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NATIONAL SENIOR CERTIFICATE

GRADE 12

JUNE 2026

TECHNICAL SCIENCES P1

MARKS: **150**

TIME: **3 hours**

This question paper consists of 15 pages including 2 data sheets.

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Write your NAME and SURNAME in the appropriate spaces on the ANSWER BOOK.
2. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH question on a NEW page.
4. You may use non-programmable calculator.
5. You may use appropriate mathematical instruments.
6. Number the answers correctly according to the numbering system used in this question paper.
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. You are advised to use the attached DATA SHEETS.
11. Write neatly and legibly.

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QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1 to 1.10) in the ANSWER BOOK, for example 1.11 D.

1.1 What does the product of mass and velocity represent?

A Force

B Mass

C Momentum

D Acceleration (2)

1.2 The velocity of a car moving westwards increases from 2.5 $m.s^{-1}$ to 5 $m.s^{-1}$.





Which ONE of the following statements CORRECTLY describes the direction of the acceleration and the resultant (net) force while the car is accelerating?

	DIRECTION OF ACCELERATION	DIRECTION OF RESULTANT FORCE
A	Due east	Due west
B	Due west	Due east
C	Due east	Due east
D	Due west	Due west

(2)

1.3 A car experiences a constant net force of 500 N as it moves towards the west. The rate at which the momentum of the car changes during its motion is …

A equal to the impulse of the car.

B equal to 500 N.

C greater than the net force.

D less than 500 N. (2)

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1.4 A minibus taxi is moving along a straight road with its sliding door open. When the taxi driver applies brakes suddenly, it is observed that the door moves forward.

Which NAME is given to the law that explains this observation?

A Pascal's Law

B Newton's First Law

C Newton's Third Law

D Newton's Second Law (2)

1.5 Which ONE of the following statements defines inertia?

A Ability to do work

B Rate of change of velocity

C Property of a body to resist any change in its state of motion or rest

D Maximum force that can be applied to a body (2)

1.6 Which ONE of the following best describes an inelastic collision?

A Both momentum and kinetic energy are conserved.

B Total kinetic energy is not conserved but total linear momentum is conserved.

C Neither kinetic energy nor momentum are conserved.

D Kinetic energy is conserved but total linear momentum is not conserved. (2)

1.7 Which ONE of the following is defined as the normal force exerted by a liquid at rest on a given surface in contact with the liquid?

A Thrust

B Weight

C Stress

D Pressure (2)

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1.8 Stress is defined as the …

A force acting per unit area.

B internal restoring force per unit area of a body.

C force that changes the shape of an object.

D ratio of change in dimension to the original dimension. (2)

1.9 Two oil containers **P** and **Q** are marked as follows:

P



Q



Which ONE of the following statements is CORRECT about the oil in container **P**? The oil in container **P** …

A is more suitable for cold conditions.

B is more suitable for hot conditions.

C has a higher viscosity in cold conditions than the oil in container **Q**.

D will stay thicker in hot conditions than the oil in container **Q**. (2)

1.10 Which ONE of the following SI units is equivalent to a Pascal (Pa)?

A $J.s^{-1}$

B $F.m^{-1}$

C $C.V^{-1}$

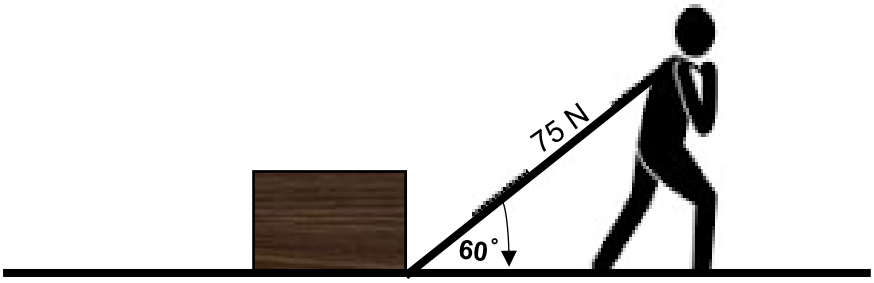
D $N.m^{-2}$ (2)

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QUESTION 2

The picture below shows a young man pulling a box by means of a rope which is inclined at 60˚ to the ground. The tension in the rope is 75 N. The box moves at a constant velocity to the right.



