



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

NOVEMBER 2019

TECHNICAL SCIENCES P1

MARKS: 150

TIME: 3 hours



This question paper consists of 17 pages including a data sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Write your FULL NAME and SURNAME in the appropriate spaces in the ANSWER BOOK.
2. Answer ALL the questions.
3. Start each question on a NEW page in the ANSWER BOOK.
4. You may use a non-programmable calculator.
5. Appropriate mathematical instruments may be used.
6. Number the answers correctly according to the numbering system used in this question paper.
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. You are advised to use the attached DATA SHEETS
11. 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 (1.1–1.10) in the ANSWER BOOK, for example 1.11 D.

- 1.1 Vectors that are in the same plane are called ...
- A co-linear
 - B resultant
 - C co-planar
 - D equilibrant (2)
- 1.2 The direction of a vector given as a bearing of x° means the angle, x° , is measured ...
- A clockwise from the Eastern direction
 - B clockwise from the Northern direction
 - C anticlockwise from the Northern direction
 - D clockwise from the vertically upward direction (2)
- 1.3 An object slides along a rough surface. The magnitude of force of kinetic friction is INDEPENDENT of the ...
- A mass of the object
 - B surface area of the object
 - C nature of the two sliding surfaces
 - D normal force acting on the object (2)

- 1.4 A motor mechanic investigates the fuel consumption of a car by measuring the amount of fuel the car consumes for every 40 km travelled.

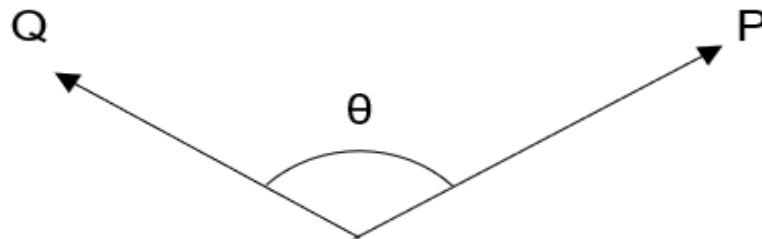
The table below shows the results obtained.

Distance travelled (km)	Fuel consumed (Litres)	Distance travelled Fuel consumed (km/litre)
40	3,2	12,5
80	6,4	12,5
120	9,6	12,5
160	12,8	12,5

Which ONE of the following is the CORRECT relationship between the distance travelled and fuel consumed?

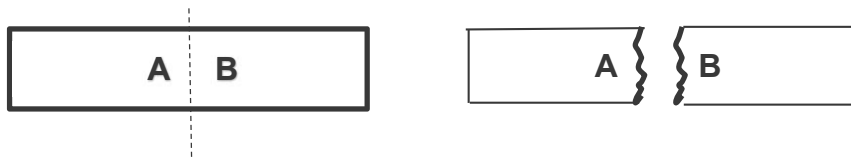
- A Direct proportion
 - B Inverse proportion
 - C Exponential relationship
 - D Symmetrical relationship (2)
- 1.5 **P** and **Q** represent forces acting at a point. The angle θ between the forces can be changed.

These two forces produce **maximum** resultant, when they act ...



- A in the same direction.
- B in the opposite direction.
- C perpendicular to each other.
- D at an angle of 150° to each other. (2)

- 1.6 Which ONE of the following will INCREASE the strength of an electric field, E , between two parallel oppositely charged metal plates?
- A Increasing the area of the plates
 - B Increasing the distance between the plates
 - C Increasing the potential difference across the plates
 - D Decreasing the potential difference between the plates (2)
- 1.7 A bar magnet is cut along the dotted line shown below into two pieces marked **A** and **B**.



A learner tries to re-assemble the magnet by bringing the cut sections of the magnets close to each other.

Which ONE of the following will happen when the two cut sections are brought close to each other?

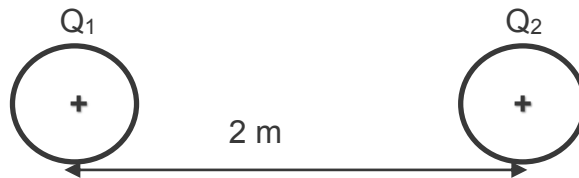
The cut sections **A** and **B** will ...

