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Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 10

NOVEMBER 2020

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TECHNICAL SCIENCES P1 (EXEMPLAR)

MARKS: 150

TIME: 3 hours

This question paper consists of 15 pages, including 2 information sheets.

INSTRUCTIONS AND INFORMATION

Read the following carefully before answering the questions that follow.

1. Answer ALL the questions.
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, e.g. 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, et cetera where required.
10. Write neatly and legibly.

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QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Choose the correct 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 E.

1.1 Candela is the SI unit for …

A length.

B electric current.

C amount of substance.

D luminous intensity. (2)

1.2 Which ONE of the following physical quantities has magnitude only?

A Force

B Bearing

C Compass direction

D Guarantee period (2)

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1.3 The correct scientific notation for 0,01 is:

A 1×10^{5}

B 10×10^{-3}

C $0,1 \times 10^{-2}$

D 100×10^{-1} (2)

1.4 Which of the following combinations represent the derived units and is NOT a fundamental unit?

	PHYSICAL QUANTITY	SYMBOL
A	Time	t
B	Length	l
C	Mass	m
D	Work	J

(2)

1.5 The correct conversion from hours (h) to seconds (s) is:

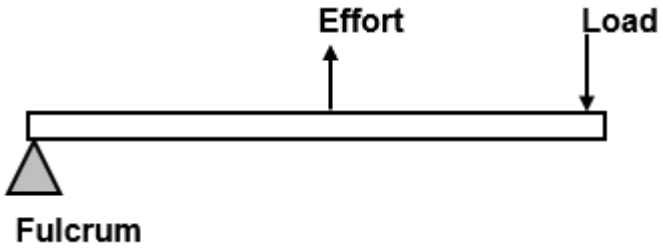
A 4 hours = 14 000 s

B 4 hours = 14 400 s

C 4 hours = 1 440 000 s

D 4 hours = 140 s (2)

1.6 The following diagram represents a lever.



What type of lever is represented in the diagram above?

A Type 2

B Type 1

C Type 3

D Type 4 (2)

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1.7 Two forces of 20 N and 50 N are used to pull an object in an eastern direction. The equilibrant of the two forces are …

A 70 N to the east.

B 30 N to the east.

C 70 N to the west.

D 30 N to the west. (2)

1.8 A car is travelling at a speed of 30 m/s on a straight road. What is the speed of the car in $km.h^{-1}$?

A 8,33 $km.h^{-1}$

B 30 $km.h^{-1}$

C 108 $km.h^{-1}$

D 130 $km.h^{-1}$ (2)

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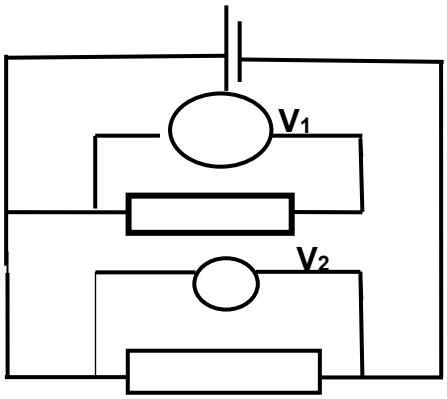
1.9 Two identical light bulbs are connected in parallel, as shown in the circuit diagram below. Voltmeter, **V_1** and **V_2**, are connected across in each light bulb.



Which ONE of the following voltmeter readings is correct?

A $V_1 = V_2$

B $V_1 = 2V_2$

C $V_1 = ½V_2$

D $V_1 = ¾ V_2$ (2)

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1.10 The SI unit in which the rate of flow of charge is measured, is called …

A ampere.
B coulomb.
C volt.
D watt. (2)

[20]

QUESTION 2 (Start on a NEW page.)

Amanda walks from her home to the shop and stops at some point to rest. The straight-line distance from her home to the shop is 500 m and from the shop to the point of rest is 280 m.

