Province of the
EASTERN CAPE
EDUCATION

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Porafensie Ya Kapa Botjahabela: Lefapha la Thuto

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2025

TECHNICAL SCIENCES P1

MARKS: **150**

TIME: **3 hours**

This question paper consists of 16 pages, including 2 data sheets.

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INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions in the ANSWER BOOK.
2. Start EACH question on a NEW page in the ANSWER BOOK.
3. Number the answers correctly according to the numbering system used in this question paper.
4. You may use a non-programmable calculator.
5. LEAVE ONE line between sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You are advised to use the attached DATA SHEETS.
7. Show ALL 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, etc. where required.
10. Write neatly and legibly.

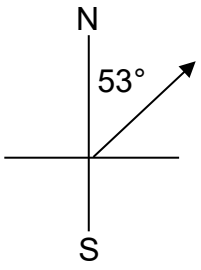
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QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as 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, for example 1.11 D.

1.1 Consider the following vector that makes an angle of 53° with north.



Which of the following directions below represents this vector?

A E 53° N

B E 53° S

C N 53° E

D W 53° N (2)

1.2 Two forces, F_1 and F_2, act at a point. If F_1 and F_2 act in the same direction, the magnitude of the resultant force is 13 N. If F_1 and F_2 act in opposite directions, the magnitude of the resultant force is 3 N.

What are the magnitudes, in Newton, of the two forces?

A 3 and 10

B 5 and 8

C 7 and 10

D 10 and 13 (2)

1.3 A body is at rest on a horizontal surface. It will start to move from rest when the frictional force is ...

A equal to the normal force.

B less than the applied force.

C greater than the normal force.

D greater than the applied force. (2)

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1.4 In which one of the following situations is the normal force equal to zero?

A A mass piece is at rest on a horizontal floor.

B A mass piece moves across a horizontal floor.

C You press against a vertical wall with your hand.

D A mass piece is suspended from the roof by means of a string. (2)

1.5 The point in the northern hemisphere where the rotation axis of the earth meets its surface is called the ...

A magnetic north pole.

B magnetic south pole.

C geographic south pole.

D geographic north pole. (2)

1.6 A negatively charged rod **RS** is brought closer to two identical, neutral conducting spheres, **P** and **Q**, which are touching each other, and which are mounted on insulated stands as shown on the left in the diagram below. **P** and **Q** are now separated and after that **RS** is removed as shown on the right in the diagram below.



Which ONE of the following CORRECTLY shows the charge on **P** and **Q** after separation and removal of **RS**?

	CHARGE ON P	CHARGE ON Q
A	Negative	Positive
B	Positive	Negative
C	Neutral	Neutral
D	Positive	Neutral

(2)

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1.7 Which ONE of the following combinations is TRUE when longitudinal waves move through a medium?

	WHAT IS TRANSFERRED BETWEEN TWO POINTS	MOVEMENT OF PARTICLES
A	Energy	Parallel to the medium
B	Particles	Parallel to the medium
C	Energy	Perpendicular to the medium
D	Particles	Perpendicular to the medium

(2)

1.8 The unit of measurement of the RATE OF FLOW OF CHARGE in a conductor is …

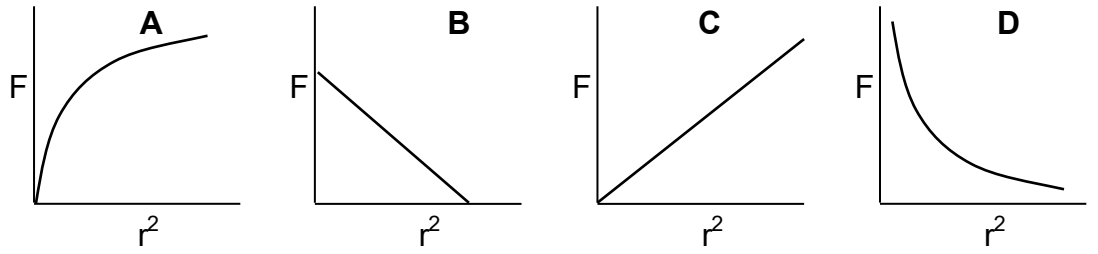
A volt.

