

EXAMINATION		NATIONAL SENIOR CERTIFICATE
GRADE		12
DATE		MAY/JUNE 2026
SUBJECT		PHYSICAL SCIENCES
PAPER		1
MARK TOTAL		150
DURATION (HOURS)		3
NUMBER OF PAGES		19



SOUTH AFRICAN COMPREHENSIVE ASSESSMENT INSTITUTE
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INSTRUCTIONS AND INFORMATION

1. This question paper consists of **10 QUESTIONS**. Answer **ALL** the questions in the **ANSWER BOOK**.
2. Start each question on a **NEW** page in the answer book.
3. Number the questions correctly according to the numbering system used in this question paper.
4. Leave **ONE** line between two sub questions, for example between **QUESTION 2.1** and **QUESTION 2.2**.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. Show **ALL** the formulae and substitutions in **ALL** calculations.
8. Round off your final numerical answers to a minimum of **TWO** decimal places.
9. Give brief motivations, discussions, *et cetera* where required.
10. You are advised to use the **ATTACHED (DATA) SHEETS**.
11. Write neatly and legibly, in **BLUE** ink only.



QUESTION 1

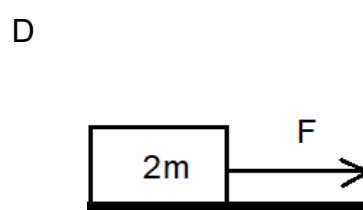
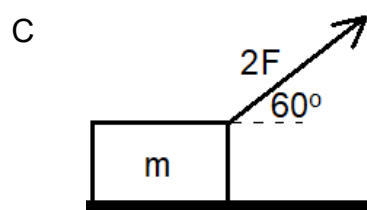
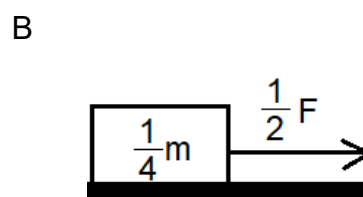
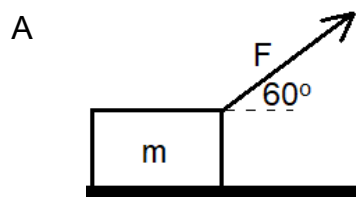
Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A–D), corresponding to the correct answer of your choice, next to the question numbers (1.1 to 1.10) in the ANSWER BOOK, for example 1.11 D.

1.1 Which physical quantity listed below is an example of a vector?

- A Speed
- B Charge
- C Power
- D Momentum

(2)

1.2 In which of the following scenarios will the object accelerate the fastest on the same horizontal surface? (Assume that the weight of the object is sufficient to keep it on the ground).



(2)

1.3 An object slides down a **rough** slope with a constant velocity.



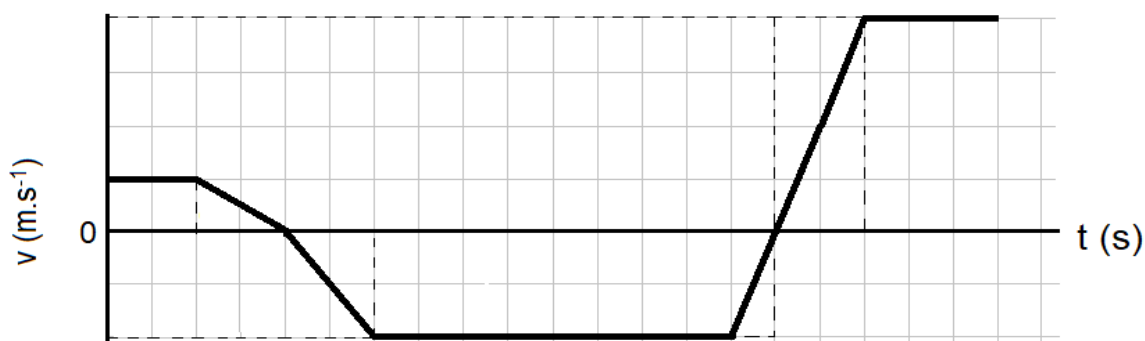
Which one of the following best represents the relationship between the forces acting on the object parallel to the slope?