2.1 Differentiate between *scalar* and *vector quantity*. (4)

2.2 Draw a vector diagram that illustrates the statement in QUESTION 2.1. (4)

2.3 Determine the:

2.3.1 Distance travelled by Amanda (2)

2.3.2 Displacement of Amanda (3)

2.4 Caster Simenya runs 400 m in 48 s. Calculate her average speed in metres per second. (3)

2.5 Convert the following:

2.5.1 48 s to hours (2)

2.5.2 400 m to km (2)

2.5.3 (Do not use a calculator.)
Divide the large numbers in scientific notation:

$18\,000 \div 900\,000$ (3)

2.5.4 A formula one racing car accelerated at 35 $m.s^{-2}$. Calculate the time it takes to accelerate from 140 km/h to 280 km/h. (4)

2.6 Classify the following quantities as vectors or scalars:

2.6.1 10 litres of petrol (1)

2.6.2 A distance of 2 km northwards (1)

2.6.3 A speed of 50 $m.s^{-1}$ towards the cliff (1)

2.6.4 Mass of 200 g (1)

2.6.5 2 hectares of land (1)

[32]

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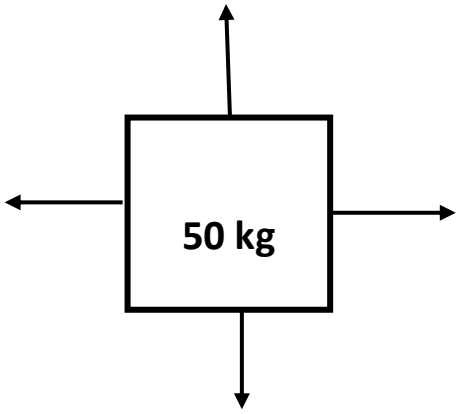
QUESTION 3 (Start on a NEW page.)

3.1 Define the following terms:

3.1.1 *Tension force* (2)

3.1.2 *Compression* (2)

3.2 Below is a force diagram with a mass of 50 kg and all forces acting on the block.



Draw a space diagram and name all forces acting on the block. (4)

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3.3 Christilene and Sipho tied a rope around a block with a mass of 20 kg from both sides. They then pulled simultaneously (at the same time) on the block on the opposite ends of the rope.

20 kg

Draw a force diagram and name all the forces acting on the block. (3)

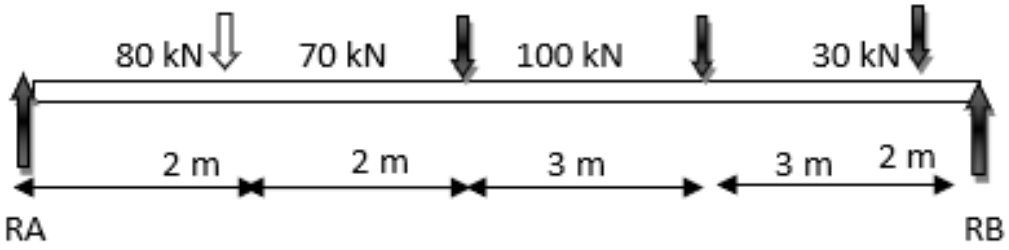
3.4 Determine the resultant forces acting on the block. (3)

3.5 Are there any contact forces acting on the block? (1)

[15]

QUESTION 4 (Start on a NEW page.)

The diagram below shows the upward and downward forces in equilibrium.



4.1 Define the term *equilibrant of forces*. (2)

4.2 Calculate the upward forces RA and RB. (8)

4.3 Show by calculation that the upward forces are equal to the downward forces. (2)

4.4 Define the following terms:

4.4.1 *Space diagram* (2)

4.2.2 *Beam* (2)

4.5 A carpenter often uses a hammer to pull out a stubborn nail.

Find the moment for the above lever and show its rotational direction. (3)

4.6 Draw a neat, labelled sketch of a CLASS TWO lever showing the FULCRUM, LOAD and EFFORT. (6)

4.7 Write down the formula to calculate the torque. (1)

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QUESTION 5 (Start on a NEW page.)

