



education

**MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA**

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

PHYSICAL SCIENCES: PHYSICS

PRE-TRIAL EXAM

AUGUST 2026

**MARKS: 150
TIME: 3 hours**

This question paper consists of 17 pages, one answer sheet and data sheets

INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate space on the FOLIO PAPER.
2. This question paper consists of TEN questions. Answer ALL the questions in the FOLIO PAPER.
3. Start EACH question on a NEW page in the FOLIO PAPER.
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, 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 only the letter (A – D) next to the question number (1.1 – 1.4) in the ANSWER BOOK, for example, 1.11 E.

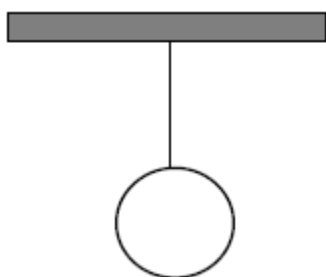
1.1 A car is moving at a CONSTANT velocity on an incline.

Which ONE of the following statements about the forces acting on the car is CORRECT?

- A There are no forces acting on the car.
- B The net force acting on the car is zero.
- C There is a non-zero net force acting on the car.
- D The weight of the car is equal to the normal force. (2)

1.2 A sphere is attached to a string, which is suspended from a fixed horizontal bar as shown in the sketch.

The reaction force to the gravitational force exerted by the earth on the sphere is ...



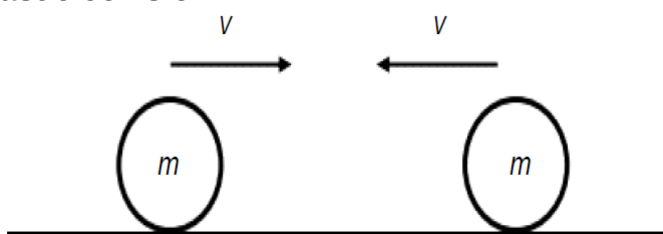
- A the force of the bar on the sphere.
- B the force of the string on the sphere.
- C the force of the sphere on the earth.
- D the force of the bar on the string. (2)

1.3 A ball is dropped from height, H , above the ground and reaches the ground with kinetic energy, E . From which height must the ball be dropped to reach the ground with kinetic energy $2E$? (Ignore all effects of friction.)

- A $2h$
- B $3h$
- C $4h$
- D $8h$

(2)

1.4 Two identical solid spheres, each with a mass m and travelling at a speed v , move towards each other in an isolated system. The spheres have a head-on **elastic collision**



Which statement is correct for the collision as described above?

- A The spheres stick together on impact.
- B The total kinetic energy after impact is mv^2 .
- C The total kinetic energy before impact is zero.
- D The total momentum before impact is $2mv$

(2)

1.5 Which ONE of the following forces is NOT an example of a non-conservative force?

- A Gravitational force
- B Tension in a chord.
- C Frictional force.
- D Normal force.

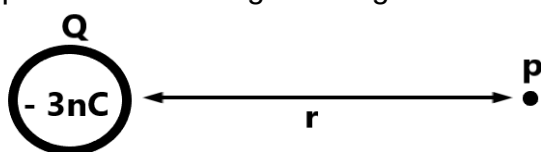
(2)

1.6 Which ONE of the following statements regarding the redshift of light is true?

- A If a source of blue light is moving away from the observer, the light will appear violet
- B If a source of red light is moving away from the observer, the light will appear blue
- C If a source of blue light is moving away from the observer, the light will appear more green
- D If a source of red light is moving away from the observer, the light will appear more orange

(2)

1.7 A sphere with a charge of magnitude $-3nC$ is at a distance, r , from a point p .

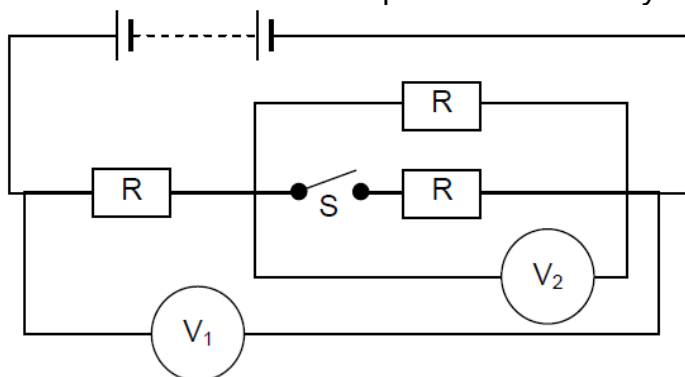


The electric field strength at point p is ...

