Po	2,5 At	86 Rn
0,7 Fr 87	0,9 Ra 226	89 Ac															

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

KEY/ *SLEUTEL*

Atoomgetal
Atomic number

Elektronegatiwiteit
Electronegativity

29
1,9 Cu
63,5

Simbool
Symbol

Benaderde relatiewe atoommassa
Approximate relative atomic mass

education

Department of Education
FREE STATE PROVINCE

JUNE EXAMINATION/*JUNIE EKSAMEN*

GRADE/*GRAAD* 10

PHYSICAL SCIENCES
FISIESE WETENSKAPPE

MEMORANDUM
UPDATED/OPGEDATEER

JUNE/*JUNIE* 2025

MARKS/*PUNTE*: 150

TIME: 3 HOURS
TYD: 3 URE

This marking guideline consists of 12 pages.
Hierdie nasienriglyn bestaan uit 12 bladsye.

QUESTION 1/*VRAAG* 1

1.1 D ✓✓

1.2 B ✓✓

1.3 A ✓✓

1.4 C✓✓

1.5 C ✓✓

1.6 D ✓✓

1.7 A ✓✓

1.8 D✓✓

1.9 D ✓✓

1.10 D ✓✓

[20]

QUESTION 2/*VRAAG*2

2.1 The number of wave pulses/waves/vibrations per second. /
Die getal golfpulse/ golf/ vibrasies per sekonde. ✓✓ (2)

2.2.1 Used in / *Gebruik in*:

- Ovens/ toasters/heaters /
  Oonde/broodroosters/verwarmers
- Remote control / *Afstandbeheerders*
- To improve night vision/
  Om nagvisie te verbeter
- Motion detector/ Bewegingsensor

(anyone/*enigeen*)✓

(1)

2.2.2 Used in/ *Gebruik in*:

- Security check at airport to detect weapons
  Wapenverklikkers by sekuriteitspunte by lughawens
- Determine atomic record/ *Bepaal atomiese rekord*
- Photo image for medical diagnosis /
  Fotoskanderings vir mediese diagnose
- Sorting minerals/ *Mineralsortering*
- To view bones/medical imaging/
  radiologie/ been-/ mediese skandering

(anyone/*enigeen*)✓

(1)

2.3.1

Option/ *Opsie* 1	**Option/ *Opsie* 2**
$E = hf$ ✓**F** $2{,}11 \times 10^{-20} = 6{,}63 \times 10^{-34} f$ ✓**S** $f = 3{,}18 \times 10^{13}\ Hz$ ✓**A**	**OR/OF** $E = \frac{hc}{\lambda}$ ✓**F** $2{,}11 \times 10^{-18} = \frac{(6{,}63\times10^{-34})(3{,}0\times10^{8})}{\lambda}$ $\lambda = 9{,}4265 \times 10^{-6} m$ ✓**S** $c = f\lambda$ $3 \times 10^{8} = f \times 9{,}4265 \times 10^{-6}$ $f = 3{,}18 \times 10^{13}\ Hz$ ✓**A**
MARKING GUIDELINE/*MERKRIGLYN*	
✓**F** Formula (any one correct) / *Formule (enige korrekte een)*	
✓**S** Full substitution (into one correct formula)/ *Volledige Invervanging (in een korrekte formule in)*	
✓**A** Final answer + unit / *Finale antwoord + eenheid*	

(3)

2.3.2

Option/ *Opsie* 1	**Option/ *Opsie* 2**
$c = f\lambda$ ✓**F** $3 \times 10^{8} = 2{,}01 \times 10^{15}.\lambda$ ✓**S** $\lambda = 149 \times 10^{-9}\ m/149nm$ ✓**A**	$E = \frac{hc}{\lambda}$ ✓**F** $1{,}33 \times 10^{-18} = \frac{(6{,}63\times10^{-34})(3{,}0\times10^{8})}{\lambda}$ ✓**S** $\lambda = 149 \times 10^{-9} m/149nm$ ✓**A**
Option/ *Opsie* 3	**MARKING GUIDELINE/*MERKRIGLYN***
E=hf **OR/OF** $1{,}33 \times 10^{-18} = (6{,}63 \times 10^{-34})f$ ✓**F** $f = 2{,}006 \times 10^{15} Hz$ $c = f\lambda$ $3 \times 10^{8} = 2{,}006 \times 10^{15}.\lambda$ ✓**S** $\lambda = 1{,}495 \times 10^{-9}\ m$ ✓**A**	✓**F** Formula (any one correct) / *Formule (enige korrekte een)* ✓**S** Full substitution (into one correct formula)/ *Volledige Invervanging (in een korrekte formule in)* ✓**A** Final answer + unit / *Finale antwoord + eenheid* **RANGE/*GRENS*:** $(\mathbf{1{,}47 \rightarrow 1{,}50}) \times \mathbf{10^{-7}}$

