Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2023

TECHNICAL SCIENCES P1

MARKS: **150**

TIME: **3 hours**

This paper consists of 15 pages, including a data sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

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 a line open between subsections, for example QUESTION 2.1 and QUESTION 2.2.
6. You are advised to use the attached DATA SHEET.
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.

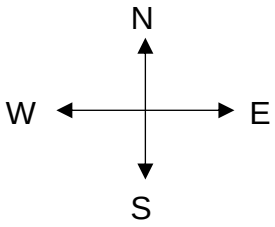
QUESTION 1: MULTIPLE-CHOICE QUESTIONS

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, for example 1.11 D.

1.1 Which ONE of the following vectors points northwest?

A 

B 



C 

D 

(2)

1.2 Two forces, $\mathbf{F_1}$ and $\mathbf{F_2}$, acts at a point. If $\mathbf{F_1}$ and $\mathbf{F_2}$ acts in the same direction, the magnitude of the resultant force is 18 N. If $\mathbf{F_1}$ and $\mathbf{F_2}$ act in opposite directions, the magnitude of the resultant force is 4 N.

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

A 7 N and 11 N

B 6 N and 12 N

C 8 N and 12 N

D 10 N and 14 N (2)

1.3 The ratio of frictional force to normal force is known as the …

A kinetic friction.

B angle of friction.

C force of friction.

D coefficient of friction. (2)

1.4 Waves with a frequency above the audible range of human beings are called …

A ultrasound waves.

B audible sound waves.

C infrasound waves.

D transverse waves. (2)

1.5 A longitudinal pulse is a …

A single disturbance in a medium.

B pulse in which the particles of the medium vibrate parallel to the direction of propagation of a pulse.

C pulse in which the particles of the medium vibrate at right angles to the direction of propagation of a pulse.

D maximum displacement of a particle from its position of rest. (2)

1.6 A reflection of a sound wave is called …

A loudness.

B frequency.

C pitch.

D an echo. (2)

1.7 In which ONE of the following mediums is the speed of sound the HIGHEST?

A Vacuum

B Sea water

C Glass

D Air (2)

1.8 A bar magnet is cut in half and divided into two pieces. Which ONE of the following statements is true regarding the force between **A** and **B**; if they face each other with a small separation/space between them.

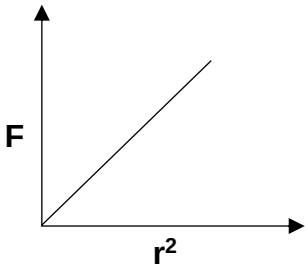
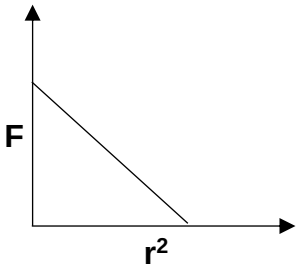
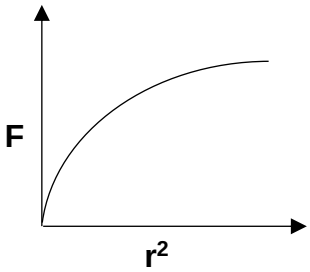
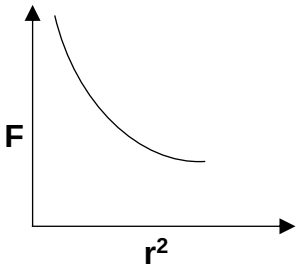
A There is a magnetic repulsive force between **A** and **B**.

B There is a magnetic attractive force between **A** and **B**.

C First there is a magnetic attractive force between **A** and **B**, then they start to repel each other when they come into contact.

D There is no force between **A** and **B** since they are demagnetised. (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?

A		B	
C		D	

(2)

1.10 Materials that act against Ohm's Law are called …

A bad conductors.

B ohmic.

C non ohmic.

D insulators. (2)

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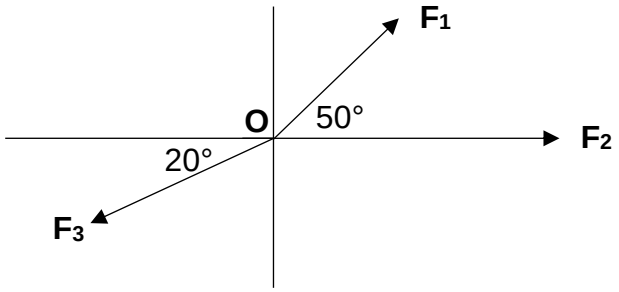
QUESTION 2 (Start on a new page.)

