



# education

Department of  
Education  
FREE STATE PROVINCE

**EXAMINATION**

**GRADE 10**

**TECHNICAL SCIENCES**

**JUNE 2019**

**MARKS: 150**

**TIME: 3 HOURS**

**This paper consists of 12 pages, three information sheets and one graph sheet.**

## **INSTRUCTIONS AND INFORMATION**

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK and on the attached GRAPH SHEET.
2. This question paper consists of eight questions. Answer ALL questions in the ANSWER BOOK with the exception of question 6.3.2 which must be answered on the attached GRAPH SHEET.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave one line between two sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable pocket calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEETS.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your FINAL numerical answers to a minimum of TWO decimal places where applicable.
11. Give brief motivations, discussions, et cetera where required.
12. 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. Choose the answer and write only the letter A, B, C or D next to the question number (1.1 – 1.10) in your ANSWER BOOK.

1.1 Which one of the following SI units represents the *newton*?

- A kg
- B  $\text{m}\cdot\text{s}^{-1}$
- C  $\text{kg}\cdot\text{m}\cdot\text{s}^{-1}$
- D  $\text{kg}\cdot\text{m}\cdot\text{s}^{-2}$  (2)

1.2 What is the SI unit for temperature?

- A Kelvin
- B Rankin
- C Celsius
- D Fahrenheit (2)

1.3 Which one of the following represents a vector quantity?

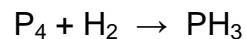
- A 10 kg
- B  $10 \text{ m}\cdot\text{s}^{-1}$
- C 10 kg to the north
- D  $10 \text{ m}\cdot\text{s}^{-1}$  to the north (2)

1.4 Which one of the following pairs represents a scalar and a vector in the respective order?

- A Velocity and force
- B Time and velocity
- C Force and speed
- D Speed and time (2)

- 1.5 A body is in equilibrium when the ...
- A resultant of the forces is zero.
  - B equilibrant is the sum of all the forces.
  - C resultant and equilibrant act in the same direction.
  - D resultant of the forces is greater than the equilibrant. (2)
- 1.6 ... is the ability to do work.
- A Light
  - B Motion
  - C Energy
  - D Gravity (2)
- 1.7 An object is moving at a constant velocity. Which statement is true?
- A It's speed increases.
  - B It experiences no acceleration.
  - C It experience negative acceleration.
  - D It experiences positive acceleration. (2)
- 1.8 What is the chemical formula for chlorine gas?
- A  $\text{Cl}$
  - B  $\text{Cl}^-$
  - C  $\text{Cl}_2$
  - D  $2\text{Cl}$  (2)
- 1.9 What is the formula for the ionic bond between a potassium ion and a sulphate ion?
- A  $\text{KSO}_3$
  - B  $\text{KSO}_4$
  - C  $\text{K}_2\text{SO}_3$
  - D  $\text{K}_2\text{SO}_4$  (2)

1.10 Consider the unbalanced chemical equation below.



Which one of the sets of coefficients will balance the equation?

- A 4, 2, 3
- B 1, 6, 4
- C 1, 4, 4
- D 2, 10, 8

(2)  
[20]

## QUESTION 2

2.1 Your mother wants to buy a new laptop and its specifications are as follows:  
2,60 GHz; 1 024 Mbytes memory

2.1.1 What does Hz stand for? (1)

For QUESTIONS 2.1.2 to 2.1.4 write down:

2.1.2 2,60 GHz as Hz (1)

2.1.3 1 024 Mbytes as bytes (1)

2.1.4 1 024 Mbytes as Gbytes (2)

2.2 Convert the following units as indicated:

2.2.1 4 m to dm (1)

2.2.2 200 cm<sup>3</sup> to dm<sup>3</sup> (2)

2.3 Rewrite the following values in scientific notation:

2.3.1 32 000 J (1)