2.1 State *Newton's First Law of Motion* in words. (2)

2.2 The young man observes that pulling the box from a stationary position to get it moving, is more difficult than pulling it when it is in motion. Explain. (2)

2.3 Calculate the kinetic frictional force acting on the box. (3)

2.4 The young man increases the angle at which the rope is inclined to the ground surface to 80° while keeping the tension in the rope at 75 N.

How will the following quantities be affected?

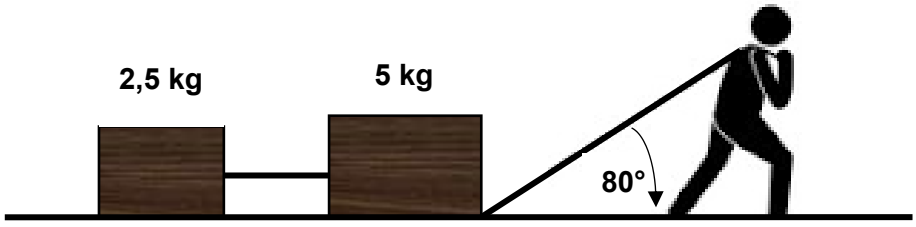
Write only DECREASE, INCREASE or REMAINS THE SAME.

2.4.1 Normal force (1)

2.4.2 Kinetic frictional force (1)

2.5 Explain your answer to QUESTION 2.4.2 above. (2)

2.6 The young man attaches a smaller box to his first box by means of another rope and continues to move to the right pulling it at an incline of 80° on the same surface. The masses of the boxes **A** and **B** are respectively 5 kg and 2,5 kg and are pulled with a force of 75 N.



2.6.1 State *Newton's Second law of motion* in words. (2)

2.6.2 Draw a free-body diagram to indicate all the forces experienced by the 5 kg block. (5)

2.6.3 Calculate the acceleration experienced by the system. (7)

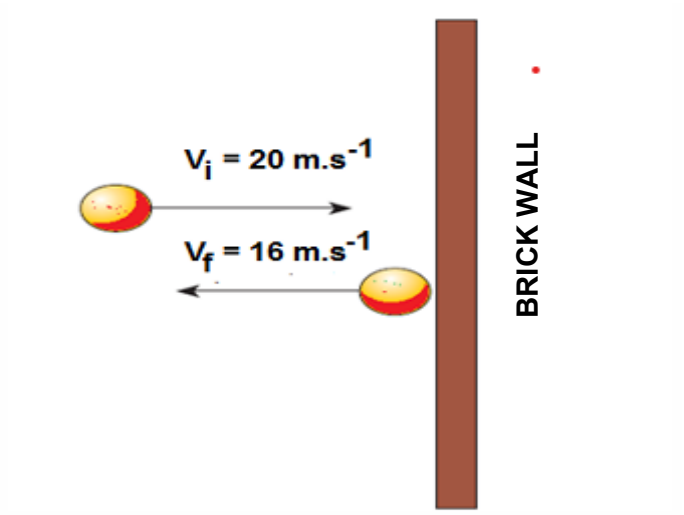
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QUESTION 3

3.1 Study the diagram below which shows a 150 g tennis ball striking the wall at 20 m.s^{-1}, and bouncing back in the opposite direction at 16 m.s^{-1}. The tennis ball is thrown against the wall at right angle.



3.1.1 Define the term *impulse* in words. (2)

3.1.2 Calculate the impulse on the ball. (4)

3.2 A car of mass 1 000 kg travels west with a velocity of 33 m.s^{-1} and collides head on with a truck of mass 2 500 kg that travels with a velocity of 19 m.s^{-1} due east. After the collision, the car and the truck move together respectively.