The diagram below represents three forces that act at the same point **O**. The magnitude of $\mathbf{F_2}$ and $\mathbf{F_3}$ are 30 N and 20 N respectively. The vertical and horizontal components of $\mathbf{F_1}$ are 8 N and 6 N respectively.



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

2.2 Is force a vector quantity? Answer only YES or NO. (1)

2.3 Are the forces in the diagram above CO-LINEAR or CO-PLANAR forces? (1)

2.4 Calculate the magnitude of the following:

2.4.1 $\mathbf{F_1}$ (2)

2.4.2 The vertical component of $\mathbf{F_3}$ (2)

2.4.3 The resultant of $\mathbf{F_1}$, $\mathbf{F_2}$ and $\mathbf{F_3}$ (5)

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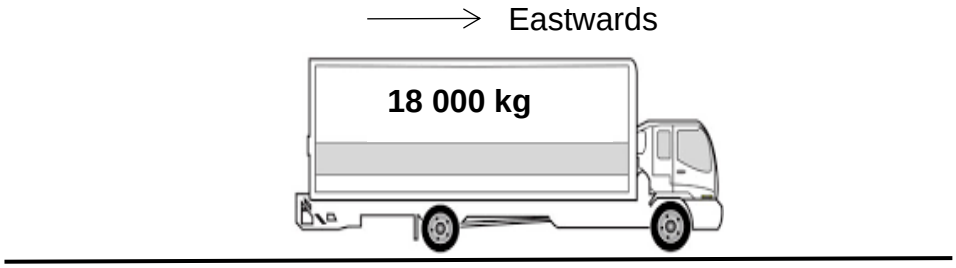
QUESTION 3 (Start on a new page.)

A truck with mass 18 000 kg travels 70 km eastward and then 40 km westward.



3.1 Calculate the magnitude of the weight of the truck. (3)

3.2 Is the weight of the truck a CONTACT or a NON-CONTACT force? (1)

3.3 What is the direction of the weight? (1)

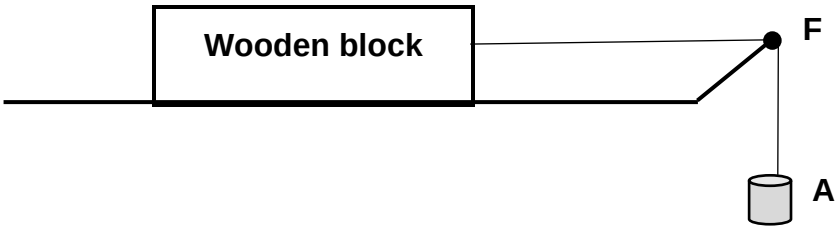
3.4 Calculate the:

3.4.1 Distance travelled by the truck (2)

3.4.2 Magnitude of the displacement of the truck (2)
[9]

QUESTION 4 (Start on a new page.)

A Grade 11 learner does an experiment to determine the coefficient of static friction between a wooden block and a polished table surface, by steadily increasing the force applied by the mass pieces at **A**.



The following results are tabled during the experiment:

Block	Mass of block (g)	Normal force (N)	Mass of mass pieces (g)	Force F in rope	Coefficient of static friction, μ_s
Wooden	504	-	80	0,78	-

4.1 Differentiate between *static friction* and *kinetic friction*. (4)

4.2 Draw a labelled free body diagram showing all the forces acting in on the wooden block. (4)

4.3 Provide the following for this experiment:

4.3.1 The dependent variable (1)

4.3.2 The independent variable (1)

The block starts moving when a force of exactly 0,78 N is applied.

4.4 Show, using a calculation, that the normal force on the block is equal to 4,94 N. (2)

4.5 Hence, determine the coefficient of static friction. (3)

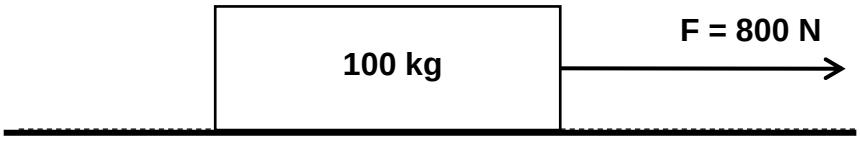
4.6 What is the mathematical relationship between normal force and frictional force? (2)

4.7 How can the static frictional force change in each of the following cases? Write down only INCREASES, DECREASES or REMAINS THE SAME.

4.7.1 If force **F** acts at an angle of 30° to the horizontal. (1)

4.7.2 If the mass of the wooden block is increased. (1)

4.8 A container with a mass of 100 kg is placed on a rough surface and is pulled by force **F** of 800 N, as shown in the diagram below. The coefficient of kinetic friction is 0,4.