- A $mg \cos \theta = f$
- B $mg \sin \theta = \mu mg$
- C $mg \sin \theta = mg \cos \theta$
- D $mg \sin \theta = \mu mg \cos \theta$

(2)



- 1.4 Below is a velocity-time graph that represents the velocity of an object over a period of time.



Which of the following is true for the motion of the object?

- A The object was only displaced forward.
- B The object was only displaced backwards.
- C The object was displaced forward and backwards and finally returned to its starting point.
- D The object was displaced forward and backwards, but did not return to its starting point.

(2)

- 1.5 Two identical eggs are dropped from the same height. Egg **A** lands on a concrete floor and egg **B** lands on a pillow. Which statement below explains why egg **B** does not break?

- A Egg **B** stops over a shorter time period.
- B Egg **B** experiences an elastic collision.
- C Egg **B** does not experience the same change in momentum as egg **A**.
- D The pillow increases the time it takes egg **B** to come to rest, reducing the force egg **B** experiences.

(2)

- 1.6 When an eagle flies at a distance r from the centre of the earth, the eagle experiences a gravitational force. Which statement below is correct?

- A The Earth does not experience a force due to the eagle.
- B A gravitational force is only exerted on objects on the surface of the Earth.
- C The force that the eagle experiences due to the Earth, is the same in magnitude as the force that the Earth experiences due to the eagle.
- D The force that the eagle experiences due to the Earth is larger in magnitude than the force that the Earth experiences due to the eagle.

(2)

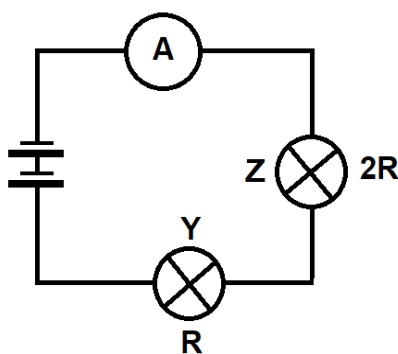


- 1.7 A train is moving towards a stationary observer. How will the observed frequency and wavelength of the emitted sound compare to that of the source at **the exact moment** the train is perpendicular to the observer (just as it passes the observer)?

	Observed frequency	Observed wavelength
A	Higher than	Shorter than
B	The same	The same
C	Lower than	Longer than
D	The same	Longer than

(2)

- 1.8 Consider the following circuit diagram with two light bulbs **Y** and **Z** of resistances R and $2R$ respectively, connected to a battery.



- A **Y** is just as bright as **Z**.
- B **Z** is twice as bright as **Y**.
- C **Y** is twice as bright as **Z**.
- D **Z** is three times as bright as **Y**.

(2)

- 1.9 A flashlight can be operated by means of a magnet moving up and down in the shaft of the flashlight. Which of the following will increase the brightness of the bulb of the flashlight the most?

- A Use a stronger magnet.
- B Shake the flashlight faster.
- C Use more coils in the solenoid inside the shaft of the flashlight.
- D All of the above together.

(2)



- 1.10 Below is a table of the different threshold frequencies of a sample of metals. An incident light with a wavelength of 250 nm is shone onto the surface of the metals. Which metal will NOT emit electrons when the incident light shines on it?

Metals	Threshold frequencies (Hz)
Zinc	$1,04 \times 10^{15}$
Copper	$1,14 \times 10^{15}$
Platinum	$1,35 \times 10^{15}$
Calcium	$7,00 \times 10^{14}$

- A Zinc
- B Copper
- C Platinum
- D Calcium

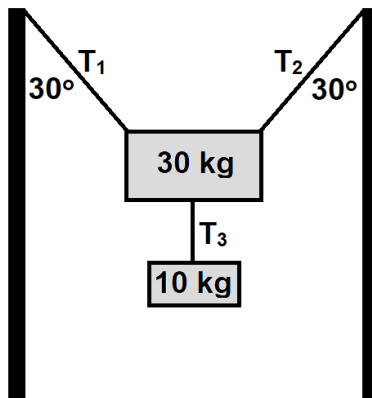
(2)

[20]



QUESTION 2 (Start on a new page)

Two blocks (30 kg and 10 kg) are connected to one another and suspended by the strings from two walls at 30° angles, as shown in the diagram below. T_1 , T_2 and T_3 are tension in the strings. (Consider all strings to be light and inextensible).



