



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

TECHNICAL SCIENCES: PHYSICS (P1)

EXEMPLAR 2016

MARKS: 150

TIME: 3 hours

This question paper consists of 13 pages and 1 data sheet.

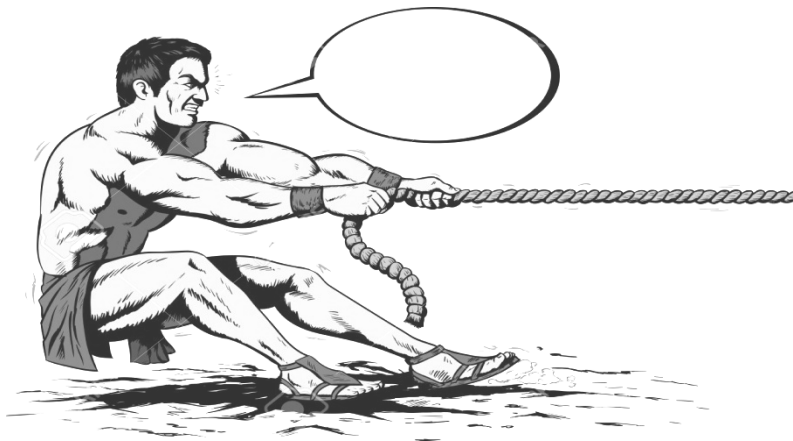
INSTRUCTIONS AND INFORMATION

1. This question paper consists of EIGHT questions. 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. Leave ONE line between two subquestions, for example between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. You are advised to use the attached DATA SHEET.
8. Show ALL formulae and substitutions in ALL calculations.
9. Round off your final numerical answers to a minimum of TWO decimal places.
10. Give brief motivations, discussions, et cetera where required.
11. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. 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 minutes.
 - C Newton.
 - D metres per second. (2)
- 1.2 Which ONE of the following physical quantities should always include direction?
- A Time
 - B Speed
 - C Distance
 - D Displacement (2)
- 1.3 A person is pulling a rope, as shown below.



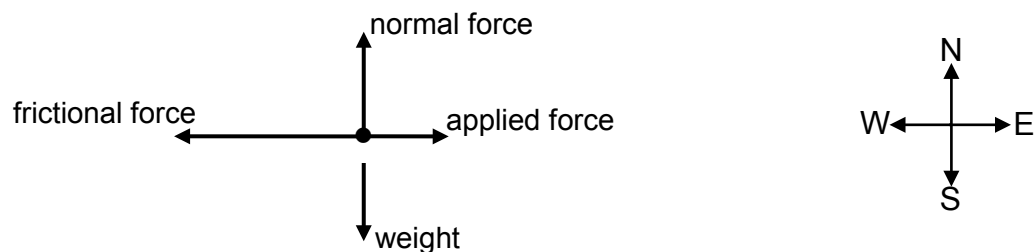
The force in this rope is called ...

- A weight.
- B tension.
- C friction.
- D acceleration. (2)

- 1.4 A fulcrum is the ...
- A middle of the lever.
 - B height of the lever.
 - C end of the lever.
 - D support or point of rest along which a lever turns. (2)

- 1.5 Which ONE of the following pairs of physical quantities are both vectors?
- A Speed, velocity
 - B Time, acceleration
 - C Distance, displacement
 - D Acceleration, displacement (2)

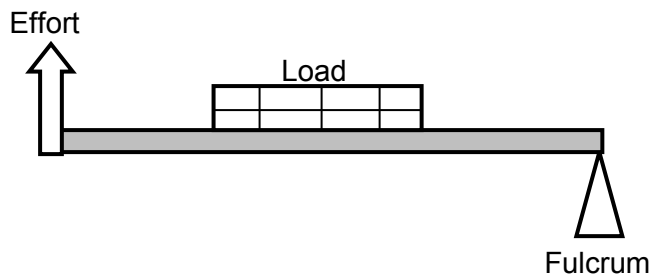
- 1.6 The free-body diagram below shows the relative magnitudes and directions of all the forces acting on an object moving horizontally in an easterly direction.