- A repel.
- B attract.
- C attract and then repel.
- D exert no force on each other. (2)

1.8 Two positive point charges Q_1 and Q_2 are placed at a distance of 2 m apart.

F_1 is the force exerted by Q_1 on Q_2 .

F_2 is the force exerted by Q_2 on Q_1 and $Q_1 > Q_2$.



Which ONE of the following statements is correct about the magnitudes of the forces and their nature?

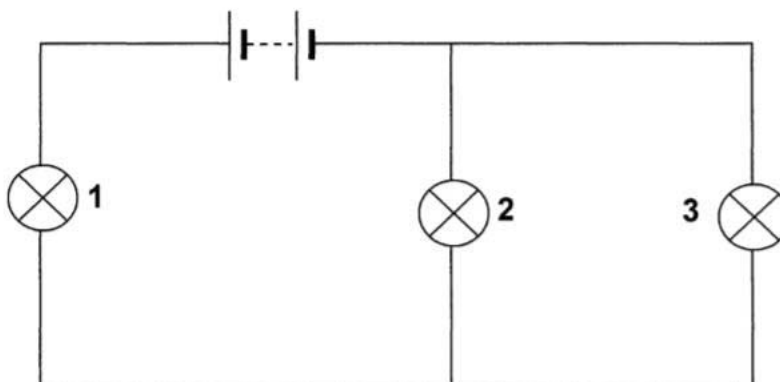
	FORCES	NATURE
A	$F_1 = F_2$	Attractive
B	$F_1 > F_2$	Attractive
C	$F_1 = F_2$	Repulsive
D	$F_1 > F_2$	Repulsive

1.9 The opposition to the flow of electric charge is called ...

- A emf.
- B resistance.
- C capacitance.
- D potential difference.

(2)

1.10 In the circuit represented below, all the bulbs are identical.



A voltmeter connected across bulb 1 reads V .

What will the reading on the voltmeter be when it is connected across bulb 3?

- A zero
- B V
- C $V/2$
- D $2V$

(2)
[20]

QUESTION 2

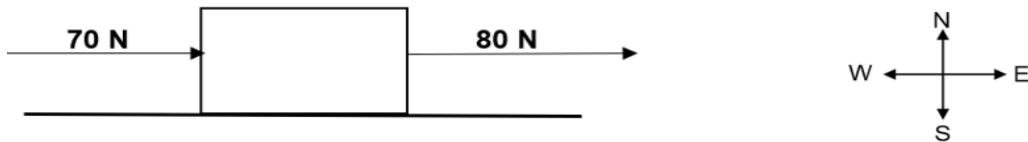
2.1 Two forces, 40 N in the x -direction and 30 N in the y -direction, act on the same object.

2.1.1 Is force a vector quantity? Yes or No. (2)

Explain the answer

2.1.2 Draw both forces on the same Cartesian plane. (Scale: 10 mm : 1 N) (4)

2.2 A worker is pulling a concrete block due east with a force of 80 N while another worker is pushing the same block due east with a force of 70 N.

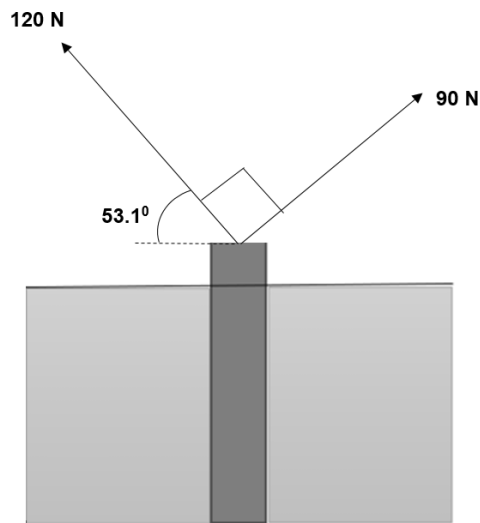


2.2.1 Find the resultant of the two forces using a scale diagram. (Scale: 10 mm : 20 N) (4)

2.2.2 Write down the magnitude and direction of the force that must be applied on the concrete block to make the resultant force equal to zero. (2)

- 2.3 Two forces, **120 N** and **90 N** are exerted on a vertical pole that is fixed to the ground using light inextensible strings.

The forces are at a right angle to each other and the 120 N force makes an angle of $53,1^\circ$ with the horizontal as shown in the diagram below.



