Hoërskool Johan Jurgens

Physical Science Gr. 11

11 March 2026

Control Test – Term 1

Marks: 100

Time: 2 hours

Examiner: S Stoltz

Moderator: N Gertenbach

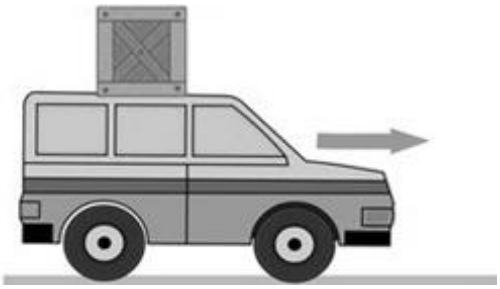
INSTRUCTIONS AND INFORMATION

1. The question paper consists of SIX questions. Answer ALL the questions.
2. Start EACH question on a NEW page.
3. Number your answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two sub-questions, e.g., between QUESTION 2.1 and QUESTION 2.2.
5. A non-programmable calculator may be used.
6. Appropriate mathematical instruments may be used.
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, etc. where required.
10. You are advised to use the attached data sheets.
11. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1 – 1.5).

1.1 A container is placed loosely on top of a car's roof while the car is stationary. The car then accelerates forward.
Friction between the car's roof and the container is negligible. Which ONE of the following statements CORRECTLY describe the motion of the container?



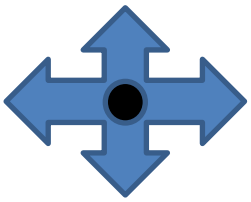
A. It will remain stationary at the position relative to the ground and then fall downwards to the ground after the car's roof has moved out from under it.

B. It will move forward in the direction of the truck.

C. It will move backwards as the car moves forward and then fall downwards to the ground.

D. It will first move forward and then backward. (2)

1.2 Several forces are acting on a moving object. Which ONE of the following statements is CORRECT when these forces are in equilibrium?



A. The velocity of the object is increasing.

B. The object is moving at a constant velocity.

C. The kinetic energy of the object is decreasing.

D. The object has a non-zero acceleration. (2)

1.3 Which ONE of the following represents a scalar quantity?

A. Force

B. Velocity

C. Acceleration

D. Speed (2)

1.4 The mass and radius of planet **A** is double the mass and radius of planet **B.** The mass of a person on planet **A** is **m**. What will be the mass of the same person on planet **B**?

A. **m**

B. 2**m**

C. 4**m**

D. ⅓**m** (2)

1.5 The resultant of two perpendicular vectors of 3 N and 4 N has a magnitude of:

A. 5 N

B. 7 N

C. 1 N

D. 12 N (2)

1.6 The direction of a vector is measured:

A. Anti-clockwise from the north

B. From the x-axis

C. From the origin

D. From the y-axis (2)

1.7 Newton's First Law states that a body will remain at rest or in uniform motion unless:

A. The net force on it is zero

B. A net external force acts on it

C. Friction acts on it

D. It loses mass (2)

1.8 If the distance between two masses is doubled, the gravitational force becomes:

A. Half

B. Double

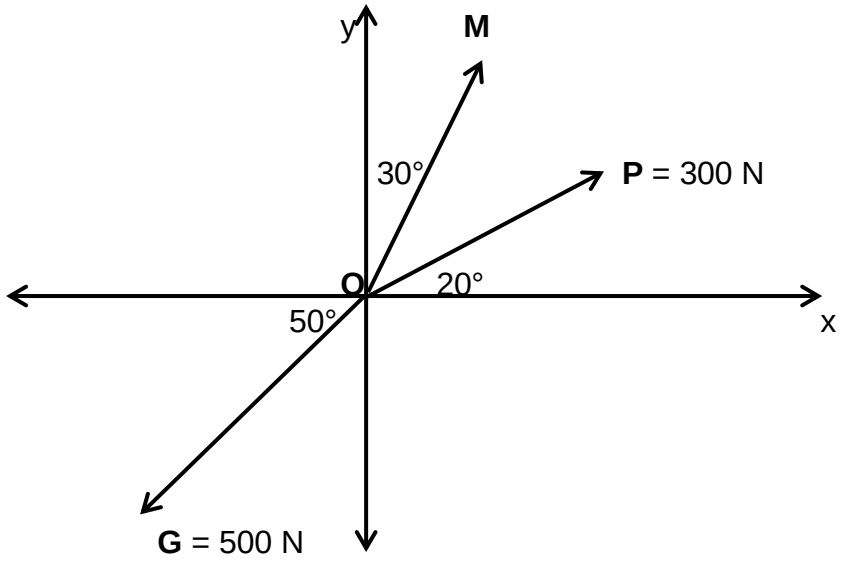
C. One-quarter

D. Four times greater (2)

[16]

QUESTION 2

Three forces **M**, **P**, and **G** act on point **O**, located at the origin of the cartesian plane. The forces are not drawn to scale.