- A directly proportional to r and to the right.
- B directly proportional to the square of r and to the left.
- C inversely proportional to the square of r and to the right.
- D inversely proportional to the square of r and to the left.

(2)

1.8 In the circuit represented below, the three resistors are identical, each with a resistance R . Switch S is open and the battery has NEGLIGIBLE internal resistance.

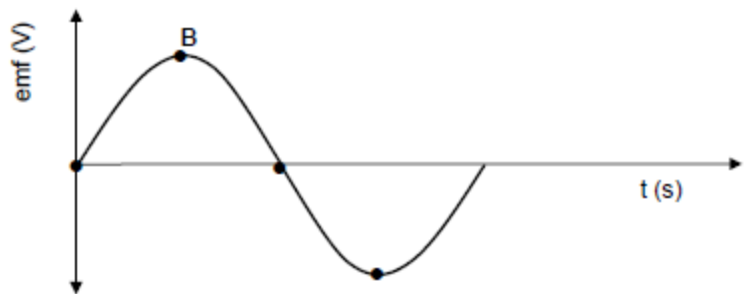


How will the readings on the voltmeters be affected if switch **S** is closed?

	Voltmeter V1	Voltmeter V1
A	Decreases	Decreases
B	Remains constant	Increases
C	Remains constant	Decreases
D	Decreases	Increases

(2)

1.9 The coils of an AC generator make one complete rotation. The resulting graph for the output emf is shown below



The position B on the graph is obtained when the plane of the coil is at an angle of ... to the magnetic field.

- A 0°
- B 60°
- C 90°
- D 120°

(2)

1.10 Which ONE of the following correctly represents the given types of electromagnetic radiation in order of INCREASING WAVELENGTH?

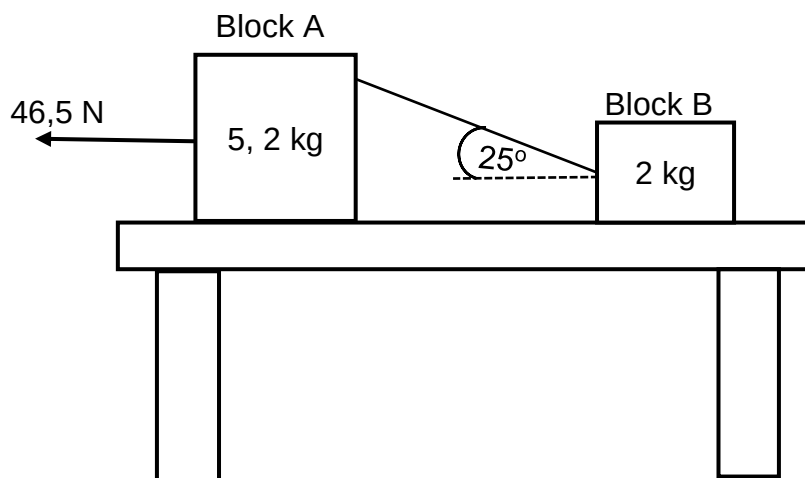
- A Microwaves; infrared; ultraviolet
- B Infrared; ultraviolet; X-rays
- C Radio waves; infrared; gamma rays
- D Ultraviolet; infrared; microwaves

(2)

[20]

QUESTION 2 (Start on a new page.)

- 2.1 A force of 46,5 N is pulling block **A** of mass 5,2 kg. Block **A** is connected to block **B** of mass 2 kg by means of a massless, inextensible cable, inclined at 25° to the horizontal, as shown on the diagram below. The kinetic frictional forces experienced by the block **A** and block **B** are 12 N and 5,1 N respectively.



