Education and Sports Development

Department of Education and Sports Development
Department van Onderwys en Sport Ontwikkeling
Lefapha la Thuto le Tlhabololo ya Metshameko
NORTH WEST PROVINCE

NATIONAL

SENIOR CERTIFICATE

GRADE 10

TECHNICAL SCIENCE

JUNE 2018

MARKS: 150

TIME : 3 hours

This question paper exists of 13 pages including the formula sheets.

INSTRUCTIONS and INFORMATION

1. This question paper consists of SIX questions. Answer ALL the sections and questions in your answering book.

2. Start each question on a new page in the answer book.

3. Make use of the numbering system used in the question paper.

4. Leave open one line between two sub questions, for example between Question 2.1 and Question 2.2.

5. You may use a non-programmable calculator.

6. You may use mathematical instruments.

7. It is suggested to make use of the attached FORMULAE SHEET at the end of the question paper

8. Show ALL formulas and substitutions in calculations.

9. Rounding off your final answers to a minimum of TWO decimals.

10. Give short motivations, discussions etc. where necessary.

11. Write neatly and legibly.

SECTION A
QUESTION 1: Multiple choice questions

Four options are given as possible answers for each question.
Each question has only ONE correct answer. Choose the correct answer, write only the letter (A to D) next to the question number (1.1 – 1.10) for example: 1.11 D.

1.1 The forces P = 580 N and Q = 277 N were applied on an object as shown in the sketch.

The resultant force of the two forces P and Q is . . .

A 857 N east.
B 303 N west.
C 303 N east.
D 857 N west. (2)

1.2 The standard SI-unit which was used to determine the **velocity** of a moving object is . . .

A $m.s^{-2}$.
B $km.h^{-1}$.
C m.s.
D $m.s^{-1}$. (2)

1.3 **Tension** is measured in . . .

A Joule.
B Watt.
C Newton.
D Newton.meter. (2)

1.4 The speed of light in a vacuum is 300 000 $km.s^{-1}$. Which of the following notations represent the speed of light in scientific notation?

A 300 $m.s^{-1}$
B 3×10^8 $m.s^{-1}$
C $0,3 \times 10^9$ $m.s^{-1}$
D 3×10^5 $m.s^{-1}$ (2)

1.5 In a certain section of an electrical circuit, the flow of charge calculated is 180 Coulomb per hour. Determine the **rate** of flow of charge in coulomb per second.

A $0,05$ $C.s^{-1}$
B 30 $C.s^{-1}$
C $1,08 \times 10^4$ $C.s^{-1}$
D 5×10^2 $C.s^{-1}$ (2)

1.6 Which one of the following sets of physical quantities represents a **scalar** and a **vector** respectively?

	Scalar	**Vector**
A	coulomb	ampere
B	force	weight
C	speed	acceleration
D	mass	time

(2)

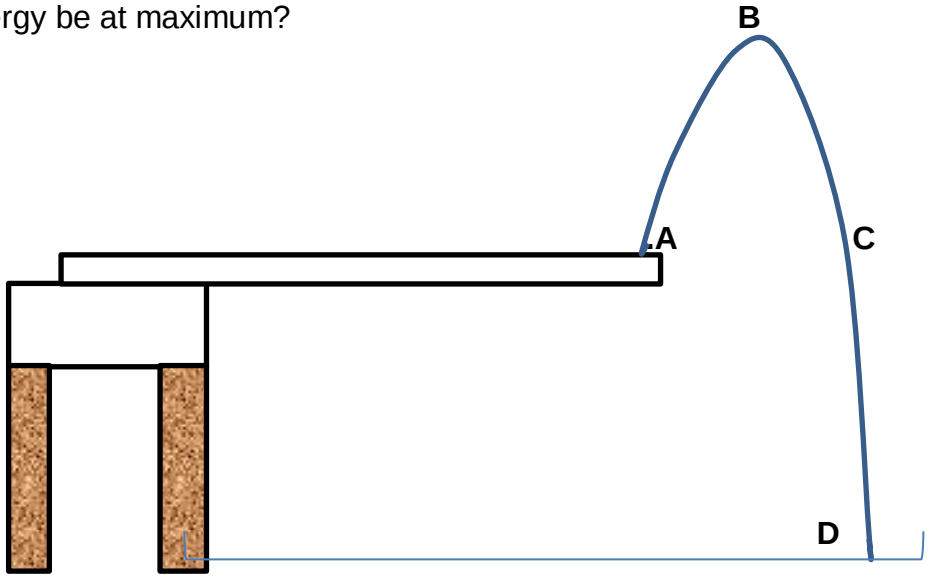
1.7 Which one of the following is not a **contact force**?