According to the free-body diagram the kinetic energy of the object:

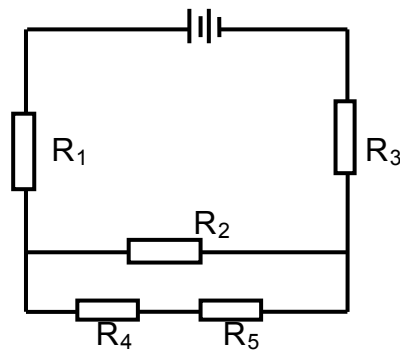
- A Is zero
 - B Is increasing
 - C Is decreasing
 - D Remains the same (2)
- 1.7 An example of a non-contact force is ...
- A tension.
 - B friction.
 - C weight.
 - D normal force. (2)

1.8 Which class of lever is illustrated in the diagram below?



- A First class
- B Second class
- C Third class
- D Fourth class (2)

1.9 The circuit diagram below consists of a battery and five resistors, R_1 to R_5 .



Which ONE of the following statements is CORRECT?

- A R_1 is connected in parallel with R_2 .
- B R_4 is connected in parallel with R_5 .
- C R_1 is connected in parallel with R_3 .
- D R_2 is connected in parallel with the series of R_4 and R_5 . (2)

1.10 The resistor has a resistance of 200 ohms with a voltage drop of 10 volts across it. The current through this resistor will be ...

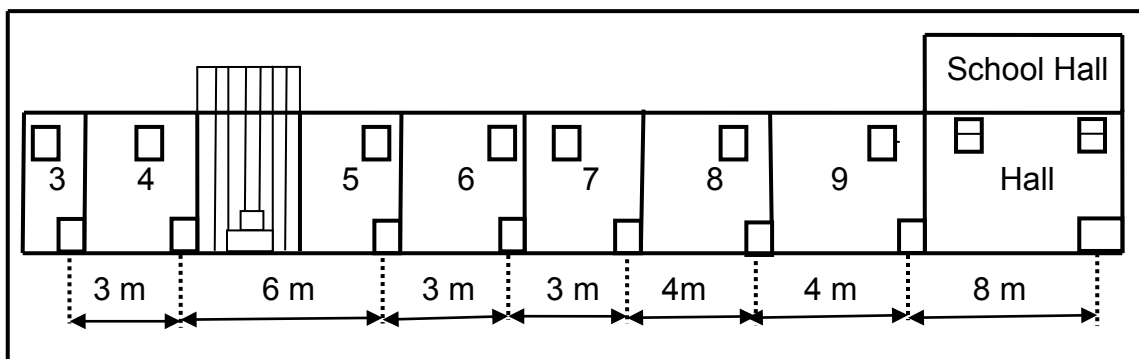
- A 0,5 A.
- B 5 A.
- C 50 mA.
- D 50 A. (2)

QUESTION 2 (Start on a new page.)

Thabo walked 15 km to town, carrying a 4 kg bag. In town he walked 1 000 m from shop to shop and finally he walked 500 m to the taxi rank for the return trip.

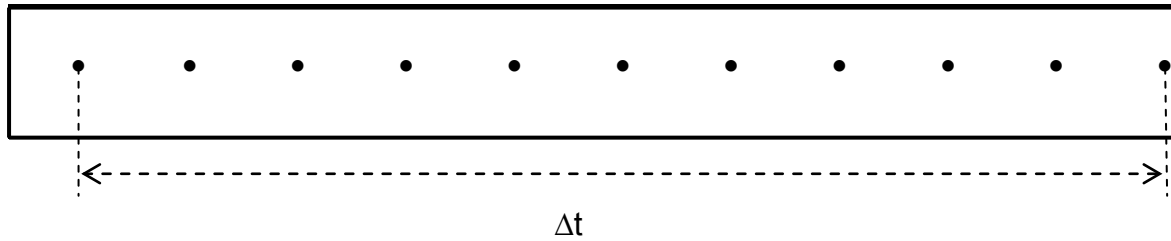
- 2.1 2.1.1 Convert 4 kg to grams. (2)
- 2.1.2 Convert 1 000 metres to kilometres (2)
- 2.1.3 Calculate the total distance he walked (in metres) and express the answer in scientific notation. (4)

