DEPARTMENT OF EDUCATION
DEPARTEMENT VAN ONDERWYS
LEFAPHA LA THUTO
ISEBE LEZEMFUNDO

PROVINSIALE VOORBEREIDENDE EKSAMEN/ PROVINCIAL PREPARATORY EXAMINATION

GRAAD/GRADE 12

FISIESE WETENSKAPPE/PHYSICAL SCIENCES

VRAESTEL/PAPER 1

FISIKA/PHYSICS

SEPTEMBER 2025

PUNTE/MARKS: 150

TYD/TIME: 3 uur/hours

Hierdie vraestel bestaan uit 15 bladsye en 3 gegewensblaaie./
This question paper consists of 15 pages and 3 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name on the ANSWER SHEETS.
2. This question paper consists of TEN questions. Answer ALL the questions.
3. Start EACH question on a NEW page.
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. Show ALL formulae and substitutions in ALL calculations.
9. Round off your final numerical answers to a minimum of TWO decimal places.
10. Give brief motivations, discussions, etc. where required.
11. You are advised to use the attached DATA SHEETS
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.10) on the ANSWER SHEET, e.g. 1.11 D.

1.1 The resistance of an object to a change in its state of motion is defined as its ...

A mass.

B impulse.

C inertia.

D acceleration. (2)

1.2 The magnitude of the gravitational force between two objects separated by a distance 2r metres is **F**. If the distance between the objects is doubled, the new force between the objects in terms of **F** will be ...

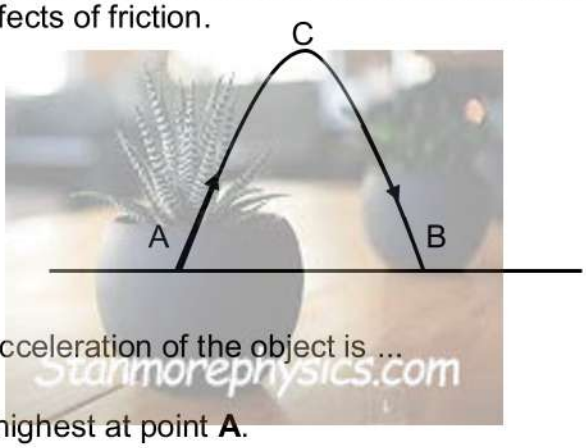
A $\frac{1}{8}$ **F**

B $\frac{1}{4}$ **F**

C 4 **F**

D 8 **F** (2)

1.3 An object is thrown vertically upwards and moves as shown below. Ignore the effects of friction.



The acceleration of the object is ...

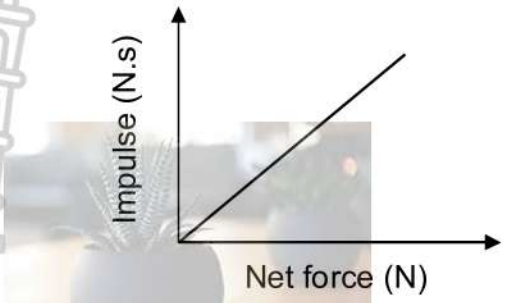
A highest at point **A**.

B zero at point **C**.

C lowest at point **B**.

D equal at points **A**, **B** and **C**. (2)

1.4 The graph below shows the relationship between impulse and net force.



The physical quantity represented by the gradient of the graph is its …

A contact time.

B change in momentum.

C change in velocity.

D displacement. (2)

1.5 An example of a conservative force is a(n) ...

A applied force.

B frictional force.

C electrostatic force.

D tension force. (2)

1.6 An ambulance approaches a stationary listener at a constant speed while emitting sound waves of a wavelength of 0,72 m.

The wavelength of the sound waves observed by the listener …

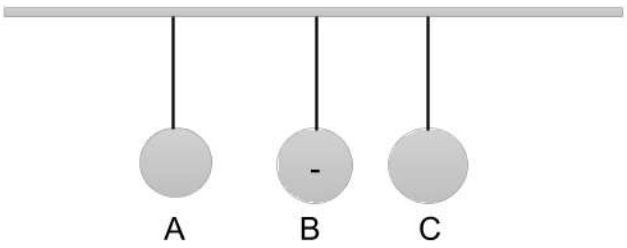
A is greater than 0,72 m.

B is less than 0,72 m.

C is equal to 0,72 m.

D will increase, then become zero. (2)

1.7 Three spheres **A**, **B** and **C** are hanging as shown below. Sphere **B,** which is negatively charged, attracts sphere **A**, but repels sphere **C**.



Which ONE of the following conclusions is CORRECT?

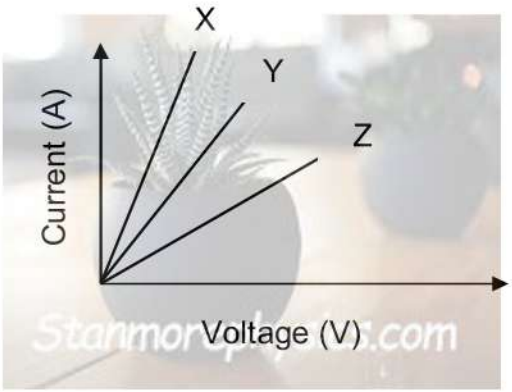
A Sphere **A** is negatively charged, and sphere **C** is negatively charged.

B Sphere **A** is positively charged, and sphere **C** is positively charged.

C Sphere **A** is negatively charged, and Sphere **C** is positively charged.

D Sphere **A** is neutral, and Sphere **C** is negatively charged. (2)

1.8 A learner carries out an experiment by measuring voltage and current that passes through three different copper wires and plots graphs **X**, **Y** and **Z** as shown below.



Which ONE of the following is TRUE?

A Resistance of **X** > **Y** > **Z**.

B Resistance of **X** = **Y** = **Z**.

C Resistance of **Y** > **X** > **Z**.

D Resistance of **Z** > **Y** > **X**. (2)

1.9 Which ONE of the following can increase the induced voltage of a generator without changing its frequency?

A Increase speed of rotation

B Increase the number of coils

C Increase the period

D Decrease the magnetic field strength (2)

1.10 Photoelectric effect proves ...

A the wave nature of light.

B the particle nature of light.

