Western Cape Government

METRO NORTH EDUCATION DISTRICT

SCHOOL-BASED ASSESSMENT

SEPTEMBER TRIAL COMMON EXAMINATION

PHYSICAL SCIENCES P1

TASK NO.: 5

SEPTEMBER 2025

TOTAL: 150
DURATION: 3 hours

This question paper consists of 19 pages and 3 data sheets

INSTRUCTIONS AND INFORMATION

1. Write your name in the space below and submit the question paper with your answer sheets.

   NAME AND SURNAME: _____

   GRADE: **12** _____

2. This question paper consists of **TEN QUESTIONS**. Answer ALL the questions on your ANSWER SHEETS.

3. Start EACH question on a NEW page on your ANSWER SHEETS.

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 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.

11. Give brief motivations, discussions etc. where required.

12. Write neatly and legibly.

QUESTION 1 (MULTIPLE CHOICE)

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A – D) next to the question numbers (1.1 to 1.10) on your ANSWER SHEETS, e.g. 1.11 E.

1.1 A horizontal force **F** is applied to a crate, causing it to move over a rough, horizontal surface as shown below.

The kinetic frictional force between the crate and the surface on which it is moving depends on …

A the applied force **F**.
B the surface area of the crate in contact with the floor.
C how quickly the crate moves along the surface.
D the upward force exerted by the surface on the crate. (2)

1.2 A person stands on a bathroom scale that is calibrated in newton, in a stationary elevator. The reading on the bathroom scale is **w**.

The elevator now moves with a constant upward acceleration of ¼ **g**, where **g** is the gravitational acceleration.

What will the reading on the bathroom scale be now?

A ¼ **w**

B ¾ **w**

C **w**

D $^{5}/_{4}$ **w** (2)

1.3 A hot air balloon is moving upwards at a constant velocity **v**. A cellphone is dropped from the hot air balloon. What is the velocity of the cellphone at the instant it is dropped from the balloon?

A **v** downwards.
B **v** upwards.
C Zero.
D 2**v** downwards. (2)

1.4 Which one of the following best describes an inelastic collision?

A Neither kinetic energy nor momentum are conserved.
B Both momentum and kinetic energy are conserved.
C Kinetic energy is conserved but total linear momentum is not conserved.
D Kinetic energy is not conserved but total linear momentum is conserved. (2)

1.5 A 1000 W motor lifts a 100 kg mass to a height of 5 meters in 10 seconds at a constant speed. What is the power output of the motor in this situation?

A 490 W
B 500 W
C 1 000 W
D 5 000 W (2)

1.6 An astronomer at SALT observes that the light spectrum of a star has been red shifted. How have the observed frequency of light from the star and the distance between the star and Earth changed?

	OBSERVED FREQUENCY OF LIGHT	DISTANCE BETWEEN THE STAR AND EARTH
A	Increased	Decreased
B	Decreased	Increased
C	Increased	Increased
D	Decreased	Decreased

(2)

1.7 Two point charges, each having a charge of Q, are placed at a distance, **d** meters apart. If the distance between them is doubled, by what factor does the force between them change?

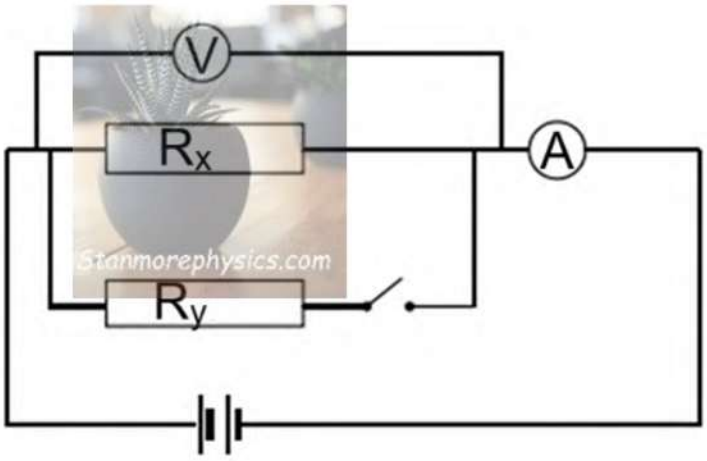
A 2

B 4

C ½

D ¼ (2)

1.8 In the circuit diagram below, $\mathbf{R_x}$ and $\mathbf{R_y}$ are identical ohmic resistors connected in parallel. When the switch is open, the ammeter reading is 0,1 A and the voltmeter reading is 3 V. Ignore the internal resistance of the battery.



What will be the reading on the AMMETER and VOLTMETER when the switch is closed?

	READING ON AMMETER	**READING ON VOLTMETER**
A	Equal to 0,1 A	Equal to 3 V
B	Greater than 0,1 A	Equal to 3 V
C	Less than 0,1 A	Less than 3 V
D	Greater than 0,1 A	Greater than 3 V

(2)

1.9 A group of learners built an electrical generator. They then used this generator to investigate how the magnitude of the induced emf would change as the magnetic field strength changed.

Which ONE of the following is CORRECT regarding the variables for the investigation?

	DEPENDENT VARIABLE	**INDEPENDENT VARIABLE**	**CONTROL VARIABLE**
A	Magnetic field strength	Number of turns of coil of generator	Magnitude of induced emf
B	Magnitude of induced emf	Number of turns of coil of generator	Magnetic field strength
C	Magnitude of induced emf	Magnetic field strength	Number of turns of coil of generator
D	Number of turns of coil of generator	Magnitude of induced emf	Magnetic field strength

(2)

1.10 To see an absorption spectrum, dispersed light must …

A Have passed through a gas that is at the same temperature as the source of light.

B Have passed through a gas that is substantially cooler than the source of light.

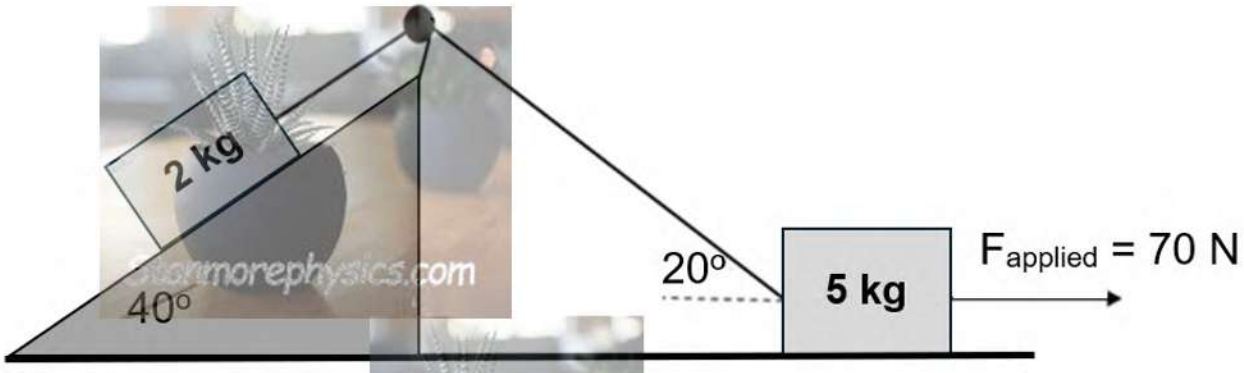
C Have passed through a gas that is substantially hotter than the source of light.

D Come straight out of a white-hot filament. (2)

[20]

QUESTION 2 (Start on a new page)

The sketch below shows a 2 kg block on an incline with an angle of 40° and is attached to a 5 kg block on the ground by an inelastic rope. The coefficient of kinetic friction on the incline is 0,2. A force of 70 N is applied to the 5 kg block **at the moment** when the rope attached to the 5 kg block is at an angle of 20°, a kinetic frictional force of 17,15 N is measured for the 5 kg block.