(3)

2.4 microwaves/radio waves / *mikrogolwe/radiogolwe* ✓

lower frequency/lower energy✓
laer frekwensie/laer energie (2)

2.5 $E=\frac{hc}{\lambda}$ ✓
$=\frac{(6{,}63\times10^{-34})(3\times10^{8})}{1{,}24\times10^{-11}}$ ✓
$=1{,}60\times10^{-14}J$ ✓ (3)
[15]

QUESTION/ *VRAAG* 3

3.1 A wave in which the disturbance is at right angle/ perpendicular✓ to the direction of the propagation of the wave ✓
'n Golf waarin die versteuring reghoekig/loodreg✓ op die rigting van die voortplanting van die golf is. (2)

3.2.1 $v=\frac{\Delta x}{\Delta t}$ ✓ $=$
$=\frac{3}{0{,}5}$ ✓ **OR/OF** $\frac{6}{1}$
$=6\ m\cdot s^{-1}$✓ (3)

ALLOW/*AANVAAR:*
$Distance = speed \times time$
$Afstand = spoed \times tyd$
OR/OF $v=\frac{\Delta x}{\Delta t}$
OR/OF $v=\frac{\lambda}{T}$

3.2.2 $t = 3 \times 60 = 180\ s$ ✓

$\therefore Distance = speed \times time$ ✓ $Afstand = spoed \times tyd$ ✓
$= 6 \times 180$ ✓
$= 1080\ m$ ✓ **(4)**

3.3.1 Longitudinal (waves) / *Longitudinale (golwe)* ✓✓ (2)

3.3.2 (a) compression / *verdigtings/verdikkings*. ✓ (1)

(b) rarefaction / *verdunnings* ✓ (1)

(c) Wavelength/ *golflengte* ✓ (1)

3.4 AFRIKAANS (t = 3 s)

Option/ *Opsie* 1	**Option/ *Opsie* 2**
Δt for sound to travel from position 1 to position 2/ *Δt vir die klank om vanaf posisie 1 na posisie 2 te beweeg*: distance = speed × time *afstand = spoed × tyd* 400 = 340 × t ✓**S** Δt = 1,176 s Δt for sound to travel from position 2 to the building / *Δt vir die klank om vanaf posisie 2 na die gebou te beweeg*: $\Delta t = \frac{3-1,176✓}{2✓}$ = 0, 912 s ✓**F** Distance = speed × time *Afstand = spoed × tyd* = 340 × 0,912✓**S** =310,08 m ✓	Δt for sound to travel from position 1 to position 2/ *Δt vir die klank om vanaf posisie 1 na posisie 2 te beweeg*:: distance = speed × time *afstand = spoed × tyd* ✓ 400 = 340 × t ✓**S** Δt = 1,176 s time from position 1 to the building: *tyd vanaf posisie 1 na die gebou:* =1,176 + 3 ✓ $= \frac{4,176}{2}$ ✓ = 2,088 s Distance/ *afstand* ***x*** Distance/*afstand* = v × t ✓**F** = 340 × 2,088 ✓**S** Distance/*afstand* ***x*** = 709,92 m Distance from position 2 to the building: *Afstand van posisie 2 na die gebou* = 709.92 – 400 = 309,92 m✓

Option/ *Opsie* 3

$v = \frac{\Delta x}{\Delta t}$ ✓

$$340✓ = \frac{2x - 400✓}{3✓}$$

$$1020 = 2x - 400$$

$x = 710$ = Position 1 from builing / *Posisie 1 vanaf gebou*

Position 2 from builing / *Posisie 2 vanaf gebou* = $x - 400$
= 710 – 400 ✓
= 310 m✓

(6)