- 2.1.1 Draw a labelled free-body diagram showing all forces acting on block **A** whilst is in motion (5)
- 2.1.2 State Newton's second Law of motion in words. (2)
- 2.1.3 Calculate the tension in the cable. (6)
- 2.1.4 What change should be made to the angle (25°) between the cable and the horizontal, to increase the frictional force between block **B** and the surface? Choose from INCREASED or DECREASED. Explain the answer. (3)
- 2.2 The mass and radius of MARS are approximately $6,39 \times 10^{23}$ kg and $3,39 \times 10^6$ m respectively. Calculate the gravitational acceleration on the surface of Mars. (3)

[19]

QUESTION 3 (Start on a new page.)

A person throws ball **A** downwards with a speed of $2 \text{ m}\cdot\text{s}^{-1}$ from the edge of a window, 45m above the ground. 1s later SECOND BALL **B** was thrown downwards and observes that both balls strike the surface of the ground at instant. BOTH balls were project from the same height. Ignore air friction.

3.1 Calculate the:

3.1.1 Speed with which ball **A** hits the surface of the ground (3)

3.1.2 Time it takes for ball **B** to hit ground (3)

3.1.3 Initial velocity of ball **B**. (5)

3.1.4 On the same set of axes, sketch a velocity versus time graph for the motion of balls **A** and **B**. Clearly indicate the following on your graph:

- Initial velocities of both balls **A** and **B**.
- The time of release of ball **B**.
- The time taken by both balls to hit the surface of the water (5)

[16]

QUESTION 4 (Start on a new page.)

4.1 TWO LEARNERS, each of mass m , are standing at the back of a flatbed skateboard of mass 4kg. The skateboard is at rest on a frictionless horizontal surface.

They jump off simultaneously at one end of the skateboard with a velocity of $2 \text{ m}\cdot\text{s}^{-1}$. The skateboards move in the opposite direction.

4.1.1 Write down the *principle of conservation of linear momentum in words* (2)

4.1.2 Calculate the final velocity of the skateboard. (5)

4.1.3 If the TWO LEARNERS jump off the skateboard one at a time. How will the velocity of the skateboard compare to that calculated in QUESTION 4.1.2 Only write down GREATER THAN, SMALLER THAN or EQUAL TO (1)

4.2 Dancers have to learn many skills, including how to land correctly. A dancer of mass 50 kg leaps into the air and lands feet first on the ground. The dancer lands on the ground with a velocity of $5 \text{ m}\cdot\text{s}^{-1}$. As the dancer lands, they bend their knees and comes to a complete stop in 0,2s.

4.2.1 Define the term impulse of a force. (2)

4.2.2 Calculate the momentum with which the dancer reaches the ground. (2)

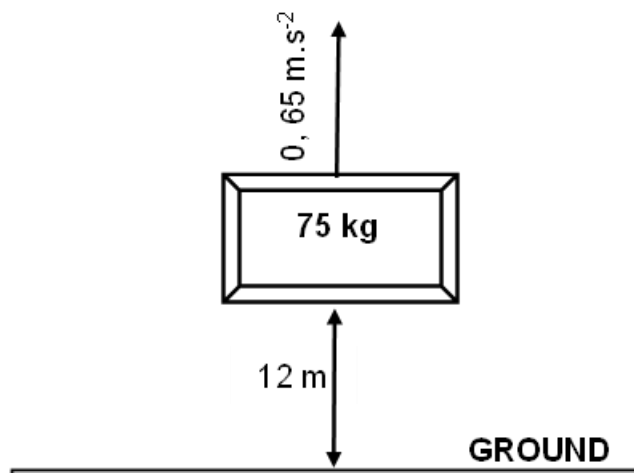
4.2.3 Calculate the magnitude of the net force acting on the dancer as she lands. (3)

Assume that the dancer performs the same jump as before but lands without bending their knees.

- 4.2.4 Will the force now be GREATER THAN, SMALLER THAN or EQUAL TO the force calculated in QUESTION 4.2.3 (1)
- 4.2.5 Give a reason for the answer to 4.2.4 (3)
- [19]**

QUESTION 5 (Start on a new page.)

A 75 kg block is initially at **rest** on the ground. It is then lifted vertically upwards at a constant acceleration of $0,65 \text{ m} \cdot \text{s}^{-2}$ by using a light inextensible string. Refer to the diagram below. Ignore the mass of the string, rotational effects and the air resistance.