The total mechanical energy in an isolated system will always remain constant. No external factors can affect the system as long as it remains isolated.

5.1 Define the term *gravitational potential energy* in words. (2)

5.2 Energy is needed for life and to do work and can also be transferred from one form of energy to another.

List FOUR different forms of energy transfers. (4)

5.3 Siphiwo Tshabalala scored the opening goal for Bafana Bafana in the 2010 Soccer World Cup. The 0,45 kg ball left his foot at a speed of 30 m/s.

Calculate the ball's kinetic energy as it left his foot. (3)

5.4 Ayanda participates in a darts competition. A dart has a gravitational potential of 1,5 J and kinetic energy of 5 J just before it hits a dartboard.

5.4.1 Calculate the dart's mechanical energy before it hits the dartboard. (3)

5.4.2 If the mass of the dart is 0,1 kg, calculate the height of the dart. (4)

[16]

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QUESTION 6 (Start on a NEW page.)

6.1 Two small metal spheres **B** and **C** on insulated stands carry charges of **10×10^{-9} C** and **-12×10^{-9} C** respectively.

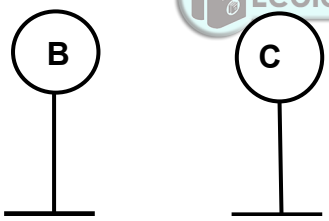
How does the number of electrons on sphere **C** compare with the number of protons on sphere **B**?
Write only LESS THAN, THE SAME AS or MORE THAN. (1)

6.2 Give a reason for your answer to QUESTION 6.1. (1)

6.3 Calculate the number of electrons in excess on sphere **C**. (3)

6.4 A capacitor of capacitance 5 µF is connected to a 6 V supply.
What is the amount of charge that is stored in the capacitor? (3)

6.5 The spheres are allowed to touch, after which they are separated again and returned to their original positions.



6.5.1 State the principle of conservation of charge. (2)

6.5.2 In which direction are the electrons flowing while spheres **B** and **C** are in contact? Write down only FROM **B** TO **C** or FROM **C** TO **B**. (2)

6.5.3 Give a reason for your answer in QUESTION 6.5.2. (1)
[13]

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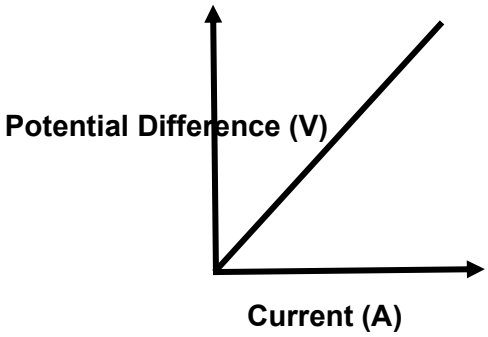
QUESTION 7 (Start on a NEW page.)

Ohm's law states that the current that flows through a conductor is directly proportional to the potential difference between the ends of the conductor when the temperature remains constant.



The graph represents the relationship between the potential difference (V) and the current (A).

7.1 Define the following terms:

7.1.1 *Electromotive force (emf)* (2)

7.1.2 *Current* (2)

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7.2 A battery of 24 V is connected by a switch to two bulbs, connected in parallel, and with equal values of 8 Ω each. An ammeter is connected in series in the circuit.

