basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS

TECHNICAL SCIENCES P1

MAY/JUNE 2026

MARKS: 150

TIME: 3 hours

This question paper consists of 17 pages and 3 data sheets.

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INSTRUCTIONS AND INFORMATION

1. Write your centre number and examination number in the appropriate spaces on the ANSWER BOOK.

2. This question paper consists of TEN questions. Answer ALL the questions in the ANSWER BOOK.

3. Start EACH question on a NEW page in the ANSWER BOOK.

4. Number the answers correctly according to the numbering system used in this question paper.

5. Leave ONE line between two subquestions, e.g. 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 QUESTIONS

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1 to 1.10) in the ANSWER BOOK, e.g. 1.11 D.

1.1 A girl is standing on a wooden box. The reaction force on her weight is the force of the ...

A girl on the Earth.

B Earth on the girl.

C girl on the wooden box.

D wooden box on the girl. (2)

1.2 A net force, **F**, is applied to an object of mass **m** kg and causes an acceleration of **a** $m \cdot s^{-2}$. What would the acceleration be if the net force, **F**, on the object is halved?

A ¼ a

B ½ a

C 2a

D 4a (2)

1.3 Which ONE of the following statements best describes the impulse-momentum theorem?

A Change in momentum is equal to the product of the net force and the time taken for the net force to act on the object.

B Momentum is equal to the product of the net force and the time taken for the net force to act on the object.

C The total linear momentum of an isolated system remains constant in magnitude and direction.

D The total linear momentum of an isolated system remains constant in magnitude only. (2)

1.4 What is the equivalent unit for the joule?

A $N \cdot s^{-1}$

B $N \cdot s$

C $N \cdot m$

D $N \cdot m^{-1}$ (2)

1.5 Which ONE of the following is INCORRECT for a motor oil graded 15W-30?

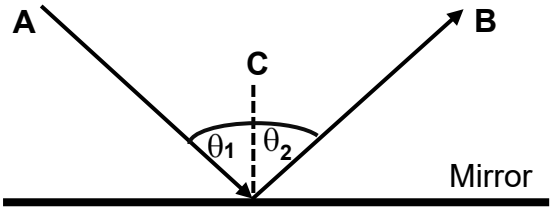
A At 0 °C, the viscosity of the oil is SAE 15.

B At 100 °C, the viscosity of the oil is SAE 15.

C The oil is best suited for vehicles that are exposed to high temperature regions.

D The oil is best suited for vehicles that are exposed to lower temperature regions. (2)

1.6 Study the diagram below carefully and then answer the question that follows.



Which ONE of the following combinations is CORRECT?

	A	B	C
A	Incident ray	Normal	Reflected ray
B	Incident ray	Normal	Refracted ray
C	Normal	Refracted ray	Incident ray
D	Incident ray	Reflected ray	Normal

(2)

1.7 How can the capacitance of a capacitor be increased?

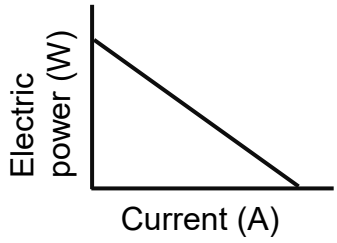
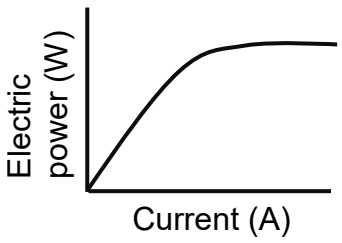
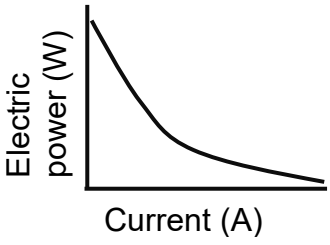
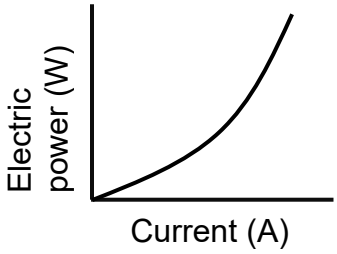
A Decrease the distance between the plates and decrease the surface area of the metal plates

B Decrease the distance between the plates and increase the surface area of the metal plates

C Increase the distance between the plates and use a dielectric with a higher dielectric constant

D Increase the distance between the plates and use a dielectric with a lower dielectric constant (2)

1.8 Which graph below best represents the relationship between the current and electric power in an electric circuit, while the resistance and temperature are kept constant?