B watt.

C ampere.

D coulomb. (2)

1.9 Which ONE of the following graphs CORRECTLY shows the relationship between the electrostatic force and the square of the distance between two charges?



(2)

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1.10 Which statement below is correct for resistors connected in PARALLEL in a circuit?

A The current is divided by all the resistors but the potential difference across the resistors is the same.

B The current in all the resistors is the same but the potential difference across the resistors is divided.

C The current in all the resistors is the same and the potential difference across the resistors is the same.

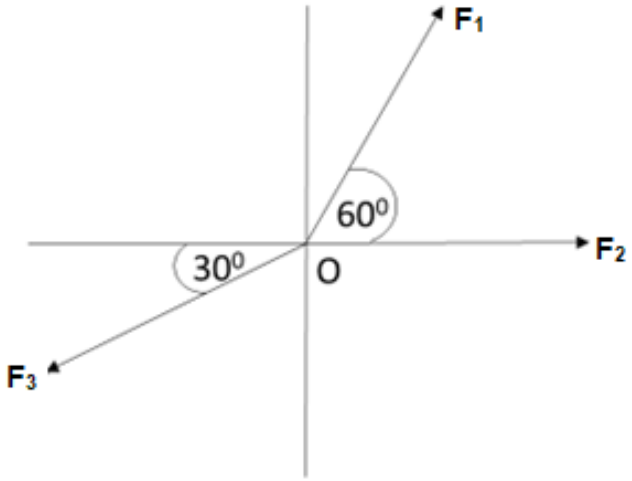
D The current is divided by all the resistors and the potential difference across the resistors is divided. (2)

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QUESTION 2: (Start on a new page.)

The diagram represents three forces that act at the same point **O** on the Cartesian plane. The magnitude of $\mathbf{F_2}$ and $\mathbf{F_3}$ are 20 N and 10 N respectively, while the vertical and horizontal components of $\mathbf{F_1}$ are 7 N and 4 N respectively.



2.1 Differentiate between *co-linear vectors* and *co-planar vectors*. (4)

2.2 Calculate the magnitude of each of the following:

2.2.1 $\mathbf{F_1}$ (2)

2.2.2 Vertical component of $\mathbf{F_3}$ (2)

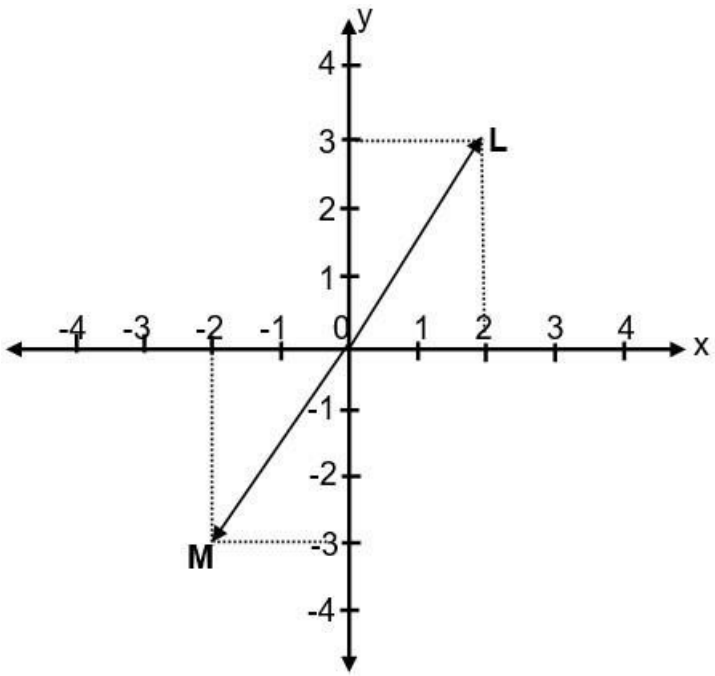
2.2.3 Resultant of $\mathbf{F_1}$, $\mathbf{F_2}$ and $\mathbf{F_3}$ (5)

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QUESTION 3: (Start on a new page.)

