Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 10

NOVEMBER 2019

ÉcoleBooks

TECHNICAL SCIENCES P1

MARKS: 150

TIME: 3 hours

XTSCE1

This question paper consists of 16 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 two 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.

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 number (1.1–1.10) in the ANSWER BOOK, for example 1.11 E.
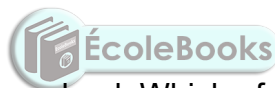
1.1 The SI unit for velocity is …

    A   seconds.
    B   Newton.
    C   minutes.
    D   metres per second.   (2)

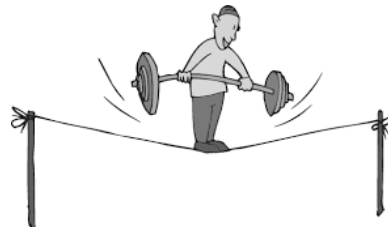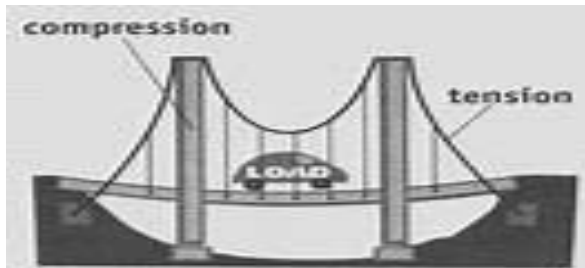1.2 Find the correct scientific notation for 0,008, from the following figures:

    A 8×10^{-3}
    B 8×10^{2}
    C 8×10^{3}
    D 8×10^{-2} (2)

1.3 A car moves at a constant speed of 100 km/h. What is the speed of the car in $m.s^{-1}$?

    A   0,022 m/s
    B   22,222 m/s
   C   288000 m/s
    D   888000 m/s   (2)

1.4 A beam is designed to carry a load. Which of the following reactions does the beam depends on?

    A   The turning effect
    B   Structural member
    C   The load of a beam
    D   The ability of the beam   (2)

1.5   Linda travels 30 m to the shop along an easterly direction, he then moves back home in a westerly direction. What is the resultant displacement in m?

        A   0 m
        B   60 m
        C   30 m
        D   120 m   (2)

1.6   A fulcrum in the second lever or type 2 appears on the … of the lever.

        A   point
        B   first
        C   end
        D   middle   (2)

1.7   What type of energy is applied by Sipho if he kicks a ball from one position to another?

        A   Kinetic energy
        B   Transitional energy
        C   Rotational energy
        D   Vibrational energy   (2)

1.8   The four colour band resistor has the following colours brown, black, and yellow with a gold colour representing the tolerance range of the resistor at the end. The value description of that resistor will be …

        A $100 \ \Omega$.
        B $10 \ \Omega \pm 10\%$.
        C $1\ 000 \ \Omega \pm 10 \ \Omega$.
        D $10\ 000 \ \Omega \pm 10\%$.   (2)

1.9 The circuit diagram below consists of three resistors connected in series.
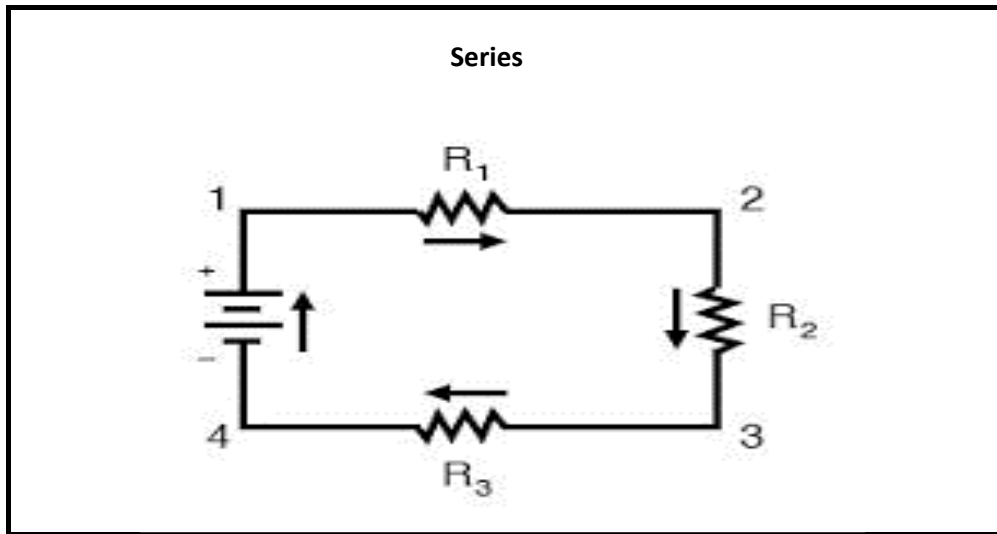
Which ONE of the following statements is correct?