- 2.3.1 Define the term *resultant vector*. (2)

- 2.3.2 Calculate the magnitude of the resultant of **120 N** and **90 N** by using Pythagoras theorem. (5)

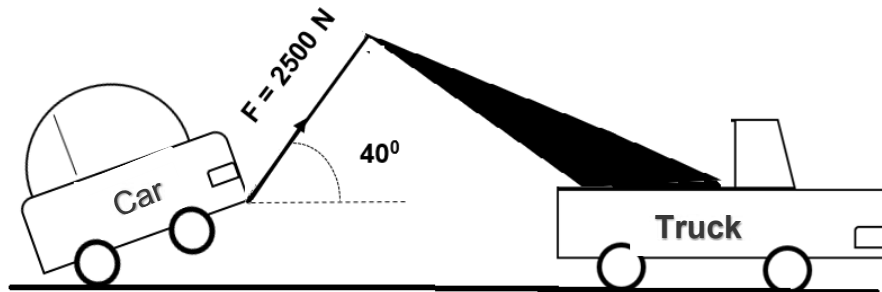
The resultant force calculated in QUESTION 2.3.2 above acts at an angle of $36,9^\circ$ relative to the 120 N force.

- 2.3.3 Are these forces large enough to pull the pole out of the ground? Explain. (3)

[22]

QUESTION 3

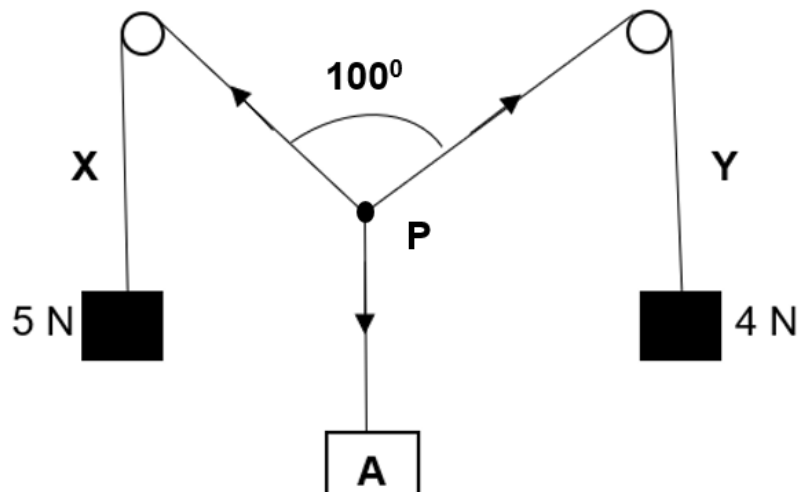
- 3.1 A tow truck is pulling a small car by means of a cable as shown in the diagram. The force exerted by the tow cable of the truck on the car is $F = 2\,500\text{ N}$ at an angle 40° to the horizontal.



- 3.1.1 Calculate the vertical component of $2\,500\text{ N}$ force (F). (3)
- 3.1.2 What would happen to each of the following force components when the angle 40° is changed to 15° ? (Use only INCREASES, DECREASES or REMAINS THE SAME.)
- (a) Horizontal component of F (1)
- (b) Vertical component of F (1)
- 3.2 The apparatus shown below has been set up to find the mass of object **A** which is suspended using a string.

The strings **X** and **Y**, which pass over smooth pulleys, are attached to two objects weighing 5 N and 4 N respectively.

All the strings are attached to point **P** as shown in the diagram below.



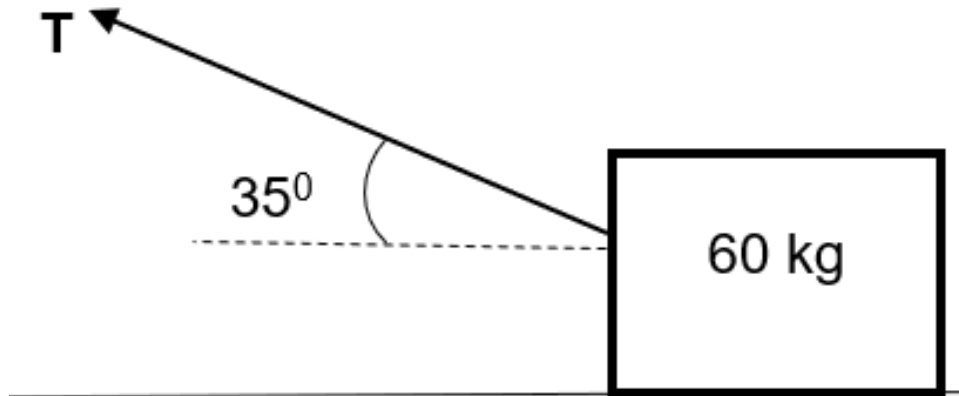
The strings **X** and **Y** act at 100° to each other.