2.1 State *Newton's second law of motion* in words. (2)

2.2 Draw a free-body diagram showing ALL forces acting on the 5 kg block. (5)

2.3 Calculate the kinetic frictional force on the 2 kg block. (3)

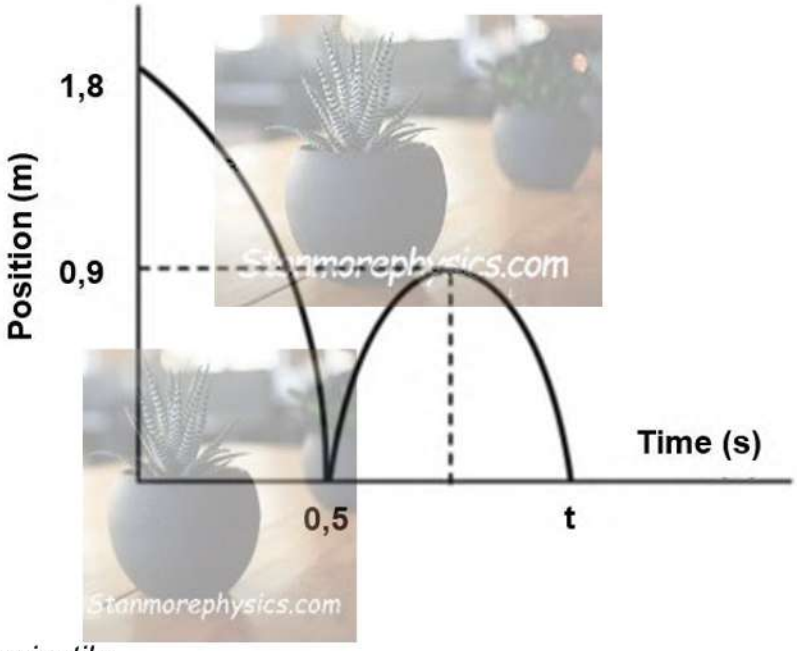
2.4 Calculate the magnitude of the 5 kg block's acceleration at the instant when the angle of the rope on the 5 kg block is 20°. (6)

[16]

QUESTION 3 (Start on a new page)

The position-time graph is given for a ball which is thrown down from a vertical height of 1,8 m. The ball bounces on reaching the ground. The contact time between the ball and the floor can be ignored.

Ignore air resistance.



3.1 Define the term *projectile*. (2)

3.2 Calculate the initial speed at which the ball was thrown. (3)

3.3 Determine the velocity of the ball as it leaves the ground following the bounce. (3)

3.4 Calculate the value of time **t**. (4)

3.5 Sketch the *velocity-time* graph to represent the motion of the ball. Indicate the following on the graph:

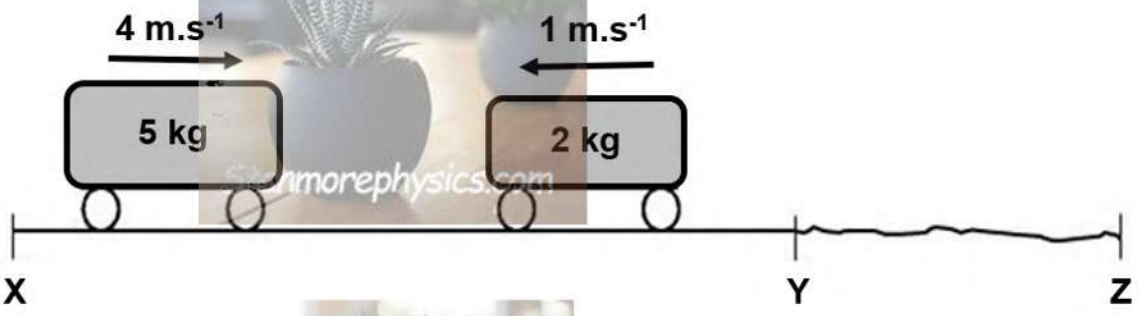
- The initial velocity at which the object was thrown.
- The velocity at which the ball bounces off the ground.
- The time of the first ball bounce. (4)

[16]

QUESTION 4 (Start on a new page)

The diagram below shows two sections, **XY** and **YZ**, of a horizontal, flat surface. Section **XY** is frictionless, while section **YZ** is rough.

A 5 kg trolley, moving with a velocity of 4 $m.s^{-1}$ to the right, collides head-on with a 2 kg trolley moving with a velocity of 1 $m.s^{-1}$ towards the 5 kg trolley. After the collision, the two trolleys stick together and move to the right pass point **Y**.



4.1 State the *principle of conservation of linear momentum* in words. (2)

4.2 Calculate the magnitude of the velocity of the combined trolleys at point **Y**. (4)

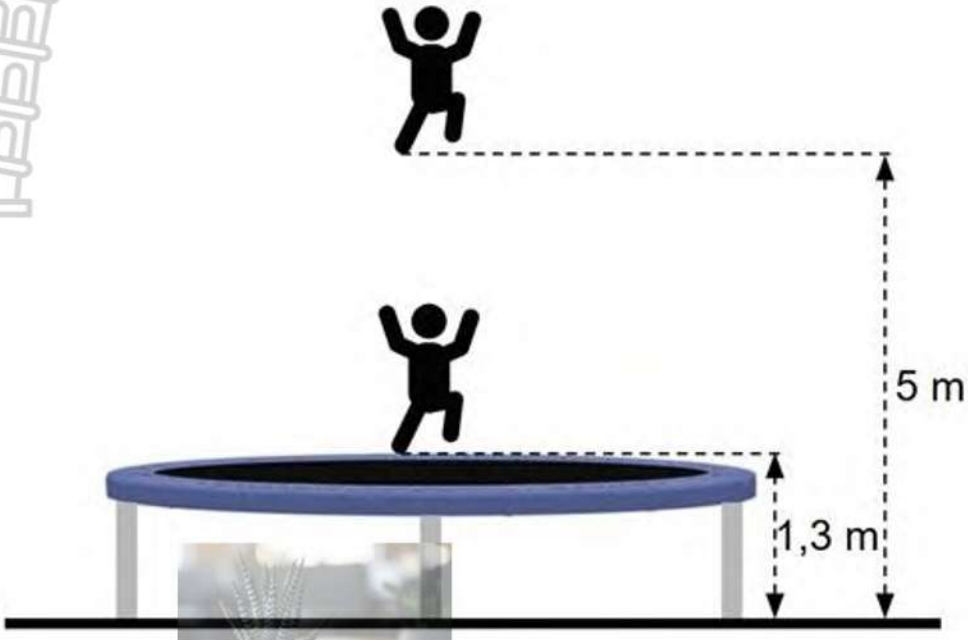
The combined trolleys travel for 0,3 s from point **Y** before coming to a stop at point **Z**.

4.3 Calculate the magnitude of the net force acting on the combined trolleys while they move through section **YZ**. (4)

[10]

QUESTION 5 (Start on a new page)

5.1 A gymnast, with an unknown mass **m**, jumps vertically upwards from a trampoline as shown below.



The gymnast loses contact with the trampoline at a height of 1,3 m above the ground and reaches a maximum height of 5 m above the ground. Ignore all effects of friction.

5.1.1 State the *law of conservation of mechanical energy* in words. (2)

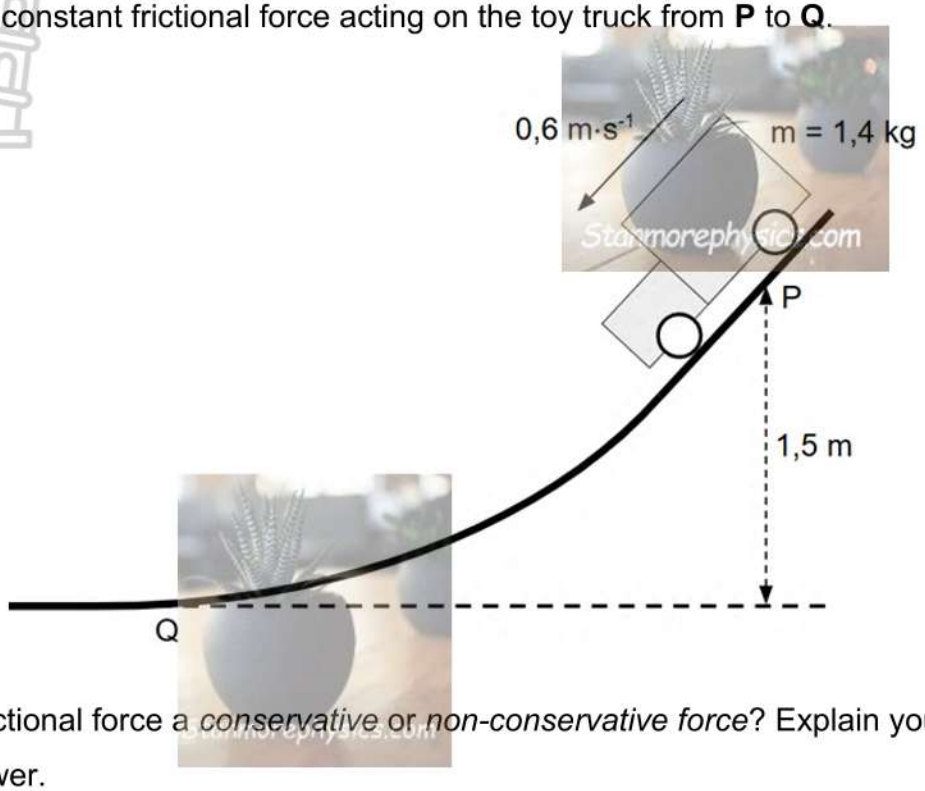
5.1.2 Use **ENERGY PRINCIPLES** to calculate the velocity with which the gymnast leaves the trampoline. (4)

5.1.3 If the effects of friction were NOT ignored, how would the maximum height reached be affected? Write only INCREASE, DECREASE or REMAIN THE SAME.