A		B	
C		D	

(2)

1.9 Which ONE of the following best defines the magnetic flux?

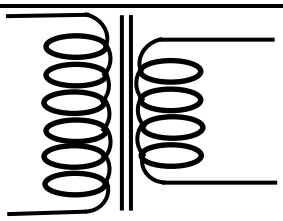
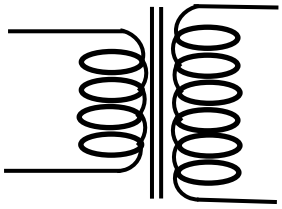
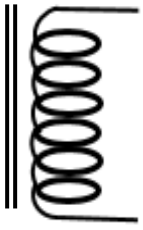
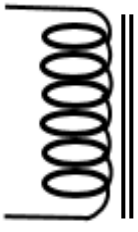
A The strength of a magnetic field at a single point

B The resistance of a material to changes in a magnetic field

C The force experienced by a magnetic material in the magnetic field

D The number of magnetic field lines perpendicular to a given surface (2)

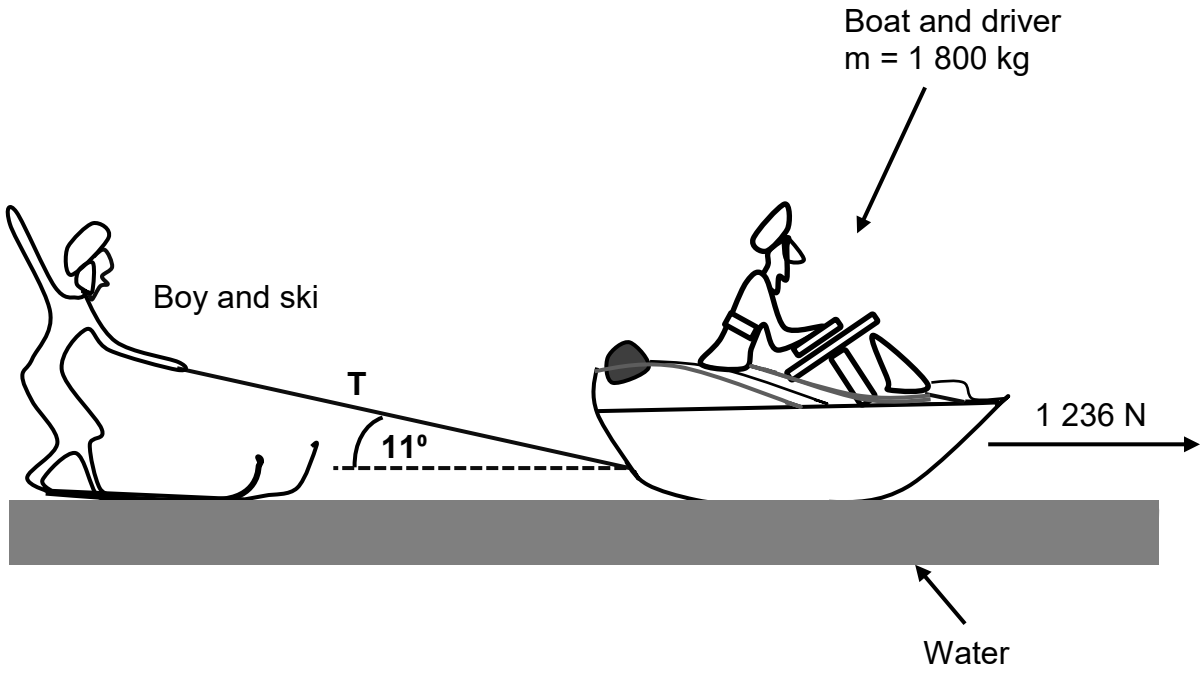
1.10 Which ONE of the diagrams below represents a step-up transformer?

A		B	
C		D	

(2)
[20]

QUESTION 2 (Start on a new page.)

A boy is skiing behind a boat, to which he is connected by a light inextensible rope. The angle between the tension, **T**, and the horizontal is 11°. The combined mass of the boat and the driver is 1 800 kg. The water exerts a frictional force of 500 N on the boat-driver system.