Force vectors **L** and **M**, measured in Newton, are drawn to scale on the Cartesian plane below.



3.1 Explain the term *resultant force*. (2)

3.2 State whether vectors **L** and **M** are co-linear or co-planar. (1)

3.3 Write down the magnitude of the horizontal and vertical components of **L** (IN THIS ORDER). (2)

3.4 Write down the magnitude of the horizontal and vertical components of **M** (IN THIS ORDER). (2)

3.5 Calculate the magnitude of **M**. (2)

3.6 Determine the direction of **M** if it is measured clockwise from the positive y-axis. (4)

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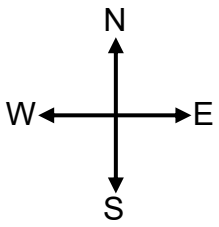
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QUESTION 4: (Start on a new page.)

A car with a mass of 1 300 kg moves on a rough horizontal road 100 km eastward and then 120 km westward in a total time of 2 hours. The coefficient of kinetic friction between the tyres and the surface of the road is 0,02.





4.1 Define *frictional force*. (2)

4.2 Calculate the normal force exerted by the surface on the car. (3)

4.3 What is the direction of the force acting on the mass of the car? (1)

4.4 Calculate the:

4.4.1 Frictional force experienced by the car (3)

4.4.2 Magnitude of the displacement of the car (2)

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QUESTION 5: (Start on a new page.)

A class of Grade 11 learners conduct an investigation into the behaviour of magnets in the laboratory.

5.1 Define the term *ferromagnetic material*. (2)

5.2 Write down the names of TWO ferromagnetic materials. (2)

5.3 During the investigation, a bar magnet was placed on the table with the north pole pointing to the left as shown in the diagram below.



5.3.1 Give THREE properties of magnetic field lines. (3)

5.3.2 Redraw the magnet in your ANSWER BOOK and draw the magnetic field lines around the bar magnet. (2)

5.4 A second bar magnet is placed on the table and both are free to move.





Explain what will be observed when the:

5.4.1 North pole of one magnet is brought closer to the north pole of the other magnet (1)

5.4.2 South pole of one magnet is brought closer to the north pole of the other magnet (1)

5.5 Draw the magnetic field lines on the bar magnets when the north pole of one magnet is brought closer to the north pole of the other magnet. (3)

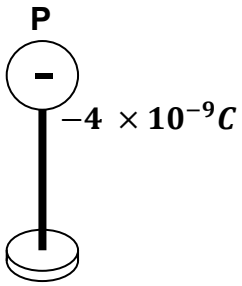
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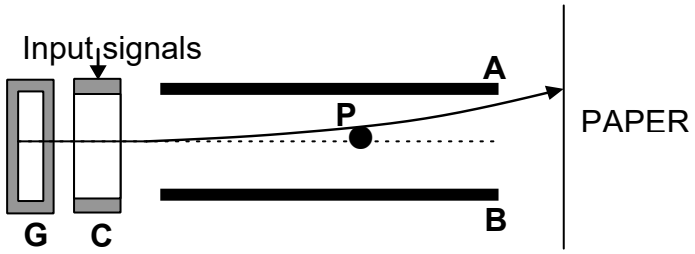
QUESTION 6: (Start on a new page.)

The diagram below shows a small metal sphere **P** on an insulated stand. The sphere carries a charge of -4 x 10^{-9} C, as shown in the diagram.