Calculate the kinetic frictional force that the container experiences. (4)

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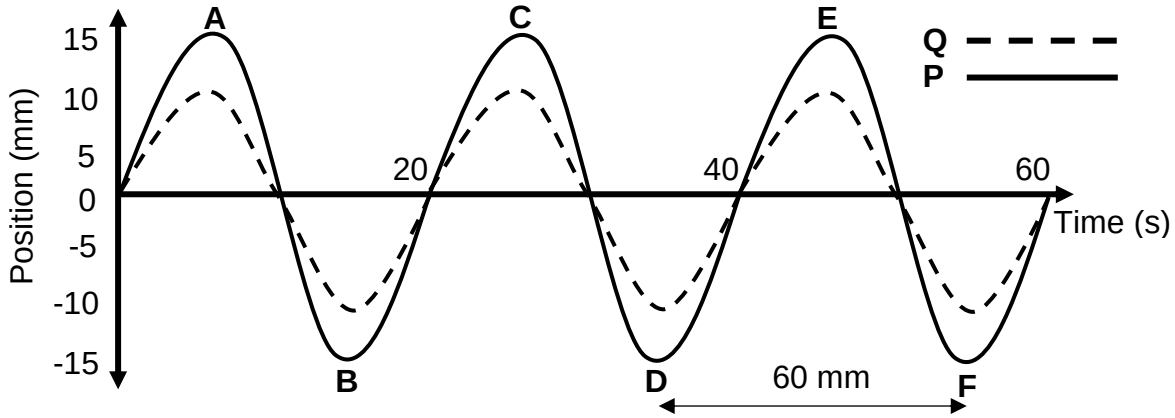
QUESTION 5 (Start on a new page.)

Consider the TWO transverse waves **P** and **Q** as shown in the diagram below.



5.1 Write down:

5.1.1 ONE difference between wave **P** and wave **Q** (1)

5.1.2 ONE similarity between wave **P** and wave **Q** (1)

5.2 Define the terms:

5.2.1 Period (2)

5.2.2 Transverse wave (2)

5.3 Label the points marked:

5.3.1 **D** (1)

5.3.2 **E** (1)

5.4 How many complete waves are represented by **Q** in the diagram? (1)

5.5 Write down the LETTERS that represent any TWO points that are:

5.5.1 Out of phase (1)

5.5.2 One wavelength apart (1)

5.6 For the wave pattern **P** above:

5.6.1 Determine the amplitude (2)

5.6.2 Calculate the frequency (3)

5.6.3 Calculate the speed of the wave (3)

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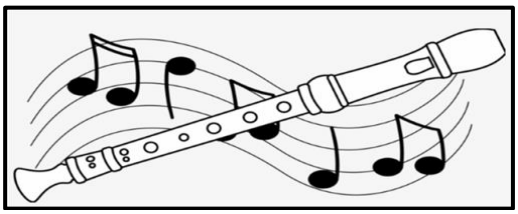
QUESTION 6 (Start on a new page.)

A flute produces a sound wave with a frequency of 360 Hz. Accept that the speed of sound at that point is 325 $m \bullet s^{-1}$.



6.1 For this sound wave, calculate the:

6.1.1 Period
Give your answer in scientific notation. (3)

6.1.2 Wavelength (3)

6.2 A string of a guitar oscillates with a period of 0,005 s. Take the speed of sound in air to be 343 $m \bullet s^{-1}$.

6.2.1 Are sound waves longitudinal or transverse waves? (2)

6.2.2 Calculate the frequency of the string's oscillations. (2)

6.2.3 Calculate the wavelength of the sound wave produces by the string. (2)

6.2.4 The frequency of the string increases. How will this affect the PITCH of the sound?

Write down only INCREASE, DECREASE or REMAINS THE SAME. (2)

6.2.5 How does the increased frequency mentioned in QUESTION 6.2.4, influence the LOUDNESS of the string's sound?

Write down only INCREASE, DECREASE or REMAINS THE SAME. (1)

6.3 Give TWO applications of ultrasound in everyday life. (2)
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QUESTION 7 (Start on a new page.)

A bar magnet **A** is placed on as shown in the diagram below.

A

7.1 Define the term *magnetic field.* (2)

7.2 Give TWO properties of magnetic field lines. (2)

7.3 Sketch the magnetic field pattern around bar magnet **A**. (3)

A second bar magnet **B** is placed near bar **A** as shown in the diagram below.