Explain your answer. (2)

5.2 A toy truck with a mass of 1,4 kg is released from rest and moves along a track down an incline as shown below. It has a speed of 0,6 m·s^{-1} at point **P,** which is at a vertical height of 1,5 m above the ground. The curved part of the track, **PQ**, is 1,8 m in length. The toy truck's speed at point **Q** is 3 m·s^{-1}.

There is a constant frictional force acting on the toy truck from **P** to **Q**.



5.2.1 Is frictional force a *conservative* or *non-conservative force*? Explain your answer. (2)

5.2.2 Calculate the magnitude of the average frictional force experienced by the toy truck. (6)

[16]

QUESTION 6 (Start on a new page)

A car moves at a constant velocity along a straight, horizontal road towards a device which is capable of emitting and detecting sound waves. The device emits sound waves with a wavelength of 0,013 m. The sound waves are reflected off the surface of the car and the device detects sound waves with a frequency of 31 500 Hz. Assume that the speed of sound in air is 340 $m.s^{-1}$.

6.1 State the *Doppler Effect* in words. (2)

6.2 Determine the frequency of the emitted waves. (3)

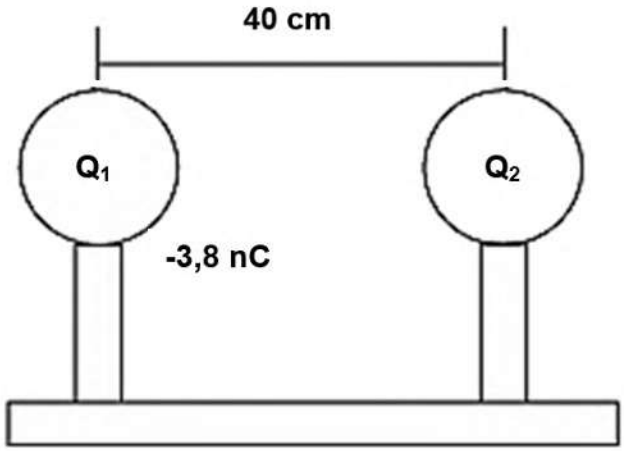
The speed limit on this road is 100 $km.h^{-1}$.

6.3 Determine if the vehicle was driving over the speed limit using an appropriate calculation. (6)

[11]

QUESTION 7 (Start on a new page)

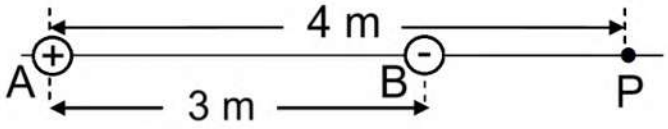
7.1 Two identical charged metal spheres Q_1 and Q_2 are placed on insulated stands with their centres 40 cm apart. The charge on Q_1 is -3,8 nC. The electrostatic force of attraction between the two spheres is $8,54 \times 10^{-7}$ N.



7.1.1 State *Coloumb's law* in words. (2)

7.1.2 Calculate the charge on Q_2. (3)

7.2 Two-point charges, **A** and **B**, are placed 3 m apart. The charge on **A** is $+6 \times 10^{-6}$ C and the charge on **B** is -3×10^{-6} C. **P** is a point 4 m to the right of charge **A**.



7.2.1 Define the term *electric field at a point*. (2)

7.2.2 Calculate the net electric field at point **P**. (4)

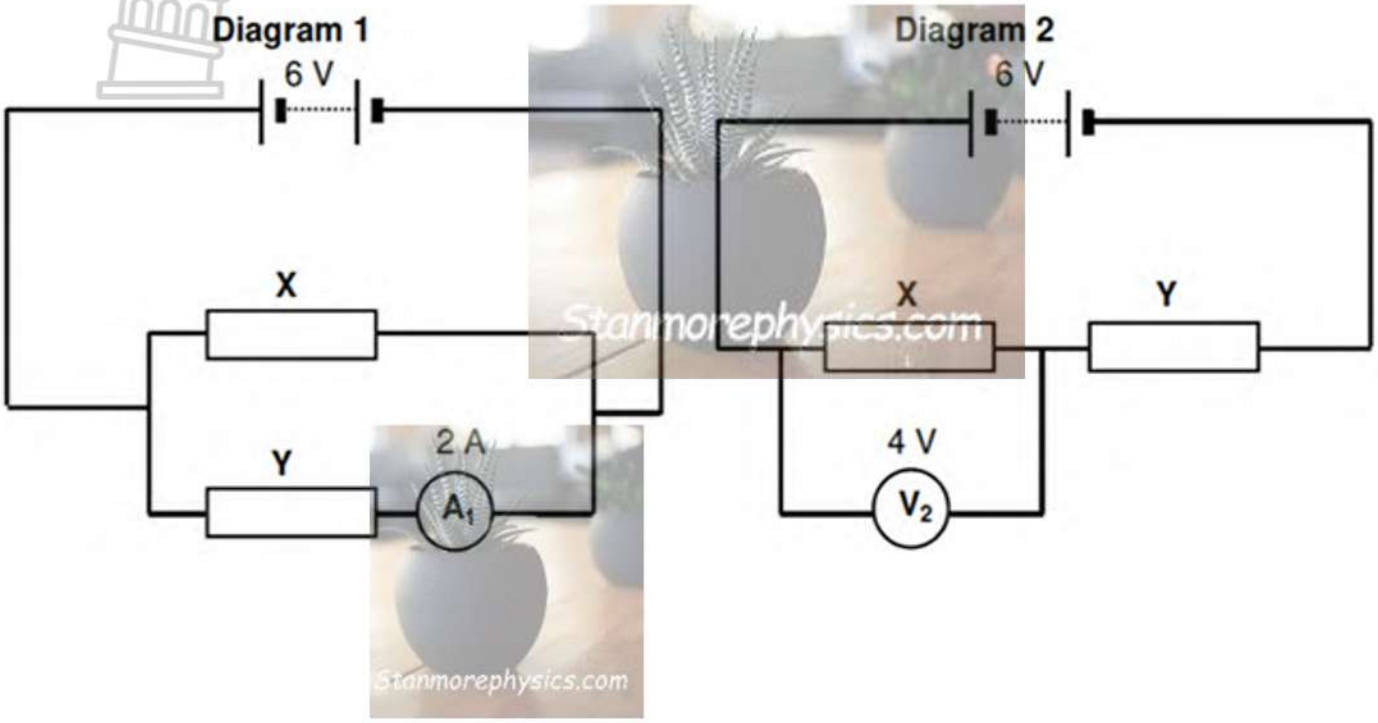
7.2.3 A proton is placed at point **P**.
Calculate the magnitude of the initial acceleration of the proton if the mass of a proton is $1,67 \times 10^{-27}$ kg. (4)

7.2.4 If an electron was placed at point **P** instead of a proton, how would the acceleration of the electron compare to that of the proton?
Write only GREATER THAN, SMALLER THAN or EQUAL TO. (1)

[16]

QUESTION 8 (Start on a new page)