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

2.2 Draw a free-body diagram showing ALL the forces that are acting on the boat-driver system. (5)

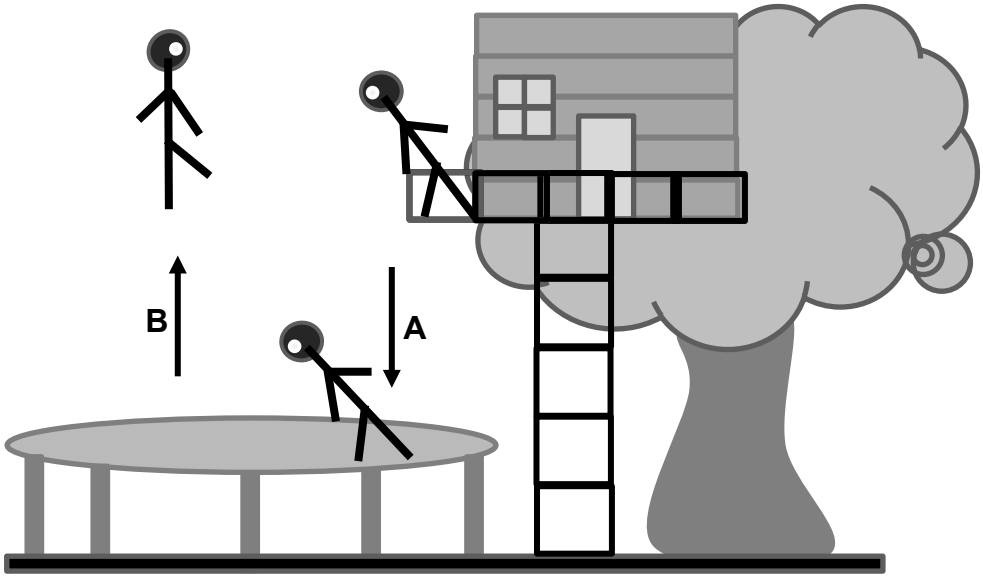
2.3 The engine of the boat supplies a force of 1 236 N to propel the boat forward. The acceleration of the system is 0,05 $m \cdot s^{-2}$ to the right.

Calculate the magnitude of the:

2.3.1 Resultant force acting on the boat-driver system (3)

2.3.2 Tension **T** (4)

2.4 A boy jumps from a treehouse and falls downwards until he hits a trampoline. He then bounces upwards immediately. Ignore the effects of friction.



2.4.1 Name and define the force that is responsible for pulling the boy towards the Earth, after jumping from the treehouse. (3)

2.4.2 Briefly explain why the boy bounces upwards after hitting the trampoline. (2)

2.4.3 Name and state the physics law applied in QUESTION 2.4.2. (3)
[22]

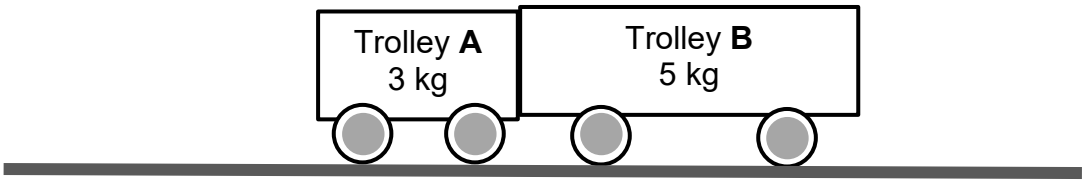
QUESTION 3 (Start on a new page.)

The diagram below shows two trolleys on a smooth horizontal surface. Trolley **A** and trolley **B** have masses of 3 kg and 5 kg respectively. Trolley **A** is moving to the right at 5 m·s^{-1} and trolley **B** is moving to the left at 2 m·s^{-1}. Trolleys **A** and **B** collide with each other and after the collision the two trolleys move together as one system.