- 3.2.1 State the parallelogram law of forces. (2)
- 3.2.2 Find the mass of the object **A** using the parallelogram method. (8)

[15]

QUESTION 4

A crate of mass **60 kg** is lying on a rough horizontal surface. The coefficient of friction between the crate and the surface is 0,4. The crate is pulled by a rope which makes an angle **35°** with the horizontal and the tension in the string is **T**.

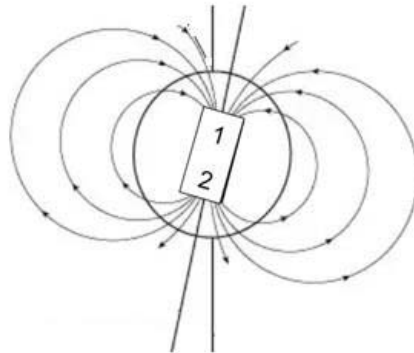


The crate moves at a **constant speed** in a straight line.

- 4.1 Write down the NAME of the force that always acts parallel to a surface in the opposite direction to motion, opposing the motion of an object. (2)
- 4.2 Differentiate between *static frictional force* and *kinetic frictional force*. (4)
- 4.3 Draw a free body diagram of all the forces acting on the crate. (4)
- 4.4 Write down the magnitude of the resultant force acting on the crate.
Give a reason for your answer. (2)
- 4.5 Calculate the tension **T** in the string. (7)
- [19]**

QUESTION 5

- 5.1 Define the term *magnetic field*. (2)
- 5.2 Name the instrument used to determine the direction of a magnetic field. (1)
- 5.3 Name THREE properties of magnetic field lines. (3)
- 5.4 In the diagram below the Earth's magnetic field is represented by magnetic field lines. The Earth is viewed as having a bar magnet at its centre.

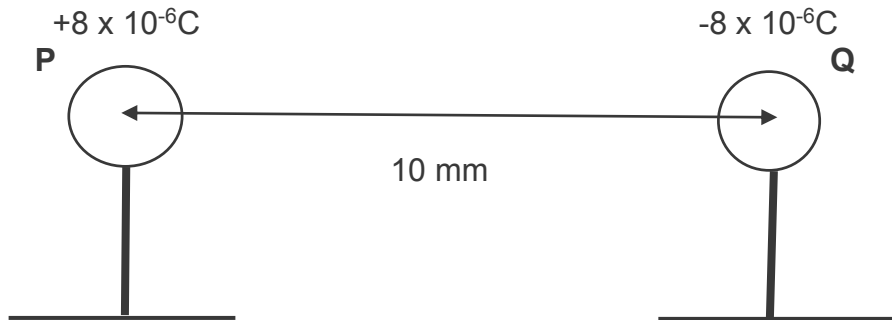


- 5.4.1 What magnetic pole (North or South) does the number **1** indicate? (1)
- 5.4.2 Differentiate between the *geographic north pole* and the *magnetic north pole*. (4)
- 5.5 Write down the names of TWO phenomena that are affected by Earth's magnetic field. (2)
- 5.6 Explain how the Earth's magnetic field provides protection from solar winds. (3)

[16]

QUESTION 6

Two identically charged conducting spheres, **P** and **Q**, on insulated stands carry charges of $+8 \times 10^{-6} \text{ C}$ and $-8 \times 10^{-6} \text{ C}$ respectively. The spheres are placed 10 mm from each other as shown in the diagram.



- 6.1 State **Coulomb's law** in words. (2)
- 6.2 Draw a neat diagram of electric field pattern due to spheres **P** and **Q**. (3)
- 6.3 Give a reason why the spheres are placed on insulated stands. (2)
- 6.4 Calculate the force exerted by sphere **P** on **Q**. (4)
- 6.5 Calculate the magnitude of the electric field strength experienced by sphere **Q** as a result of sphere **P**. (3)
- 6.6 The charge on sphere **P** is doubled without changing the distance between the spheres.