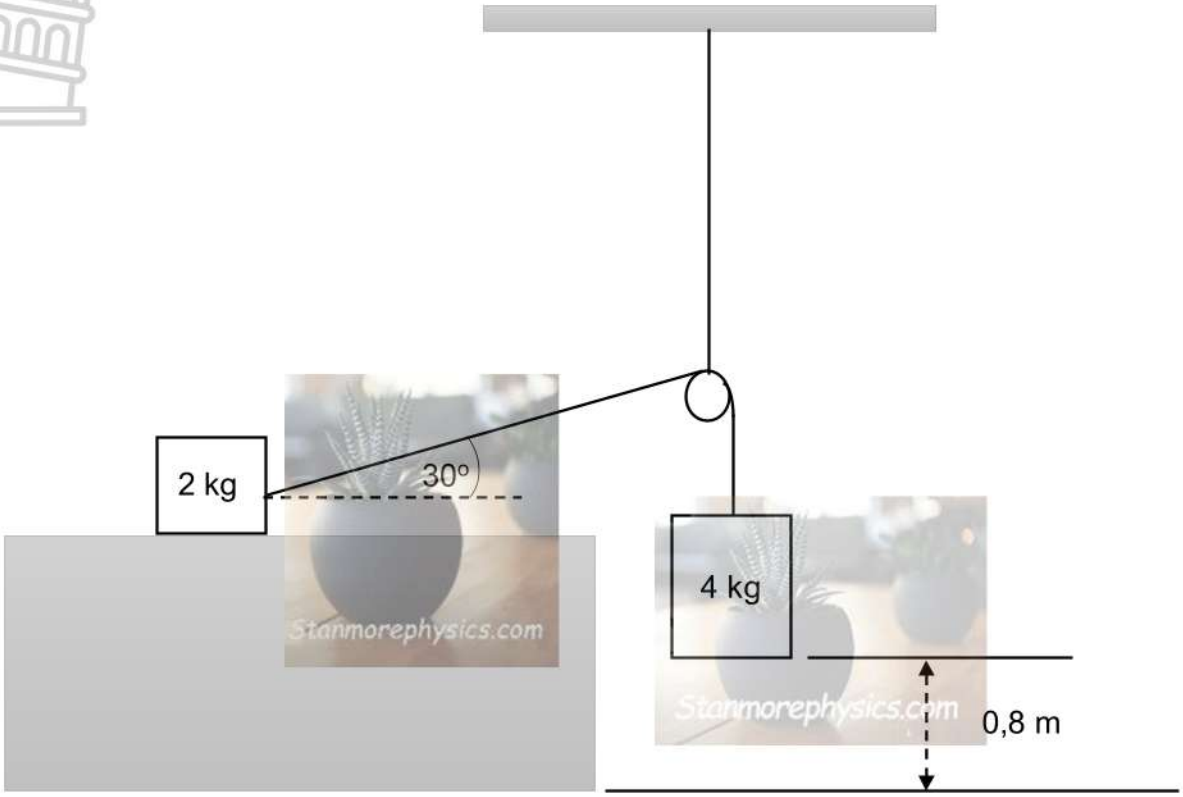
C that light can go under diffraction.

D that the universe is expanding. (2)

[20]

QUESTION 2 (Start on a new page)

A 2 kg and a 4 kg block are connected by a light inextensible string through a frictionless pulley as shown below. The 4 kg block is 0,8 m above the ground.



When the system is released from rest, the 2 kg block accelerates to the right on a rough horizontal surface, and the 4 kg block touches the ground with a speed of 3 m·s^{-1}.

2.1 Define the term *frictional force*. (2)

2.2 Draw a labelled force diagram for the 4 kg block. (2)

2.3 Calculate the:

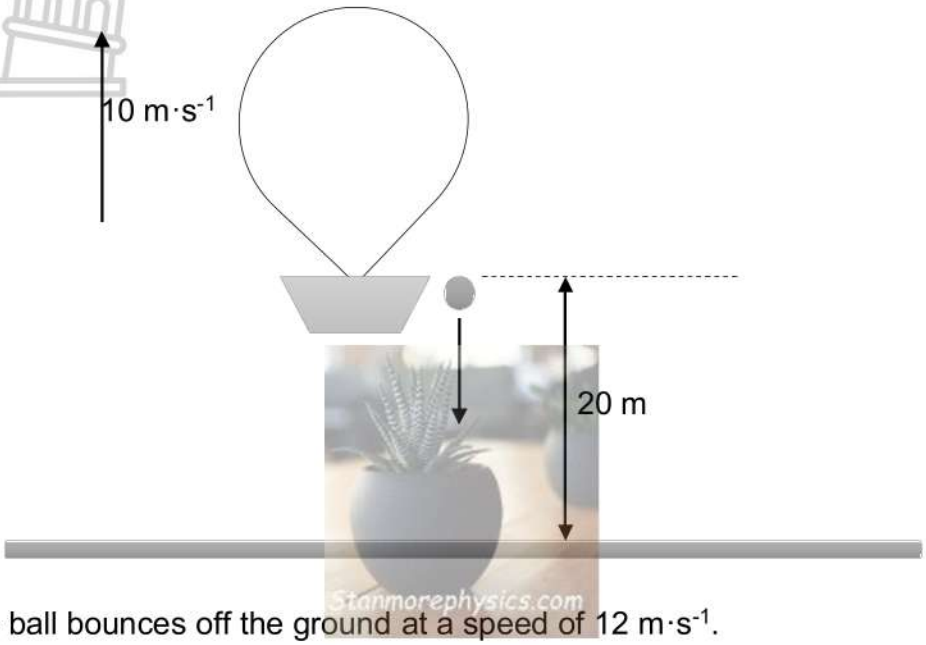
2.3.1 Tension in the string (4)

2.3.2 Coefficient of kinetic friction of the rough surface (5)

[13]

QUESTION 3 (Start on a new page)

A hot-air balloon is moving upwards with a constant velocity of 10 m·s^{-1}. A person inside the balloon drops a ball when the balloon is 20 m above the ground. Ignore the effects of air resistance.



The ball bounces off the ground at a speed of 12 m·s^{-1}.

3.1 Define the term *free-fall.* (2)

3.2 Use equations of motion to calculate the:

3.2.1 Time taken by the ball to reach the ground. (4)

3.2.2 The distance between the balloon and the ball when the ball has reached maximum height after bouncing. (6)

3.3 Draw a velocity-time graph (not to scale) on the same set of axes as the balloon (label it B) and of the ball for the motion from the moment the ball was dropped until it reached maximum height after bouncing. Take upwards as positive.

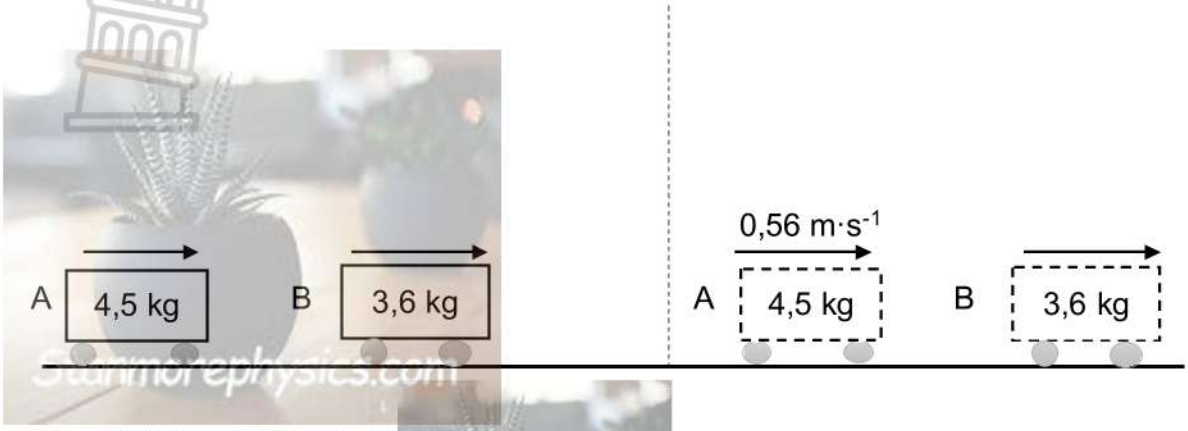
Show the following on the graphs:

- Initial velocity of the balloon
- Initial velocity of the ball and its final velocity after bouncing
- Time to reach the ground
- Use time for the entire motion as t (4)

[16]

QUESTION 4 (Start on a new page)

Trolley **A** of mass 4,5 kg collides with trolley **B** of mass 3,6 kg. After collision, the total kinetic energy of the trolleys is 10 J and trolley **A** moves with a speed of 0,56 $m \cdot s^{-1}$ as shown below. Ignore the effects of friction.