BEFORE COLLISION



AFTER COLLISION



3.1 Is momentum a vector or scalar quantity? Explain. (3)

3.2 Calculate the total momentum of the system before the collision. (4)

3.3 State the *law of conservation of linear momentum* in words. (2)

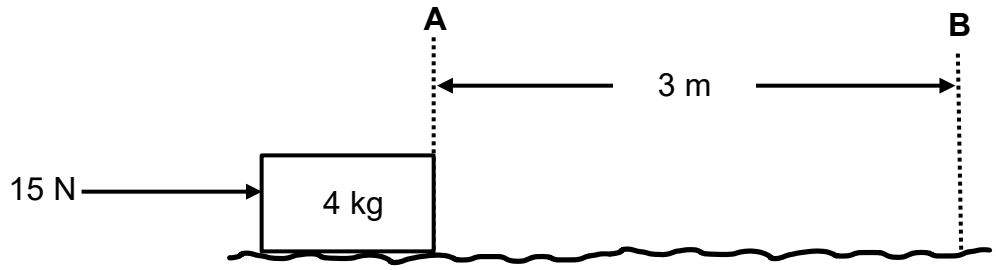
3.4 Calculate the magnitude of the velocity of the system after the collision. (4)

3.5 The crumple zone is one of the safety features in modern vehicles.

Explain how crumple zones minimise the severity of injuries during collisions on the road. (3)
[16]

QUESTION 4 (Start on a new page.)

A crate of mass 4 kg is being pushed to the right across a rough horizontal surface from point **A** to point **B**. A constant force of 15 N is applied, as shown in the diagram below.



4.1 Define the term *kinetic frictional force*. (2)

4.2 Draw a labelled free-body diagram showing ALL HORIZONTAL FORCES acting on the crate. (2)

The coefficient of kinetic friction between the crate and the surface is 0,15.

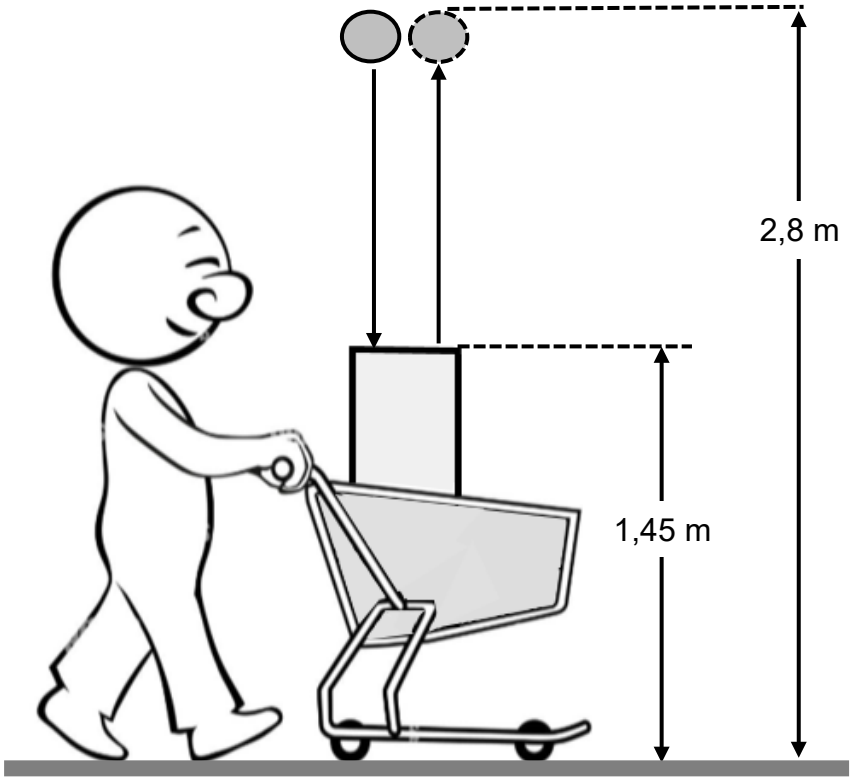
4.3 Calculate the:

4.3.1 Kinetic frictional force (3)

4.3.2 Net work done on the crate (4)

A table-tennis ball, initially at rest, falls from a shelf that is 2,8 m above the floor of a store. The ball hits the top of a metal toolbox which was placed in a trolley. The height of the toolbox from the ground is 1,45 m.

The sum of the gravitational potential energy and kinetic energy remains the same throughout on the path followed by the table-tennis ball.