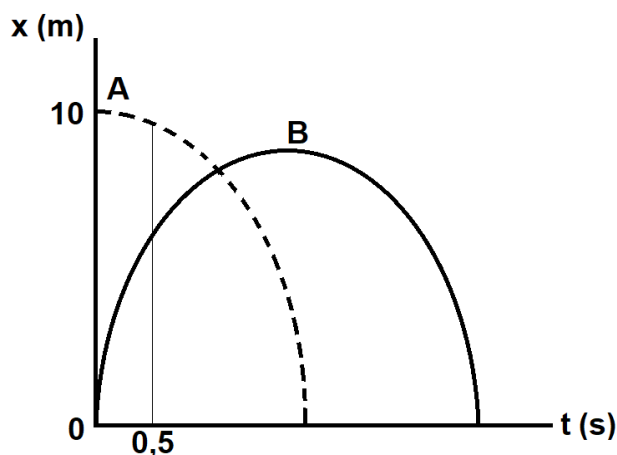
- 2.1 Explain the term *tension* in words. (2)
- 2.2 What is the relationship between T_1 , T_2 and T_3 ? Choose from **GREATER THAN**, **LESS THAN** or **EQUAL TO**.
 - 2.2.1 T_1 is _____ T_2 . (2)
 - 2.2.2 T_2 is _____ T_3 . (2)
- 2.3 Calculate T_3 . (3)
- 2.4 Draw a labelled free-body diagram of all the forces acting on the 30 kg block. (4)
- 2.5 Calculate the magnitude of T_2 . (5)
- 2.6 T_3 and the 10 kg block are removed.
 - 2.6.1 What will happen to the magnitude of T_2 ? Choose from **INCREASES**, **DECREASES** or **REMAINS THE SAME**. (2)
 - 2.6.2 What will happen to the angle between the string and the wall? Choose from **INCREASES**, **DECREASES** or **REMAINS THE SAME**. (2)

[22]



QUESTION 3 (Start on a new page)

Object **A** is thrown downwards with a velocity of 2 m.s^{-1} from a height of 10 m ; at the same time object **B** is projected upwards from the ground with a velocity of 12 m.s^{-1} . Below is a position-time graph of the two different objects. **Take the upward direction to be positive** (the graph below is not drawn to scale).



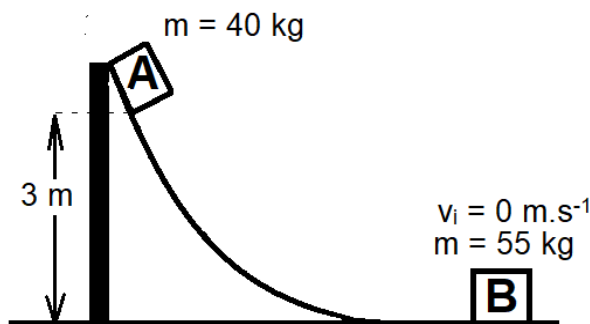
- 3.1 Why is *displacement* considered as a vector quantity? (2)
- 3.2 Calculate the maximum height reached by object **B** above the ground. (4)
- 3.3 Calculate how long it takes object **B** to reach the ground again. (4)
- 3.4 Calculate how far object **A** falls in $0,5 \text{ s}$. (2)
- 3.5 Calculate how far apart objects **A** and **B** are from each other after $0,5 \text{ s}$. (5)

[17]



QUESTION 4 (Start on a new page)

Box **A** slides from rest, from a height of 3 m, down a curved slope. At the bottom of the slope, box **A** collides with box **B**, and they move **together** to the right on a slippery platform. Assume that the boxes move as one unit after the collision. (Ignore the effect of friction).