A The voltage is constant
B Voltage in R_1 equal to voltage in R_3
C The voltage is not the same across the resistors
D The total voltage is equal to the voltage across R_1 (2)

1.10 Which ONE of these forces below can be regarded as a type of contact forces?

A Tension
B Weight
C Electric force
D Magnetic force (2)

[20]

QUESTION 2 (Start on a NEW page.)

Pamela weighs 122 000 g. She then decided to lose weight by carrying 5 000 g of weights over 4 days for 6 hours per day (i.e. total time is 24 hours). She also walks a distance of 50 000 cm to town and then when in town she walks another 2 000 cm to the taxi rank for the return trip home.

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

2.2 Give TWO examples of vector quantities. (2)

2.3 Convert the following:

2.3.1 122 000 g to kg (2)

2.3.2 24 hours to seconds (2)

2.4 Calculate the total distance, in metres, covered by Pamela for her trip and express your answer in scientific notation. (3)

2.5 Qhamata a business manager, built new offices and in each office he fits a radio buzzer system. The purpose of the buzzer is to be used by the manager to call his employers from other offices to his office. The offices are made to be side by side along an 80 m long passage that runs east over a walking distance that will take a period of 3,4 minutes. The transmitter is 25 m from the west end, opposite the door of the manager's office.
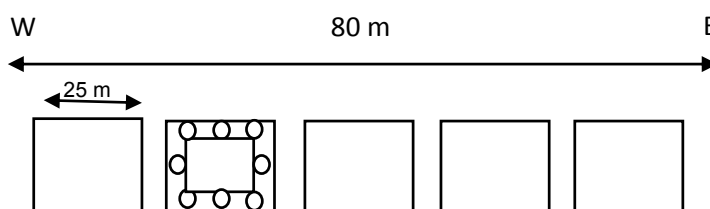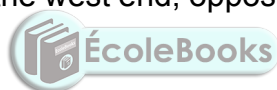
2.5.1 Define the term *displacement*. (2)

2.5.2 An assistant manager then walks along a passage to test the system, he walked 15 m to the east and walks another 20 m along the passage and it does work. He turns around and walks 10 m back along the passage.

What is the range of the transmitter in the east end of the passage? (3)

2.5.3 Calculate the speed of the assistant manager. (4)

2.5.4 Calculate the total distance due east from the transmitter to the test room. (2)

2.5.5 Draw a vector diagram that will illustrate your calculations. (4)

2.6 A Technical Sciences teacher conducted an experiment with his learners to determine the speed of a trolley, 20 dots were made in 10 s on a ticker tape of which a part is shown. The distances between the dots are all the same.
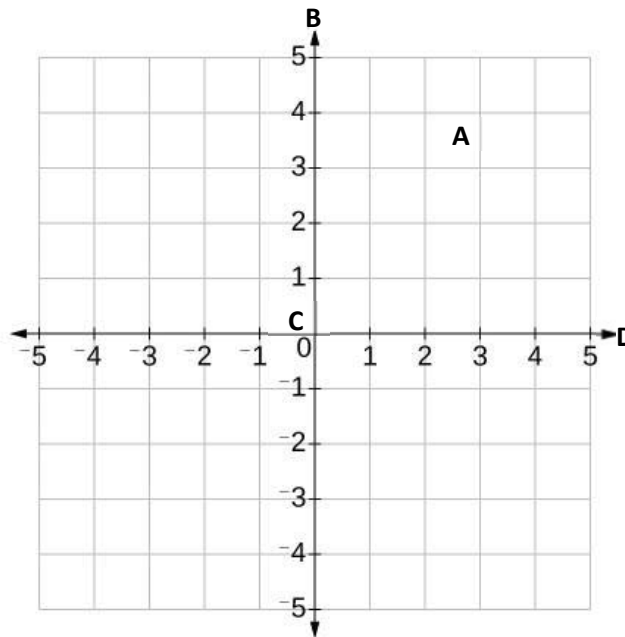
20 cm