4.4 Name the principle associated with the underlined words. (1)

4.5 Calculate the mass of the table-tennis ball if the mechanical energy is equal to 0,27 J at a height of 2,8 m above the ground. (3)

4.6 When the table-tennis ball hits the toolbox, it bounces back to its initial height. Ignore the effects of friction.

4.6.1 What happens to the gravitational potential energy of the table-tennis ball as it bounces to its initial height?
Write down only INCREASES, DECREASES or REMAINS THE SAME. (1)

4.6.2 Use a calculation to justify the answer to QUESTION 4.6.1. (6)

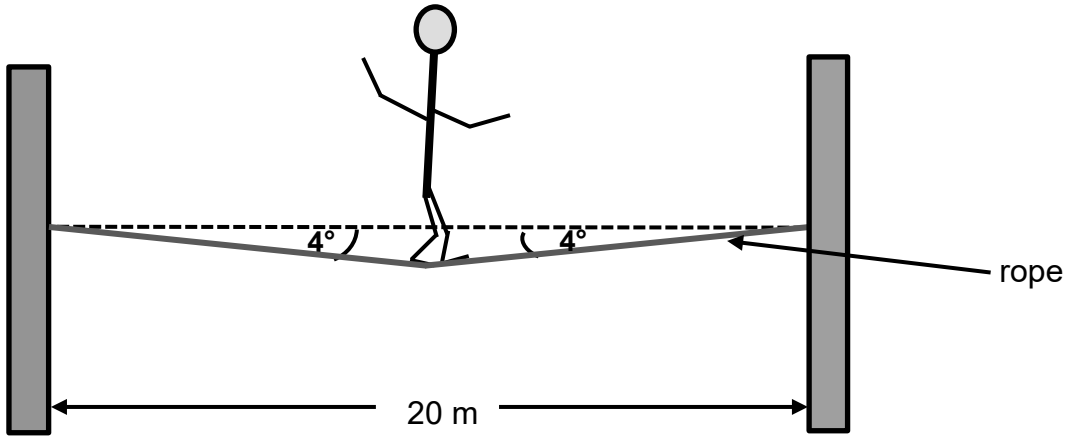
The ball falls to the ground after reaching its highest point.

4.7 What is the magnitude of the kinetic energy at the instant when the table-tennis ball hits the ground? (1)

[23]

QUESTION 5 (Start on a new page.)

A tightrope walker, with a mass of 80 kg, stands stationary at the midpoint of a rope. Due to the walker's weight, the rope stretches, forming an angle of 4° with the horizontal.



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

5.2 Calculate the:

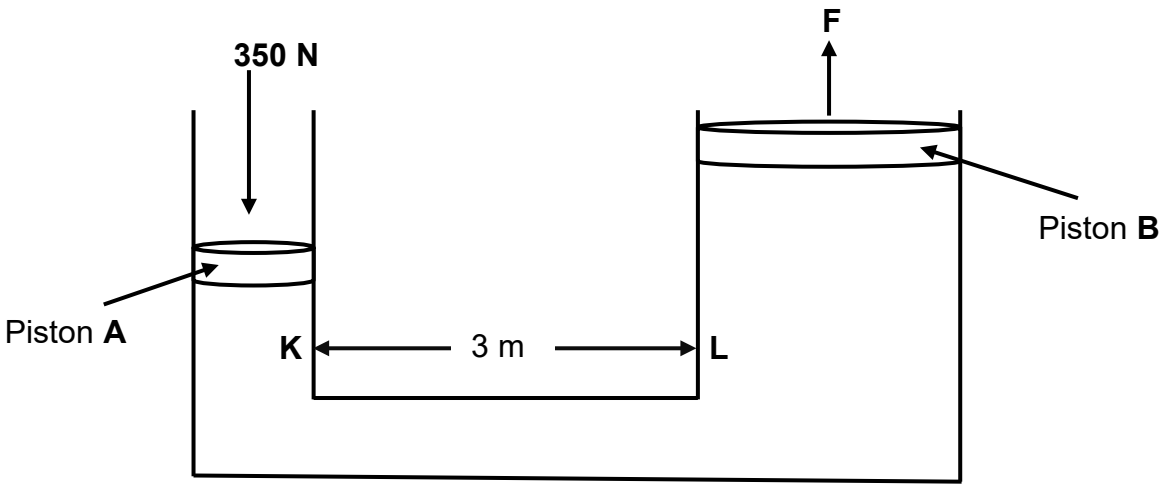
5.2.1 Change in length of the rope (4)

5.2.2 Strain experienced by the rope (3)

5.3 Give TWO examples of perfectly elastic bodies. (2)
[11]

QUESTION 6 (Start on a new page.)

A force of 350 N is applied on piston **A**, which has an area of 0,020 m^2. Piston **B** has a radius, **r**, of 280 mm.