6.1 Draw the electric field pattern around sphere **P**. Assume that no other charges affect this pattern. (2)

6.2 An ink-jet printer makes use of the electric field between two oppositely charged parallel plates to control the position of an ink drop on paper. In the diagram below, the generator **G** of the printer shoots out ink drops that are charged in the charging unit **C**. The input signal from a computer controls the charge given to each ink drop. **P is a negatively charged ink drop.**



6.2.1 Define the *electric field* at a point in space. (2)

6.2.2 Is plate **B** negatively or positively charged? Give a reason for your answer. (3)

6.2.3 Sketch the electric field pattern between plates **A** and **B** (3)

6.3 The plates **A** and **B** are 6,4 x 10^{-4} m apart and ink drop **P** has a charge of magnitude 1,5 x 10^{-13} C. When the ink drop enters the field, it experiences an electrical force of 2,1 x 10^{-7} N.

6.3.1 Calculate the potential difference across the parallel plates. (6)

6.3.2 What is the relationship between electric field strength **E** and the distance **D** between the two parallel plates? (2)

6.4 Electrostatics has numerous applications in technology. Apart from the printers and photocopiers, mention any other THREE applications. (3)

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QUESTION 7: (Start on a new page.)

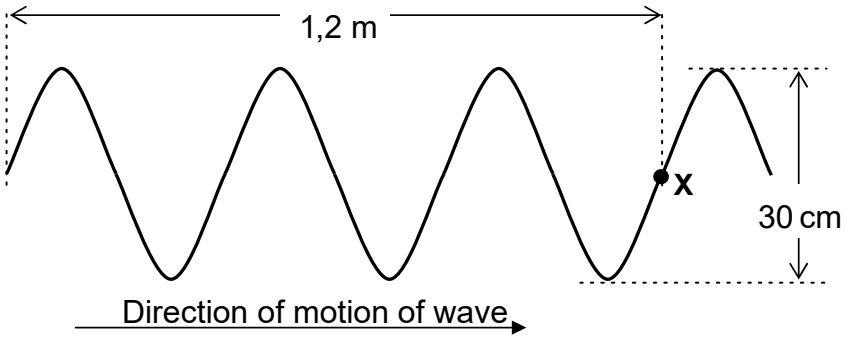
The vibration of a generator causes a transverse wave in the power cable connected to it. The wave moves at 8 $m \cdot s^{-1}$ in the cable.

7.1 Define the *frequency of a wave* in words. (2)

7.2 Calculate the frequency of the wave if the wavelength of the wave in the power cable is 200 mm. (4)

7.3 Show the calculation to convert 8 $m \cdot s^{-1}$ to kilometre per hour. (3)

7.4 The diagram below represents waves with a frequency of 10 Hz.



7.4.1 What is meant by the wavelength of a wave. (2)

7.4.2 Calculate the wavelength of this wave. (2)

7.4.3 What is the magnitude of the amplitude of this wave in metres? (2)

7.4.4 Calculate the speed of the wave. (3)

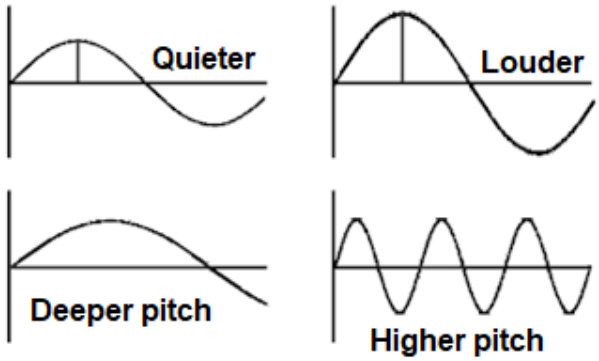
7.4.5 Calculate how long it will take THREE waves to pass point **X**. (4)

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QUESTION 8: (Start on a new page.)

The four graphical wave patterns below demonstrate pitch and loudness.