3.2.1 State the principle of *conservation of linear momentum* in words. (2)

3.2.2 Calculate the speed of the system immediately after the collision. (5)

3.2.3 By means of calculations show whether the collision is elastic or inelastic. (5)

3.2.4 The car was fitted with an airbag. Explain how the airbag reduces the fatal injuries on a driver. (3)

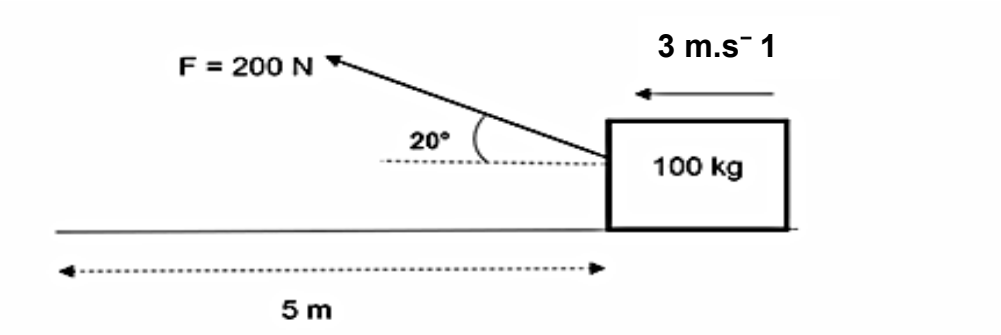
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QUESTION 4

4.1 A man is pulling a crate of mass 100 kg across a rough horizontal surface. The man exerts a force of 200 N at an angle of 20° with the horizontal. The crate moves at a constant velocity of 3 $m.s^{-1}$ to the left.
The crate is pulled over a distance of 5 m.



4.1.1 Define the term *work done* in words. (2)

4.1.2 Calculate the work done by the man. (3)

4.1.3 What is the net work done on the box? (1)

4.1.4 Explain the answer in QUESTION 4.1.3 above. (2)

4.1.5 Does the force of gravity do any work on the box? Explain. (3)

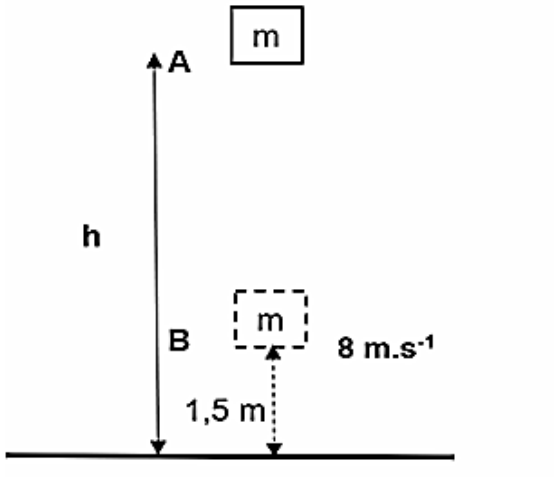
4.2 An electric motor lifts a 2 000 kg container of water per minute to the top of a building which is 20 m high.

4.2.1 Define the term *power*. (2)

4.2.2 Calculate the power generated by the motor in horsepower. (4)

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4.3 A block of mass **m** is dropped from rest from a height **h** meters above the ground as shown in the diagram below.
The block reaches point **B**, which is 1,5 m above the ground, at a speed of 8 $m.s^{-1}$.



4.3.1 What is the value of the kinetic energy at position **A**? (2)

4.3.2 Define *mechanical energy* in words. (2)

4.3.3 What change takes place on the following quantities while the block is falling?

Write down only INCREASES, DECREASES or REMAINS THE SAME.