6.1 Define the term *thrust.* (2)

6.2 Calculate the magnitude of the force exerted on piston **B**. (5)

6.3 The 3 m distance between **K** and **L** is reduced to 1,5 m.

6.3.1 How would this change affect the pressure of the system? Write down only INCREASES, DECREASES or REMAINS THE SAME. (1)

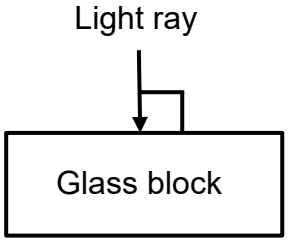
6.3.2 Explain the answer to QUESTION 6.3.1. (2)

6.4 Write down ONE use of hydraulic systems in technology. (1)
[11]

QUESTION 7 (Start on a new page.)

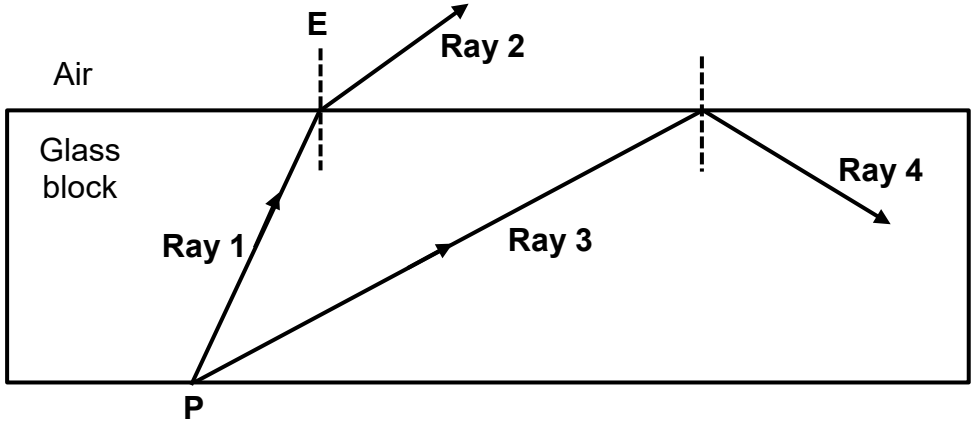
7.1 Define the term *refraction*. (2)

7.2 Consider the diagram below, which indicates the path of a light ray through a rectangular glass block.



Redraw the diagram in the ANSWER BOOK and complete the path of the light ray as it passes through the glass block. (2)

7.3 The sketch below shows two light rays which travel from point **P** at the bottom of a glass block.



Write down the name of:

7.3.1 Ray **2** (1)

7.3.2 Line **E** (1)

7.4 Which medium has a higher optical density? Write down only AIR or GLASS. (1)

7.5 Explain the answer to QUESTION 7.4. (2)

7.6 Consider the path of rays **3** and **4**.

7.6.1 What is the name of the phenomenon that is illustrated by the path of these rays? (1)

7.6.2 State TWO conditions necessary for the phenomenon in QUESTION 7.6.1 to occur. (2)

7.7 The following are examples of the use of electromagnetic radiation:

A. Used to treat cancer; sterilise food and instruments
B. Remote controllers; photography and thermal imaging
C. Used in hospitals to sterilise equipment; forensic detection of drugs

Match ONE of the uses of electromagnetic radiation listed above with EACH of the following types of waves:

7.7.1 Infrared light (1)

7.7.2 Gamma rays (1)

7.8 Calculate the wavelength of electromagnetic radiation that has energy of 1×10^{-14} J. (4)

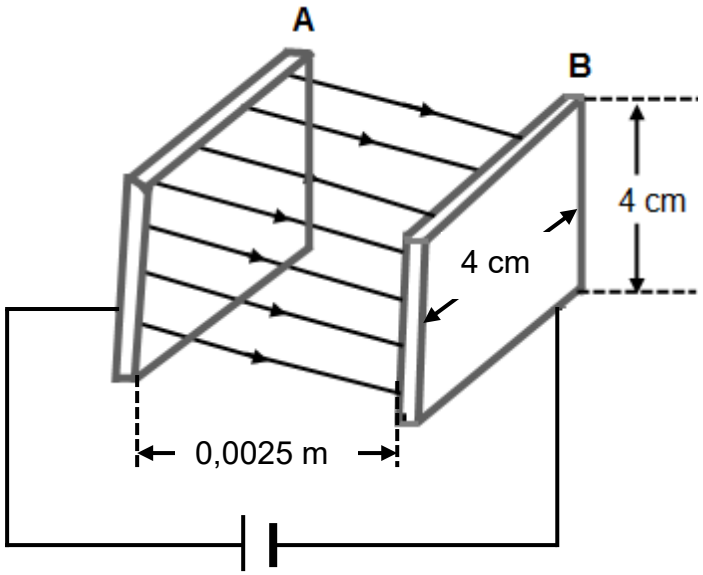
7.9 Concave and convex lenses are used in everyday life.