2.2 The principal of Wadela Secondary School walked from classroom number 3 to the school hall to address the Grade 10 learners assembled there. He entered the hall after exactly 3,4 minutes. (All calculations work from door to door.)



- 2.2.1 Define a *scalar quantity*. (2)
- 2.2.2 Determine the total distance covered by the principal as he walked from the door of classroom number 3 to the entrance of the school hall. (2)
- 2.2.3 Calculate the speed of his movement as he walked from classroom number 3 to the school hall. (4)
- 2.2.4 After assembly he walks back to classroom number 7 to teach the Grade 12 Tourism class. Calculate the total displacement for his movement. (3)
- 2.2.5 Draw a vector diagram to illustrate the calculation in QUESTION 2.2.4. (Indicate magnitudes and direction(s) of vectors, where needed.) (4)

2.3 This strip has passed through a ticker-timer.



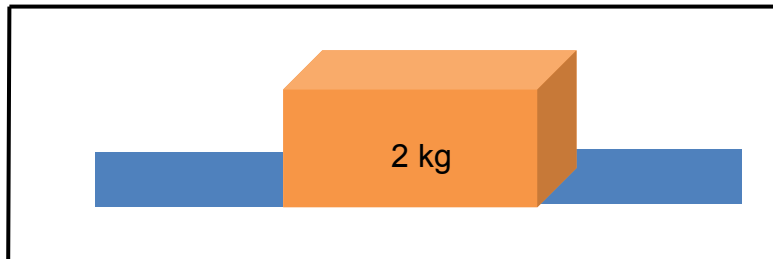
The timer makes **50 dots per second**.

- 2.3.1 Calculate the value of Δt . (3)
- 2.3.2 The dots are all 1 cm apart. What does this tell us about the velocity and acceleration of this motion? (2)
- 2.3.3 Calculate the velocity represented by this strip. (4)
- [32]**

QUESTION 3 (Start on a new page.)

A 2 kg box is resting on a horizontal surface.

3.1 Draw a free body diagram of ALL the forces acting on the box.



(4)

3.2 A learner ties a rope around the box and applies a horizontal pulling force of 60 N to the right, as shown in the diagram below. The box experiences a frictional force of 35 N.



- 3.2.1 Is the 60 N a frictional or applied force and what is its direction? (2)
 - 3.2.2 Draw a force diagram of ALL the forces acting on the box. (4)
 - 3.2.3 Determine the resultant force on the box. (3)
- [13]**

QUESTION 4 (Start on a new page.)

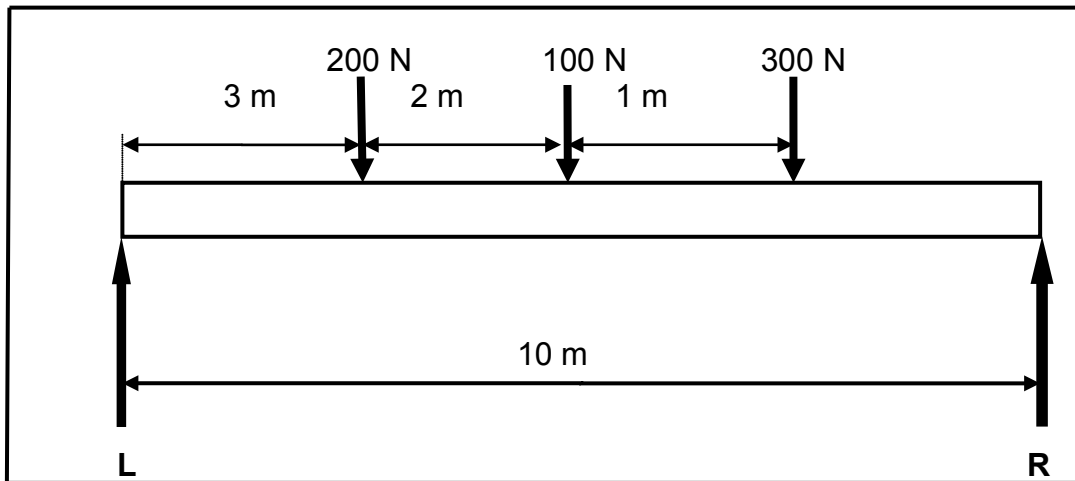
4.1 Define the following terms:

4.1.1 Moments of a force (2)

4.1.2 Beam (2)

4.1.3 Mechanical advantage (2)

4.2 In the diagram below a beam is subjected to a three-point load.

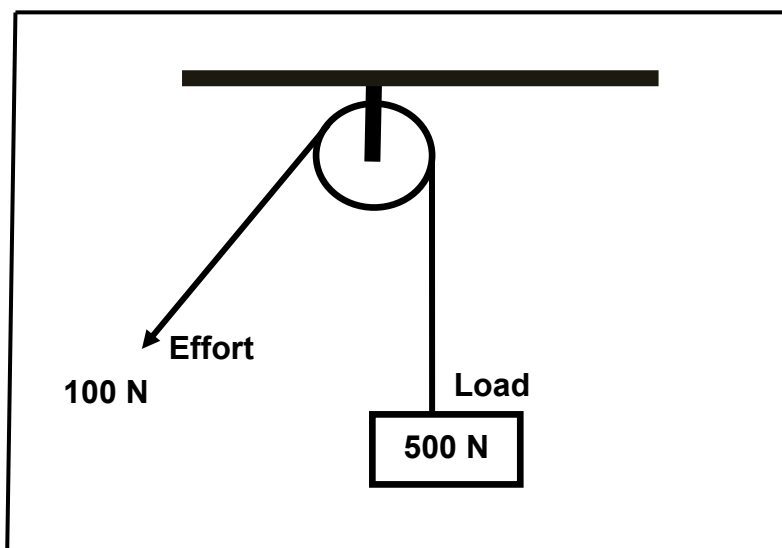


4.2.1 Calculate the upward forces at L and R. (7)

4.2.2 Show by calculation that the upward forces are equal to the downward forces. (3)

4.3 Make a neat, labelled sketch of a CLASS ONE lever showing the fulcrum, load and the effort. (6)

4.4 The diagram shown below is a simple pulley system. An effort of 100 N is used to lift a load of 500 N.



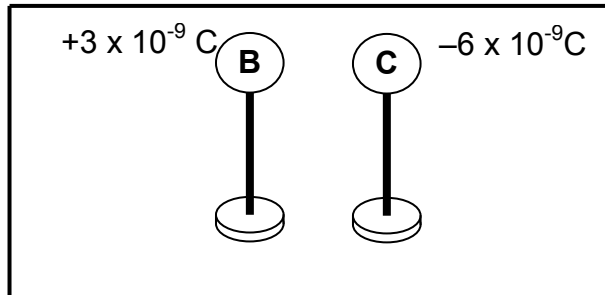
Calculate the mechanical advantage. (3)
[25]

QUESTION 5 (Start on a new page.)