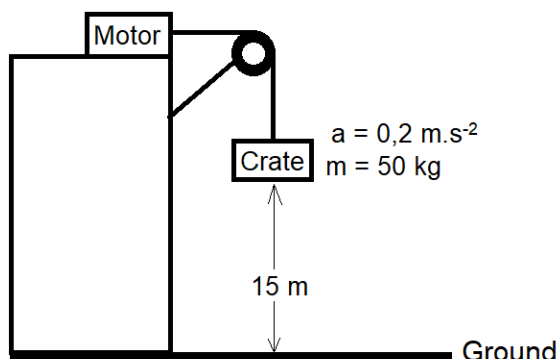
- 4.1 Calculate the magnitude of the velocity of box **A** at the bottom of the slope, just as the box **A** is about to collide with box **B**. (3)
- 4.2 State the *principle of conservation of linear momentum* in words. (2)
- 4.3 Calculate the velocity of the two combined boxes immediately after the collision. (4)

[9]



QUESTION 5 (Start on a new page)

A motor pulls a 50 kg crate from rest at a constant acceleration of $0,2 \text{ m}\cdot\text{s}^{-2}$ to a height of 15 m above the ground. The weight of the rope is insignificant and may be ignored. (Ignore air resistance and any other frictional forces).



- 5.1 State the *work-energy theorem* in words. (2)
- 5.2 Use the work-energy theorem to calculate the magnitude of the velocity of the crate when it reaches a height of 15 m above the ground. (4)

The rope suddenly breaks when the crate is 15 m above the ground.

- 5.3 Without making use of the principle of conservation of mechanical energy, calculate the magnitude of the velocity of the crate once it reaches the ground. (3)
- 5.4 Determine the magnitude of the force the ground exerts on the crate the moment it hits the ground, to bring it to rest in 0,85 s. (5)

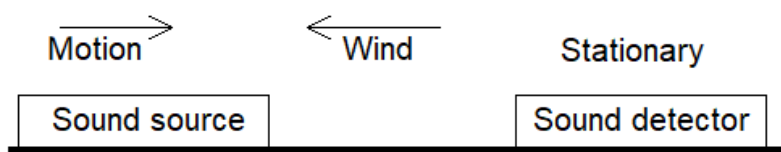
[14]



QUESTION 6 (Start on a new page)

A sound source emitting a frequency of 6 000 Hz is moving at a constant speed of 280 m.s^{-1} towards a stationary sound detector. Assume that the speed of sound in air is 340 m.s^{-1} .

- 6.1 State the *Doppler effect* in words. (2)
- 6.2 Calculate the frequency detected by the sound detector. (4)
- 6.3 Predict how a sudden very strong wind, blowing in the opposite direction to the constantly moving sound source, will influence the following? Choose from **INCREASES**, **DECREASES** or **REMAINS THE SAME**.



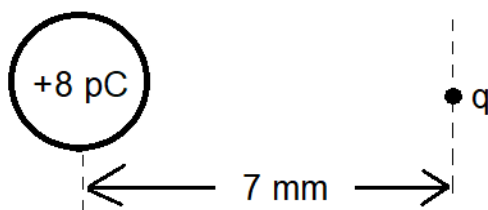
- 6.3.1 The frequency of the sound source. Motivate your answer. (2)
- 6.3.2 The wavelengths detected by the sound detector. Motivate your answer. (2)

[10]



QUESTION 7 (Start on a new page)

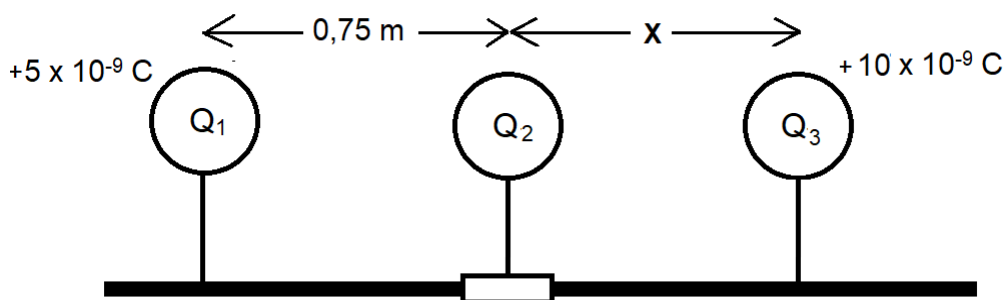
7.1 Point **q** is 7 mm away from a +8 pC charge as indicated by the diagram below.