4.1 Define an *elastic collision*. (2)

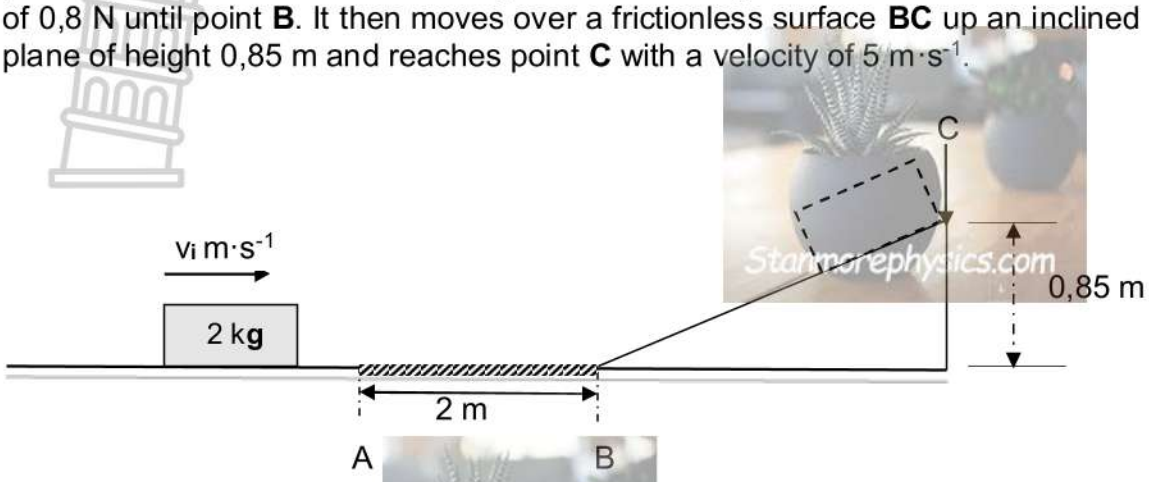
4.2 Calculate the speed of trolley **B** after the collision. (4)

4.3 The magnitude of the impulse on trolley **A** is 2,07 N.s. Calculate the initial velocity of trolley **B**. (5)

[11]

QUESTION 5 (Start on a new page)

A box of mass 2 kg is moving with a constant velocity of $\mathbf{v_i}$ m·s^{-1} when it arrives at point **A,** where it moves over a rough surface of length 2 m and a frictional force of 0,8 N until point **B**. It then moves over a frictionless surface **BC** up an inclined plane of height 0,85 m and reaches point **C** with a velocity of 5 m·s^{-1}.



5.1 During which points is mechanical energy conserved?

Write down **AB** or **BC**. (1)

5.2 Give a reason for the answer to QUESTION 5.1. (1)

5.3 Calculate the:

5.3.1 Mechanical energy at point **C** (3)

5.3.2 Velocity at point **A** (5)

A car of mass 1 500 kg is travelling along a straight horizontal road at 25 m·s^{-1} when the traffic lights change from green to amber. The driver applies the brakes 25 m from the lights and just manages to stop on the line.

5.4 Use ENERGY PRINCIPLES to calculate the:

5.4.1 Work done in bringing the car to rest (3)

5.4.2 Magnitude of the frictional force if the work done by the brakes is 350 000 J (3)

[16]

QUESTION 6 (Start on a new page)

A drone fixed with a sound detector and transmitter is flying towards a wall at a constant speed of 20 $m \cdot s^{-1}$. The transmitter emits sound waves of frequency 125 Hz towards the wall, which is then reflected back to the detector. The speed of sound in air is 343 $m \cdot s^{-1}$.

6.1 What type of waves are sound waves? (1)

6.2 Calculate the frequency observed by the detector. (5)

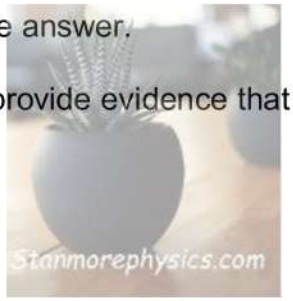
6.3 The speed of the drone is increased to 30 $m \cdot s^{-1}$.

Will the frequency calculated in QUESTION 6.2 INCREASE, DECREASE OR REMAIN THE SAME?

Give a reason for the answer. (3)

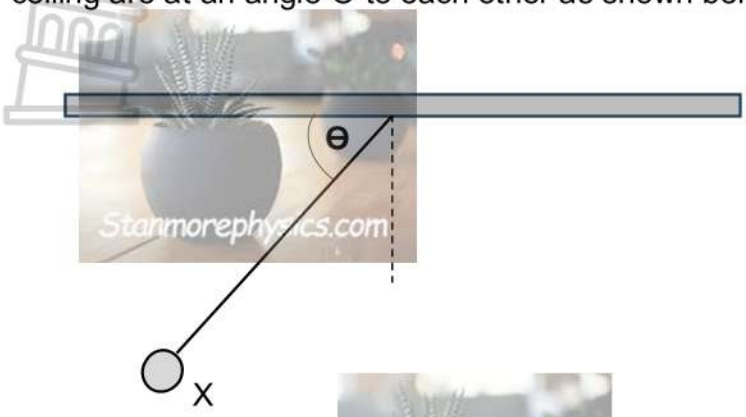
6.4 How does red shift provide evidence that the universe is expanding? (2)

[11]



QUESTION 7 (Start on a new page)

A charged sphere **X**, of mass 10 g, is suspended from a ceiling by a light inextensible string in a uniform electric field of 5×10^6 N·C^{-1} due west. The electrostatic force experienced by the sphere is 0,09 N due West. The string and the ceiling are at an angle Θ to each other as shown below.