A The northern wind lets the windmill's wheel turn.
B The upward force which a Boeing A380 undergoes during flight.
C The gravitational force which the moon undergoes due to the earth's mass.
D A vehicle which collides with another vehicle. (2)

1.8 The magnitude of **moment of a force** is dependant on the following factor:

A Size of the applied force.
B The bearing of the applied force.
C The time of the moment.
D The speed of the moment. (2)

1.9 A swimmer dives from a high platform into a swimming pool as shown in the sketch. At which ONE of the positions A, B, C or D will the magnitude of potential energy be at maximum?



A position A
B position B
C position C
D position D (2)

1.10 The balanced chemical reaction equation when calcium reacts with oxygen is given as:

A $Ca + O_2 \rightarrow CaO_2$
B $2Ca + O_2 \rightarrow 2CaO$
C $K + O_2 \rightarrow KO_2$
D $4K + O_2 \rightarrow 2K_2O$ (2)

[20]

SECTION B

QUESTION 2: Item questions

Choose from column B the description that best matches the term in column A.
Write the letter next to the question number.

Column A		Column B	
2.1	Friction force	A	A wheelbarrow
2.2	Speed	B	The physical identity which indicates size, unit and bearing
2.3	Ţ	C	A molecule which lost an electron(s)
2.4	Rate	D	The change of a physical quantity during a given time
2.5	Type 2 lever	E	The rate of change of distance
2.6	Negative ion	F	The energy as a result of the movement of an object
2.7	Vector	G	An atom which lost a proton/s
2.8	Kinetic energy	H	The working of the brake system of a motor vehicle.
		I	Moment
		J	The energy which an object has as a result of its position above the earth's surface
		K	Time
		L	An atom which gained electron(s)
		M	A see – saw.

(8 x 2) (16)

SECTION C

QUESTION 3: Mechanics

3.1 Caster Semenya participated in the 2018 Common Wealth Games and won a gold medal in the 1500 m item event. The official time of her event was 4 min 0,7 sec.

Determine Caster's average speed in this event. (5)

3.2 We use the next formula to calculate the acceleration of a moving object:

$$a = \frac{(vf - vi)}{t}$$

Write down the meaning of each of the symbols and also give the SI-unit of each symbol:

3.2.1 v_f (1)

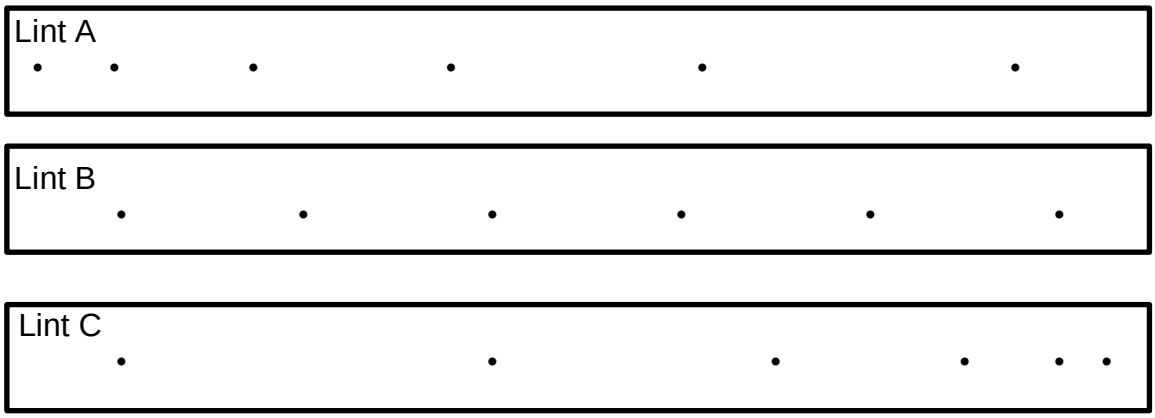
3.2.2 v_i (1)

3.2.3 t (1)

3.2.4 a (1)

(4)

3.3 In the diagram are the results of trollies experiments paper lints. The frequency of the time ticker is 50 Hz.



3.3.1 Give the time difference between two consecutive dots (2)

3.3.2 Make use of the diagrams, redraw the table in your answer book and complete it to only write: increase, decrease, constant or none, in each block.