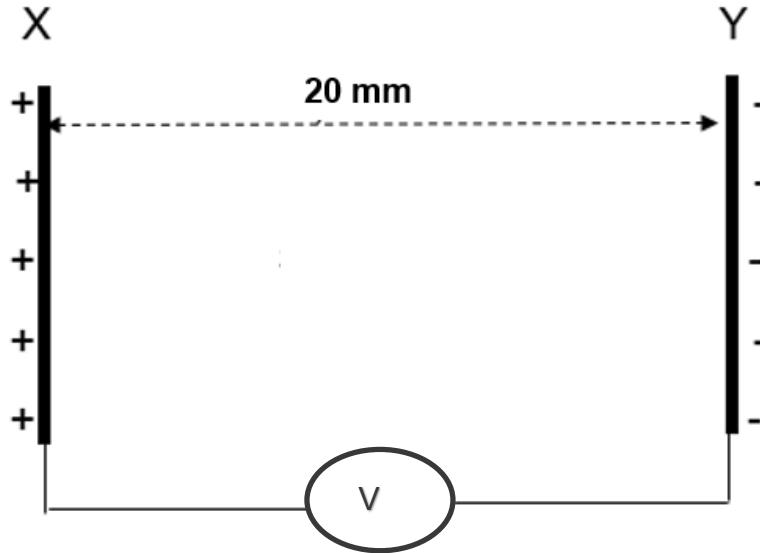
Write down the magnitude of the electric field strength now experienced by sphere **P** as a result of sphere **Q**.

Explain the answer.

(3)
[17]

QUESTION 7

X and **Y** are two oppositely charged parallel metal plates placed at a distance of 20 mm apart and the electric field between the parallel plates is 500 N.C^{-1} .

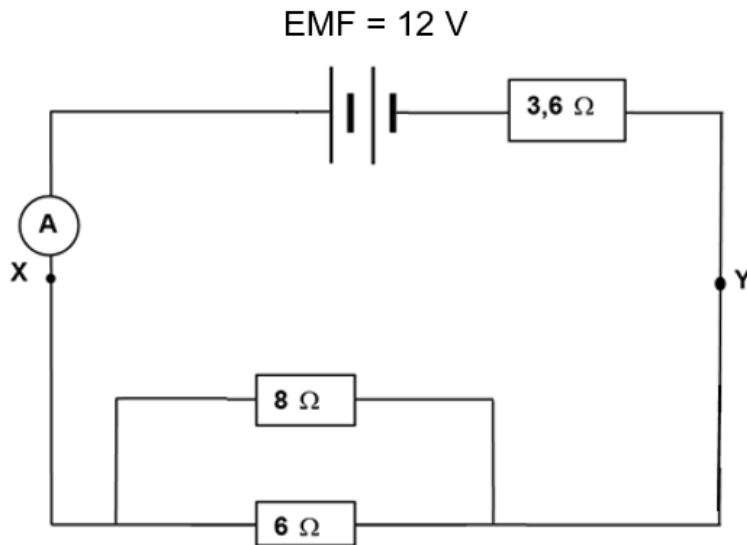


- 7.1 Define the term *electric field*. (2)
- 7.2 Draw the electric field lines between plates **X** and **Y**. (3)
- 7.3 Calculate the potential difference, **V**, across the plates. (3)
- 7.4 The electric field between the plates is said to be *uniform*. What does this mean? (2)
- 7.5 Give any TWO applications of electrostatics in technology. (2)

[12]

QUESTION 8

The circuit diagram below represents a combination of resistors in series and in parallel. The battery has an EMF of 12 V and zero internal resistance.



8.1 Define the following terms:

8.1.1 *EMF* (2)

8.1.2 *Internal resistance* (2)

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

8.3 Define the term *electric current*. (2)

8.4 Calculate the reading on the ammeter. (3)

8.5 A conducting wire of negligible resistance is now connected between points **X** and **Y**. What effect will this have on the ammeter reading?

(Write down only INCREASES DECREASES or REMAINS THE SAME.)

Explain the answer.