7.1 Describe the term *electric field*. (2)

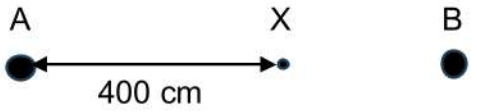
7.2 Draw a complete vector diagram showing all the forces acting on the charged sphere. (3)

7.3 Calculate:

7.3.1 The magnitude of charge **X** (3)

7.3.2 The magnitude of the tension in the string and the angle Θ (4)

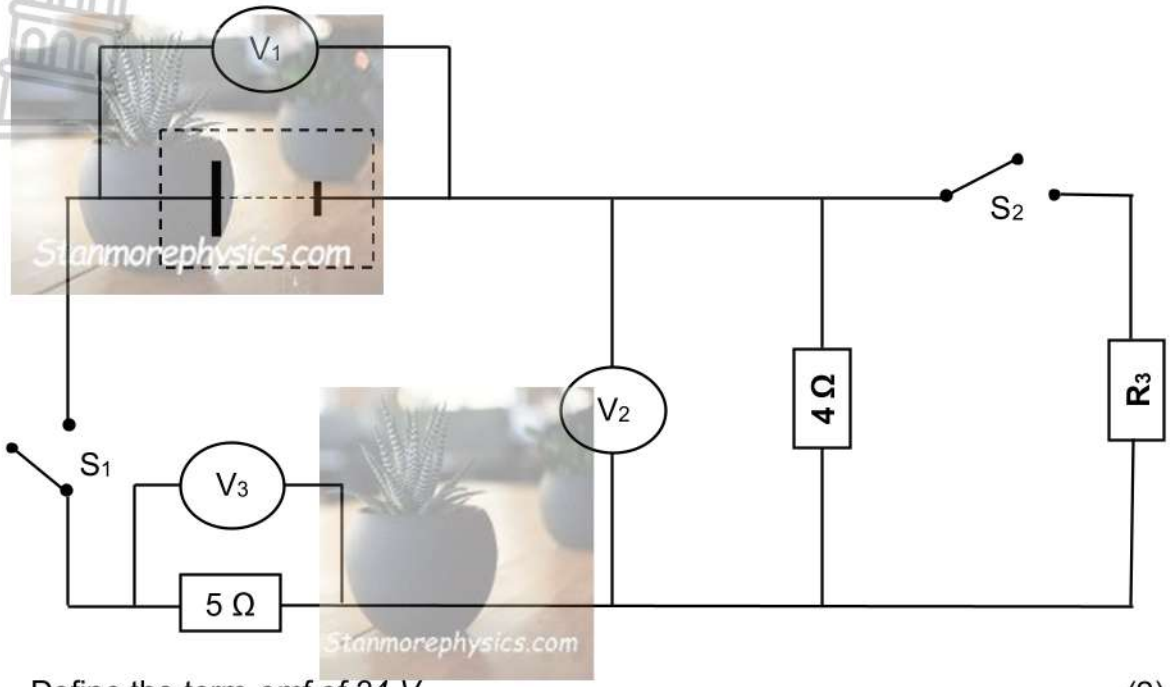
7.4 Two identical spheres **A** and **B** are separated by a distance of 600 cm. Sphere **A** has a positive charge of unknown magnitude, and sphere **B** has a charge of 9 nC. The distance from point **X** to charge **A** is 400 cm.



Determine the electric field at point **X** due to charge **B**. (4)
[16]

QUESTION 8 (Start on a new page)

The diagram below shows an electric circuit with a battery of unknown internal resistance, resistors 4 Ω, 5 Ω and R_3 with voltmeters V_1, V_2 and V_3. Switch S_1 and S_2 are both open, and voltmeter V_1 has a reading of 24 V.



8.1 Define the term *emf of 24 V.* (2)

With switch S_1 closed and S_2 open, V_3 has a voltage of 12 V.

8.2 Calculate the:

8.2.1 Current in the 4 Ω resistor (3)

8.2.2 Voltage of voltmeter V_1 (2)

8.3 When switches S_1 and S_2 are both closed, the current in the 5 Ω resistor changes to 3 A.

8.3.1 Calculate the resistance of resistor R_3. (6)

8.3.2 The 4 Ω resistor burns out. Will the current in the 5 Ω resistor INCREASE, DECREASE, or REMAIN THE SAME? (2)

8.4 An electric kettle is used to boil water. It is rated 800 W and is connected to a 220 V main supply.

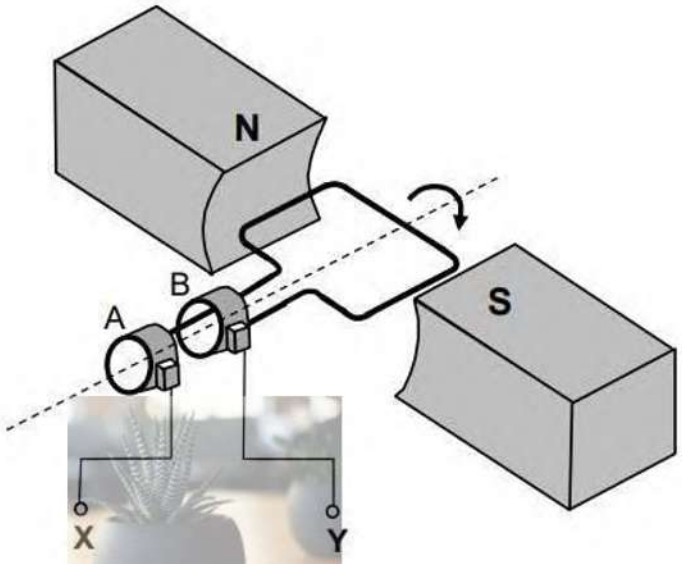
8.4.1 How much current is required by the kettle to boil the water? (3)

8.4.2 If the cost of electricity is R1,50 per kilowatt hour, what is the cost of using the electric kettle for 40 minutes? (2)

[20]

QUESTION 9 (Start on a new page)

The diagram below shows a generator which produces a maximum voltage of 250 V.



9.1 Name the components labelled **A** and **B** and state their function. (2)

9.2 Give a reason why the magnets are curved. (1)

9.3 Explain how current is formed in the conductor. (3)

9.4 What change can be made on this generator for it to produce direct current at terminals **X** and **Y**? (2)

9.5 The generator is connected to an electric motor, which lifts a mass of 1 000 kg at a constant speed of 1 $m \cdot s^{-1}$.

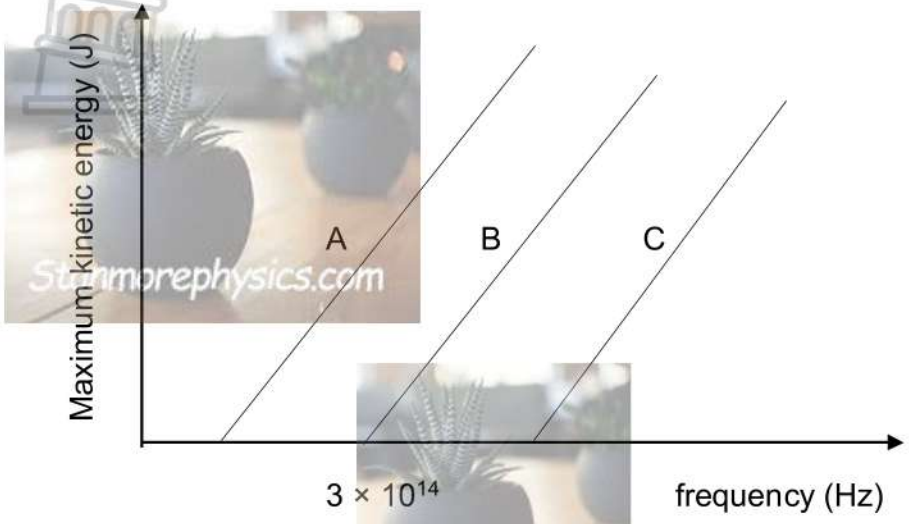
9.5.1 Draw a voltage vs time sketch graph for one cycle of the generator. Include voltage values. (2)

9.5.2 Calculate the root mean square current flowing in the electric motor. (5)

[15]

QUESTION 10 (Start on a new page)

The diagram below shows the relationship between maximum kinetic energy of ejected electrons and frequency of light shining on metals **A**, **B** and **C**.