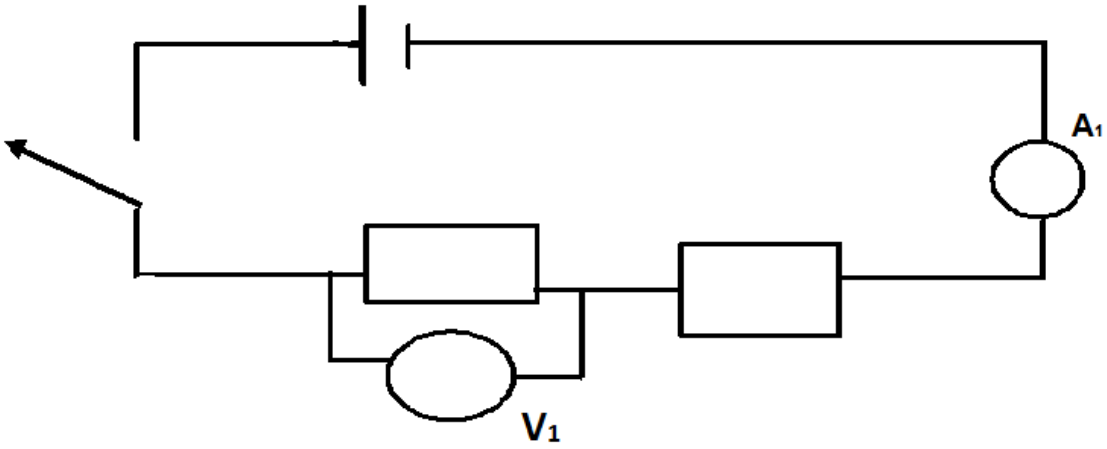
7.2.1 Draw the circuit diagram mentioned above and indicate ALL the appropriate symbols and values. (6)

7.2.2 Calculate the total resistance of this circuit. (3)

[13]

QUESTION 8 (Start on a NEW page.)

The circuit diagram below contains some unit measurements for the connected instruments.



8.1 Define the term *potential difference*. (2)

8.2 Write down the scientific meanings for the readings on instruments **V_1** and **A_1** in the diagram above. (2)

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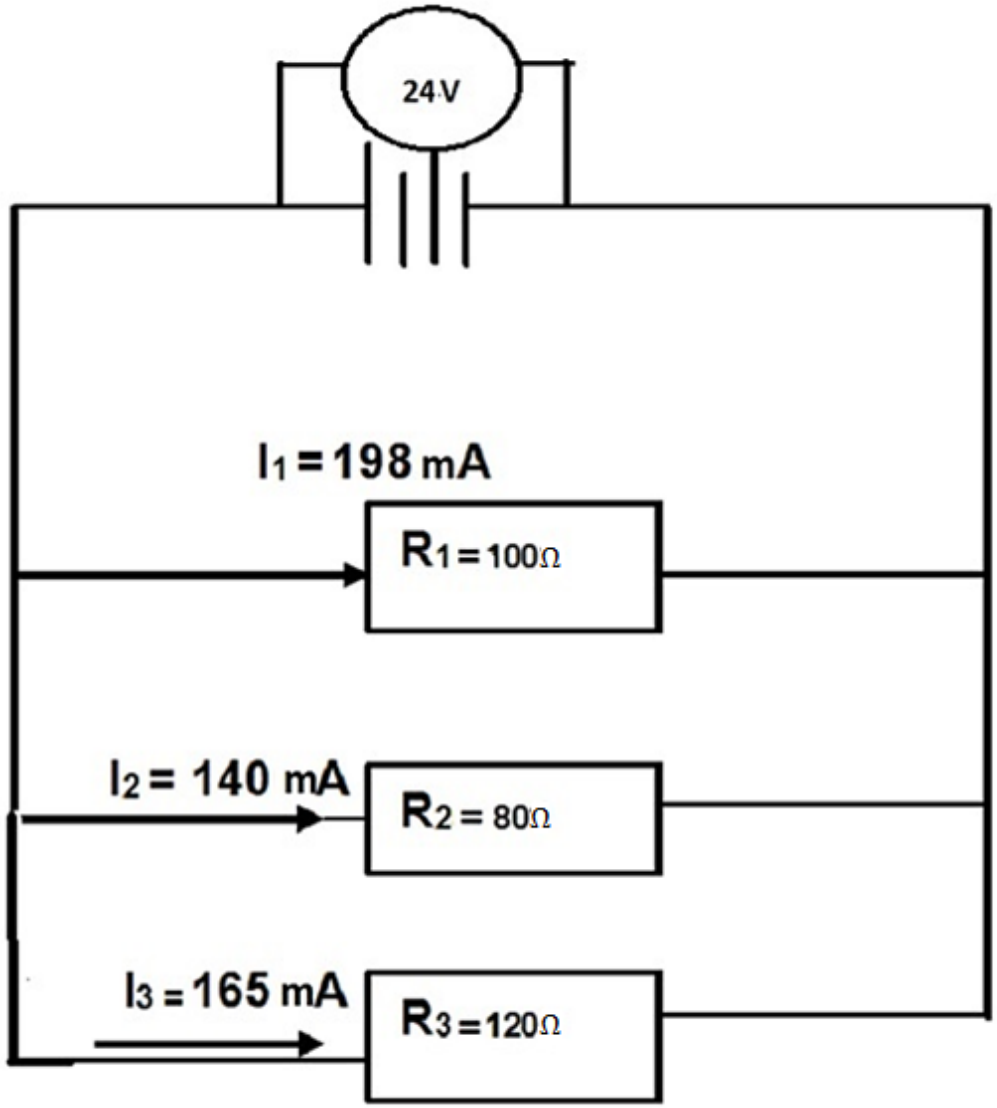
8.3 Study the electric circuit below and answer the question that follow.