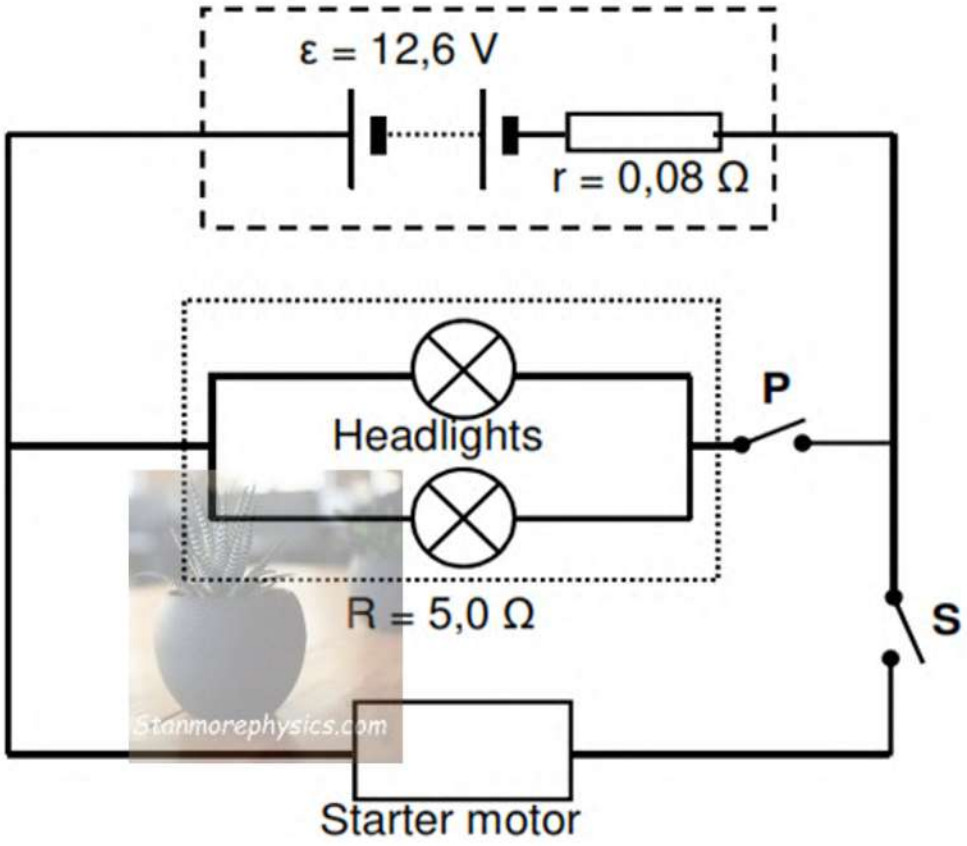
8.1 In **diagram 1**, when two NON-IDENTICAL resistors **X** and **Y** are connected in parallel across a 6 V battery, the current through $\mathbf{A_1}$ is found to be 2 A. In **diagram 2**, when the two resistors are connected in series to a 6 V battery, $\mathbf{V_2}$ reads 4 V. The internal resistance of the battery and the resistance of the conducting wires may be ignored.



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

8.1.2 Calculate the resistance of **X** and **Y** respectively. (6)

8.2 A car battery has an emf of 12,6 V and an internal resistance of 0,08 Ω. The two headlights have a total external resistance of 5,0 Ω. The starter motor is connected in parallel with the headlights as shown in the diagram below. Assume the headlights are ohmic resistors.



8.2.1 Write down the magnitude of the potential difference across switch **S** when both switches are open. (1)

Switch **P** is now CLOSED but **S** is still OPEN.

8.2.2 Calculate the potential difference across the headlights when switch **P** is closed. (5)

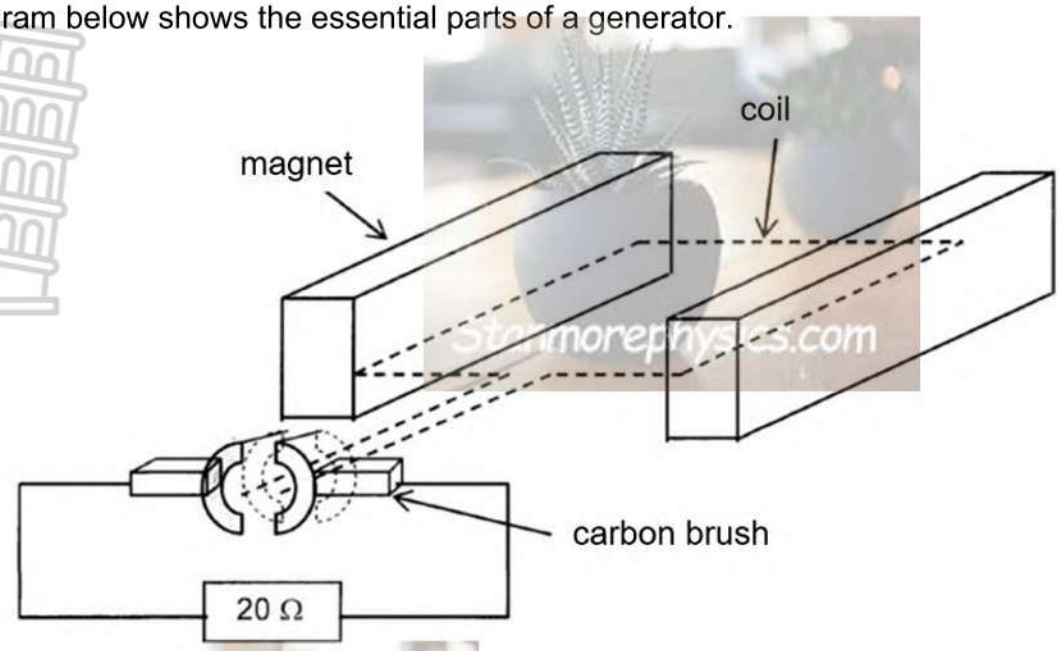
BOTH switches (**P** and **S**) are now CLOSED.

8.2.3 What will happen with the brightness of the headlights? Write down only INCREASE, DECREASE or REMAIN THE SAME. Explain your answer. (5)

[19]

QUESTION 9 (Start on a new page)

9.1 The diagram below shows the essential parts of a generator.



The coil rotates within the magnetic field.

Write down the type of current (direct current (DC) or alternating current (AC)):

9.1.1 induced in the coil. (1)

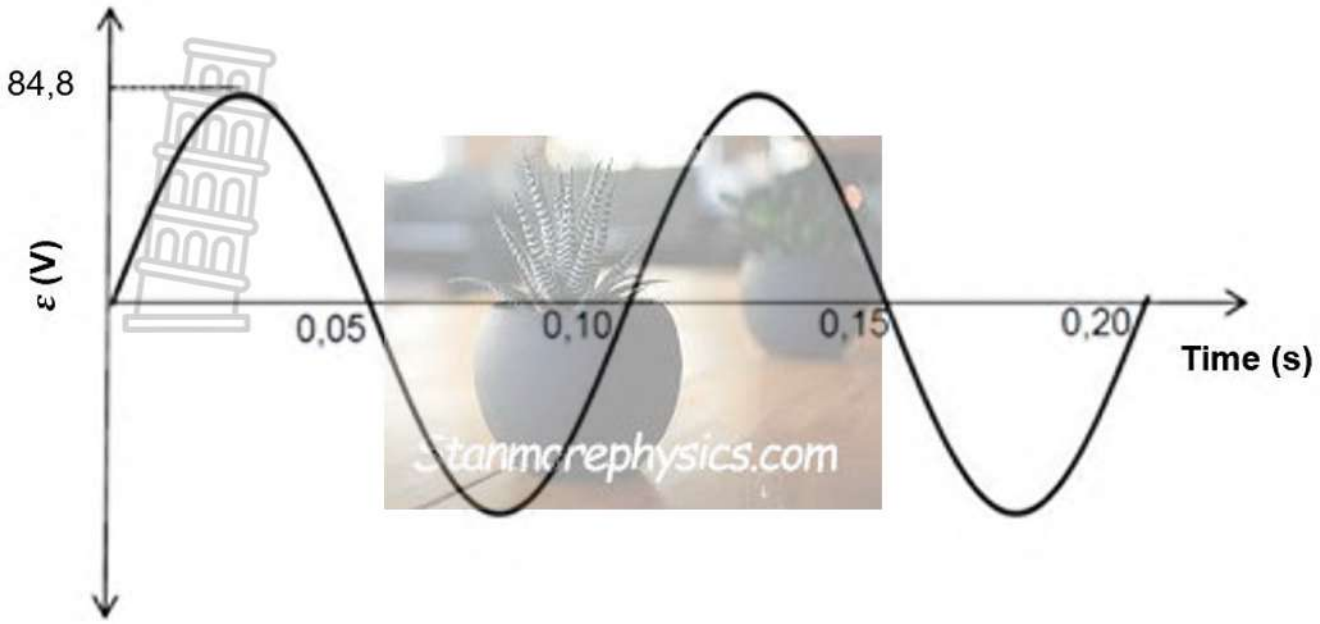
9.1.2 passing through the 20 Ω resistor. Give a reason for the answer. (2)