(a) Kinetic energy (1)

(b) Mechanical energy (1)

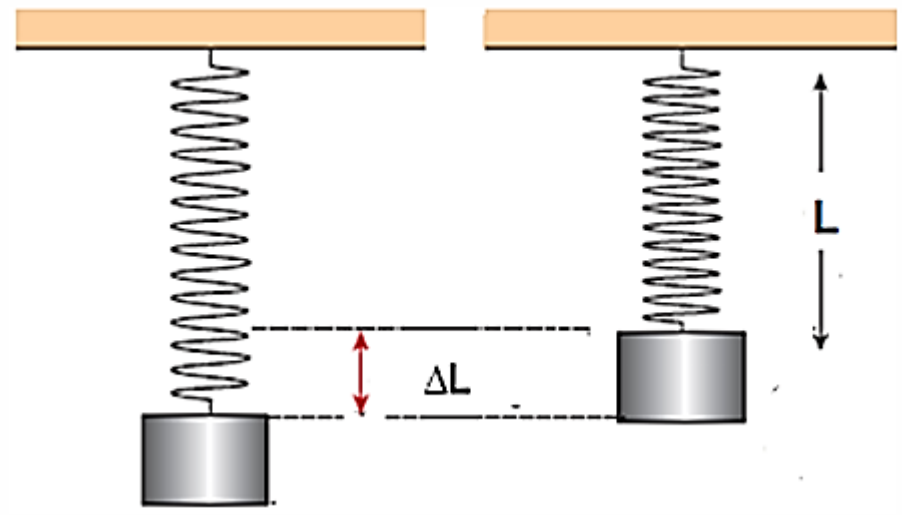
4.3.4 State the principle of *conservation of mechanical energy* in words. (2)

4.3.5 Calculate the height **h** from which the block was dropped. (7)
[32]

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QUESTION 5

A compressive force causes internal stress of 1 MPa in a spring which is made of an unknown metal. The resistance area of the round spring is 2×10^{-3} m^2 and its original length is 50 mm. The force causes the round spring to increase by 1×10^{-3} mm.



5.1 Distinguish between a *deforming force* and a *restoring force*. (4)

5.2 Define the term *strain* in words. (2)

5.3 State Hooke's Law in formula form stating what each symbol represents in the formula. (3)

5.4 Calculate the:

5.4.1 Force that causes the spring to stretch (4)

5.4.2 Strain in the metal which is caused by the force (3)

5.4.3 Elasticity modulus of this metal (3)
[19]

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QUESTION 6

6.1 Define *viscosity*. (2)

6.2 Modern engine oils are specially designed as multi-grades. Motor oils that are marked 5W-30, 20W-50 and SAE-40 are shown in the picture below.



6.2.1 What does SAE stand for? (2)

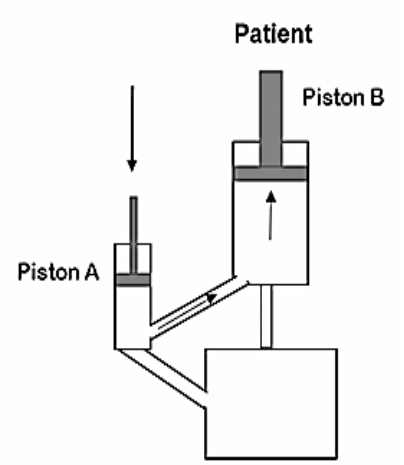
Which ONE of the two types of motor oils (5W-30 and 20W-50):

6.2.2 Has a higher viscosity at engine start up? (2)

6.2.3 Is recommended for the winter season? (2)

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6.3 A hydraulic system is used to lift patients in a dentistry chair. A force of 100 N is applied on Piston **A**, with an area of 1,2 x 10^{-3} m^2, to lift a patient of weight 1 200 N.



6.3.1 State *Pascal's law* in words. (2)

6.3.2 Calculate the area of piston **B**. (4)

A doctor wants to lift a heavier patient but with a smaller applied force.