A **B**

7.4 What kind of force does each magnet experience due to the other magnet?

Write down only ATTRACTION or REPULSION. (1)

7.5 Define the term *magnet* in words. (2)

7.6 Write down TWO examples of ferromagnetic materials. (2)

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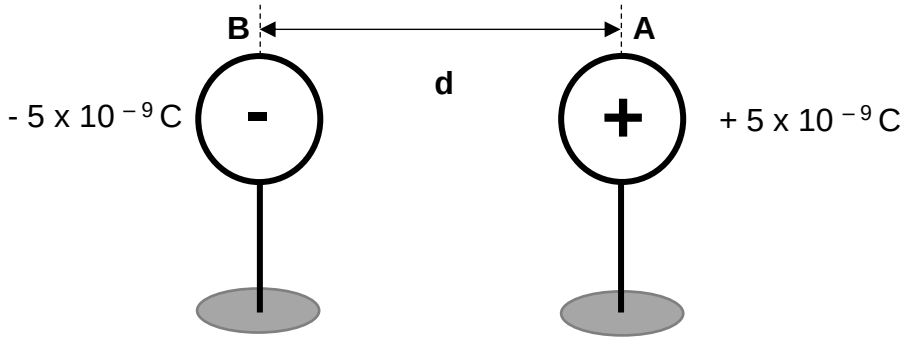
QUESTION 8 (Start on a new page.)

Two small identical metallic spheres are placed, on insulated stands. The charge of each sphere is indicated on the diagram below. The magnitude of the force that sphere **A** experiences due to the charge on **B** is $4,3 \times 10^{-5}$ N.



8.1 Which sphere **A** or **B** has an excess of electrons? (1)

8.2 Complete the following definition by writing only the question numbers (8.2.1 to 8.2.2) and the correct word.

Coulomb's law states that the force of attraction or repulsion between two point charges is (**8.2.1**) to the product of their charges and (**8.2.2**) to the square of the distance between the two charges. (2)

8.3 Draw the resultant electric field pattern between **A** and **B**. (3)

8.4 Calculate the magnitude of the:

8.4.1 Electric field strength at **B** due to **A** (4)

8.4.2 Distance **d** between the charges (5)

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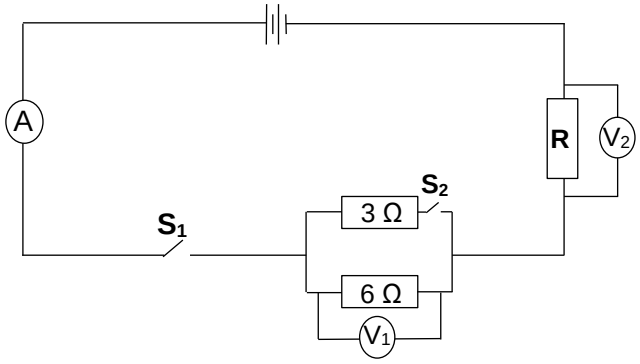
QUESTION 9 (Start on a new page.)

In the circuit diagram below the battery has an emf of 12 V. Ignore the internal resistance of the battery and any resistance in the connecting wires.



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

When switch **S_1** is CLOSED and switch **S_2** is OPEN, the current in the ammeter is 0,9 A.

9.2 Calculate the:

9.2.1 Resistance of resistor **R** (4)

9.2.2 Potential difference **V_1** across the 6 Ω resistor (3)

Switch **S_2** is also CLOSED.

9.3 Calculate the:

9.3.1 Total resistance of the circuit (4)

9.3.2 Total current of the circuit (3)

9.3.3 Reading on **V_1** (3)

9.3.4 Current in the 6 Ω resistor (3)

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TOTAL: 150

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 $m \cdot s^{-2}$
Coulomb's constant *Coulomb se konstante*	k	9 x 10^9 $N.m^2.C^{-2}$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

FORCE/*KRAG*

$F_{net} = ma$	$F_g = mg$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$

ENERGY/*ENERGIE*

$K = \frac{1}{2}mv^2$ **OR/*OF*** $E_k = \frac{1}{2}mv^2$	$U = mgh$ **OR/*OF*** $E_P = mgh$
$M_E = E_k + E_p$	

ELECTROSTATICS/*ELEKTROSTATIKA*

$E = \frac{V}{d}$	$F = Eq$	$F = \frac{kQ_1Q_2}{r^2}$

CURRENT ELECTRICITY/*STROOMELEKTRISITEIT*

$R = \frac{V}{I}$	$R_s = R_1 + R_2 + ...$	$q = I\Delta t$
$W = VQ$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + ...$ **OR/*OF*** $R_p = \frac{R_1R_2}{R_1 + R_2}$	