● ● ● ● ● ● ● ● ●
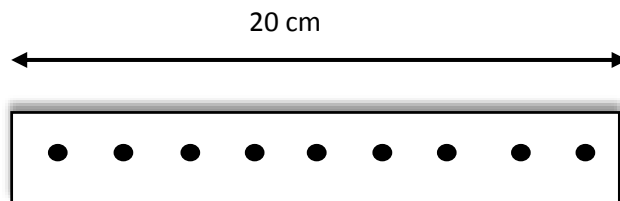
2.6.1 Determine the total time represented by the strip in seconds. (1)

2.6.2 Calculate the frequency of the ticker timer. (3)

2.6.3 What will the velocity in cm/s represented by the tape above be? (3)

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QUESTION 3 (Start on a NEW page.)

The illustration below is the Cartesian plane not drawn to scale and is represented by **A**, **B**, **C** and **D**.

3.1   Identify the parts labelled **A, B, C** and **D** in the Cartesian plane.
(Do not redraw the diagram.)   (4)

3.2   The diagram below shows two forces **A** and **B** acting on an engine on which they are applied. Force A = 60 N.

Draw a free body diagram and also name the forces acting on the block.   (3)

3.3 Define the following terms:

    3.3.1 Frictional force (2)

    3.3.2 Equilibrium of forces (2)

3.4 The magnitude of force **B** of the engine is 50 N. The engine is kept stationary after it has been lifted.

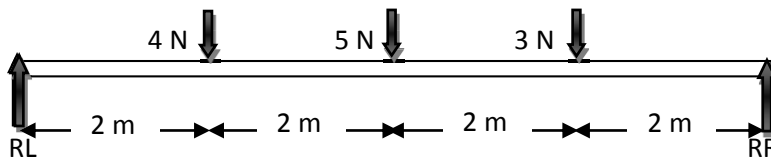Determine the magnitude and direction of the resultant force acting on the engine. (3)

3.5 Write down the name of a non-contact force acting on the engine. (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 *mechanical advantage*.   (2)

4.2   Calculate the upward forces RL and RR.   (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   Moment of force   (2)

        4.2.2   Tension force   (2)

4.5   Sara applied a force of 300 N to loosen a nut using a spanner with a length of 25 cm.
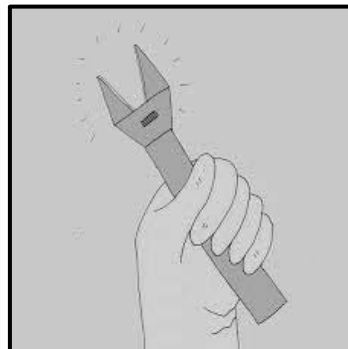
        Calculate the maximum torque involved in loosening the nut.   (4)

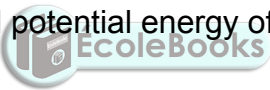4.6   The following is a diagram of a lever.
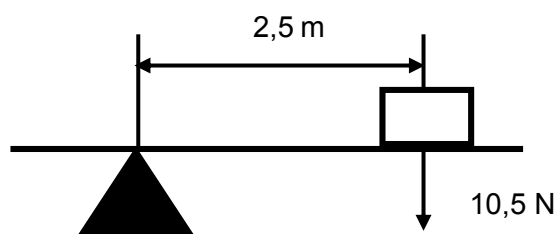
        4.6.1   What type of a lever is represented in QUESTION 4.6 above?   (2)

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

                                                               [25]

QUESTION 5 (Start on a NEW page.)