7.9.1 Write down ONE difference between *concave* and *convex lenses*. (2)

7.9.2 Draw diagrams of the two lenses referred to in QUESTION 7.9.1. Label the diagrams as CONCAVE LENS and CONVEX LENS. (2)
[22]

QUESTION 8 (Start on a new page.)

A capacitor consists of two square metal plates, **A** and **B**, each side with a length of 4 cm. The metal plates are separated by an air gap of 0,0025 m.



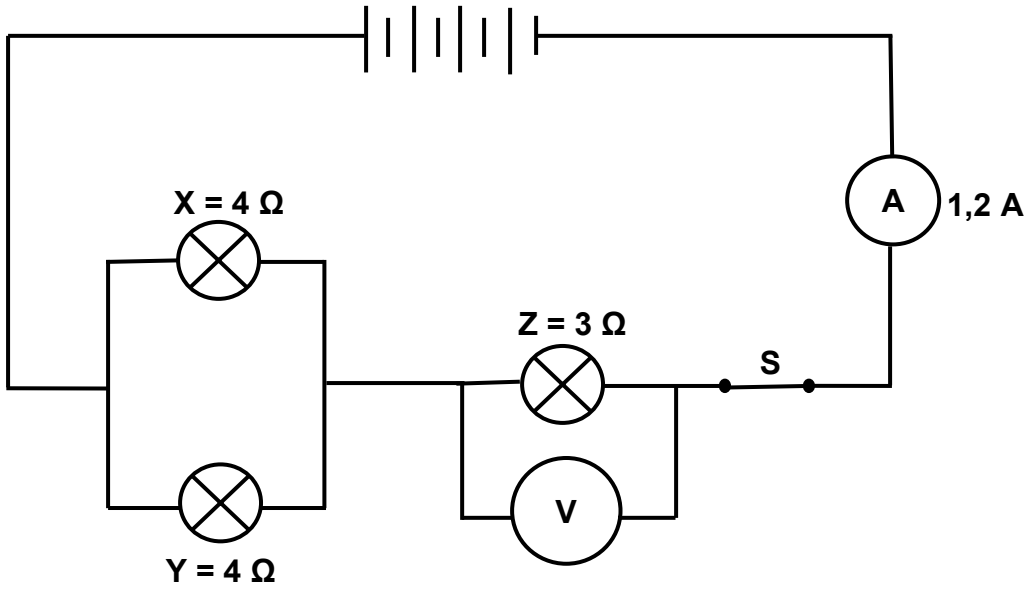
8.1 Define the term *capacitor*. (2)

8.2 The capacitor can store a charge of 5×10^{-11} C.

Calculate the potential difference across the metal plates. (5)
[7]

QUESTION 9 (Start on a new page.)

In the diagram below, light bulbs **X** and **Y** have resistances of 4 Ω each, and light bulb **Z** has a resistance of 3 Ω. The total current in the electric circuit is 1,2 A.



Switch **S** is now closed.

9.1 Define the term *resistance*. (2)

9.2 Calculate the:

9.2.1 Total resistance of light bulbs **X** and **Y** (3)

9.2.2 Energy transferred in light bulb **Z** if current flows through it for 3 seconds (3)

9.3 Light bulbs **X**, **Y** and **Z** are now connected in series.
How will this affect the total current in the circuit?
Write down REMAINS THE SAME, INCREASES or DECREASES. (1)
[9]