9.2 An alternating current generator is used in the commercial generation of electricity.

9.2.1 State ONE fundamental difference in the design of an alternating current generator and the direct current generator. (2)

9.2.2 Fully explain why alternating current is preferred over direct current for the transmission of electricity over long distances. (2)

9.3 An AC generator produces the following graph of *emf* versus *time*.



9.3.1 Write down the period for one revolution of the coil of the generator. (1)

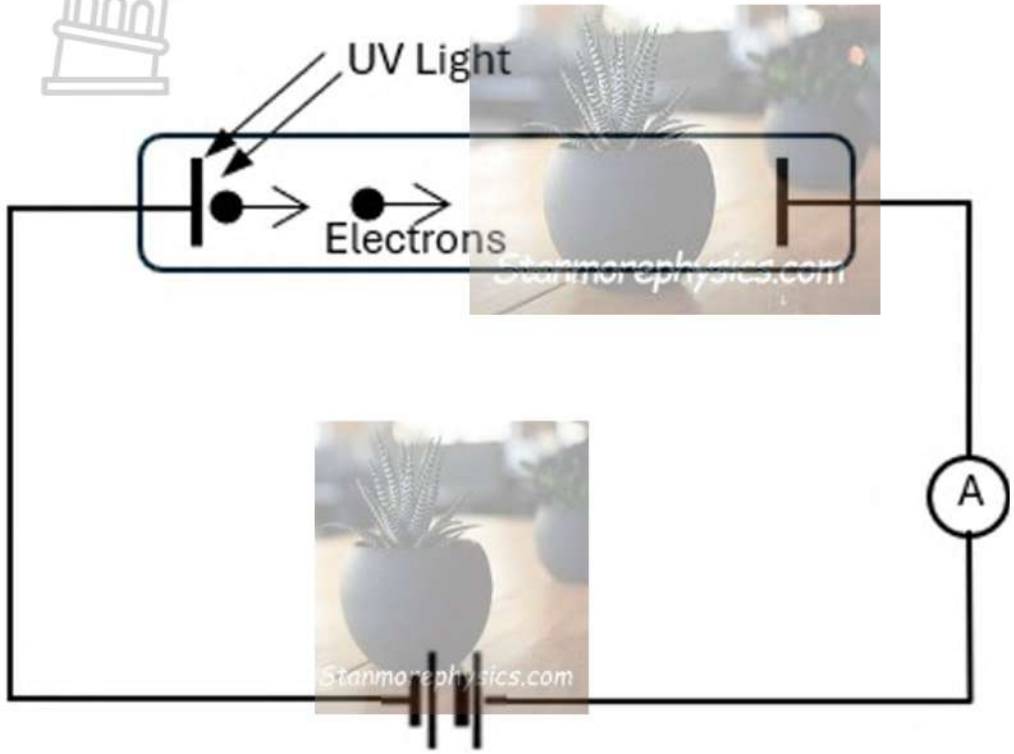
9.3.2 Calculate the root mean square voltage (V_{rms}) for this generator. (2)

9.3.3 Calculate the resistance of a 40 W ohmic bulb connected to the generator. (3)

[13]

QUESTION 10 (Start on a new page)

The photocell below demonstrates an ultraviolet (UV) source of light shone onto a metal plate. The UV light with a wavelength of 284 nm ejects electrons from the surface of the metal plate with an average speed of 1,48 x 10^5 $m.s^{-1}$.



10.1 Calculate the frequency of the UV light photons. (3)

Some metals and their corresponding work functions are listed in the table below.

Metal	Work function (x10^{-19} J)
Gold	7,8
Zinc	6,9
Calcium	4,3
Potassium	3,2

10.2 Define the term *work function*. (2)

10.3 By means of calculations, identify the metal that is used in this photocell from the table above. (5)

10.4 The metal described in Question 10.3 is now replaced with potassium.

State how this change will influence the following.

Choose from INCREASES, DECREASES or NO EFFECT.

10.4.1 the number of photoelectrons that will be ejected from the potassium metal surface. (1)

10.4.2 the ammeter reading. (1)

10.4.3 the kinetic energy of the photoelectrons. (1)

[13]

TOTAL: 150 MARKS

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
VRAESTEL 1 (FISIKA)

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

NAME	SYMBOL	VALUE
Acceleration due to gravity *Swaartekragversnelling*	g	9,8 $m \cdot s^{-2}$
Universal gravitational constant *Universele gravitasiekonstant*	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Radius of Earth *Radius van die Aarde*	R_E	6,38 x 10^6 m
Mass of Earth *Massa van die Aarde*	M_E	5,98 x 10^{24} kg
Speed of light in a vacuum *Spoed van lig in 'n vacuum*	c	3,0 x 10^8 $m \cdot s^{-1}$
Planck's constant *Planck se constant*	h	6,63 x 10^{-34} J·s
Coulomb's constant *Coulomb se konstant*	k	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
Charge on electron *Lading op electron*	e	-1,6 x 10^{-19} C
Electron mass *Electronmassa*	m_e	9,11 x 10^{-31} kg

TABLE 2: FORMULAE/ *TABEL 2: FORMULES*

MOTION/*BEWEGING*

$v_f = v_i + a\Delta t$	$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ or/*of* $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$v_f{}^2 = v_i{}^2 + 2a\Delta x$ or/*of* $v_f{}^2 = v_i{}^2 + 2a\Delta y$	$\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$ or/*of* $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$

$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_k N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p = mv_f - mv_i$	$w = mg$
$F = G\frac{m_1 m_2}{d^2}$ or/*of* $F = G\frac{m_1 m_2}{r^2}$	$g = G\frac{M}{d^2}$ or/*of* $g = G\frac{M}{r^2}$

WORK, ENERGY AND POWER/*ARBEID, ENERGIE EN DRYWING*

$W = F\Delta x\cos\theta$	$U = mgh$ or/*of* $E_P = mgh$
$K = \frac{1}{2}mv^2$ or/*of* $E_k = \frac{1}{2}mv^2$	$W_{net} = \Delta K$ or/*of* $W_{net} = \Delta E_k$ $\Delta K = K_f - K_i$ or/*of* $\Delta E_k = E_{kf} - E_{ki}$
$W_{nc} = \Delta K + \Delta U$ or/*of* $W_{nc} = \Delta E_k + \Delta E_p$	$P = \frac{W}{\Delta t}$
$P_{ave} = Fv_{ave}$	

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

$v = f\lambda$	$T = \frac{1}{f}$
$f_L = \frac{v \pm v_L}{v \pm v_s} f_s$	$E = hf$ or $E = h\frac{c}{\lambda}$
$E = W_o + E_{k(max)}$ or $E = W_o + K_{max}$ where $E = hf$ and $W_0 = hf_0$ and $E_{k(max)} = \frac{1}{2}mv_{max}^2$ or $K_{max} = \frac{1}{2}mv_{max}^2$	
$E = W_o + E_{k(max)}$ *or* $E = W_o + K_{max}$ *where* $E = hf$ *and* $W_0 = hf_0$ *and* $E_{k(max)} = \frac{1}{2}mv_{max}^2$ *or* $K_{max} = \frac{1}{2}mv_{max}^2$	

$F = \frac{kQ_1Q_2}{r^2}$	$E = \frac{kQ}{r^2}$
$V = \frac{W}{q}$	$E = \frac{F}{q}$
$n = \frac{Q}{e}$ or/*of* $n = \frac{Q}{q_e}$	

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$R = \frac{V}{I}$	$emf\,(\mathcal{E}) = I(R + r)$
$R_s = R_1 + R_2 + \ldots$ $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$	$q = I\Delta t$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$

ALTERNATING CURRENT/*WISSELSTROOM*

$I_{rms} = \frac{I_{max}}{\sqrt{2}}$	$P_{ave} = V_{rms}I_{rms}$
$V_{rms} = \frac{V_{max}}{\sqrt{2}}$	$P_{ave} = I_{rms}^2R$ $P_{ave} = \frac{V_{rms}^2}{R}$

Western Cape Government
Education
FOR YOU

CAPE WINELANDS EDUCATION DISTRICT

PHYSICAL SCIENCES PAPER 1
MARKING GUIDELINE
GRADE 12

COMMON TRIAL EXAMINATION
SEPTEMBER 2025

MARKS: 150

TIME: 3 hours

This exam paper consists of 14 pages.