Light of wavelength 900 nm is radiated on each metal.

10.1 Define the term *threshold wavelength*. (2)

10.2 What does the gradient of the graph represent? (1)

10.3 Which metal has the highest work function?

Give a reason for the answer. (2)

10.4 Calculate the kinetic energy of the ejected electrons in metal **B**. (5)

10.5 The same light shines on metal **C**.

Will the answer to QUESTION 10.4 INCREASE, DECREASE OR REMAIN THE SAME? (2)

[12]

TOTAL: 150

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
VRAESTEL 1 (FISIKA)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	9,8 $m \cdot s^{-2}$
Universal gravitational constant *Universele gravitasiekonstante*	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Radius of the Earth *Radius van die Aarde*	R_E	6,38 x 10^6 m
Mass of the Earth *Massa van die Aarde*	M	5,98 x 10^{24} kg
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	3,0 x 10^8 $m \cdot s^{-1}$
Planck's constant *Planck se konstante*	h	6,63 x 10^{-34} J·s
Coulomb's constant *Coulomb se konstante*	k	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
Charge on electron *Lading op elektron*	e^-	-1,6 x 10^{-19} C
Electron mass *Elektronmassa*	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 $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$ or $v_f^2 = v_i^2 + 2a\Delta y$	$\Delta x = \left(\frac{v_f + v_i}{2}\right)\Delta t$ or $\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$

FORCE/*KRAG*

$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = G\frac{m_1 m_2}{d^2}$ 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 $W_{nc} = \Delta E_k + \Delta E_p$	$P = \frac{W}{\Delta t}$
$P_{ave} = Fv_{ave}$ / $P_{gemid} = Fv_{gemid}$	

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

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

ELECTROSTATICS/*ELEKTROSTATIKA*

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

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$R = \frac{V}{I}$	emf (ε)= 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*

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

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GRADE/*GRAAD 12*

PHYSICAL SCIENCES: PHYSICS
FISIESE WETENSKAPPE: FISIKA

PAPER/*VRAESTEL* 1

SEPTEMBER 2025

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 14 pages./
Hierdie nasienriglyne bestaan uit 14 bladsye.

QUESTION 1/*VRAAG 1*

1.1 C ✓✓ (2)

1.2 B ✓✓ (2)

1.3 D ✓✓ (2)

1.4 A ✓✓ (2)

1.5 C ✓✓ (2)

1.6 B ✓✓ (2)

1.7 D ✓✓ (2)

1.8 D ✓✓ (2)

1.9 B ✓✓ (2)

1.10 B ✓✓ (2)
[20]

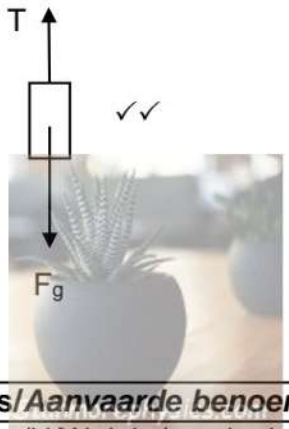
QUESTION 2/VRAAG 2

2.1

Marking criteria/*Nasienkriteria*
If any of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark./*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

A contact force that opposes motion and is parallel to the surface. ✓✓
"n Kontak krag wat die beweging van 'n voorwerp teenwerk en wat parallel met die oppervlak inwerk (2)

2.2



✓✓

Accepted labels/*Aanvaarde benoemings*	
w	F_w/Fg/mg/N/Weight/gravitational force/39,2 N *F_w/Fg/mg/N/Gewig/gravitasiekrag/39,2 N*
T	F_T/Tension/*Spanning*

Notes/*Aantekeninge*
- ***Do Not Accept a Free-body diagram***
- Mark awarded for label and arrow.
  Punt toegeken vir byskrif en pyltjie
- Do not penalise for length of arrows.
  Moenie vir die lengte van die pyljie penaliseer nie.
- Any other additional force(s). Max ½
  Engie ander addisionele krag(te) Maks ½
- If everything is correct, but no arrows. Max ½
  ***I**ndien alles korrek, maar geen pyltjies Maks ½* (2)

2.3.1

DOWNWARDS AS POSITIVE ***AFWAARTS AS POSITIEF***	**DOWNWARDS AS NEGATIVE** ***AFWAARTS AS NEGATIEF***
$v_f^2 = v_i^2 + 2a\Delta y$	$v_f^2 = v_i^2 + 2a\Delta y$
$(3)^2 = (0)^2 + 2(a)0,8$ ✓	$(-3)^2 = (0)^2 + 2(a)(-0,8)$ ✓
$a = 5,625\ m.s^{-2}$	$a = -5,625\ m.s^{-2}$
$F_{net} = ma$ ✓	$F_{net} = ma$ ✓
$(4)(9,8) - T = (4)(5,625)$ ✓	$T - (4)(9,8) = (4)(-5,625)$ ✓
$T = 16,7\ N$ ✓	$T = 16,7\ N$ ✓

(4)

2.3.2

POSITIVE MARKING FROM 2.3.1 ***POSITIEWE NASIEN VANAF 2.3.1*** **EAST AS POSITIVE** ***OOS AS POSITIEF***	**EAST AS NEGATIVE** ***OOS AS NEGATIEF***
$F_{net} = ma$ $F_x + f = ma$ $16,7\cos30^\circ - f_k = (2)(5,625)$ $f_k = 3,21$ N **OR /*OF*** $16,7\sin60^\circ - f_k = (2)(5,625)$ $f_k = 3,21$ N ✓ $F_N + 16,7\sin30^\circ = (2)(9,8)$ ✓ $F_N = 11,25$ N $f_k = \mu_k N$ ✓ $3,21 = \mu(11,25)$ ✓ $\mu = 0,29$ ✓	$F_{net} = ma$ $F_x + f = ma$ $-16,7\cos30^\circ + f_k = (2)(-5,625)$ $f_k = 3,21$ N **OR/*OF*** $-16,7\sin60^\circ + f_k = (2)(-5,625)$ $f_k = 3,21$ N ✓ $F_N + 16,7\sin30 = (2)(9,8)$ ✓ $F_N = 11,25$ N $f_k = \mu_k N$ ✓ $3,21 = \mu(11,25)$ ✓ $\mu = 0,29$ ✓

(5)
[13]

QUESTION 3/*VRAAG 3*

3.1

Marking criteria If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark./*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

Motion of an object under the influence of gravitational force only.✓✓
Beweging van 'n voorwerp onder die invloed van slegs die gravitasiekrag (2)