- 5.1 Name ONE non-conservative force acting on the block. (1)
- 5.2 Draw a labelled free-body diagram for the block while it moves upward. (2)
- 5.3 Calculate the work done on the block by the gravitational force when the block has reached a height of 12 m. (3)
- 5.4 State the *work-energy theorem* in words. (2)
- 5.5 Use the WORK-ENERGY THEOREM to calculate the speed of the block when it is at a height of 12 m. (5)

[13]

QUESTION 6 (Start on a new page.)

The Doppler effect is applicable to both sound and light waves. It also has very important applications in our everyday lives.

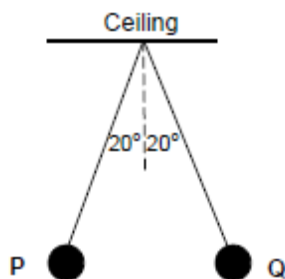
- 6.1 A hooter on a stationary train emits sound with a frequency of 520 Hz, as detected by a person standing on the platform. Assume that the speed of sound is $340 \text{ m}\cdot\text{s}^{-1}$ in still air

Calculate the:

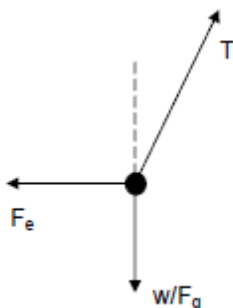
- 6.1.1 Wavelength of the sound detected by the person (2)
- 6.1.2 Wavelength of the sound detected by the person when the train moves towards him/her at a constant speed of $15 \text{ m}\cdot\text{s}^{-1}$ with the hooter still emitting sound. (6)
- 6.2 Explain why the wavelength calculated in QUESTION 6.1.1 differs from that obtained in QUESTION 6.1.2. (2)
- 6.3 Use your knowledge of the Doppler effect to explain *red shifts* (2)
- [12]**

QUESTION 7 (Start on a new page.)

Two identical spherical balls, **P** and **Q**, each of mass 100 g, are suspended at the same point from a ceiling by means of identical light, inextensible insulating strings. Each ball carries a charge of +250 nC. The balls come to rest in the positions shown in the diagram below.



- 7.1 In the diagram, the angles between each string and the vertical are the same. Give a reason why the angles are the same (1)
- 7.2 State Coulomb's law in words. (2)
- 7.3 The free-body diagram, not drawn to scale, of the forces acting on ball **P** is shown below.