QUESTION 1/ VRAAG 1

1.1	D	✔✔	(2)
1.2	D	✔✔	(2)
1.3	B	✔✔	(2)
1.4	D	✔✔	(2)
1.5	A	✔✔	(2)
1.6	B	✔✔	(2)
1.7	D	✔✔	(2)
1.8	B	✔✔	(2)
1.9	C	✔✔	(2)
1.10	B	✔✔	(2)

[20]

QUESTION 2/ VRAAG 2

2.1 When a net force acts on an object, the object will accelerate in the direction of the force and the acceleration is directly proportional to the force and inversely proportional to the mass of the object. ✔✔

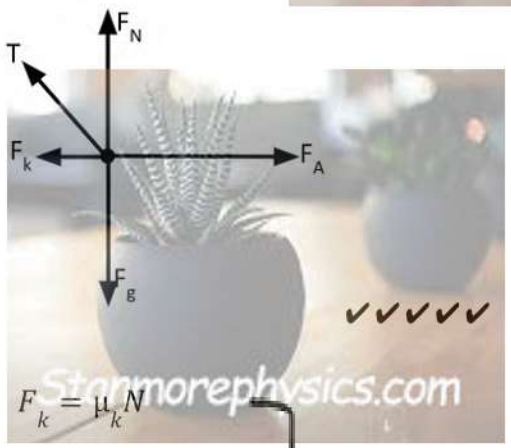
(Deduct one mark if any of the underlined phrases are omitted.)

Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, versnel die voorwerp in die rigting van die krag teen 'n versnelling direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.

(Trek een punt af indien enige van die onderstreepte frases weggelaat word.) (2)

2.2 *Note:* 1 mark for each arrow WITH its label, deduct 1 mark for every extra force included.

Let wel: 1 punt vir elke pyl MET sy byskrif, trek 1 punt af vir elke ekstra krag wat ingesluit is.



(5)

2.3 $F_k = \mu_k N$

$= \mu_k mgcos\theta$ ✔ mark for either

$= (0,2)\left(2\right)(9,8)(cos40^o)$ ✔

$= 3,0\ N$ down the slope ✔ (3)

2.4 **POSITIVE MARKING FROM QUESTION 2.3/POSITIEWE NASIEN VANAF VRAAG 2.3:**

2kg:	5kg:
$F_{net} = ma$ ✔ $T - F_k - Fg_{\parallel} = ma$ $T - F_k - mgsin\theta = ma$ $(T - 3 - (2\times 9,8\times sin40^o))$✔ $= 2a$✔ (for both 2a & 5a) $T = 2a + 15,599$ ...eq 1	$F_{net} = ma$ $F_A - F_k - Tcos\theta = ma$ $(70 - 17,15 - Tcos20^o)$✔ $= 5a$ $52,85 - Tcos20^o = 5a$ ... eq 2

Substitute **equation 1** into **equation 2**:

$52,85 - (2a + 15,599)cos20^o = 5a$ ✔

$38,19 = (5 + 2cos20^o)a$

$a = 5,55\ m.s^{-2}$ ✔ (6)

[16]

QUESTION 3/ VRAAG 3

3.1 An object which has been given an initial velocity and then it moves under the influence of the gravitational force only. ✔✔ **(2 or 0)**
'n Voorwerp waaraan 'n beginsnelheid gegee is en wat dan slegs onder die invloed van die gravitasiekrag beweeg. **(2 of 0)** (2)

3.2

Downwards as positive

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✔

$1,8 = v_i(0,5) + \frac{1}{2}(9,8)(0,5^2)$ ✔

$v_i = 1,15\ m{\cdot}s^{-1}$ ✔

Upwards as positive

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✔

$-1,8 = v_i(0,5) + \frac{1}{2}(-9,8)(0,5^2)$ ✔

$v_i = -1,15\ m{\cdot}s^{-1}$

$\therefore speed = 1,15\ m{\cdot}s^{-1}$ ✔ (3)

3.3

$v_f^2 = v_i^2 + 2a\Delta y$ ✔

$0 = v_i^2 + 2(9,8)(-0,9)$ ✔

$v_i = \sqrt{17,64}$

$v_f^2 = v_i^2 + 2a\Delta y$ ✔

$0 = v_i^2 + 2(-9,8)(0,9)$ ✔

$v_i = \sqrt{17,64}$

$v_i = 4,2\ m{\cdot}s^{-1}\ upwards$ ✔

3.4 $v_f = v_i + a\Delta t$ ✔

$0 = -4,2 + 9,8\Delta t$ ✔ **+ MARKING**

$\Delta t = 0,43\ s$

$t = 0,5 + 2(0,43)$ ✔

$t = 1,36\ s$ ✔

(3)

$v_i = 4,2\ m{\cdot}s^{-1}\ upwards$ ✔

$v_f = v_i + a\Delta t$ ✔

$0 = 4,2 + (-9,8)\Delta t$ ✔ **+ MARKING**

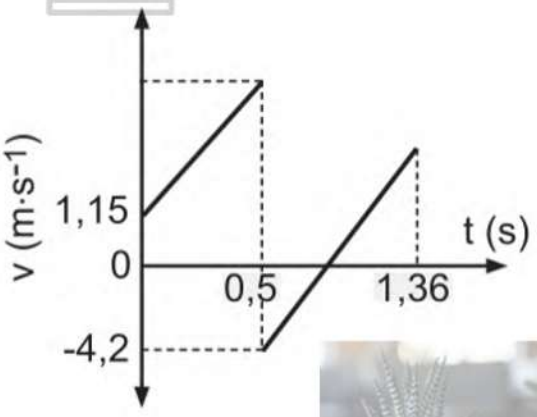
$\Delta t = 0,43\ s$

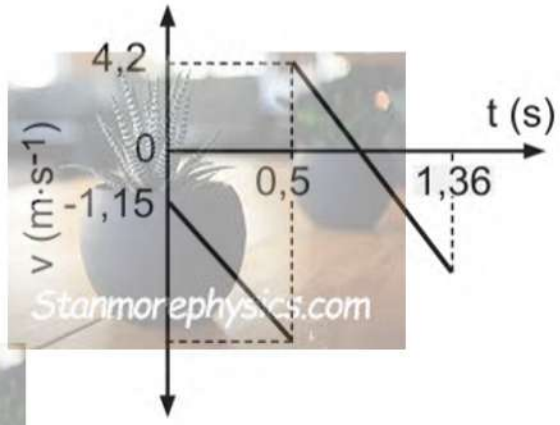
$t = 0,5 + 2(0,43)$ ✔

$t = 1,36\ s$ ✔

(4)

3.5





POSITIVE MARKING FROM Q3.3/POSITIEF NASIEN VANAF V3.3

Criteria for marking/ Nasienkriteria:

- Lines are correctly drawn (parallel)/ Lyne is korrek getrek (parallel) ✔
- Initial velocity correctly indicated/ Aanvangssnelheid korrek aangedui ✔
- Velocity of the ball as it leaves the ground./ Snelheid van die bal soos dit die grond verlaat. ✔
- Time when the ball strikes the ground after the first bounce (0,5 s)/ Tyd wanneer die bal die grond tref na die eerste bons (0,5 s).✔ (4)

[16]

QUESTION 4/ VRAAG 4

4.1 The total linear momentum of an isolated system✔ remains constant / is conserved ✔

Die totale lineêre momentum in 'n geïsoleerde sisteem ✔bly konstant / behoue.✔

OR

Accept: In an isolated system, ✔ the total linear momentum before collision is equal to the total linear momentum after collision. ✔

Aanvaar: In 'n geïsoleerde stelsel, ✔ is die totale lineêre momentum voor botsing gelyk aan die totale lineêre momentum na botsing. ✔ (2)

4.2

Right as +:	**Left as +:**
$\Sigma p_{(initial)} = \Sigma p_{(final)}$ ✔ OR	$\Sigma p_{(initial)} = \Sigma p_{(final)}$ ✔
$m_1v_{i1} + m_2v_{i2} = (m_1 + m_2)v_f$	$m_1v_{i1} + m_2v_{i2} = (m_1 + m_2)v_f$
(5)(4) + (2)(-1) ✔ = (5 + 2) (v_f) ✔	(5)(-4) + (2)(1) ✔ = (5 + 2) (v_f) ✔
$\therefore v_f = 2,57\ m\cdot s^{-1}$ ✔	$\therefore v_f = -2,57\ m\cdot s^{-1}$ ✔