3.2.1

OPTION 1/*OPSIE 1*	
UPWARDS AS POSITIVE ***OPWAARTS AS POSITIEF***	**UPWARDS AS NEGATIVE** ***OPWAARTS AS NEGATIEF***
$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$✓	$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$✓
-20 ✓$= (10)\Delta t + \frac{1}{2} (-9,8)\Delta t^2$✓	20 ✓$= (-10)\Delta t + \frac{1}{2} (9,8)\Delta t^2$✓
$\Delta t = 3,28$ s✓	$\Delta t = 3,28$ s✓

OPTION 2/*OPSIE 2*	
UPWARDS AS POSITIVE ***OPWAARTS AS POSITIEF***	**UPWARDS AS NEGATIVE** ***OPWAARTS AS NEGATIEF***
$v_f^2 = v_i^2 + 2a\Delta y$	$v_f^2 = v_i^2 + 2a\Delta y$
$v_f^2 = (10)^2 + 2(-9,8)(-20)$✓	$v_f^2 = (-10)^2 + 2(9,8)(20)$✓
$v_f = 22,181$ m.s^{-1}	$v_f = 22,181$ m.s^{-1}
$v_f = v_i + a\Delta t$✓	$v_f = v_i + a\Delta t$✓
$-22,181 = 10 + (-9,8)\Delta t$✓	$22,181 = -10 + (9,8)\Delta t$ ✓
$\Delta t = 3,28$ s✓	$\Delta t = 3,28$ s✓

OPTION 3/*OPSIE 3*	
UPWARDS AS POSITIVE ***OPWAARTS AS POSITIEF***	**UPWARDS AS NEGATIVE** ***OPWAARTS AS NEGATIEF***
$v_f = v_i + a\Delta t$	$v_f = v_i + a\Delta t$
$0 = 10 + (-9,8)\Delta t$ ✓	$0 = -10 + (9,8)\Delta t$ ✓
$\Delta t = 1,02$ s	$\Delta t = 1,02$ s
$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$	$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$
$\Delta y = (10)(1,02) + \frac{1}{2} (-9,8)(1,02)^2$	$\Delta y = (-10)(1,02) + \frac{1}{2} (9,8)(1,02)^2$
$\Delta y = 5,10$ m	$\Delta y = 5,10$ m
$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$✓	$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$✓
$-25,10 = (0)(\Delta t) + \frac{1}{2} (-9,8)(\Delta t)^2$✓	$25,10 = (0)(\Delta t) + \frac{1}{2} (9,8)(\Delta t)^2$✓
$\Delta t = 2,26$ s	$\Delta t = 2,26$ s
$\Delta t = 2,26 + 1,02$ $= 3,28$ s ✓	$\Delta t = 2,26 + 1,02$ $= 3,28$ s ✓

(4)

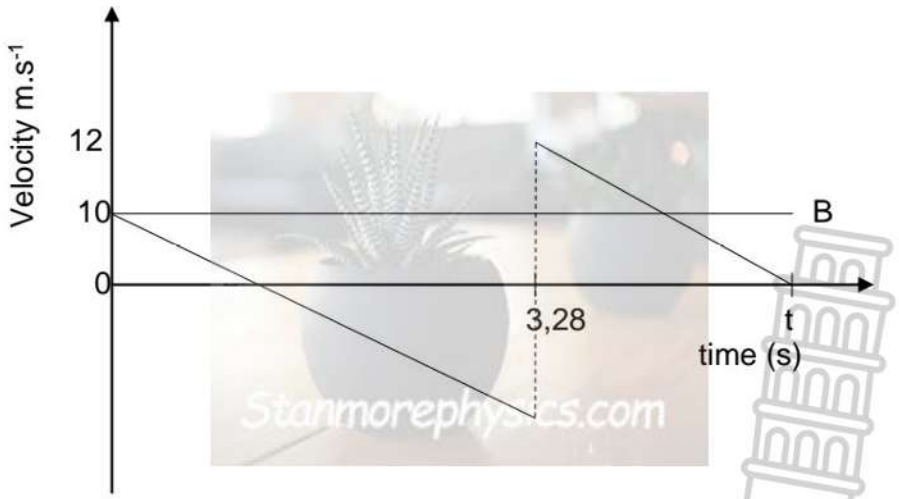
3.2.2

POSITIVE MARKING FROM 3.2.1 ***POSITIEWE NASIES VANAF 3.2.1*** **UPWARDS AS POSITIVE** ***OPWAARTS AS POSITIEF*** **Motion of the ball** ***Beweging van die bal*** $v_f = v_i + a\Delta t$ $0 = 12 + (-9,8)\,\Delta t$ ✓ $\Delta t = 1,22$ s $\Delta y = v_i\Delta t + \frac{1}{2}\,a\Delta t^2$ ✓ $\Delta y = (12)(1,22) + \frac{1}{2}\,(-9,8)(1,22)^2$ ✓ $\Delta y = 7,32$ m **Motion of the balloon** ***Bewging van die balon*** $\Delta y = v_i\Delta t + \frac{1}{2}\,a\Delta t^2$ $\Delta y = (10)(4,5) + \frac{1}{2}\,(0)(4,5)^2$ ✓ $\Delta y = 45$m $\Delta y = 65 - 7,32$ ✓ $\Delta y = 57,68$ m ✓ OR $\Delta y = 45 + 12,68$ m ✓ $\Delta y = 57,68$ m ✓	**UPWARDS AS NEGATIVE** ***OPWAARTS AS NEGATIEF*** **Motion of the ball** ***Beweging van die bal*** $v_f = v_i + a\Delta t$ $0 = -12 + (9,8)\,\Delta t$ ✓ $\Delta t = 1,22$ s $\Delta y = v_i\Delta t + \frac{1}{2}\,a\Delta t^2$ ✓ $\Delta y = (-12)(1,22) + \frac{1}{2}\,(9,8)(1,22)^2$ ✓ $\Delta y = 7,32$ m **Motion of the balloon** ***Beweging van die balon*** $\Delta y = v_i\Delta t + \frac{1}{2}\,a\Delta t^2$ $\Delta y = (-10)(4,5) + \frac{1}{2}\,(0)(4,5)^2$ ✓ $\Delta y = 45$m $\Delta y = 65 - 7,32$ ✓ $\Delta y = 57,68$ m ✓ OR $\Delta y = 45 + 12,68$ m ✓ $\Delta y = 57,68$ m ✓

(6)

3.3

POSITIVE MARKING FROM QUESTION 3.2.1
POSITIEWE NASIEN VANAF VRAAG 3.2.1



Marking Guidelines/*Nasienriglyne*

Initial and final velocity of the ball *Aanvanklike en final snelheid van die bal*	✓
Graph of the balloon/*Grafiek van die balon*	✓
Graph of the ball/*Grafiek van die bal*	✓
Time to reach the ground/*Tyd om grond te bereik*	✓

(4)

[16]

QUESTION 4/VRAAG 4

4.1

Marking criteria
If any of the underlined key words/phrases in the **correct context** are omitted, deduct 1 mark.
*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

A collision in which both total momentum and total kinetic energy are conserved.✓✓
'n Botsing waarin beide totale momentum en totale kinetiese energie behoue bly. (2)

4.2

$E_K = ½ mv^2$✓
10 ✓ $= (½)(4,5)(0,56^2) + (½)(3,6)(V_B)^2$✓
$v_{Bf} = 2,27 \text{ m.s}^{-1}$✓ (4)