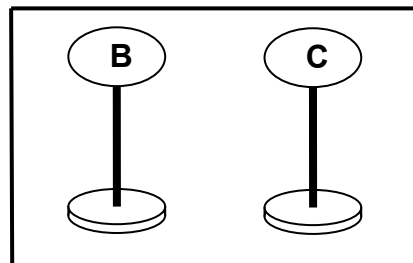
- 5.1 Define the term *kinetic energy*. (2)
- 5.2 An object with a mass of 15 kg travels at a speed of $5 \text{ m}\cdot\text{s}^{-1}$. Calculate the kinetic energy of the object. (3)
- 5.3 A ball with a mass of 2 kg is held 3 m above the ground. Calculate its gravitational potential energy of the ball relative to the ground. (3)
- 5.4 A falling object with a mass of 0,8 kg has a kinetic energy of 0,5 J and a mechanical energy of 1,2 J.
- Calculate the:
- 5.4.1 Speed of object at that stage (3)
- 5.4.2 Height of object at that stage (5)
- [16]**

QUESTION 6 (Start on a new page.)

- 6.1 Two small metal spheres, **B** and **C**, on insulated stands, carry charges of $+3 \times 10^{-9} \text{ C}$ and $-6 \times 10^{-9} \text{ C}$ respectively.



- 6.1.1 How does the number of electrons on sphere **C** compare with the number of protons on sphere **C**? Choose your answer from one of the following: LESS THAN, THE SAME AS or MORE THAN. (1)
- 6.1.2 Give a reason for the answer to QUESTION 6.1.1. (1)
- 6.1.3 Calculate the NUMBER of electrons in excess on sphere **C**. (3)
- 6.2 The spheres are allowed to touch, after which they are separated again and returned to their original positions.



- 6.2.1 State the *principle of conservation of charge*. (2)
- 6.2.2 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**. (1)
- 6.2.3 Give a reason for your answer to QUESTION 6.2.2. (1)
- 6.2.4 Calculate the charge on each sphere after they have been separated again. (3)

[12]

QUESTION 7 (Start on a new page.)

7.1 A battery of 24 V is connected by a switch to three series resistors:
R1 = 20 Ω; R2 = 100 Ω; R3 = 150 Ω

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

7.2 Define *electric current*. (2)

7.3 Calculate the current in the circuit if 3 C passes a point in a conductor in 0,6 s. (3)

7.4 Define *resistance*. (2)

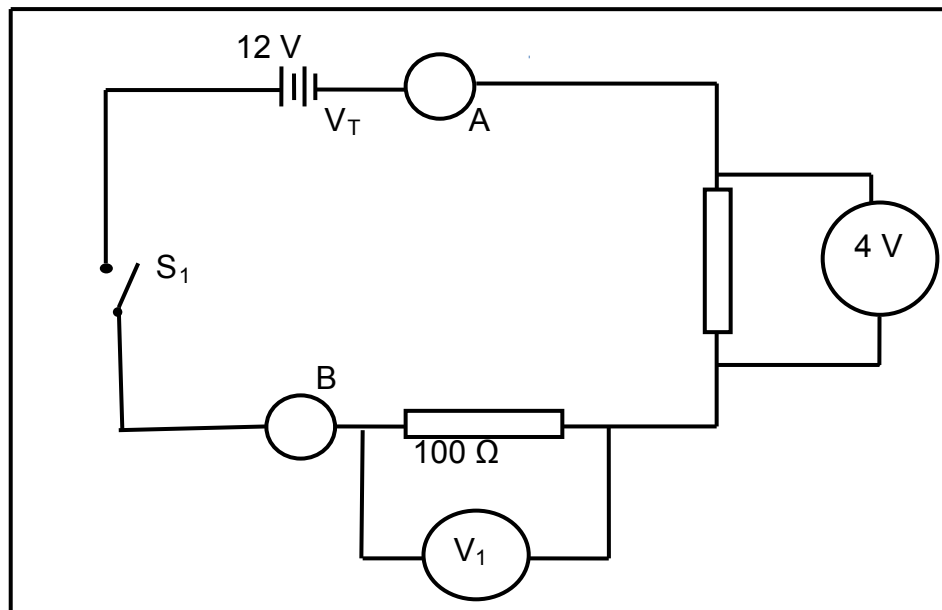
7.5 State the symbol for the SI unit of resistance. (1)

7.6 State FOUR factors that affect the resistance of a conductor. (4)

[18]

QUESTION 8 (Start on a new page.)