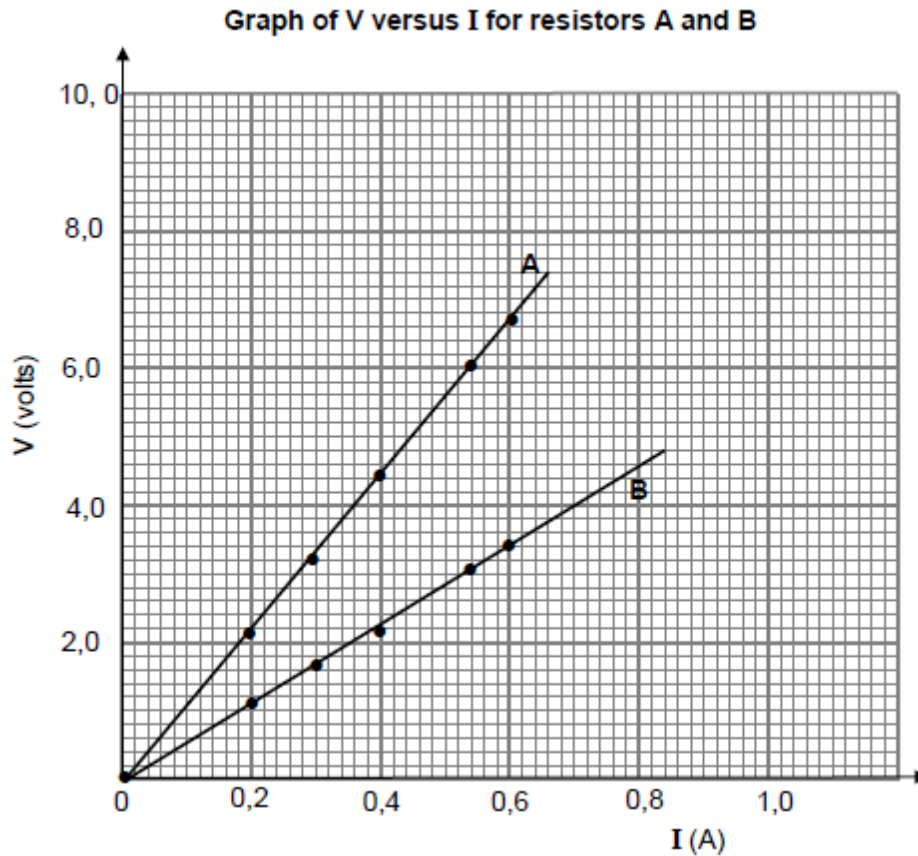


Calculate the:

- 7.3.1 Magnitude of the tension (T) in the string. (3)
- 7.3.2. Distance between balls **P** and **Q** (5)
- [11]**

QUESTION 8 (Start on a new page.)

- 8.1 Learners want to construct an electric heater using one of two wires, **A** and **B**, of different resistances. They conduct experiments and draw the graphs as shown below.

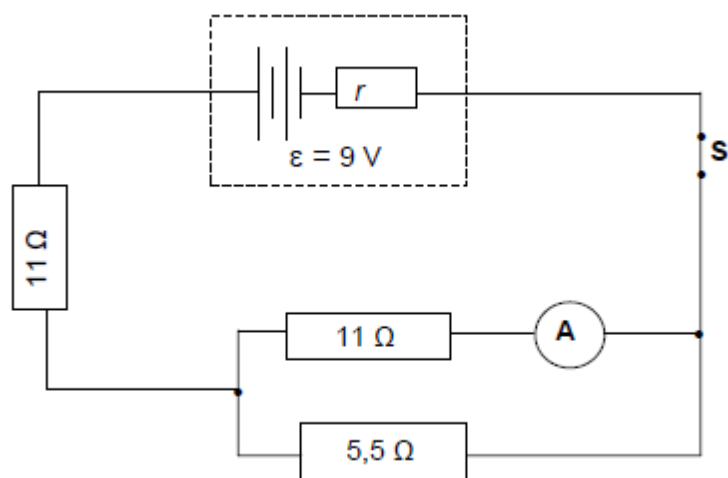


- 8.1.1 Apart from temperature, write down TWO other factors that the learners should consider to ensure a fair test when choosing which wire to use. (2)
- 8.1.2 Assuming all other factors are kept constant, state which ONE of the two wires will be the most suitable to use in the heater.

Use suitable calculations to show clearly how you arrive at the answer.

(8)

- 8.2 In the circuit below the reading on ammeter **A** is 0,2 A. The battery has an emf of 9 V and internal resistance r .

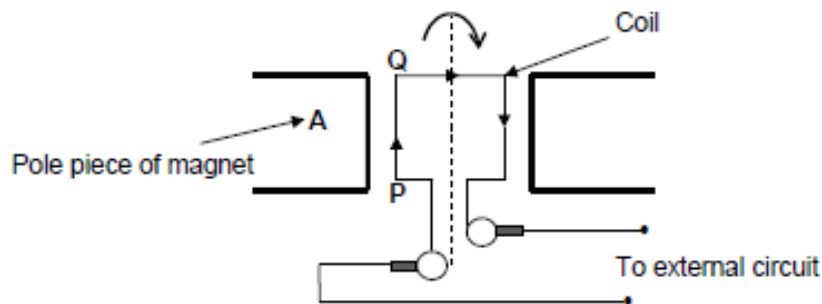


- 8.2.1 Calculate the current through the 5,5 Ω resistor (3)
- 8.2.2 Calculate the internal resistance of the battery. (7)
- 8.2.3 Will the ammeter reading INCREASE, DECREASE or REMAIN THE SAME if the 5,5 Ω resistor is removed from the circuit? Give a reason for the answer (2)

[22]

QUESTION 9 (Start on a new page.)