4.3

OPTION 1/*OPSIE 1*
POSITIVE MARKING FROM 4.2/*POSITIEWE NASIEN VANAF 4.2*
$\Delta p = m(v_f - v_i)$
$2,07 = 4,5(0,56 - v_i)$ ✓
$v_i = 0,1 \text{ m·s}^{-1}$
EAST/RIGHT AS POSITIVE/*OOS/REGS AS POSITIEF*
$\Sigma p_i = \Sigma p_f$
$m_1v_i + m_2v_i = m_1v_f + m_2v_f$ ✓Any one /*Enige een*
$(4,5)(0,1) + (3,6)(V_{Bi})$ ✓ $= (4,5)(0,56) + (3,6)(2,27)$✓
$V_{Bi} = 2,85 \text{ m·s}^{-1}$, (East/Right)✓ (*Allocate the mark irrespective of direction given or not/Ken die punt ongeag die aanwysings wat gegee word of nie*)
WEST/LEFT AS POSITIVE/*WES/LINKS AS POSITIEF*
$\Sigma p_i = \Sigma p_f$
$m_1v_i + m_2v_i = m_1v_f + m_2v_f$ ✓Any one /*Enige een*
$(4,5)(-0,1) + (3,6)(V_{Bi})$ ✓ $= (4,5)(-0,56) + (3,6)(-2,27)$✓
$v_{Bi} = -2,85 \text{ m·s}^{-1}$
$v_{Bi} = 2,85 \text{ m·s}^{-1}$, (East/Right)✓ (*Allocate the mark irrespective of direction given or not/ Ken die punt ongeag die aanwysings wat gegee word of nie*)

OPTION 2/*OPSIE 2*
POSITIVE MARKING FROM 4.2/*POSITIEWE NASIEN VANAF 4.2*
$\Delta p = m(v_f - v_i)$ ✓
$-2,07$✓✓ $= 3,6(2,27 - v_i)$✓
$v_i = 2,85 \text{ m.s}^{-1}$✓ (5)

[11]

QUESTION 5/*VRAAG 5*

5.1. BC ✓ (1)

5.2 Only gravitational force is acting on the object./ W_{nc} = 0/Is an Isolated system ✓(**ACCEPT**: No Frictional Force)
Die gravitasiekrag is die enigste krag wat op die voorwerp inwerk (1)

5.3.1
$E_{mech} = ½ mv^2 + mgh$ ✓
$= (½)(2)(5^2) + (2)(9,8)(0,85)$✓
$= 41,66$ J ✓ (3)

5.3.2
POSITIVE MARKING FROM 5.3.1/*POSITIEWE NASIEN VANAF 5.3.1*
$(E_k + E_p)_B = (E_k + E_p)_C$
$½ m v^2_B + mgh_B = ½ m v^2_C + mgh_c = 41,66$
$41,66 = ½(2)(v^2_B) + 0$ ✓
$v_B = 6,45$ m.s^{-1}
OPTION 1/*OPSIE 1*
$W_{net} = ½ m v^2_f - ½ m v^2_i$✓
$f_k \Delta x \cos\theta = ½ m v^2_f - ½ m v^2_i$
$(0,8)(2)(\cos180^o)$✓ $= (½)(2)(6,45^2)$ ✓ $- ½ (2)(v^2_i)$
$v_A = 6,57$ m.s^{-1}✓
OPTION 2/*OPSIE 2*
$F_{net} = ma$
$0,8 = (2)a$ ✓
$a = -0,4$ m·s^{-2}

$vf^2 = vi^2 + 2a\Delta x$
$(6,45)^2$ ✓$= v_i^2 + 2(-0,4)(2)$✓
$v_i = 6,57$ m·s^{-1} ✓ (5)

5.4.1
OPTION 1/*OPSIE 1*
$W_{net} = ½ m v^2_f - ½ m v^2_i$✓
$W_{net} = ½(1\,500)(0^2) - ½(1\,500)(25)^2$✓
$W_{net} = -468\,750$ J
Work done = 468 750 J✓

OPTION 2/*OPSIE 2*
$W_{nc} = \Delta E_p + \Delta E_k$ ✓
$= 0 + ½(1\,500)(0^2) - ½(1\,500)(25)^2$✓
$= -468\,750$ J ✓ (3)

5.4.2
POSITIVE MARKING FROM 5.3.1/*POSITIEWE NASIEN VANAF 5.3.1*
$W_{net} = W_{fk} + W_b$
$-468\,750 = W_{fk} + (-350\,000)$✓
$W_{fk} = -118\,750$ J
$W_{fk} = f_k \Delta x \cos\Theta$
$-118\,750 = f_k(25)(\cos180^o)$✓
$f_k = 4\,750$ N✓ (3)
[16]

QUESTION 6/VRAAG 6

6.1 Longitudinal waves/*Longitudinal golwe* ✓ (1)

6.2
$f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓
$f_L = \frac{343+0}{343-20}(125)$✓
$f_L = 132{,}74$ Hz

$f_L = \frac{343+20}{343-0}$✓$(132{,}74)$✓
$f_L = 140{,}48$ Hz✓ (5)

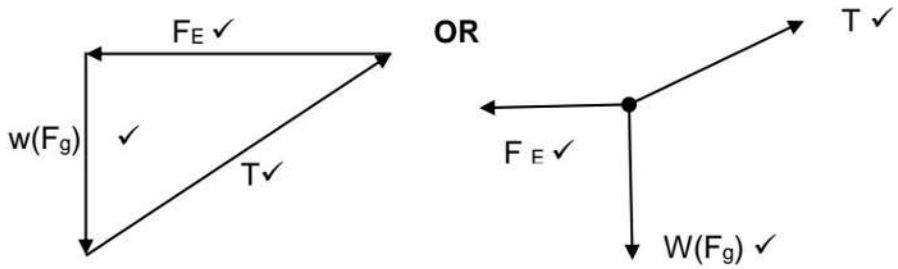
6.3 Increases✓ , when the listener moves towards the source✓ , the frequency of the listener is directly proportional to the velocity of the listener.✓
Neem toe, wanneer die luisteraar na die bron beweeg, frekwensie van luisteraar is direk eweredig aan die snelheid ban die luisteraar. (3)

6.4 It shows that the galaxies are moving away from us✓as the observed wavelength is increasing /the observed frequency is decreasing ✓.
Dit toon aan dat die sterrestelsels van ons af wegbeweeg✓namate die waargenome golflengte toeneem/die waargenome frekwensie afneem.✓ (2)
[11]

QUESTION 7/*VRAAG 7*

7.1 A region of space where a charge will experience a force.✓✓
'n Gebied in die ruimte waarin 'n elektriese lading 'n krag ondervind. (2)

7.2



(3)

7.3.1
$F = EQ$ ✓
$0,09 = (5 \times 10^{6} \times Q)$✓
$Q = 1,80 \times 10^{-8}$ C✓ (3)