3.4 ENGLISH (t = 2 s)

Option/ *Opsie* 1	**Option/ *Opsie* 2**
Δt for sound to travel from position 1 to position 2/ *Δt vir die klank om vanaf posisie 1 na posisie 2 te beweeg*: distance = speed × time *afstand = spoed × tyd* 400 = 340 × t ✓**S** Δt = 1,176 s Δt for sound to travel from position 2 to the building / *Δt vir die klank om vanaf posisie 2 na die gebou te beweeg*: $\Delta t = \frac{2 - 1{,}176\checkmark}{2\checkmark}$ = 0, 411 s ✓**F** Distance = speed × time *Afstand = spoed × tyd* = 340 × 0,411✓**S** =140 m ✓	Δt for sound to travel from position 1 to position 2/ *Δt vir die klank om vanaf posisie 1 na posisie 2 te beweeg*:: distance = speed × time *afstand = spoed × tyd* ✓ 400 = 340 × t ✓**S** Δt = 1,176 s time from position 1 to the building: *tyd vanaf posisie 1 na die gebou:* =1,176 + 2 ✓ $= \frac{3{,}176}{2}$ ✓ =1,588 s Distance/ *afstand* ***x*** Distance/*afstand* = v × t ✓**F** = 340 × 1,588 ✓**S** Distance/*afstand* ***x*** = 540 m Distance from position 2 to the building: *Afstand van posisie 2 na die gebou* = 540 – 400 = 140 m✓

Option/ *Opsie* 3

$v = \frac{\Delta x}{\Delta t}$ ✓

$340\checkmark = \frac{2x - 400\ \checkmark}{2\ \checkmark}$

$680 = 2x - 400$

$x = 540$ = Position 1 from builing / *Posisie 1 vanaf gebou*

Position 2 from builing / *Posisie 2 vanaf gebou* = $x - 400$
= 540 – 400 ✓
= 140 m✓

(6)
[20]

QUESTION/ *VRAAG* 4

4.1 The net charge of an isolated system remains the same./
Die netto lading van 'n geïsoleerde sisteem bly konstant gedurende enige fisiese proses✓✓
OR/OF
Charge cannot be destroyed nor created, only transferred from one object to another. / *Lading kan nie geskep of vernietig word nie, maar slegs van een voorwerp na 'n ander oorgedra word.* ✓✓

(2)

4.2 **S** ✓ the sphere is negatively charge/ *die sfeer is negatief gelaai.*✓ (2)

4.3.1 $Q_{new} = \frac{Q_R + Q_S}{2}$ ✓

$Q_{new} = \frac{2\times10^{-9} + -4\times10^{-9}}{2}$ ✓

$Q_{new} = -1 \times 10^{-9}C$ ✓ (3)

4.3.2 $n = \frac{\Delta Q}{q_e}$ ✓

$n = \frac{-1\times10^{-9} - 2\times10^{-9}}{-1,6\times10^{-19}}$ ✓

$n = 1,875 \times 10^{10}$ (electrons) ✓ (3)

4.4 During contact, electrons are transferred from **S** to **R**. ✓
The spheres acquire equal charges. ✓
Spheres thus repel each other. ✓

*Tydens kontak word elektrone van **S** na **R oorgedra**.* ✓
Die sfere verkry gelyke ladings. ✓
Sfere stoot mekaar dus af. ✓ (3)
[13]

QUESTION/ *VRAAG* 5

5.1 ~~The potential difference across the conductor is directly proportional to the current through the conductor at constant temperature./~~
~~*Die potensiaalverskil oor die geleier is direk eweredig aan die stroom deur die geleier by konstante temperatuur.*✓✓~~ ~~(2)~~
(One mark carried to 5.2.2 and 5.2.5 respectively./
Een punt is na vraag 5.2.2 en 5.3.5 onderskeidelik oorgedra.)