	Lint A	Lint B	Lint C
velocity			
acceleration			

(6)

[8]

3.4 A building has four levels, without the attic and ground floor.
The specification of a lift in this building are as follows:

Maximum number of persons: 13
Maximum operational mass: 1,2 ton.

3.4.1 Define the Force of gravity. (2)

3.4.2 The lift transports nearly half of its operational mass from the fourth floor to the attic. Draw a force diagram for this situation.
(Hint: 1 ton = 1000 kg) (2)

3.4.3 Use the formula $W = F.\Delta x$ and determine the total quantity work done by the electronic motor of the lift, if the height of each floor is 2,5 m. The mass of the lift is 0,6 ton. The lift moves upwards from the attic to the fourth floor. (5)

[9]

3.5 Show your calculations and determine the resultant of the following vectors: 4,3 cm SO; 5,8 cm SO and 3 cm NW. (4)

3.6 Use the tail-to-head method and graphically determine the direction of the resultant displacement. (Use a suitable scale)
30 N 0º; 55 N 180º; 48 N 0º (5)

[35]

QUESTION 4: Forces

4.1 Define a normal force and draw it with a suitable force diagram. (3)

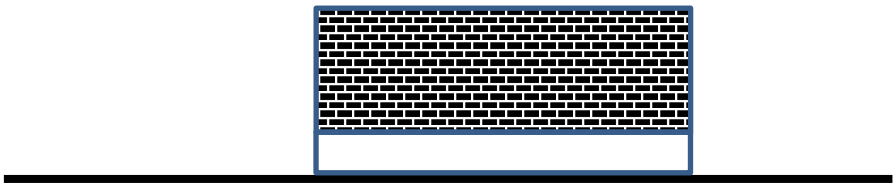
4.2 Redraw this table in your answer book and complete it with 3 examples of each type of force:

Examples of contact forces		Examples of non-contact forces	
4.2.1		4.2.4	
4.2.2		4.2.5	
4.2.3		4.2.6	

(6)

4.3 Determine, with **calculation**, the equilibrant force of the 3 forces in the next description:
F_1 = 28 N south west; F_2 = 36 N north east; F_3 = 42 N south west. (4)

4.4 In the diagram below 100 paving stones are packed on a wooden pallet. The total mass is 2350 kg. There is a friction force of 30 N between the wooden pallet and the horizontal surface.



4.4.1 Determine the weight of the wooden pallet with the paving stones. (2)

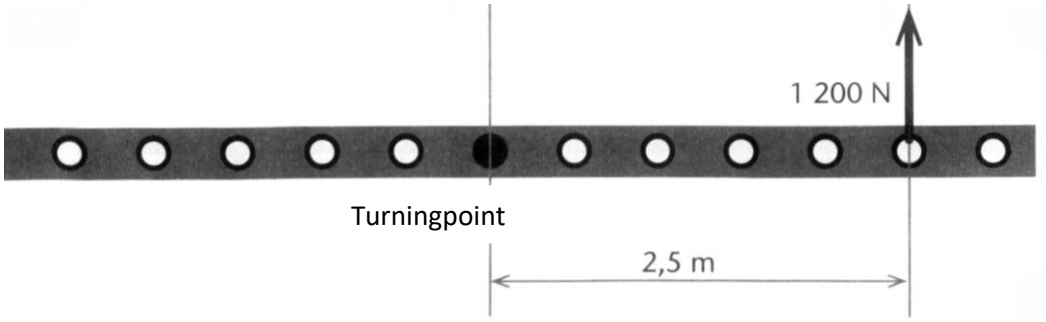
4.4.2 A few workers push the wooden pallet with a applied force of 270 N to the right. Use all the given information and show all the forces applied to the wooden pallet with all the necessary captions on a free body diagram. (6)

[21]