7.3.2
$T^2 = (9,8 \times 10^{-2})^2 + (0,09)^2$✓
$T = 0,13$ N✓

$\tan^{-1}(\theta) = \frac{9,8\times10^{-2}}{0,09}$✓
$\theta = 47,44^{\circ}$✓

OR

$0,13\cos\theta = 0.09$✓
$\theta = 46,19^{\circ}$✓

OR

$0.13\sin\theta = 9,8\times10^{-2}$✓
$\theta = 48,92^{\circ}$✓
Range of/*Gebied van* θ ($46,19^{\circ}$ - $48,92^{\circ}$) (4)

7.4
$E = \frac{kQ}{r^2}$✓
$E = \frac{(9\times10^{9})(9\times10^{-9})}{(2)^2}$✓✓
$E = 20,25$ N.C^{-1} due west/*reg wes*✓ (4)
[16]

QUESTION 8/VRAAG 8

8.1 **Marking criteria/*Nasienkriteria***
If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark./ *Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

The maximum energy given by the battery is 24 J per unit charge passing through it.✓✓ *Die maximum energie deur 'n battery gelewer is 24 J per eenheidslading wat deur dit beweeg.* (2)

8.2.1
$V = IR$✓
$12 = I(5)$✓
$I = 2,4$ A ✓ (3)

8.2.2 **POSITIVE MARKING FROM 8.2.1/*POSITIEWE NASIEN VANAF 8.2.1***
OPTION 1/*OPSIE 1*
$V_1 = V_2 + V_3$
$V_1 = (2,4)(4) + 12$✓
$V_1 = 21,6$ V✓

OPTION 2
$V = IR$
$V = (2,4)(9)$✓
$V = 21,6$ V✓ (2)

8.3.1 **POSITIVE MARKING FROM 8.2.1 AND 8.2.2**
POSITIEWE NASIEN VANAF 8.2.1 EN 8.2.2
$\varepsilon = I(R + r)$ ✓
24✓ $= V_{ex} + 2,4r$✓ OR $24 = 2,4(9 + r)$
$24 = 21,6 + 2,4r$
$r = 1\ \Omega$
$\varepsilon = I(R + r)$
$24 = 3(R + 1)$ ✓
$R = 7\ \Omega$
$\frac{(4)(R_3)}{(4 + R_3)} + 5 = 7$✓
$R_3 = 4\ \Omega$✓ (6)

8.3.2 Decreases✓✓ (2)

8.4.1
$P = VI$✓
$800 = 220I$✓
$I = 3,64$ A✓ (3)

8.4.2
Cost = tariff × kwhr
$= (R1,50)\ \frac{(800)}{(1000)}$ ✓ $\frac{(40)}{(60)}$ ✓
$= R0,80$✓ (3)

[21]

QUESTION 9/*VRAAG 9*

9.1 Slip rings/*Sleepringe* ✓ ,

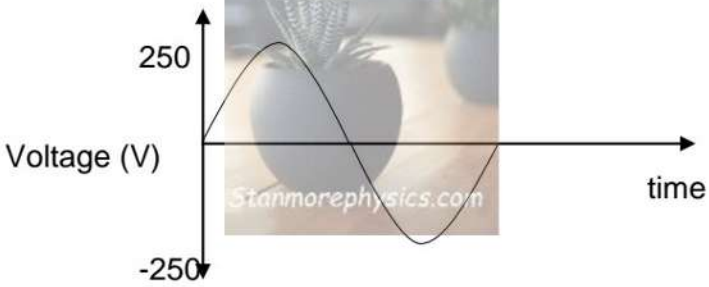
Transfers power to the external circuit✓
Dra drywing oor na die eksterne stroombaan (2)

9.2 To increase the magnetic field strength. ✓
Om die magneetveldsterkte te verhoog. (1)

9.3 The magnetic flux changes✓ as the coil is rotated,✓ which induces an emf in the conductor✓ which causes current to flow.
Die magnetiese vloed verander as die spoel roteer word wat 'n emk in die geleier induseer wat veroorsaak dat die stroom vloei. (3)

9.4 Replace slip rings✓ with split rings/commutator✓
Vervang die gly ringe met 'n kommutator (2)

9.5.1



Marking Criteria/Nasienkriteria

- Shape of the graph/*Vorm van die grafiek*✓
- Maximum and minimum value of potential difference ✓
  Maximum en minimum waarde van potensiaalverskil (2)

9.5.2

OPTION 1/*OPSIE 1*

$P_{ave} = Fv_{ave}$
$P_{ave} = (1\ 000)(9,8)(1)$ ✓
$P_{ave} = 9800$ W

$$V_{rms} = \frac{V_{max}}{\sqrt{2}}$$
$= \frac{250}{\sqrt{2}}$ ✓
$= 176,78$ V

$P_{ave} = V_{rms}I_{rms}$ ✓
$9800 = (176,78)(I_{rms})$ ✓
$I_{rms} = 55,43$ A ✓

OPTION 2/*OPSIE 2*

$P_{ave} = Fv_{ave}$
$P_{ave} = (1000)(9,8)(1)$ ✓
$P_{ave} = 9800$ W

$$V_{rms} = \frac{V_{max}}{\sqrt{2}}$$
$= \frac{250}{\sqrt{2}}$ ✓
$= 176,78$ V

$$P_{ave} = \frac{V_{rms}^2}{R}$$
$$R = \frac{(176,78)^2}{9800}$$
$= 31,89\ \Omega$

$$R = \frac{V_{rms}}{I_{rms}}$$ ✓
$$31,89 = \frac{176,78}{I_{rms}}$$ ✓
$I_{rms} = 55,43$ A ✓

OPTION 3

$P_{ave} = Fv_{ave}$
$P_{ave} = (1000)(9,8)(1)$ ✓
$P_{ave} = 9800$ W

$$V_{rms} = \frac{V_{max}}{\sqrt{2}}$$
$= \frac{250}{\sqrt{2}}$ ✓
$= 176,78\ldots$ V

$$P_{ave} = \frac{V_{rms}^2}{R}$$
$$R = \frac{(176,78)^2}{9800}$$
$= 31,89\ \Omega$

$P_{ave} = I^2_{rms}R$ ✓
$9800 = I^2_{rms}31,89$ ✓
$I_{rms} = 55,43$ A ✓

(5)
[15]

QUESTION 10/*VRAAG 10*

10.1 The (maximum wavelength) of light needed to emit electrons from a certain metal surface.✓ (*0/1*)
Die (maksimum golflengte) van lig wat benodig (word) om elektrone uit/vanaf 'n sekere metaaloppervlak vry te stel (1)

10.2 Planck's constant.✓
Planck se konstante (1)

10.3 C✓.

It has the highest threshold frequency.✓
Dit het die hoogste drumpelfrekwensie (2)

10.4 $E = W_o + E_{k(max)}$
$E = W_o + K_{max}$ ✓(any one/*enige een*)

$\frac{(6{,}63 \times 10^{-34})(3 \times 10^{8})}{(900 \times 10^{-9})}$ ✓✓ $= (6{,}63 \times 10^{-34})(3 \times 10^{14}) + E_k$✓

$E_k = 2{,}21 \times 10^{-20}$ J✓ (5)

10.5 Decreases ✓✓
Neem af (2)
[11]

TOTAL/*TOTAAL*: 150