5.2.1 $\frac{1}{R_{||}} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓

$\frac{1}{R_{||}} = \frac{1}{6} + \frac{1}{5}$ ✓

$R_{||} = 2.73\Omega$ ✓ (3)

5.2.2 $R = \frac{V}{I}$ ✓

6 ✓ $= \frac{V_2}{0,8}$ ✓

$V_2 = 4,8\ V$ ✓ **(4)**

5.2.3 **POSITIVE MARKING FROM 5.2.1 and 5.2.2 /**
POSITIEWE NASIEN VANAF 5.2.1 en 5.2.2

Option/ *Opsie* 1	**Option/ *Opsie* 2**
$R = \frac{V}{I}$ ✓ $2.73 = \frac{4,8}{I}$ ✓ $I = 1.76A$ ✓	$R = \frac{V}{I}$ ✓ $5 = \frac{4,8}{I}$ $I = 0.96A$ $I_{\parallel} = 0,8 + 0,96$ ✓ $I_{\parallel} = 1.76A$ ✓

(3)

5.2.4 **POSITIVE MARKING FROM 5.2.3/ *POSITIEWE NASIEN VANAF 5.2.3***

$I = \frac{Q}{\Delta t}$ ✓

$1,76 = \frac{Q}{10}$ ✓

$Q = 17,6\ C$ ✓ (3)

5.2.5 **POSITIVE MARKING FROM 5.2.3 AND 5.2.2 /**
POSITIEWE NASIEN VANAF 5.2.3 EN 5.2.2

Option/ *Opsie* 1	**Option/ *Opsie* 2**
$R = \frac{V}{I}$ ✓ $3 = \frac{V}{1,76}$ ✓ $V = 5,28\ V$ ✓ $V_1 = 5,28 + 4,8$ ✓ $V_1 = 10,08\ V$ ✓	$R_{tot} = 3 + 2,73$ ✓ $= 5,73\ \Omega$ ✓ $V_{tot} = I_{main} \times R_{tot}$ ✓ $= 1,76 \times 5,73$ ✓ $= 10,08\ V$ ✓

(5)

5.3 The energy transferred per unit electric charge flowing through it. ✓✓
Die energie oorgedra per eenheid elektriese lading wat daardeur vloei. (2)

5.4 **POSITIVE MARKING FROM 5.2.2 / *POSITIEWE NASIEN VANAF 5.2.2***

$V = \frac{W}{Q}$ ✓ $= 4,8 = \frac{W}{9,6}$ ✓

$W = 46,08\ J$ ✓ (3)
[23]

QUESTION/ *VRAAG* 6

6.1 Boiling point is the temperature at which the vapour pressure of the liquid equals the atmospheric pressure. / *Die temperatuur van 'n vloeistof waar sy dampdruk gelyk is aan die eksterne (atmosferiese) druk.*✓✓ (2)

6.2.1 117 (°C) ✓ (1)

6.2.2 Liquid/ *Vloeistof* ✓ (1)

6.3 Two / *Twee* / 2 ✓ (1)

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

6.5 The boiling point of the pure substance is greater than / not equal to that of water. /*Die kookpunt van die suiwer stof is hoër as/ nie gelyk aan die kookpunt van wate nier.*

(117 °C >100 °C). OF/OR (117 °C≠100 °C).✓✓ **(Compare/*vergelyk*)**

OR

The melting point of the substance is greater than / not equal to that of water./ *Die smeltpunt van die suiwer stof is hoër as/ nie gelyk aan die kookpunt van water nie.*

(17 °C > 0 °C) OF/OR (17 °C ≠ 0 °C).✓✓**(Compare/*vergelyk*)**

(2)

6.6 Gaseous phase / *Gasfase* ✓✓ (2)

[10]

QUESTION/*VRAAG* 7

7.1.1 The number of protons in an atom of an element.

Die aantal protone in 'n atom van 'n element. ✓✓ (2)

7.1.2 Calcium/ Kalsium/ Ca ✓ (1)

7.1.3 Group VIII / group 18 / group 0 / Noble gases

Groep VIII / Groep 8 / Groep 0 / Edelgasse ✓ (1)

7.1.4 Chlorine / *Chloor* / Cl /Element P✓ (1)

7.1.5 $CaCl_2$ ✓✓ (2)

7.2.1 Noble gases/ *Edelgasse* ✓ (1)

7.2.2 Eight/ *Agt* / 8 ✓ (1)

7.2.3 Zero/ *Nul* / 0 ✓ (1)

[10]

QUESTION/ *VRAAG* 8

8.1 Ionisation energy is the amount of energy (per mol) required to remove the outermost electron ✓ from an atom in the gaseous phase. ✓
Ionisasie-energie is die hoeveelheid energie benodig (per mol) om 'n buitenste elektron(e) uit 'n atoom in die gasfase te verwyder✓. (2)

8.2 Potassium/ *Kalium* ✓ (1)

8.3

- The distance between valence orbitals and the nucleus increases. ✓
- The force of attraction between nucleus and outermost electrons decrease.✓
- Ionization energy decreases ✓thus, less energy is required to remove the outermost electron.

