



education

Department of
Education
FREE STATE PROVINCE

CONTROL TEST

GRADE 10

TECHNICAL SCIENCES

SEPTEMBER 2018

MARKS: 100

TIME: 2 HOURS

This paper consists of 10 pages, one data sheet and one answer sheet.

INSTRUCTIONS AND INFORMATION

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of FIVE questions. Answer ALL the questions in the ANSWER BOOK.
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

Different 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 the ANSWER BOOK.

1.1 The SI unit for FORCE is ...

- A joule.
- B newton.
- C kilogram.
- D newton meter.

(2)

1.2 A force applied to an object can cause the object to ...


- (i) speed up.
- (ii) slow down.
- (iii) stop.



Which answer correctly completes the statement?

- A (i) only
- B (i) and (ii) only
- C (i), (ii) and (iii)
- D None of the above

(2)

- 1.3 What is best associated with "push" and "pull"?
- A Fulcrum
 - B Pulley
 - C Force
 - D Lever
- (2)
- 1.4 What do you get when you add two forces to get a SINGLE force that has the same effect as the two forces together?
- A Dominant force
 - B Equilibrant
 - C Final force
 - D Resultant
- (2)
- 1.5 Leaves and fruits fall from a tree to the ground due to ...
- A a magnetic force.
 - B a frictional force.
 - C a gravitational force.
 - D an electrostatic force.
- (2)
- 
- 1.6 When body **X** TOUCHES body **Y**, body **Y** experiences a ...
- A contact force of body **X** on body **Y**.
 - B contact force of body **Y** on body **X**.
 - C non-contact force of body **X** on body **Y**.
 - D non-contact force of body **Y** on body **X**.
- (2)

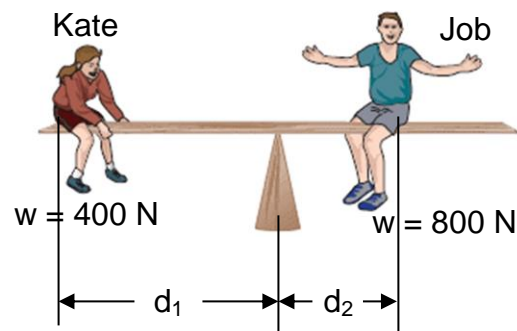
1.7 Which one of the following guarantees that the *law of moments* is satisfied for a beam carrying two objects; one on each side of the fulcrum?

- A The resultant force on the beam is zero.
- B The tension is equal on both sides of the fulcrum.
- C The weights of the two objects on the beam are the same.
- D The distance between each object and the fulcrum is the same. (2)

1.8 Kate and Job are sitting on a **BALANCED** seesaw.

Which one of the following is correct?

- A $d_1 = d_2$
- B $d_1 > d_2$
- C $d_1 < d_2$ (2)



1.9 A beam of which one end is free to move while the other end is fixed is called ...

- A a cantilever beam.
- B a continuous beam.
- C an overhanging beam.
- D a simple supported beam. (2)

1.10 A man lifts a heavy rock in his garden by using a lever as indicated.

Which part of the lever moves the rock?

- A Load
- B Pivot
- C Effort
- D Fulcrum



(2)
[20]

QUESTION 2

A man applies a horizontal force of 50 N to move a wheelbarrow, mass 8 kg, from left to right along a ROUGH, horizontal surface. The frictional force on the wheelbarrow is 5 N.



2.1 Define the term *frictional force*. (2)

2.2 Identify the following forces acting on the wheelbarrow and write down their NAMES:

2.2.1 TWO contact forces (2)

2.2.2 ONE non-contact force (1)

2.3 Draw a labelled free-body diagram to show ALL the forces acting on the wheelbarrow. (4)

2.4 Calculate the weight of the wheelbarrow. (4)

2.5 Write down the magnitude of the OTHER VERTICAL force on the wheelbarrow. (1)

2.6 Consider all the HORIZONTAL forces on the wheelbarrow. Calculate the following for these forces:

2.6.1 Resultant (3)

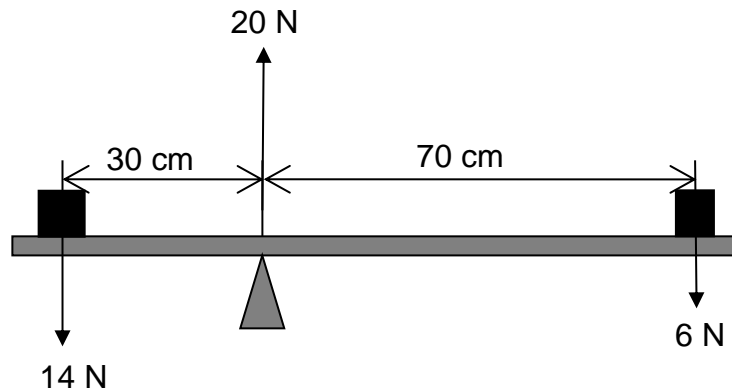
2.6.2 Equilibrant (2)

[19]

QUESTION 3

3.1 Define the term *moment of force*. (2)

3.2 The diagram shows a rigid (cannot bend) 1 m ruler, pivoted as shown. A 14 N force acts at a distance of 30 cm from the pivot, a 6 N force acts at a distance of 70 cm from the pivot and a 20 N force acts through the pivot. Ignore the mass of the ruler.