6.3.3 What design change must the doctor make to the system to achieve this? (2)

6.3.4 Give THREE applications of Pascal's law. (3)
[19]

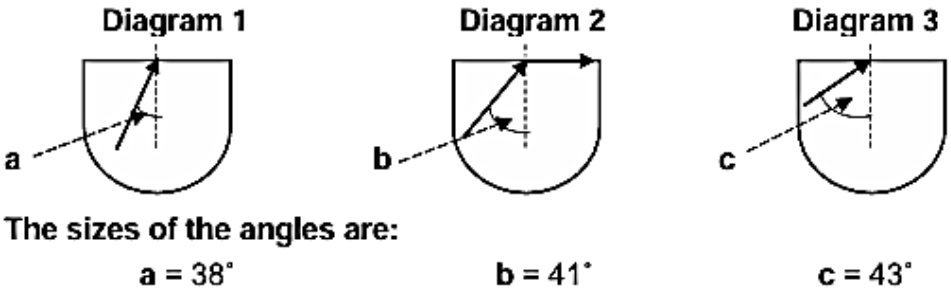
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QUESTION 7

7.1 State the *law of reflection of light*. (2)

7.2 Write down THREE properties of an image formed by a plane mirror. (3)

7.3 The diagrams below show the refraction of light in a semi-circular glass prism:



The sizes of the angles are:

a = 38° **b** = 41° **c** = 43°

7.3.1 Define *refraction of light.* (2)

7.3.2 What NAME is given to the angle of incidence labelled **B** in **Diagram 2**? (1)

7.3.3 Which medium (glass or air), is optically denser? (1)

7.3.4 In which diagram (**1** or **3)** will total internal reflection occur?
Give a reason for your answer. (3)

7.3.5 Write down TWO applications of total internal reflection. (2)
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TOTAL: 150

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DATA FOR TECHNICAL SCIENCES GRADE 12 PAPER 1/

GEGEWENS VIR TEGNIESE WETENSKAPPE GRAAD 12 VRAESTEL 1

TABLE 1/*TABEL 1*

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	9,8 $m \cdot s^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10^{8}$ $m \cdot s^{-1}$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}$ J·s
Coulomb's constant *Coulomb se konstante*	k	$9,0 \times 10^{9}$ $N \cdot m^{2} \cdot C^{-2}$
Charge on electron *Lading op elektron*	-e	$-1,6 \times 10^{-19}$ C
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}$ kg

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

FORCE/*KRAG*

$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F_{net} \Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$F_g = mg$
Torque = F x r⊥	MA = $\frac{L}{E} = \frac{e}{l}$

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

Speed/*Spoed*	$c = f\lambda$
Energy/*Energie*	$E = hf$ or/*of* $E = \frac{hc}{\lambda}$

WORK, ENERGY AND POWER/*ARBEID, ENERGIE EN DRYWING*

$W = F\Delta x\cos\theta$	$U = mgh$ or/*of* $E_P = mgh$
$K = \frac{1}{2}mv^2$ or/*of* $E_k = \frac{1}{2}mv^2$	$W_{net} = \Delta K$ or/*of* $W_{net} = \Delta E_k$ $\Delta K = K_f - K_i$ or/*of* $\Delta E_k = E_{kf} - E_{ki}$
$W_{nc} = \Delta K + \Delta U$ or/*of* $W_{nc} = \Delta E_k + \Delta E_p$	$P = \frac{W}{\Delta t}$
$P_{ave} = Fv_{ave}$ / $P_{gemid} = Fv_{gemid}$	$M_E = E_k + E_p$

ELASTICITY, VISCOSITY AND HYDRAULICS/*ELASTISITEIT, VISKOSITEIT EN HIDROULIKA*

$\sigma = \frac{F}{A}$	$\varepsilon = \frac{\Delta\ell}{L}$
$\frac{\sigma}{\varepsilon} = K$	$\frac{F_1}{A_1} = \frac{F_2}{A_2}$

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