If no subscripts: mv + mv = mv + mv max. 3/4

(4)

4.3 **POSITIVE MARKING FROM 4.2/ POSITIEF NASIEN VANAF 4.2**

OPTION 1:	**OPTION 2:**
$F_{net}\Delta t = m\Delta v$ ✔ or $F_{net}\Delta t = \Delta p$	$v_f = v_i + a\Delta t$
$F_{net}(0,3)$✔ $= (7)(0 - 2,57)$✔	$0 = 2,57 + a(0,3)$✔
$F_{net} = -59,97\ N$	$a = -8,57\ m.s^{-2}$
$magnitude\ of\ F_{net} = 59,97\ N$✔	$F_{net} = ma$✔
	$F_{net} = (7)(-8,57)$✔
	$F_{net} = -59,99\ N$
	$magnitude\ of\ F_{net} = 59,99\ N$✔
Range/Gebied: 59,97 N to/tot 60,20 N	**Range/gebied: 59,97 N to/tot 60,20 N**

(4)
[10]

QUESTION 5/ VRAAG 5

5.1.1 The total mechanical energy in an isolated system✔ is conserved/remains constant. ✔
Die totale meganiese energie in 'n geïsoleerde stelsel✔ word behoue/bly konstant. ✔ (2)

5.1.2

OPTION 1:	**OPTION 2:**
$E_{M(initial)} = E_{M(final)}$ ✔ $\frac{1}{2}mv_i^2 + m(9,8)(1,3)$ ✔ $= m(9,8)(5)$✔ $+ 0$ $v_i = 8,52\ m.s^{-1}\ upwards/opwaarts$ ✔	$W_{net} = \Delta E_K$ ✔ $m(9,8)(3,7)cos180^o$ ✔ $= 0 - \frac{1}{2}mv^2$ ✔ $v = 8,52\ m.s^{-1}\ upwards/opwaarts$ ✔
OPTION 3: $W_{nc} = \Delta E_K + \Delta E_P$ ✔ $= (\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2) + (mgh_f - mgh_i)$ $0 = \frac{1}{2}m(0) - \frac{1}{2}mv_i^2$ ✔+ m(9,8)(5) - m(9,8)(1,3)✔ $v_i = 8,52\ m.s^{-1}\ upwards/opwaarts$ ✔	**NOTE/LET WEL:** If learners used equations of motion: 0/4 Indien leerders bewegingsvergelykings gebruik het: 0/4

(4)

5.1.3 DECREASE / AFNEEM ✔
Friction will remove energy from the system.✔ /
Wrywing sal energie uit die stelsel verwyder.
OR/OF
Some of the object's kinetic energy would be converted into heat and sound due to friction, leaving less energy available to convert into gravitational potential energy./
Van die voorwerp se kinetiese energie sal as gevolg van wrywing in hitte en klank omgeskakel word, wat minder energie beskikbaar laat om in gravitasiepotensiële energie om te skakel.
OR/OF

Friction opposes motion, causing the object to lose energy more quickly as it moves upward. /

Wrywing staan beweging teë, wat veroorsaak dat die voorwerp vinniger energie verloor soos dit opwaarts beweeg.

OR/OF

With less energy available to overcome gravity, the object would not rise as high, resulting in a lower maximum height. /

Met minder energie beskikbaar om gravitasiekrag te oorkom, sal die voorwerp nie so hoog styg nie, wat 'n laer maksimum hoogte tot gevolg sal hê.

OR/OF

Increased F_{net} downwards/increased acceleration downwards/loses velocity faster, resulting in a lower maximum height./

F_{net} afwaarts neem toe/versnelling afwaarts neem toe/verloor snelheid vinniger, wat lei tot 'n laer maksimum hoogte. (2)

5.2.1 Non-conservative/ Nie-konserwatiewe krag ✔

It is a force for which the work done in moving an object between two points depends on the path taken. ✔

Dit is 'n krag waarvoor die arbeid verrig om 'n voorwerp tussen twee punte te beweeg, afhanklik is van die roete wat gevolg word. (2)

5.2.2 $W_{nc} = \Delta E_K + \Delta E_P$ ✔

$W_{friction} = (\frac{1}{2}(1,4)(3)^2 - \frac{1}{2}(1,4)(0,6)^2)$ ✔ $+ (1,4)(9,8)(0 - 1,5)$ ✔

$W_{friction} = -14,532\ J$

$W_{friction} = F_{friction}\Delta x cos\theta$

$-14,532 = F_{friction}(1,8)$✔$cos180^o$ ✔

$F_{friction} = 8,07\ N$ ✔

OR/OF

$W_{net} = \Delta E_K$ ✔

$W_f + W_{fg//} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$F_f \Delta x cos180 + mg\Delta x sin\theta cos0 = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$F_f(1,8)$✔$cos180$✔ $+ 1,4(9,8)(1,8)(\frac{1,5}{1,8})$✔ $= \frac{1}{2}(1,4)(3)^2 - \frac{1}{2}(1,4)(0,6)^2$✔

$F_{friction} = 8,07\ N$ ✔ OR/OF

$v_f^2 = v_i^2 + 2a\Delta x$

$(3)^2$✔ $= (0,6)^2 + 2a(1,8)$ ✔

$a = 2,4\ m.s^{-2}$

$F_{net} = ma$ ✔

$F_{net} = (1,4)(2,4)$✔

$F_{net} = 3,36\ N$

$F_{net} = F_{g\ parallel} - F_f$

$F_{net} = F_g sin\theta - F_f$

$3,36 = (1,4)(9,8)(\frac{1,5}{1,8})$✔ $- F_f$

$3,36 = 11,43 - F_f$

$F_f = 8,07\ N$ ✔

(6)

[16]

QUESTION 6/ VRAAG 6

6.1 The apparent change in frequency (or pitch)✔ detected by a listener because the source and the listener have different velocities relative to the medium of propagation. ✔

Die skynbare verandering in frekwensie (of toonhoogte) wat deur 'n luisteraar waargeneem word omdat die bron en die luisteraar verskillende snelhede het relatief tot die voortplantingsmedium.

OR/OF

An apparent change in detected frequency✔ as a result of the relative motion between a source and a listener. ✔

'n Skynbare verandering in waargenome frekwensie as gevolg van die relatiewe beweging tussen 'n bron en 'n luisteraar. (2)

6.2 $v = f\lambda$ ✔

$340 = f(0.013)$ ✔

$f = 26153,85$ Hz ✔ (3)

6.3 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✔

$f_L = \frac{340 + v_{car}}{340}(26153,85)$ ✔ ***positive marking from Q6.2***

$f_L = \left(340 + v_{car}\right)(76,92308824)$

$f_L = \frac{v \pm v_L}{v \pm v_s} f_s$

31500 ✔ $= \left(\frac{340}{340 - v_{car}}\right)\left(340 + v_{car}\right)(76,92308824)$ ✔

$409,4999398 = \frac{115600 + 340v_{car}}{340 - v_{car}}$

$139229,9795 - 409,4999398v_{car} = 115600 + 340v_{car}$

$23629,97953 = 749,4999398v_{car}$

$v_{car} = 31,53\ m.s^{-1}$ ✔ *OR/OF* $v_{car} = 113,51\ km.h^{-1}$ (Note: 100 $km.h^{-1}$ = 27,78 $m.s^{-1}$)

∴ The car is speeding./Die kar oorskry die spoedgrens ✔(***positive marking from v_{car}***)

(6)

[11]

QUESTION 7/ VRAAG 7

7.1.1 The magnitude of the electrostatic force exerted by one point charge on another point charge is directly proportional to the product of the magnitude of the charges and inversely proportional to the square of the distance between them. ✓ ✓

Die grootte van die elektrostatiese krag wat deur een puntlading op 'n ander puntlading uitgeoefen word, is direk eweredig aan die produk van die grootte van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle.