9.1 A simplified sketch of an AC generator is shown below



The coil of the generator rotates clockwise between the pole pieces of two magnets. At a particular instant, the current in the segment **PQ** has the direction shown above

9.1.1 Identify the magnetic pole A.
Only write NORTH POLE or SOUTH POLE. (1)

9.1.2 The coil is rotated through 180°
Will the direction of the current in segment **PQ** be from **P** to **Q** or **Q** to **P**? (1)

9.1.3 Give TWO reasons why AC voltage is preferred to DC voltage for everyday use. (2)

9.2 An electrical device is connected to a generator which produces a rms potential difference of 220 V. The maximum current passing through the device is 8 A

Calculate the:

9.2.1 Resistance of the device (5)
[9]

QUESTION 10 (Start on a new page.)

In an experiment to demonstrate the photoelectric effect, light of different wavelengths was shone onto a metal surface of a photoelectric cell. The maximum kinetic energy of the emitted electrons was determined for the various wavelengths and recorded in the table below.

INVERSE OF WAVELENGTH $\frac{1}{\lambda}$ ($\times 10^6 \text{ m}^{-1}$)	MAXIMUM KINETIC ENERGY $E_{k(\text{max})}$ ($\times 10^{-19} \text{ J}$)
5,00	6,60
3,30	3,30
2,50	1,70
2,00	0,70

10.1 Define the term *photoelectric effect*? (2)

10.2 Use the result from the table to Draw a graph of $E_{k(\text{max})}$ (y-axis) versus $\frac{1}{\lambda}$ (x-axis)
(use a graph paper attached) (3)

10.3 USE THE GRAPH to determine

10.3.1 The threshold frequency of the metal in the photoelectric cell (4)
[9]

TOTAL MARKS [150]

Name and Surname:

EXAMINATION NUMBER:

ANSWER SHEET

QUESTION 10.2

Hand in this ANSWER SHEET with your ANSWER BOOK.