8.3.1 Calculate the total current in the circuit. (3)

8.3.2 What will be happening to the voltage when the resistors are connected in parallel? (2)

8.3.3 Calculate the current in a conductor if 10 C of charge passes a point in a conductor in 0,6 s. (3)

8.3.4 Identify THREE components in the above circuit. (3)
[15]

TOTAL: 150

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DATA FOR TECHNICALSCIENCES
GRADE 10 PAPER 1 (PHYSISCS)/

GEGEWENS VIR TEGNIESE WETENSKAPPE
GRAAD 10 VRAESTEL 1

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	9,8 $m \cdot s^{-2}$
Charge on an electron Lading op 'n elektron	e^-	$-1,6 \times 10^{-19}$ C

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

PERIMETER/*OMTREK*	FORCE/KRAG
Perimeter of a rectangle = 2ℓ + 2w *Omtrek van 'n reghoek = 2ℓ + 2b*	F_g = mg OR/*OF* w = mg

MOTION/*BEWEGING*

$Speed = \frac{distance}{time}$	$Spoed = \frac{afstand}{tyd}$
$Velocity = \frac{displacement}{time}$	$Snelheid = \frac{verplasing}{tyd}$
$Acceleration = \frac{change\ in\ velocity}{time}$	$Versnelling = \frac{verandering\ in\ snelheid}{tyd}$

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MOMENT OF FORCE (TORQUE) / *KRAGMOMENT / DRAAIMOMENT / WRINGKRAG*

τ = F x d⊥ OR Moment = Force x perpendicular distance	τ = F x d⊥ OF Kragmoment = krag x loodregte afstand

SIMPLE MACHINES/*EENVOUDIGE MASJIENE*

$MA = \frac{Load}{Effort}\ \ OR\ \ MA = \frac{effort\ distance}{Load\ distance}$	$MV = \frac{Las}{Krag}\ \ OF\ \ MV = \frac{krag\ afstand}{Las\ afstand}$

ENERGY/*ENERGIE*

E_p = mgh OR / *OF* U = mgh	E_k = ½mv^2 OR / *OF* K = ½mv^2

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ELECTROSTATICS/*ELEKTROSTATIKA*

$Q = \frac{Q_1 + Q_2}{2}$

ELECTRIC CIRCUITS / *ELEKTRIESE STROOMBANE*

	Serie	Parallel
$I = \frac{Q}{\Delta t}$	$R_T = R_1 + R_2 + R_3$	$R_p = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$
$V = \frac{W}{Q}$	$I_T = I_1 = I_2 = I_3$	$I_T = I_1 + I_2 + I_3$
$R = \frac{V}{I}$	$V_T = V_1 + V_2 + V_3$	$V_T = V_1 = V_2 = V_3$

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