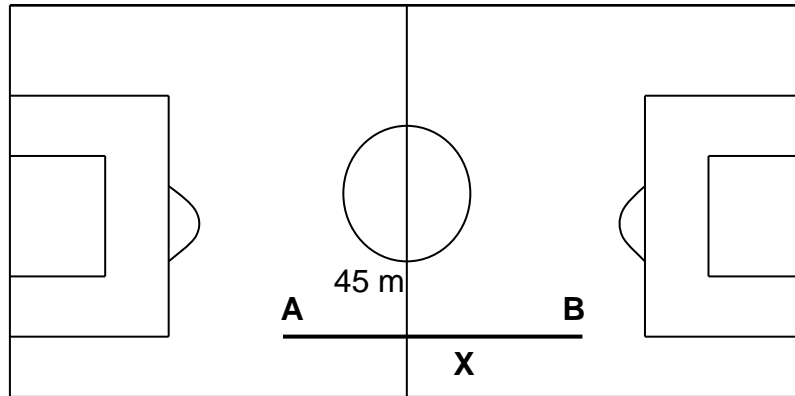
2.3.2 0,0435 A (1)

2.4 A soccer ball has a spherical shape with a diameter of 22 cm. Calculate the surface area of the soccer ball. Take  $\pi = 3,14$ . (4)

2.5 A pumpkin has a volume of 10 cm<sup>3</sup> and a mass of 8 g. Calculate the density of the pumpkin? (3)  
[17]

### QUESTION 3

In a soccer match, a player runs 45 m due east from position **A** to position **B**. He stops at **B**, turns around immediately, and runs due west. He stops at position **X**, which is 20 m from **B**.



- 3.1 Define *displacement*. (2)
- 3.2 Is displacement a scalar or a vector quantity? Explain your answer. (2)
- 3.3 Use the tail-to-head method and draw an accurate, labelled scale diagram to determine the **RESULTANT DISPLACEMENT** of the player from **A** to **X**. Use 2 cm to represent 10 m in your construction. (4)
- 3.4 Calculate the **TOTAL DISTANCE** covered by the player from **A** to **X**. (1)
- 3.5 Define *speed*. (2)
- 3.6 The player runs in 10 s from **A** to **B** and in another 4 s from **B** to **X**. Calculate the player's average **SPEED** from **A** to **X**. Ignore any loss of time due to turning around. (4)
- 3.7 Calculate the player's average **VELOCITY** from **A** to **X**. (4)
- 3.8 Define *acceleration*. (2)

**[21]**

## QUESTION 4

- 4.1 Thato pushes a 15 kg box with a horizontal force of 20 N across a rough, horizontal surface at constant velocity. The box experiences a frictional force.