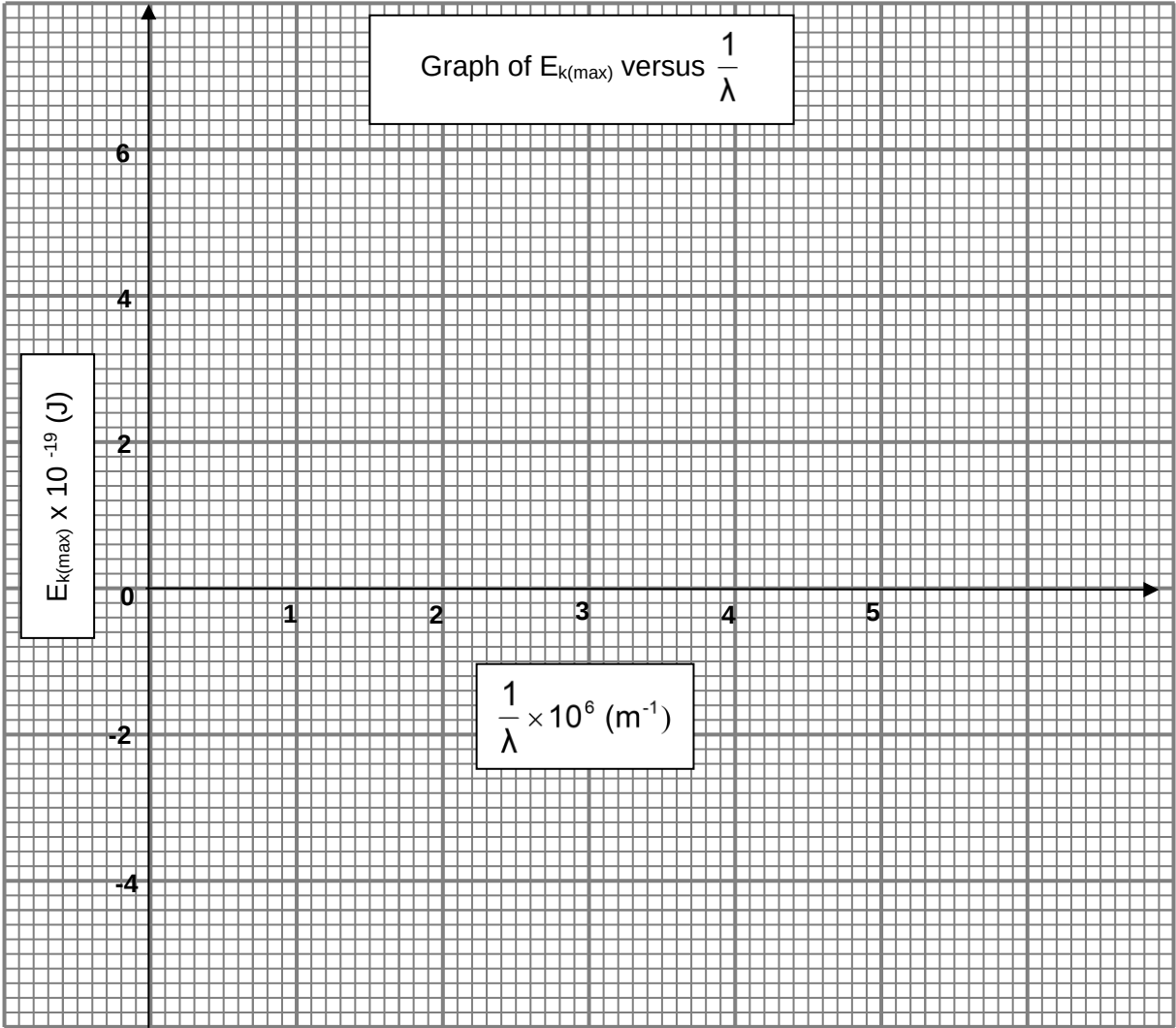


TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIESE KONSTANTES

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Acceleration due to gravity <i>Swaartekragversnelling</i>	g	$9,8 \text{ m}\cdot\text{s}^{-2}$
Universal gravitational constant <i>Universele gravitasiekonstante</i>	G	$6,67 \times 10^{-11} \text{ N}\cdot\text{m}^2\cdot\text{kg}^{-2}$
Radius of the Earth <i>Radius van die Aarde</i>	R_E	$6,38 \times 10^6 \text{ m}$
Mass of the Earth <i>Massa van die Aarde</i>	M_E	$5,98 \times 10^{24} \text{ kg}$
Speed of light in a vacuum <i>Spoed van lig in 'n vakuum</i>	c	$3,0 \times 10^8 \text{ m}\cdot\text{s}^{-1}$
Planck's constant <i>Planck se konstante</i>	h	$6,63 \times 10^{-34} \text{ J}\cdot\text{s}$
Coulomb's constant <i>Coulomb se konstante</i>	k	$9,0 \times 10^9 \text{ N}\cdot\text{m}^2\cdot\text{C}^{-2}$
Charge on electron <i>Lading op elektron</i>	e	$-1,6 \times 10^{-19} \text{ C}$
Electron mass <i>Elektronmassa</i>	m_e	$9,11 \times 10^{-31} \text{ kg}$

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 $\Delta y = \left(\frac{v_i + v_f}{2} \right) \Delta t$

FORCE/KRAG

$F_{\text{net}} = ma$	$p = mv$
$f_s^{\text{max}} = \mu_s N$	$f_k = \mu_k N$
$F_{\text{net}} \Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = G \frac{m_1 m_2}{d^2}$ 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 $E_k = \frac{1}{2} mv^2$	$W_{\text{net}} = \Delta K$ or/of $W_{\text{net}} = \Delta E_k$ $\Delta K = K_f - K_i$ or/of $\Delta E_k = E_{kf} - E_{ki}$
$W_{\text{nc}} = \Delta K + \Delta U$ or/of $W_{\text{nc}} = \Delta E_k + \Delta E_p$	$P = \frac{W}{\Delta t}$
$P_{\text{ave}} = F v_{\text{ave}}$ / $P_{\text{gemid}} = F v_{\text{gemid}}$	

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/of $E = \frac{hc}{\lambda}$
$E = W_0 + E_{k(\text{max})}$ or/of $E = W_0 + K_{\text{max}}$ where/waar $E = hf$ and/en $W_0 = hf_0$ and/en $E_{k(\text{max})} = \frac{1}{2} mv_{\text{max}}^2$ or/of $K_{\text{max}} = \frac{1}{2} mv_{\text{max}}^2$	

ELECTROSTATICS/ELEKTROSTATIKA

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

ELECTRIC CIRCUITS/ELEKTRIESE STROOMBANE

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

ALTERNATING CURRENT/WISSELSTROOM

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