3.2.1 Which force has no force moment about the pivot? Explain. (2)

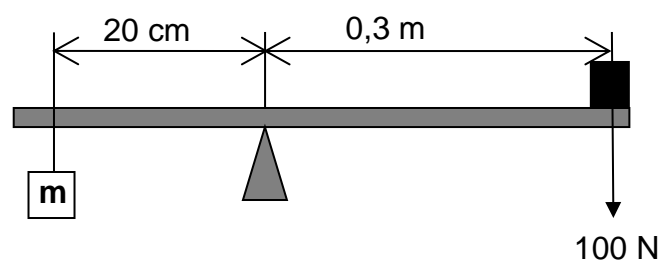
3.2.2 Calculate the force moment of the 14 N force about the pivot. (3)

3.2.3 Calculate the force moment of the 6 N force about the pivot. (2)

3.2.4 Is the ruler turning? Explain. (2)

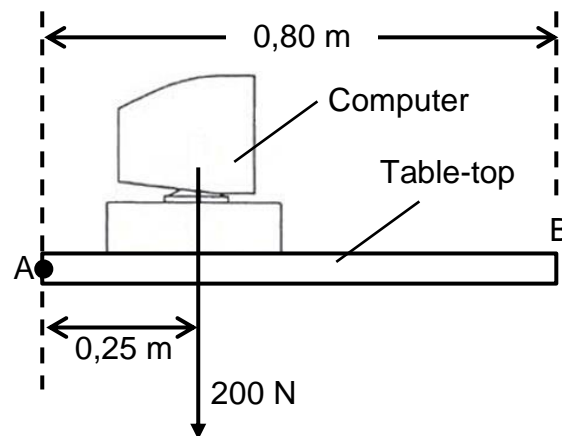
3.3 State the *law of moments* in words. (2)

3.4 The figure shows a balanced, rigid metre rule. A 100 N force, at a distance of 0,3 m from the pivot, is **BALANCED** by an unknown object with a mass m , hung at a distance of 20 cm from the pivot. Ignore the mass of the metre rule.



Calculate mass m of the object. (5)

- 3.5 The diagram shows a stationary computer, weight 200 N, on a table-top that is fixed to a wall at **A**. The table-top is kept HORIZONTAL by a force F acting vertically at **B** (the edge of the table-top). The distance **AB** is 0,80 m.



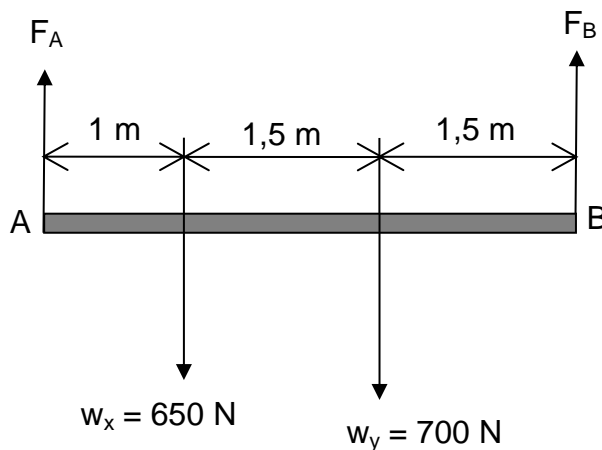
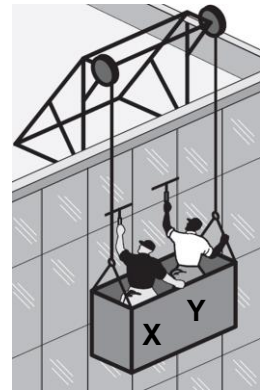
Take moments about **A** and apply the *law of moments* to determine the magnitude and direction of the vertical force F acting at **B**.

(4)
[22]

QUESTION 4

Two men, **X** and **Y**, use a window-cleaning platform to clean the windows of an office block. The platform is **BALANCED**.

The diagram **BELOW** shows the forces acting on the platform. The weights of the men on the platform are w_X and w_Y as shown. The platform is supported by two cables that exert upward forces F_A and F_B on the sides of the platform at **A** and **B**. Ignore the mass of the platform.