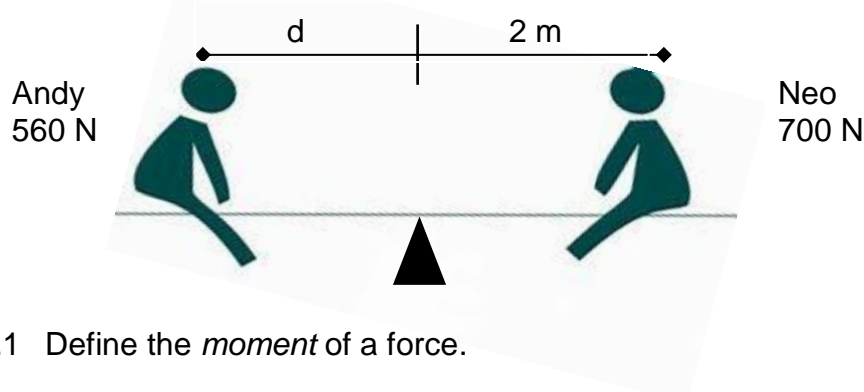


- 4.1.1 Define the term *frictional force*. (2)
- 4.1.2 Draw a labelled, free-body diagram and identify ALL forces acting on the box. (4)
- 4.1.3 Define the term *non-contact force*. (2)
- 4.1.4 Give the name of the non-contact force acting on the box. (1)
- 4.1.5 Calculate the magnitude of the weight of the box. (3)
- 4.2 Three forces  $F_1$ ,  $F_2$  and  $F_3$  are acting on an object. The forces have the following specifications:
- $F_1 = 8 \text{ N east}$
  - $F_2 = 6 \text{ N east}$
  - $F_3 = 4 \text{ N west}$
- 4.2.1 What is the difference between a *resultant* and an *equilibrant*? (4)
- 4.2.2 Determine the resultant of  $F_1$ ,  $F_2$  and  $F_3$ . (3)
- 4.2.3 Write down the equilibrant of  $F_1$ ,  $F_2$  and  $F_3$ . (2)

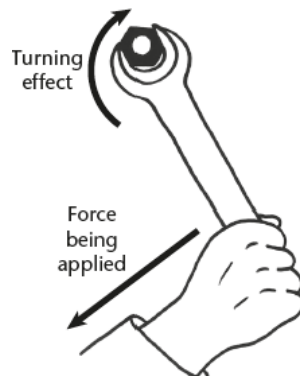
**[21]**

### QUESTION 5

- 5.1 Andy and Neo are playing on a see-saw on the playground. Neo weighs 700 N and sits 2 m away from the fulcrum on the right-hand side. Andy weighs 560 N and sits at an unknown distance  $d$  to the left of the fulcrum.



- 5.1.1 Define the *moment* of a force. (2)
- 5.1.2 Calculate the force moment about the fulcrum caused by Neo. (3)
- 5.1.3 Calculate Andy's distance from the fulcrum to balance the see-saw. (4)
- 5.1.4 Name and state the law in words you have used to answer question 5.1.3. (3)
- 5.2 You apply a 200 N force to loosen a nut with a spanner.



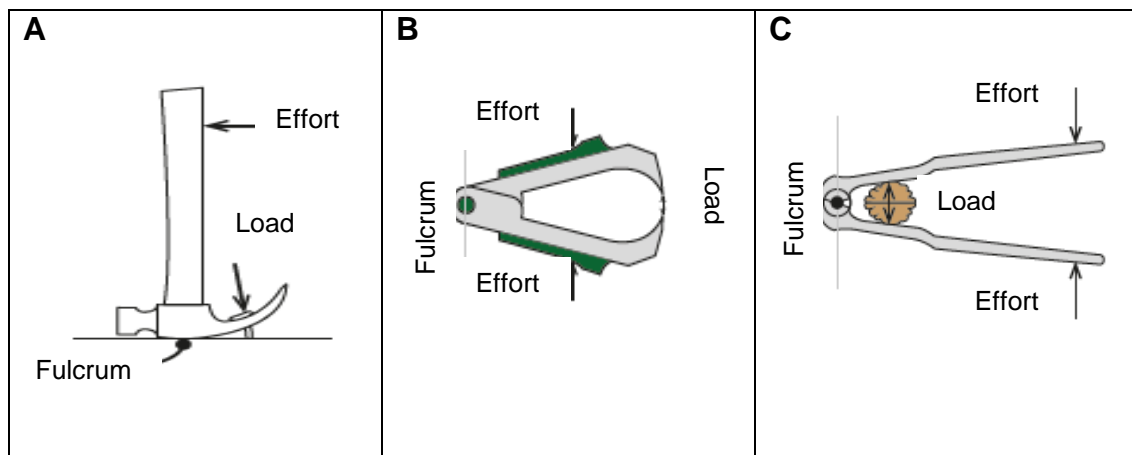
Calculate the magnitude of the maximum torque, in N·m, if the spanner has a length of 25 cm.