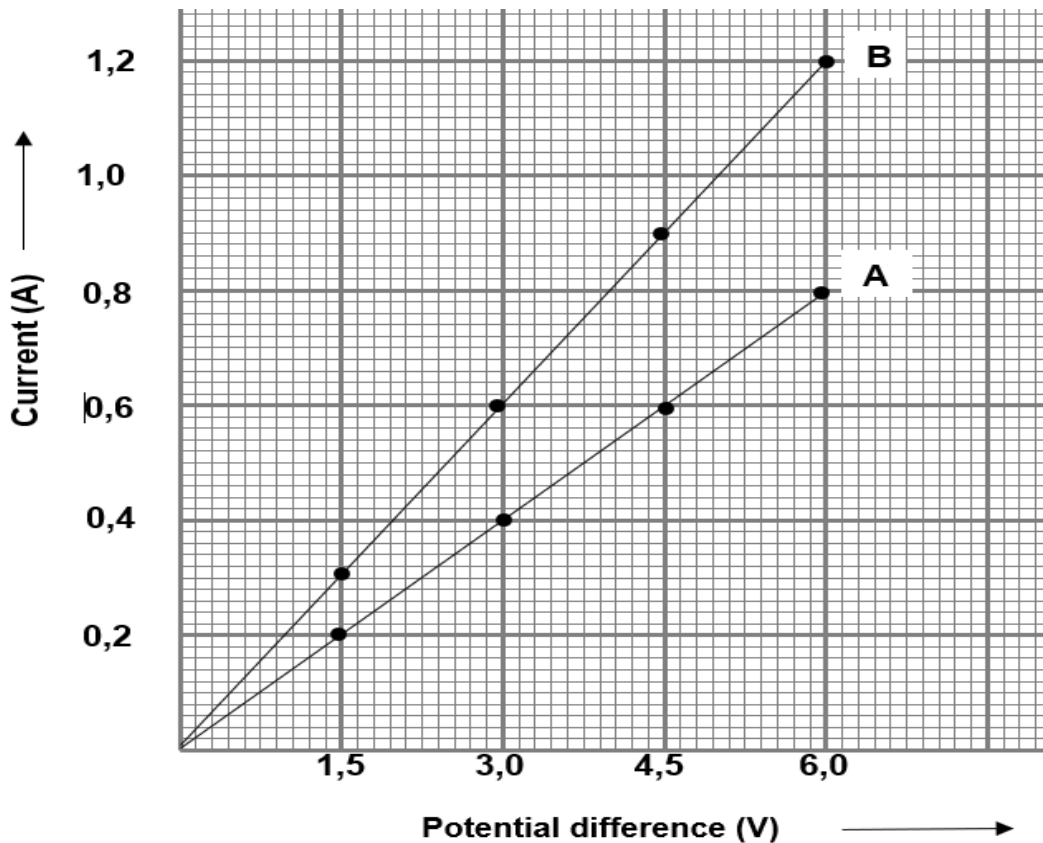
(3)
[15]

QUESTION 9

Learners use Ohm's law to determine which ONE of two resistors, **A** or **B** has a higher resistance. For each resistor, they measure the current through the resistor and potential difference across the resistor using the same battery at the same temperature.

The graph below shows the results that were obtained.

GRAPH OF CURRENT VERSUS POTENTIAL DIFFERENCE



- 9.1 State Ohm's law in words. (2)
- 9.2 Write down ONE controlled variable in the experiment. (1)
- 9.3 Are the resistors (**A** and **B**) ohmic or non-ohmic? Explain. (3)
- 9.4 Give ONE example of a non-ohmic conductor. (1)
- 9.5 Calculate the resistance of resistor **A**. (4)
- 9.6 Which ONE of **A** or **B**, will draw a larger current when the resistors are connected in parallel in a circuit? (3)

[14]

TOTAL: 150

DATA FOR TECHNICAL SCIENCES GRADE 11 PAPER 1

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL/SIMBOOL	VALUE/WAARDE
Acceleration due to gravity	g	9,8 m·s ⁻²
Coulomb's constant	k	9 x 10 ⁹ N.m ² .C ⁻²

TABLE 2: FORMULAE

FORCE

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

ENERGY

$K = \frac{1}{2}mv^2$	or	$E_k = \frac{1}{2}mv^2$	$U = mgh$	or	$E_p = mgh$
$M_E = E_k + E_p$					

ELECTROSTATICS

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

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