4.1 Define the following terms:

4.1.1 Beam (2)

4.1.2 Shear force (2)

4.1.3 Bending moment (2)

4.2 Calculate the magnitude of F_B by taking moments about **A**. (5)

4.3 Calculate the magnitude of F_A . (4)

4.4 Use the answer sheet attached at the end of the question paper to draw the following diagrams for this platform:

4.4.1 Shear force diagram (5)



4.4.2 Bending moment diagram (5)

Remember to HAND IN your answer sheet with the rest of your answers.

[25]

QUESTION 5

The table shows two types of levers that we frequently use.

| Shovel | Pair of tweezers |
|---|--|
|  |  |

5.1 Define the term *lever*. (1)

5.2 To which class does each of the following levers belong? Only write down 1, 2 or 3.

5.2.1 Shovel (1)

5.2.2 Pair of tweezers (1)

5.3 Define the term *fulcrum*. (1)

5.4 Brian squeezes EACH one of the hand brakes of his bicycle's braking system with a force of 60 N. As a result of this, the brakes exert a total braking force of 300 N PER WHEEL.



5.4.1 Define the term *mechanical advantage*. (2)

5.4.2 Calculate the mechanical advantage of the brakes at ONE of the wheels. (4)

5.5 Irene applies the SAME FORCE to three DIFFERENT machines, **A**, **B** and **C**. The OUTPUT FORCE of each machine is as follows:

- Machine **A**: 50 N
- Machine **B**: 30 N
- Machine **C**: 80 N

List the three machines in order of lowest to highest mechanical advantage.

Show all steps used to arrive at the answer.

(4)

[14]

GRAND TOTAL: 100

**DATA FOR TECHNICALSCIENCES GRADE 10
CONTROLTEST 2**

**GEGEWENS VIR TEGNIESE WETENSKAPPE GRAAD 10
KONTROLETOETS 2**

TABLE 1: FORMULAE/TABEL 1: FORMULES

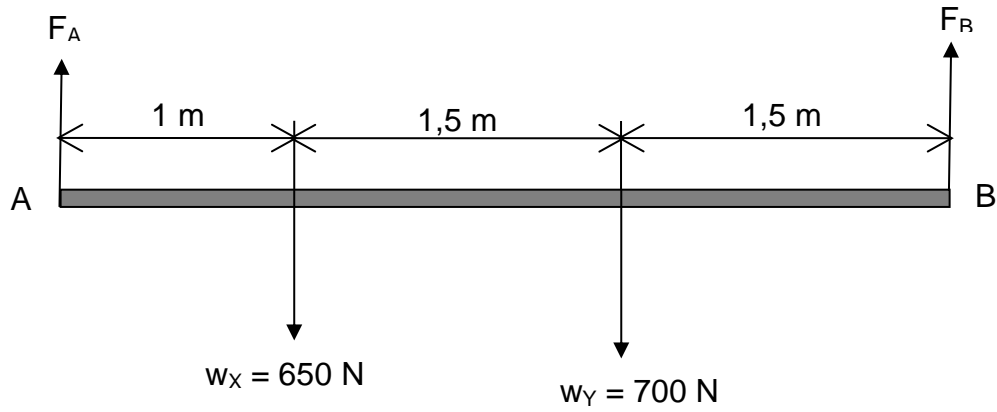
| | |
|--|---|
| <p>Torque / Moment of force</p> <p><i>Draaimoment / Wringkrag / Kragmoment</i></p> | <p>$\tau = F \times d_{\perp}$</p> <p>OR / OF</p> <p>Moment = Force x perpendicular distance <i>Moment = Krag x loodregte afstand</i></p> |
| <p>Weight / Gewig</p> | <p>$w = mg$ ($g = 9,8 \text{ m} \cdot \text{s}^{-2}$)</p> |
| <p>Mechanical advantage (MA)</p> <p><i>Meganiese voordeel (MV)</i></p> | <p> $MA = \frac{\text{Load}}{\text{Effort}}$ OR $MA = \frac{\text{Output force}}{\text{Input force}}$ OR $MA = \frac{\text{Effort distance}}{\text{Load distance}}$ OR $MA = \frac{\text{Input arm distance}}{\text{Output arm distance}}$ </p> <p> $MV = \frac{Las}{Krag}$ OF $MV = \frac{Uitsetkrag}{Insetkrag}$ OF $MV = \frac{Kragafstand}{Lasafstand}$ OF $MV = \frac{Insetkragafstand}{Uitsetkragafstand}$ </p> |

QUESTION 4

DO YOUR SHEAR FORCE AND BENDING MOMENT DIAGRAMS ON THIS SHEET. REMEMBER TO **HAND IT IN WITH YOUR ANSWER BOOK.**

Name of learner: _____

Class: _____



4.4.1

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|--|--|--|
| | | |
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| | | |

(5)

4.4.2

| | | |
|--|--|--|
| | | |
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| | | |

(5)