(3)  
[15]



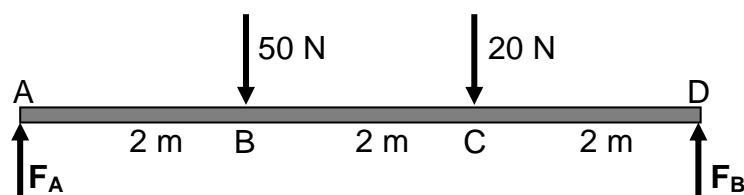
## QUESTION 6

6.1 Study the following simple machines and answer the questions that follow:



Write down only the symbol for the:

- 6.1.1 Type 1 lever (1)
- 6.1.2 Type 2 lever (1)
- 6.1.3 Type of lever with a mechanical advantage of less than one (1)
- 6.2 Calculate the mechanical advantage of a lever that can move a load of 400 N with an effort of 150 N. (3)
- 6.3 A beam, supported by two reaction forces  $F_A$  and  $F_B$  at points **A** and **D** respectively, experiences forces of 50 N and 20 N at points **B** and **C** respectively. **A**, **B**, **C** and **D** are equally spaced with distances of 2 m between them. Ignore the mass of the beam.

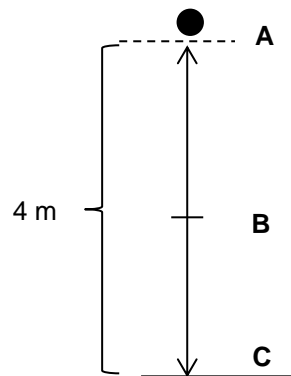


- 6.3.1 Determine the magnitudes of  $F_A$  and  $F_B$ . (7)
- 6.3.2 Draw a shear force diagram for the beam ON THE ATTACHED GRAPH SHEET. Remember to detach the graph sheet and hand it in with your answer book. (4)

**[17]**

### QUESTION 7

A ball, mass 3 kg, is dropped from rest from point **A** at a height of 4 m above the ground. The ball falls freely to point **C** as shown in the diagram.



7.1 Define *gravitational potential energy*. (2)

7.2 Calculate the kinetic energy of the ball at point **A**. Remember to show your calculation. (3)

7.3 Calculate the gravitational potential energy of the ball at point **A**. (3)

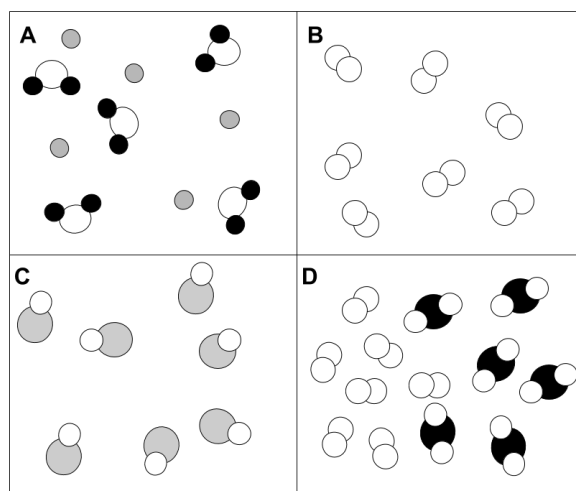
7.4 Calculate the mechanical energy of the ball at point **A**. (3)

7.5 Write down the mechanical energy of the ball at point **B**? (1)

7.6 Calculate the speed of the ball when it strikes the ground at point **C**. (4)  
**[16]**

## QUESTION 8

8.1 Study the diagrams **A** to **D** below.



Write down the letter(s) that represent(s):

8.1.1 Pure substances (2)

8.1.2 An element (1)

8.1.3 A compound (1)

8.1.4 Mixtures of elements and compounds (2)

8.2 Write down the name of each of the following compounds:

8.2.1  $\text{Al}_2\text{O}_3$  (2)

8.2.2  $\text{CaSO}_3$  (2)

8.3 Write down the chemical formula for each of the following:

8.3.1 Hydrogen sulphate (sulphuric acid) (2)

8.3.2 Ammonium carbonate (2)

8.4 Consider the list of substances below:

**copper      glass      iron      silicon      wood**

Choose from the above-mentioned list the substance that is best suited for the task specified below:

8.4.1 Used as a surface on which hot food can be placed to protect the table against the heat. (1)

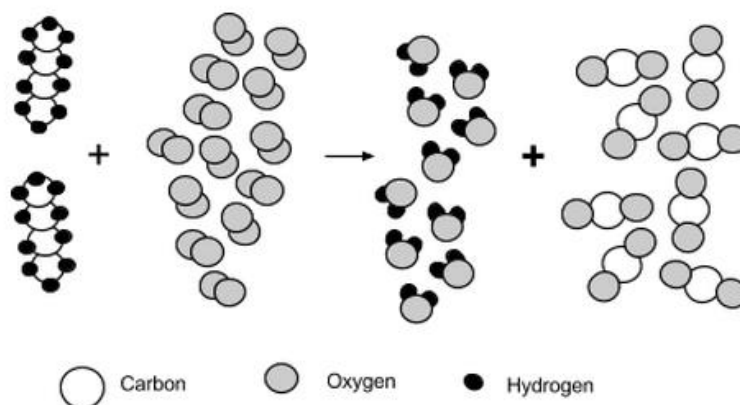
8.4.2 Used in the electrical wiring of houses. (1)

8.4.3 Used to put notes on metallic refrigerator doors. (1)

8.5 Write down balanced chemical equations for the reactions represented below.

8.5.1 Sodium + water → sodium hydroxide + hydrogen (3)

8.5.2



(3)  
[23]

**GRAND TOTAL: 150**

**DATA FOR TECHNICAL SCIENCES 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 <i>Swaartekragversnelling</i>	g	9,8 m·s <sup>-2</sup>
Charge on an electron <i>Lading op 'n electron</i>	e <sup>-</sup>	-1,6 x 10 <sup>-19</sup> C

**TABLE 2: FORMULAE / TABEL 2: FORMULES**

**PERIMETER, AREA, VOLUME & DENSITY**  
**OMTREK, OPPERVLAKTE, VOLUME & DIGTHEID**

Volume <i>Volume</i>	Volume = area of base x height <i>Volume = oppervlakte van basis x hoogte</i>
Perimeter of a rectangle <i>Omtrek van 'n reghoek</i>	Perimeter = 2ℓ + 2w <i>Omtrek = 2ℓ + 2b</i>
Area of a rectangle <i>Oppervlakte van 'n reghoek</i>	Area = ℓ x w <i>Oppervlakte = ℓ x b</i>
Area of a square <i>Oppervlakte van 'n vierkant</i>	Area = side x side <i>Oppervlakte = sy x sy</i>
Area of a circle	Area = πr <sup>2</sup>
Area of a sphere	Area = 4πr <sup>2</sup>
Density of an object <i>Digtheid van 'n voorwerp</i>	Density = $\frac{\text{Mass}}{\text{Volume}}$ <i>Digtheid = <math>\frac{\text{Massa}}{\text{Volume}}</math></i>

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

$$\Gamma = F \times d_{\perp}$$

**SIMPLE MACHINES / EENVOUDIGE MASJIENE**

$$MA = \frac{\text{Load}}{\text{Effort}} \quad \text{OR} \quad MA = \frac{\text{Effort distance}}{\text{Load distance}}$$

$$MV = \frac{\text{Las}}{\text{Krag}} \quad \text{OF} \quad MV = \frac{\text{Kragafstand}}{\text{Lasafstand}}$$

**FORCE / KRAAG**

$F_g = mg$ OR/OF $w = mg$
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**MOTION / BEWEGING**

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

**ENERGY / ENERGIE**

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

**KEY/SLEUTEL**

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

**GRAPH SHEET FOR QUESTION 6.3.2**

NAME AND SURNAME: \_\_\_\_\_ GRADE: \_\_\_\_\_

REMEMBER TO HAND IN THIS GRAPH SHEET WITH THE REST OF YOUR  
ANSWERS.