The diagram below shows a demolition crane. The operator is standing having a mass of 50 kg. The height of a truck is 5 m high. The operator jumps 5 m upwards reaching a speed of 6 m•s^{-1} at a height above the ground.
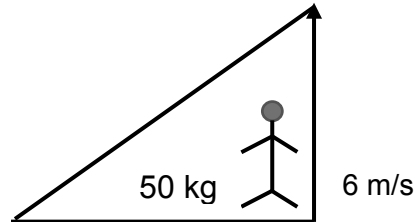
5.1   Differentiate between *kinetic energy* and *gravitational potential energy*.   (4)

5.2   Calculate the following:

    5.2.1   The kinetic energy of the operator   (3)

    5.2.2   The gravitational potential energy of the operator   (3)

5.3   Suppose the gravitational potential energy of the operator is registered to be 506 J.

    Determine the height of his jump.   (3)

5.4   Give THREE different forms of kinetic energy.   (3)

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QUESTION 6 (Start on a NEW page.)

During an experiment, Linda used a cotton cloth to wipe two straws in different intervals in the same way for charge transfer purposes.

6.1   Is the force experienced by the charged straws a pulling or a pushing force?   (1)

6.2   Give ONE word for each of the following statements:

         6.2.1   A force experienced by two objects having the same kind of electric charges on them   (1)

         6.2.2   An object with fewer negative charges than positive charges   (1)

6.3   Two small metal spheres **X** and **Y** insulated stand carry charges of **+ 10×10^{-9} C** and **-8×10^{-9} C** respectively.

+10 x 10^{-9} C   **-8 x 10^{-9} C**
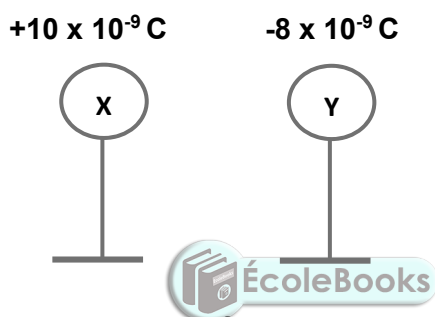
         6.3.1   State the principle of conservation of charge.   (2)

         6.3.2   Determine the total charge on each sphere after they touch.   (3)

         6.3.3   Calculate the number of electrons in excess on sphere **Y** after they separate.   (3)

         6.3.4   In which direction are the electrons flowing while spheres **X** and **Y** are in contact? Give a reason for your answer.   (2)

                                                                     [13]

QUESTION 7 (Start on a NEW page.)

Consider the electric circuit below and answer the questions that follow.
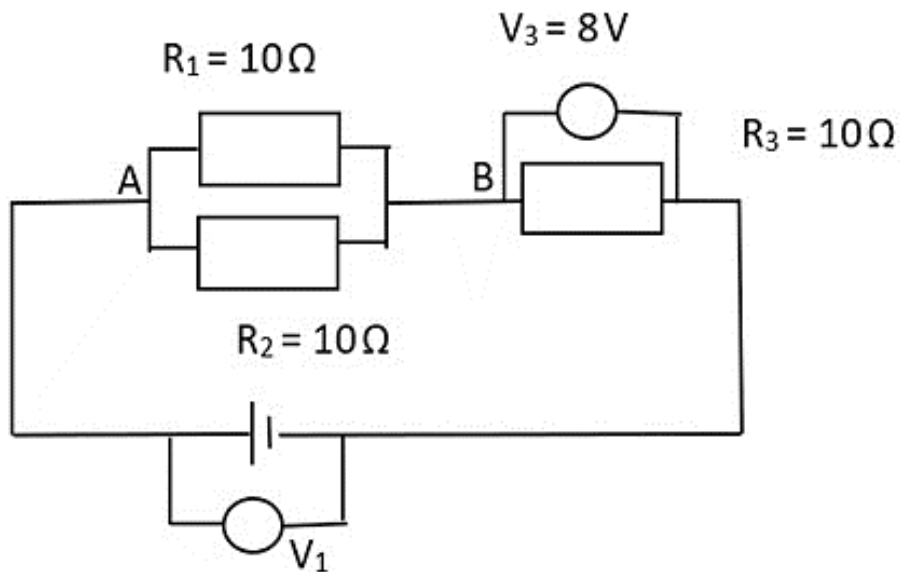
7.1 Define the following terms:

    7.1.1 Electric current (2)

    7.1.2 Resistance (2)

7.2 State FOUR factors that affect the resistance of a resistor. (4)

7.3 What will happen to the current when it reaches point **A** in the circuit diagram above? (1)

7.4 Calculate the total resistance of the circuit. (4)

[13]

QUESTION 8 (Start on a NEW page.)