7.1.1 Draw the electric field pattern around the +8 pC charge. (2)

7.1.2 Calculate the electric field that a point charge placed at **q** would experience due to the +8 pC charge. (3)

7.2 Three small metal spheres, **Q₁**, **Q₂** and **Q₃**, are placed in a vacuum. Spheres **Q₁** and **Q₃** are placed on insulated stands at fixed positions while **Q₂** is placed on an insulated stand that can glide left and right on a frictionless track. **Q₂** comes to rest at a distance **X** from sphere **Q₃**. The spheres are arranged as shown in the diagram below.



7.2.1 State *Coulomb's law* in words. (2)

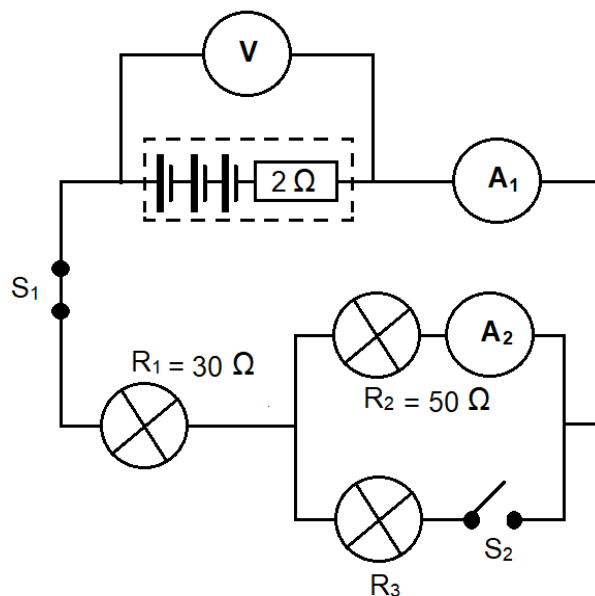
7.2.2 Calculate the distance between **Q₁** and **Q₃**. (6)

[13]



QUESTION 8 (Start on a new page)

In the circuit below a battery with an EMF ($\mathcal{E}$) of 24 V and internal resistance of $2\ \Omega$ is used to operate three light bulbs (R_1 , R_2 and R_3). The components are connected as indicated by the diagram below. The resistance of the connecting wires and ammeters is negligible.



Switch S_1 is closed and switch S_2 is open.

- 8.1 Calculate the reading on A_2 when switch S_2 is open. (4)
- 8.2 Define *power* in words. (2)
- 8.3 Calculate the power of light bulb R_1 . (3)

The reading on A_1 reads 0,47 A when both switches are closed.

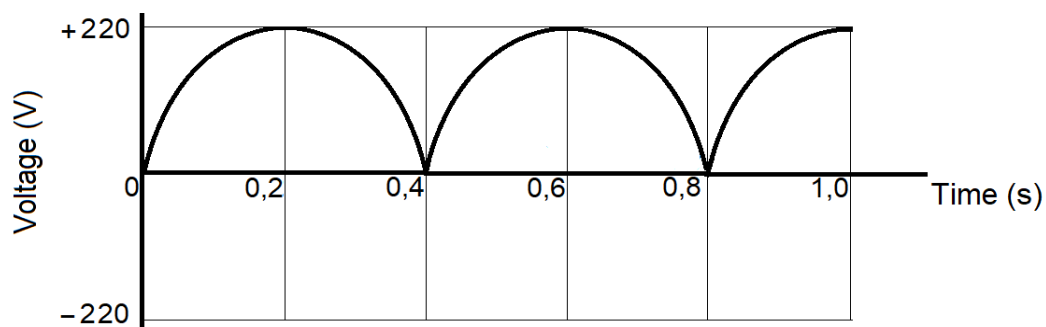
- 8.4 Calculate the potential difference across R_1 . (3)
- 8.5 Calculate the potential difference across the parallel connection. (4)
- 8.6 Calculate the resistance of R_3 . (4)

[20]



QUESTION 9 (Start on a new page)

The diagram below shows the voltage output of a generator.