- *Die afstand tussen valensorbitale en die kern neem toe.* ✓
- *Die aantrekkingskrag tussen kern en buitenste elektrone neem af.*✓
- *Ionisasie-energie neem dus af* ✓*, minder energie is nodig om die buitenste elektron te verwyder.* (3)

8.4 Neutrons/ *Neutrone* ✓ (1)

8.5.1 Ne-22 / Neon-22 ✓ It has highest atomic mass/mass number ✓
Dit het 'n hoër attoommassa/ massagetal. (2)

8.5.2 Relative atomic mass/ *Relatiewe attommassa*

$= \frac{(20 \times 88{,}48)+(21 \times 0{,}27)+(22 \times 11{,}25)✓}{100✓}$

= 20,23 ✓

OR/ *OF*

$(20 \times 0{,}8848) + (21 \times 0{,}0027) + (22 \times 0{,}1125)✓✓ = 20{,}23✓$ (3)

[12]

QUESTION/ *VRAAG* 9

9.1.1 Mutual attraction between two atoms resulting from the simultaneous attraction between their nuclei and the outer electrons.
'n Wedersydse aantrekking tussen twee atome wat die gevolg is van die gelyktydige aantrekking tussen hulle kerne en die buitenste elektrone.✓✓ (2)

9.1.2

Marking criteria/ Merkriglyne
✓ for labelling the orbitals/ *orbitale benoem*
✓ arrows with opposite spin/ *pyltjies ways in teenoorgestelde spinrigting*
✓ correct number of electrons/ *korrekte aantal elektrone*

(3)

9.1.3 Covalent (bond)/ *Kovalente (binding)* ✓ (1)

9.2

8 electrons around N/ *8 elektrone rondom N*	✓
3 bonding pairs of electrons/ *3 bindingspare elektrone*	✓
Single lone pair on N atom/ *Een alleenpaar op N-atoom*	✓

(3)

9.3.1 Change in which new chemical substances are formed/ Energy changes are much larger than those of the physical change/Mass and atoms are conserved, but the number of molecules is not. ✓✓
Verandering waarin nuwe chemiese stowwe gevorm word / Energieveranderinge is baie groter as dié van die fisiese verandering / Massa en atome word behou, maar die aantal molekules is nie.✓✓ (2)

9.3.2 $2Na + CuSO_4 \rightarrow Cu + Na_2SO_4$ ✓✓ (2)

9.3.3 Sodium + Copper(II)✓sulphate ✓→ Copper + Sodium sulphate ✓
Natrium + koper(II)✓sulfaat ✓ → koper + natriumsulfaat ✓ (3)

9.3.4 Solid / *Vastestof* ✓ (1)

9.3.5

2Na	+	$CuSO_4$	→	Cu	+	Na_2SO_4
2 x 23 =46 ✓	+	63,5+32+ (16x4) ✓		63,5	+	(2 x 23) +32+ (16x4) ✓
205,5 ✓			**= ✓**	**205,5**		

=✓ Is awarded for comparing/verifying that the total mass of reactant and total mass of products are equal, not just copying the value left and right.

=✓ *is toegeken vir die vergelyking/bevestiging van die totale massa van reaktante teenoor totale massa van produkte, nie net eenvoudig die kopiëring van die waarde links en regs nie.*

(5)

9.4.1 The process during which a solid change directly into a gas without passing through an intermediate liquid phase. /
Die proses waartydens 'n vaste stof direk in 'n gas verander sonder om deur 'n intermediêre vloeistoffase te gaan. ✓✓ (2)

9.4.2 Physical (change) / *Fisiese (verandering)*✓ (1)

9.4.3 Because no new substance is formed; ✓ the CO_2 remains chemically the same, ✓**OR** only its physical state changes.

Omdat geen nuwe stof gevorm word nie; ✓ die CO_2 bly chemies dieselfde, ✓**OF** slegs die fisiese toestand daarvan verander. (2)
[27]

GRAND TOTAL/ GROOTTOTAAL: 150