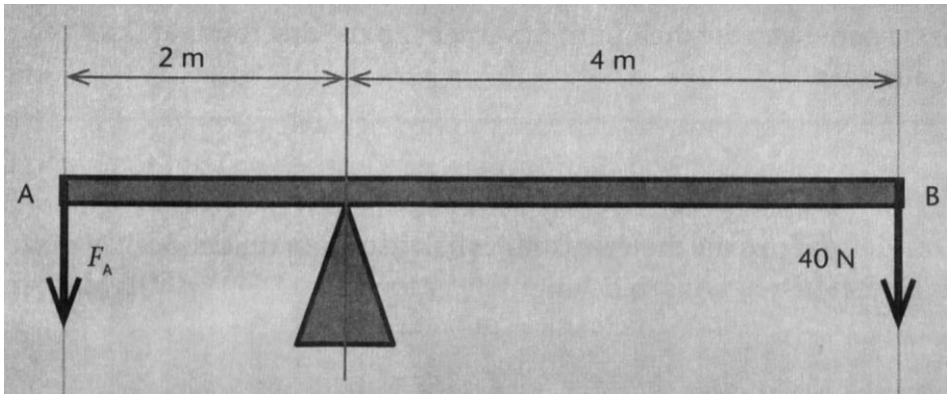
QUESTION 5: Moments and Energy

5.1 Define the law of moments. (2)

5.2 Determine the moment of the object in the sketch. (4)



5.3 Use the sketch hereby to determine the magnitude of the unknown force at A which balances a weightless beam. (4)



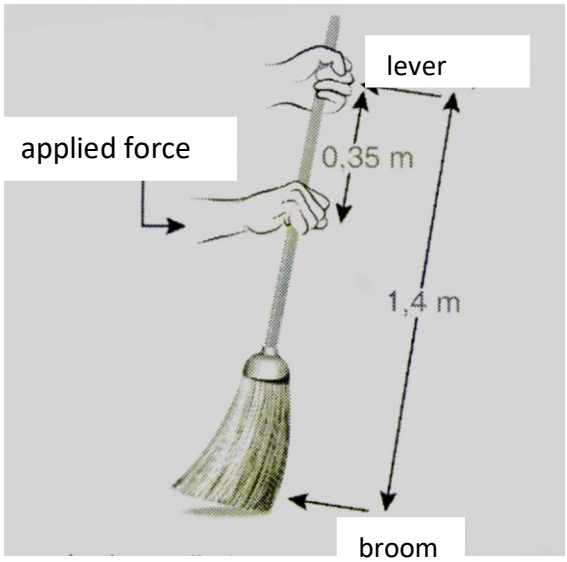
5.4 Define a cantilever. (2)

5.5 A worker uses a long beam and a round tree stump to lift and roll a heavy stone out of the road. The worker applies a force of 355 N on the beam.

5.5.1 If the section of the beam between the worker and the stump is 2,8 m in length and the section between the stump and the stone is 30cm. Determine the mechanical advantage of the fulcrum. (4)

5.5.2 Determine the maximum mass of the stone which he could roll away with the lever. (3)

5.6 In the sketch below a broom is used to sweep a floor.



5.6.1 What type of lever is the broom? (1)

5.6.2 Calculate the mechanical advantage of the broom. (3)
(4)

5.7 A hailstone has a mass of 8,5 g. At a height of 30 m above the ground, the velocity of the hailstone is 3,5 $m.s^{-1}$.
Calculate the hailstone's

5.7.1 potential energy at this position. (3)

5.7.2 kinetic energy at this position. (3)

5.7.3 mechanical energy at this position. (3)

5.7.4 velocity of it when it reaches the ground. (3)
(12)

[35]

QUESTION 6: Matter

6.1 Explain the **difference** between thermal and electrical conductivity. Use examples to explain the difference. (4)

6.2 Define a **pure substance** and give an **example**. (2)

6.3 Use the following information to answer the questions below:

Argon	**Sulphur**	**Sodium chloride**	**Magnesium**	**Calcium sulphate**
KNO_3	**Cr**	**Sodium carbonate**	**NH_3**	**Br^-**

6.3.1 Give the symbol of the metal(s). (2)

6.3.2 Give the formula of the anion. (1)

6.3.3 Give the symbol of a noble gas. (1)

6.3.4 Give the chemical name of NH_3 (1)

6.3.5 Give the formula of the cat-ion that is present in KNO_3. (1)

6.3.6 Give the names of at least two salts that are shown above. (2)
(8)

6.4 In each of the following cases, say whether the substance is a element, a mixture or a compound:

6.4.1 Cu (1)
6.4.2 Iron + sulphur (1)
6.4.3 Ag (1)
6.4.4 H_2SO_4 (1)
6.4.5 SO_3 (1)
(5)

6.5 Rewrite and balance the following chemical equations:

6.5.1 $Na_2CO_3 + HCl \longrightarrow NaCl + H_2O + CO_2$ (2)