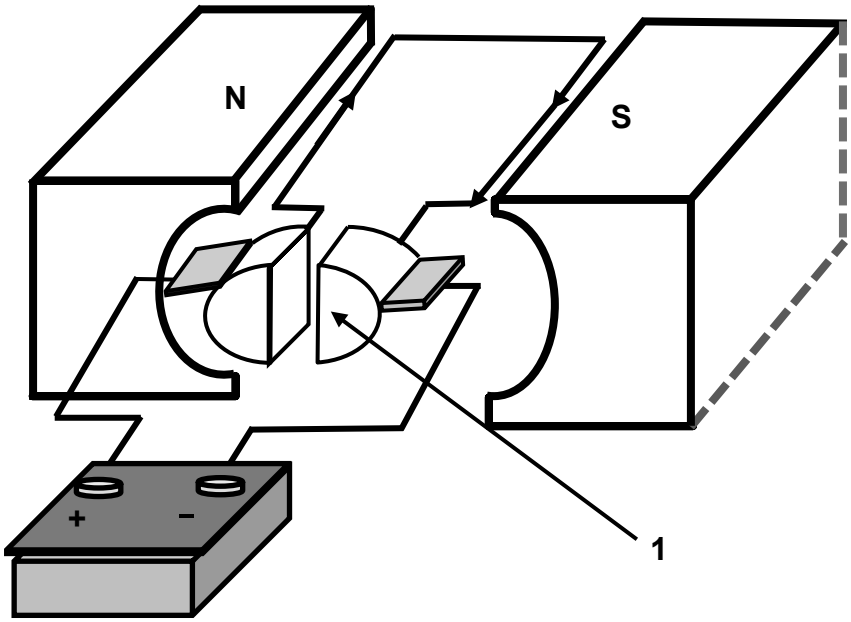
QUESTION 10 (Start on a new page.)

10.1 Define the term *electromagnetic induction*. (2)

10.2 A coil with 250 windings is rotated so that the magnetic flux linkage with each winding changes from 5×10^{-4} Wb to 1×10^{-4} Wb. The induced emf is 0,25 V.

Calculate the time taken for the magnetic flux linkage in the coil to change. (4)

Study the diagram of an electric device below carefully and answer the questions that follow.



10.3 Write down the function of part **1**. (1)

10.4 The power source is now switched on.

10.4.1 In which direction will the coil rotate?
Write down only CLOCKWISE or ANTICLOCKWISE. (1)

10.4.2 Name the principle that was applied to answer QUESTION 10.4.1. (1)
[9]

TOTAL: 150

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DATA FOR TECHNICAL SCIENCES GRADE 12
PAPER 1

GEGEWENS VIR TEGNIESE WETENSKAPPE GRAAD 12
VRAESTEL 1

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	9,8 $m \cdot s^{-2}$
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} $J \cdot s$
Electron mass *Elektronmassa*	m_e	9,11 x 10^{-31} kg
Permittivity of free space *Permittiwiteit van vrye ruimte*	ε_o	8,85 x 10^{-12} $F \cdot m^{-1}$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

FORCE/*KRAG*

$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$F_g = mg$
$v = \frac{\Delta x}{\Delta t}$	$a = \frac{\Delta v}{\Delta t}$

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* $E_k = \frac{1}{2}mv^2$	$M_E = E_k + E_p$
$P_{ave} = Fv_{ave}$ / $P_{gemid} = Fv_{gemid}$	$P = \frac{W}{\Delta t}$

ELASTICITY, VISCOSITY AND HYDRAULICS/*ELASTISITEIT, VISKOSITEIT EN HIDROULIKA*

$\sigma = \frac{F}{A}$	$\varepsilon = \frac{\Delta \ell}{L}$
$\frac{\sigma}{\varepsilon} = K$	$\frac{F_1}{A_1} = \frac{F_2}{A_2}$
$P = \frac{F}{A}$	$P = \rho g h$

ELECTROSTATICS/*ELEKTROSTATIKA*

$C = \frac{Q}{V}$	$C = \frac{\varepsilon_o A}{d}$

CURRENT ELECTRICITY/*STROOMELEKTRISITEIT*

$R = \frac{V}{I}$	$R_s = R_1 + R_2 + \ldots$ $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$
$W = VQ$ $W = VI\Delta t$ $W = I^2 R \Delta t$ $W = \frac{V^2 \Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2 R$ $P = \frac{V^2}{R}$

ELECTROMAGNETISM/*ELEKTROMAGNETISME*

$\Phi = BA$	$\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$
$\frac{V_s}{V_p} = \frac{N_s}{N_p}$	

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

$v = f\lambda$	$T = \frac{1}{f}$
$E = hf$ or/*of* $E = h\frac{c}{\lambda}$	

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