Deduct one mark if any of the underlined phrases are omitted./Trek een punt af indien enige van die onderstreepte frases weggelaat word. (2)

7.1.2 $F = \frac{kQ_1Q_2}{r^2}$ ✔

$8,54 \times 10^{-7} = \frac{(9 \times 10^9)(3,8 \times 10^{-9})Q_2}{(0,4)^2}$ ✔

$Q_2 = 4 \times 10^{-9}$ C ✔

If Q_2 is written as a negative charge, no mark for final answer.
Indien Q_2 as 'n negatiewe lading geskryf is, geen punt vir die finale antwoord nie

(3)

7.2.1 The electric field at a point is the electrostatic force experienced per unit positive charge placed at that point. ✔✔ **(2 or 0)**

Die elektriese veld by 'n punt is die elektrostatiese krag wat per eenheidspositiewe-lading wat by daardie punt geplaas is, ondervind word. **(2 of 0)** (2)

7.2.2

Right as positive	Left as positive
$E_{net} = \frac{kQ_1}{r^2} + \frac{kQ_2}{r^2}$ ✔ $= (\frac{(9\times10^9)(6\times10^{-6})}{(4)^2})$ ✔ $- \frac{(9\times10^9)(3\times10^{-6})}{(1)^2}$ ✔ $= 3375 - 27\,000$ $= 23\,625\ N.C^{-1}$ to the left/ na links ✔	$E_{net} = \frac{k}{r^2} + \frac{kQ_2}{r^2}$ ✔ $= -(\frac{(9\times10^9)(6\times10^{-6})}{(4)^2})$ ✔ $+ \frac{(9\times10^9)(3\times10^{-6})}{(1)^2}$ ✔ $= -3375 + 27\,000$ $= 23\,625\ N.C^{-1}$ to the left/ na links ✔

(4)

7.2.3 ***POSITIVE MARKING FROM Q7.2.2/POSITIEF NASIEN VANAF V7.2.2***

OPTION 1/OPSIE 1	**OPTION 2/OPSIE 2**
$E = \frac{F}{q}$ ✔ OR/OF $F = Eq$ $F = (1,6 \times 10^{-19})(23\,625)$ ✔ $= 3,78 \times 10^{-15} N$ $a = \frac{F}{m}$ $a = \frac{3,78\times10^{-15}}{1,67\times10^{-27}}$ ✔ $a = 2,26 \times 10^{12} m.s^{-2}$ ✔	$F_{net} = \frac{kQ_1Q_2}{r^2} + \frac{kQ_1Q_2}{r^2}$ ✔ $F_{net} = \frac{(9\times10^9)(3\times10^{-6})(1,6\times10^{-19})}{(1)^2} - \frac{(9\times10^9)(6\times10^{-6})(1,6\times10^{-19})}{(4)^2}$ ✔ $F_{net} = 3,78 \times 10^{-15} N$ $F_{net} = ma$ $3,78 \times 10^{-15} = (1,67 \times 10^{-27})$ ✔a $a = 2,26 \times 10^{12} m.s^{-2}$ ✔
Marking Criteria: • Correct formula • Calculate force • Substitute mass in F = ma • Correct answer	**Nasienkriteria:** • Korrekte formule • Bereken krag • Vervang massa in F = ma • Korrekte antwoord

(4)

7.2.4 Greater than/Groter as ✔ (1)

[16]

QUESTION 8/ VRAAG 8

8.1.1 The potential difference across a conductor is directly proportional to the current ✔

in the conductor at constant temperature. ✔

Deduct one mark if any of the underlined phrases are omitted.

Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom in die geleier by konstante temperatuur.

Trek een punt af indien enige van die onderstreepte frases weggelaat word. (2)

8.1.2

Diagram 1:

$R_Y = \frac{V}{I}$ ✔

$= \frac{6}{2}$ ✔

$= 3\ \Omega$

Diagram 2:

$V_Y = emf - V_X$

$= 6 - 4$

$= 2\ V$ ✔

$I_Y = \frac{V_Y}{R_Y}$

$= \frac{2}{3}$ ✔

$= 0,67\ A$

$R_X = \frac{V_X}{I_X}$

$= \frac{4}{0.67}$ ✔

$= 5,97\ \Omega$ ✔ **Range/Gebied:** 5,71Ω to/tot 6Ω

(6)

8.2.1 $12,6\ V$ ✔ (1)

8.2.2 ***POSITIVE MARKING FROM Q8.2.1/POSITIEF NASIEN VANAF V8.2.1***

OPTION 1/OPSIE 1

$\varepsilon = I(R + r)$✔

$12,6$✔ $= I(5 + 0,08)$✔ $I = 2,48\ A$

$V_{ext} = IR$

$V_{ext} = (2,48)(5)$✔

$V_{ext} = 12,4\ V$✔

OPTION 2/OPSIE 2

$V_1 = \frac{R_1}{R_1+R_2} \times V_{total}$✔ OR/OF $V_2 = \frac{R_2}{R_1+R_2} \times V_{total}$

$V_{headlamps} = \frac{5✔}{5+0,08✔} \times 12,6✔$

$V_{headlamps} = 12,4V$✔ (5)

8.2.3 Decrease (brightness) /Verminder (helderheid)✔

- $R_{external}$ decrease/ $R_{eksterne}$ verminder✔
- I_t increase/ I_t vermeerder✔
- $V_{internal\ resistance}$ (or V_{lost}) increase **OR** V_{ext} decrease (emf remain constant)✔/
  $V_{interne\ weerstand}$ (of $V_{verlore}$) vermeerder **OF** V_{ext} verminder (as emk konstant bly)
- P (Power) decrease (according to $P = V^2/R$)✔ /
  P (Drywing) verminder (volgens $P = V^2/R$) (5)

[19]

QUESTION 9/ VRAAG 9

9.1.1 AC / Alternating current / WS / Wisselstroom ✔ (1)

9.1.2 DC / Direct current✔ / GS / Gelykstroom

Due to the presence of the split ring/commutator. ✔

A.g.v. die teenwoordigheid van die splitring/kommutator. (2)

9.2.1 The AC generator has slip rings ✔ whilst a DC generator has a split ring/commutator. ✔

Die WS generator het sleepringe, terwyl die GS generator splitring/kommutator het. (2)

9.2.2 Increase in voltage and decrease in current. ✔

Verhoging in potensiaalverskil en verlaging in stroom.

Loss in power/energy decreases. ($P = I^2R$) ✔

Verlies aan drywing/energie verminder ($P = I^2R$) (2)

9.3.1 0,1 s ✔ (1)

9.3.2 $V_{rms} = \frac{V_{max}}{\sqrt{2}} = \frac{84,8}{\sqrt{2}}$ ✔ $= 59,96V$ ✔ (2)

9.3.3 $P_{ave} = \frac{(V_{rms})^2}{R}$ ✔

$40 = \frac{59,96^2}{R}$ ✔ ***Positive marking from Q9.3.2***

$R = 89,88\ \Omega$ ✔ (3)

[13]

QUESTION 10/ VRAAG 10

10.1 $f = \frac{c}{\lambda}$ ✔ (Accept/Aanvaar: $f = \frac{v}{\lambda}$)

$= \frac{3 \times 10^{8}}{284 \times 10^{-9}}$ ✔

$= (1,06 \times 10^{15} Hz)$ ✔ (3)

10.2 It is the minimum energy that an electron in the metal needs to be emitted from the metal surface ✔✔

Dit is die minimum energie benodig om 'n elektron uit die oppervlak van 'n metaal vry te stel.

Deduct one mark if any of the underlined phrases are omitted./Trek een punt af indien enige van die onderstreepte frases weggelaat word. (2)

10.3 ***POSITIVE MARKING FROM Q10.1/ POSITIEF NASIEN VANAF V10.1***

$E = W_o + E_{k(max)}$ OR/OF $hf = W_o + \frac{1}{2}mv^2$ ✔ (Any one of the formulae)

$(6,63 \times 10^{-34})(1,06 \times 10^{15})$ ✔ $= W_o + \frac{1}{2}(9,11 \times 10^{-31})(1,48 \times 10^{5})^2$ ✔

$W_o = 6,93 \times 10^{-19}$ J ✔ (**Range/Gebied:** $6,90 \times 10^{-19}$ J to/tot $6,93 \times 10^{-19}$ J)

∴ The metal is zinc/ Die metaal is sink ✔ (5)

10.4.1 No effect / Geen effek ✔ (1)

10.4.2 No effect / Geen effek ✔ (1)

10.4.3 Increases / Toeneem ✔ (1)

[13]

TOTAL/TOTAAL: 150 MARKS/PUNTE