6.5.2 $H_2 + N_2 \longrightarrow NH_3$ (2)
(4)
[23]
TOTAL: 150

DATA FOR TECHNICAL SCIENCES GRADE 10

GEGEWENS VIR TEGNIESE WETENSKAPPE GRAAD 10

TABLE 1A: PHYSICAL CONSTANTS/TABEL1A: FISIESE KONSTANTES

NAME/*NAAM*	**SYMBOL/*SIMBOOL***	**VALUE/*WAARDE***
Acceleration due to gravity *Swaartekragversnelling*	g	9,8 $m \cdot s^{-2}$
Speed of sound in air *Spoed van klank in lug*	c	340 $m.s^{-1}$
Charge on electron *Lading op 'n elektron*	- e	$-1,6 \times 10^{-19}$ C
Coulomb's constant *Coulomb se konstante*	k	$9,0 \times 10^{9} N \cdot m^{2} \cdot C^{-2}$
Electron mass *Elektronmassa*	m	$9,11 \times 10^{-31}$ kg

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*	**SIMPLE MACHINES/*EENVOUDIGE MASJIENE***	**MOMENTS/*MOMENTE***
Speed = $\frac{\textbf{distance}}{\textbf{time}}$ *Spoed* = $\frac{\boldsymbol{afstand}}{\boldsymbol{tyd}}$ $s = \frac{\Delta \mathbf{d}}{\Delta \mathbf{t}}$ $\mathbf{v} = \frac{\mathbf{D}}{\Delta \boldsymbol{t}}$ $\mathbf{a} = \frac{\Delta \mathbf{v}}{\Delta \mathbf{t}}$	MA = $\frac{L}{E} = \frac{e}{l}$ MV = $\frac{L}{M} = \frac{m}{l}$	Torque = F x $r_{\perp}$ τ = F x $r_{\perp}$
	VECTORS/VEKTORE	**FORCE/*KRAG***
	$F_R = F_1 + F_2$ $F_R^{\,2} = F_1^{\,2} + F_2^{\,2}$ $F_x = F\cos\theta$ $F_y = F\sin\theta$	w = mg $F_{net} = ma$ $F_s = \mu_s F_N$ $F_{s(max)} = \mu_s F_N$ $F_k = \mu_k F_N$

ENERGY/*ENERGIE*
$\mathbf{E_P = mgh \ \ or \ (U = mgh)}$ $\mathbf{E_K = \frac{1}{2}mv^2 or \ (K = \frac{1}{2}mv^2)}$

ELECTRICITY & MAGNETISM *ELEKTRISITEIT & MAGNETISME*	
$\mathbf{I = \frac{Q}{\Delta t}}$ $\boldsymbol{V = \frac{W}{\Delta t}}$ $V = IR$	$Q = \frac{Q_1 + Q_2}{2}$ $F = k\frac{Q_1 Q_2}{r^2}$ **ELECTRIC FIELD STRENGTH / *ELEKTRIESE VELDSTERKTE*** $E = k\frac{Q_1}{r^2}$ $E = \frac{V}{d}$
PARALLEL CIRCUIT/*PARALLELE STROOMBAAN* $\mathbf{\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots\ldots..}$ $\mathbf{R_P = \frac{R_1 . x \, R_2}{R_1 + R_2}}$ $\mathbf{V_T = V_1 = V_2 = V_3 \ ...}$ $\mathbf{I_T = I_1 + I_2 + I_3 \ ... ...}$	**SERIES CIRCUIT/*SERIE STROOMBAAN*** $R_S = R_1 + R_2 + R_3 \ ...$ $V_T = V_1 + V_2 + V_3 \ ...$ $I_T = I_1 = I_2 = I_3 \ ...$

HEAT AND THERMODYNAMICS/*WARMTE EN TERMODINAMIKA*

$C = c\,m$	$C = \frac{Q}{\Delta t}$	$Q = c\,m\,\Delta t$	$\Delta Q = \Delta U + \Delta W$

WAVES, SOUND AND LIGHT/*GOLWE, KLANK EN LIG*

$T = \frac{1}{f}$	$v = \frac{\lambda}{T}$
$f = \frac{1}{T}$	$v = f\lambda$