8.1 Define *pitch*. (2)

8.2 Describe, by referring to the above graphical wave patterns, the relationships between:

8.2.1 Frequency and pitch (2)

8.2.2 Amplitude and loudness (2)

8.3 Differentiate between *infrasound* and *ultrasound* in terms of frequency range? (2)

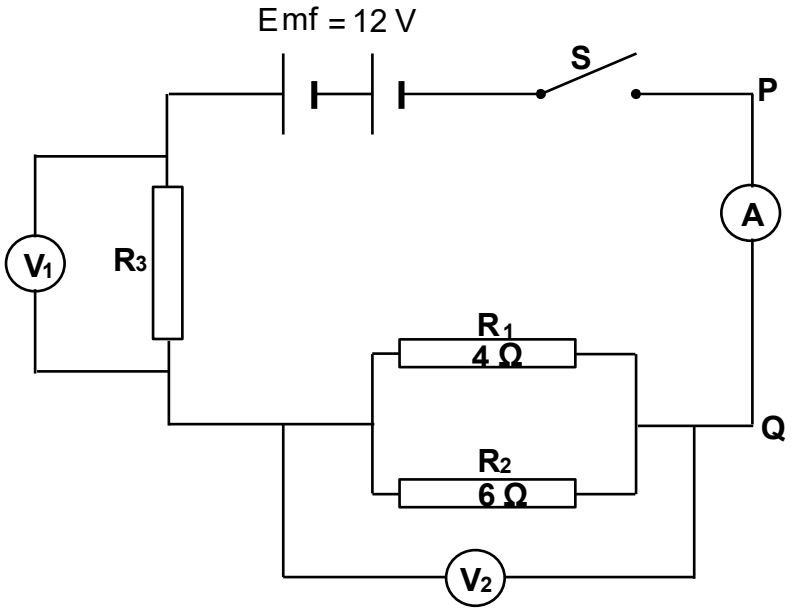
8.4 Mention any FOUR applications of ultrasound in the industry. (4)
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QUESTION 9: (Start on a new page.)

In the circuit below the emf of the battery is 12 V. The resistances of R_1 and R_2 are **4 Ω** and **6 Ω** respectively. The resistance of R_3 is unknown. The internal resistance of the battery and the resistance of the wires can be ignored.



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

9.2 The current in the ammeter **(A)** when switch **S** is closed is 1 A.

Calculate the:

9.2.1 Equivalent resistance of the parallel resistors, R_1 and R_2 (3)

9.2.2 Reading on V_2 (3)

9.2.3 Value of the resistance R_3 (3)

9.2.4 Reading on V_1 (3)

9.3 In which direction does the current flow in section **PQ** of the circuit? Choose your answer from **P** to **Q** or **Q** to **P**. Explain your answer. (3)

9.4 The **4 Ω** resistor is now removed from the circuit and switch **S** is closed.

9.4.1 How will the ammeter reading be affected? Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

9.4.2 Explain your answer to QUESTION 9.4.1. (3)

9.4.3 Calculate the total resistance of the circuit. (3)

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TOTAL: 150

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DATA FOR TECHNICAL SCIENCES GRADE 11
PAPER 1

GEGEWENS VIR TEGNIESE WETENSKAPPE GRAAD 11

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	$3,0 \times 10^{8}$ $m \cdot s^{-1}$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}$ J·s
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}$ kg
Permittivity of free space *Permittiwiteit van vrye ruimte*	$\varepsilon_\circ$	$8,85 \times 10^{-12}$ $F.m^{-1}$
Coulomb's contant Coulomb se konstante	k	$9,0 \times 10^{9}$ $Nm^2.C^{-2}$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

FORCE/*KRAG*

$F_{net} = ma$	$F_g = mg$
$f_{s\ max} = \mu_s N$	$f_k = \mu_k N$

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

$v = f\lambda$	$T = \frac{1}{f}$

ELECTROSTATICS/*ELEKTROSTATIKA*

$F = \frac{(kQ_1Q_2)}{r^2}$	$E = \frac{F}{Q}$
$E = \frac{V}{d}$	

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CURRENT ELECTRICITY/*STROOMELEKTRISITEIT*

$R = \frac{V}{I}$	$W = VQ$
$R_s = R_1 + R_2 + ...$ $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + ...$	$q = I\ \Delta t$

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