8.1 The diagram below contains measurement instruments marked **A**; **B** and **V₁**.



8.1.1 Name instrument **A** and instrument **B**. (1)

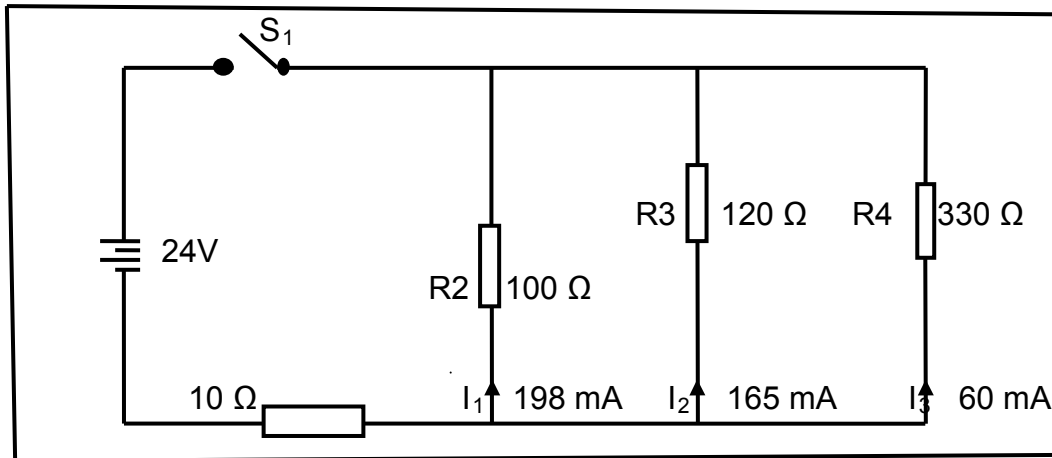
8.1.2 How do the readings on the above-mentioned two instruments compare? (1)

8.1.3 Name instrument **V₁**. (1)

8.1.4 Calculate the reading on instrument **V₁** when **S₁** is closed. (3)

8.2 Define the *emf*. (2)

8.3 Study the diagram below and answer the questions that follow.



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

8.3.2 Calculate the total value of the THREE parallel resistors of the circuit. (3)
[14]

TOTAL: 150

**DATA FOR TECHNICAL SCIENCES
GRADE 10 PAPER 1 (PHYSICS)**

**GEGEWENS VIR TEGNIESE WETENSKAPPE
GRAAD 10 VRAESTEL 1 (FISIKA)**

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIIESE KONSTANTES

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Acceleration due to gravity <i>Swaartekragversnelling</i>	G	9,8m·s ⁻²
Charge on electron <i>Lading op elektron</i>	-e	-1,6x10 ⁻¹⁹ C

TABLE 2: FORMULAE/TABEL 2: FORMULES

MOTION	ENERGY
speed = distance/time	$E_p = mgh$ or $(U = mgh)$
velocity = displacement/time	$E_k = \frac{1}{2} mv^2$ or $(U = \frac{1}{2} mv^2)$
acceleration = change in velocity/time	
	ELECTRICITY/ELECTROSTATIC
FORCE	$Q = \frac{Q_1 + Q_2}{2}$
$F_g = mg$	$I = \frac{Q}{\Delta t}$
$F_{res} = F_1 + F_2$	$V = \frac{W}{Q}$
MOMENTS	$V = IR$
Torque = $F \times r_{\perp}$	SERIES CIRCUIT
$t = F \times r_{\perp}$	$R_T = R_1 + R_2 + R_3 \dots$
SIMPLE MACHINES	$V_T = V_1 + V_2 + V_3 \dots$
$MA = \frac{L}{E} = \frac{e}{I}$	$I_T = I_1 = I_2 = I_3 \dots$
	PARALLEL CIRCUIT
	$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$
	$V_T = V_1 = V_2 = V_3$
	$I_T = I_1 + I_2 + I_3$