The diagram below represents a circuit with resistors connected in series, with an instrument labelled **A**, 2 instruments labelled B_1 and B_2 respectively.
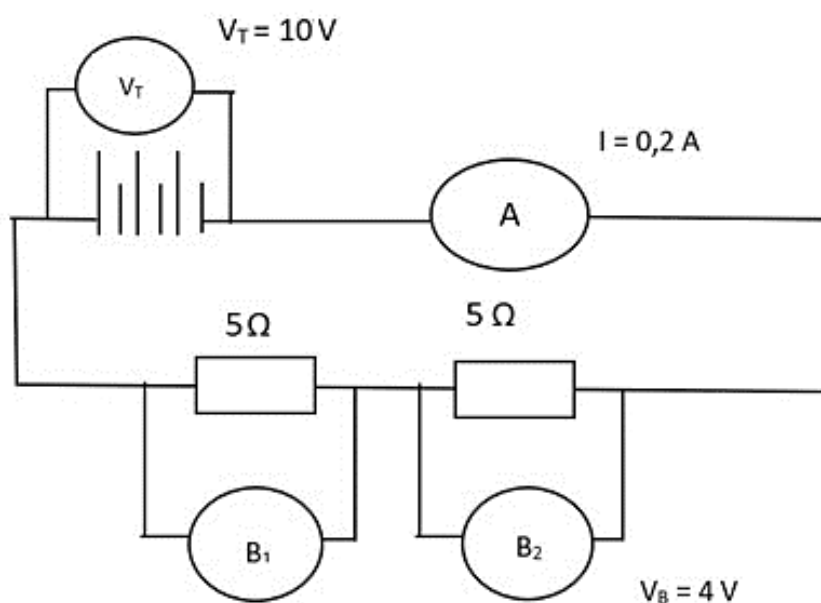
8.1 Name the instruments labelled **A** and **B**. (2)

8.2 What will the comparison in the readings of instrument B_1 and B_2 be? (1)

8.3 Calculate the value of the reading in instrument B_1. (3)

8.4 Name the FOUR basic components that are needed to build the circuit. (4)

8.5 Differentiate between *alternative current* and *direct current*. (2)

8.6 Calculate the current in a conductor if 2 C of charge pass a point in a conductor in 0,4 s. (3)

[15]

TOTAAL: 150

DATA FOR TECHNICALSCIENCES GRADE 10
GEGEWENS VIR TEGNIESE WETENSKAPPE GRAAD 10

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

NAME / *NAAM*	SYMBOL / *SIMBOOL*	VALUE / *WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	**g**	**9,8 m·s⁻²**
Charge on an electron Lading op 'n elektron	**e⁻**	**-1,6 x 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*

$speed = \dfrac{distance}{time}$	$spoed = \dfrac{afstand}{tyd}$
$velocity = \dfrac{displacement}{time}$	$snelheid = \dfrac{verplasing}{tyd}$
$acceleration = \dfrac{change\ in\ velocity}{time}$	$versnelling = \dfrac{verandering\ in\ snelheid}{tyd}$

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

$\tau = F \times d_\perp$ OR Moment = Force x perpendicular distance	$\tau = F \times d_\perp$ *OF* Kragmoment = krag x loodregte afstand

SIMPLE MACHINES / *EENVOUDIGE MASJIENE*

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

ENERGY / *ENERGIE*

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

ELECTROSTATICS / *ELEKTROSTATIKA*

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

ELECTRIC CIRCUITS / *ELEKTRIESE STROOMBANE*

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