- 9.1 Is this a direct current (DC) or alternating current (AC) generator? Motivate your answer. (2)
- 9.2 Calculate the root mean square (rms) voltage for this generator. Assume that the output is sinusoidal. (3)

A device with a resistance of $50\ \Omega$ is connected to this generator.

- 9.3 Calculate the average power delivered by the generator to the device. (3)
- 9.4 Calculate the maximum current delivered by the generator to the device. (4)

[12]



QUESTION 10 (Start on a new page)

A potassium metal plate is irradiated with light during a photoelectric experiment. Below is a table of the maximum kinetic energy of the emitted electrons that was measured for several incident frequencies.

Incident frequency ($\times 10^{14}$ Hz)	Maximum kinetic energy of the emitted electrons ($\times 10^{-19}$ J)
4,6	0,2
5,6	0,7
6,8	1,6
7,6	2,3
9,6	3,3
10,0	3,7

- 10.1 Identify the dependent variable in this experiment. (1)
- 10.2 Use the given data to plot a graph of the maximum kinetic energy of the emitted electrons against the incident frequency.
Remove and use the graph paper provided on the last page of this question paper. (6)
- 10.3 Use the graph drawn in QUESTION 10.2 to determine:
- 10.3.1 the threshold frequency of potassium. (2)
- 10.3.2 Planck's constant. (4)

[13]

GRAND TOTAL: [150]



**DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 1 (PHYSICS)**

**GEGEWENS VIR FISIIESE WETENSKAPPE GRAAD 12
VRAESTEL 1 (FISIKA)**

TABLE 1: PHYSICAL CONSTANTS / TABEL 1: FISIIESE 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 or q_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**

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

FORCE / KRAAG

$F_{\text{net}} = ma$	$p = mv$
$F_{\text{net}}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$ or/of $F_g = mg$
$F = \frac{GMm}{r^2}$ or/of $g = \frac{GM}{r^2}$	$F_s^{\text{max}} = \mu_s N$ or/of $F_k = \mu_k N$ $F_s^{\text{maks}} = \mu_s N$

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 $W_{\text{net}} = \Delta E_k$
$W_{\text{nc}} = \Delta K + \Delta U$ or $W_{\text{nc}} = \Delta E_k + \Delta E_p$ $W_{\text{nk}} = \Delta K + \Delta U$ of $W_{\text{nk}} = \Delta E_k + \Delta E_p$	$\Delta K = K_f - K_i$ or/of $\Delta E_k = E_{kf} - E_{ki}$
$P_{\text{ave}} = Fv_{\text{ave}}$ $P_{\text{gem}} = Fv_{\text{gem}}$	$P = \frac{W}{\Delta t}$

WAVES, SOUND AND LIGHT / GOLWE, KLANK EN LIG

$v = f\lambda$	$T = \frac{1}{f}$
$f_L = \left(\frac{v \pm v_L}{v \pm v_s}\right)f_s$	$E = hf$ or/of $E = \frac{hc}{\lambda}$
$E = W_o + K_{\text{max}}$ or $E = W_o + E_{k(\text{max})}$ $E = W_o + K_{\text{maks}}$ of $E = W_o + E_{k(\text{maks})}$	
$E = hf$ and $W_o = hf_o$ and $K_{\text{max}} = \frac{1}{2}mv_{\text{max}}^2$ or $E_{k(\text{max})} = \frac{1}{2}mv_{\text{max}}^2$	
$E = hf$ en $W_o = hf_o$ en $K_{\text{maks}} = \frac{1}{2}mv_{\text{maks}}^2$ of $E_{k(\text{maks})} = \frac{1}{2}mv_{\text{maks}}^2$	

**ELECTROSTATICS / ELEKTROSTATIKA**

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

ELECTRIC CIRCUITS / ELEKTRIESE STROOMBANE

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

ALTERNATING CURRENT / WISSELSTROOM

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



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NATIONAL SENIOR CERTIFICATE EXAMINATION

PHYSICAL SCIENCES PAPER 1

JUNE 2026

Examination number													
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