2.1 Define a *vector*. (2)

2.2 Calculate the magnitude of the HORIZONTAL COMPONENT for force:

2.2.1 **P** (3)

2.2.2 **G** (2)

The horizontal of the components of the forces **M**, **P** and **G** is 266,94 N

2.3 Calculate the magnitude of force **M**. (3)

2.4 Define *resultant force*. (2)

2.5 Calculate the magnitude of the resultant force acting at point **O**. (5)

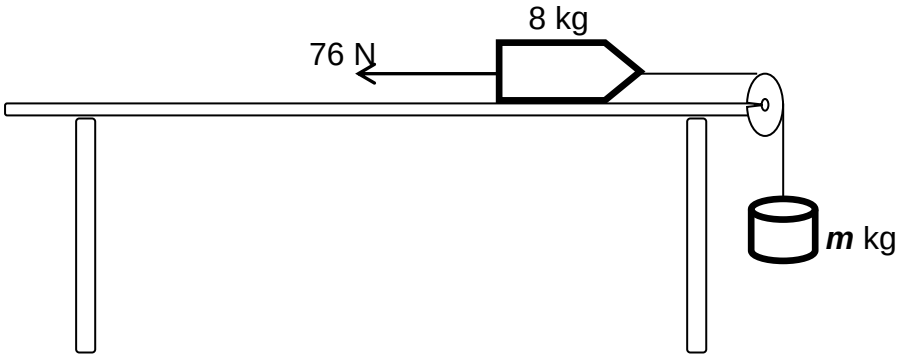
2.6 Is this system in equilibrium? Write YES or NO. (2)

2.7 Give a reason for your answer in QUESTION 2.6. (2)

[21]

QUESTION 3

A block of mass 8 kg is placed on a horizontal surface and is connected to an ***m*** kg block which hangs vertically by means of an INEXTENSIBLE string that passes over a light frictionless pulley as shown in the diagram below. A force of 76 N is applied horizontally to keep the system sliding to the right and downwards at a CONSTANT VELOCITY.



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

3.2 Draw a labelled free-body diagram of all forces acting on the 8 kg block. (5)

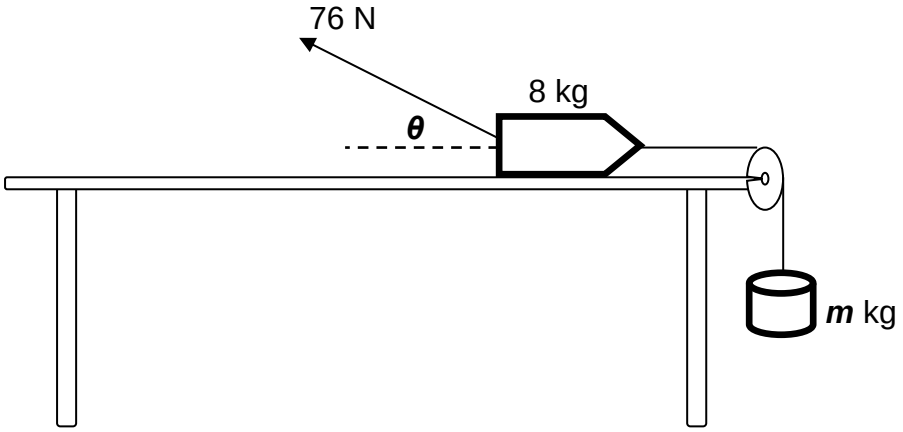
3.3 The coefficient of kinetic friction between the block and the surface is 0,2.

Calculate:

3.3.1 The frictional force acting on the 8 kg block. (3)

3.3.2 **m**, the mass of the hanging block. (4)

3.4 The applied force now acts at an angle ***θ*** to the horizontal as shown in the diagram below.



What will the effect be on the following?
Choose from INCREASE, DECREASE or REMAIN THE SAME.

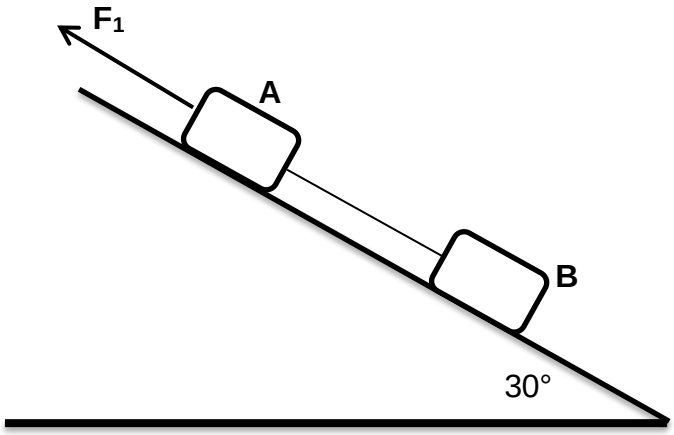
3.4.1 The coefficient of kinetic friction? (1)

3.4.2 The kinetic friction acting on the 8 kg block? Explain your answer. (3)

[18]

QUESTION 4

A light inelastic string connects two blocks **A** and **B** of mass 2 kg and ***m*** kg respectively.
The blocks are pulled up an inclined plane that makes an angle of 30° with the horizontal by a force of magnitude $\mathbf{F_1}$, as shown in the diagram.



The coefficients of kinetic friction for block **A** and block **B** are 0,15 and 0,45 respectively.

4.1 Draw a labelled free-body diagram indicating all the forces acting on block **B** as it moves up the inclined plane. (4)

The blocks accelerate up the incline at 5,72 $m.s^{-2}$ and the tension in the string joining the two blocks is 18 N.

4.2 Define *acceleration*. (2)

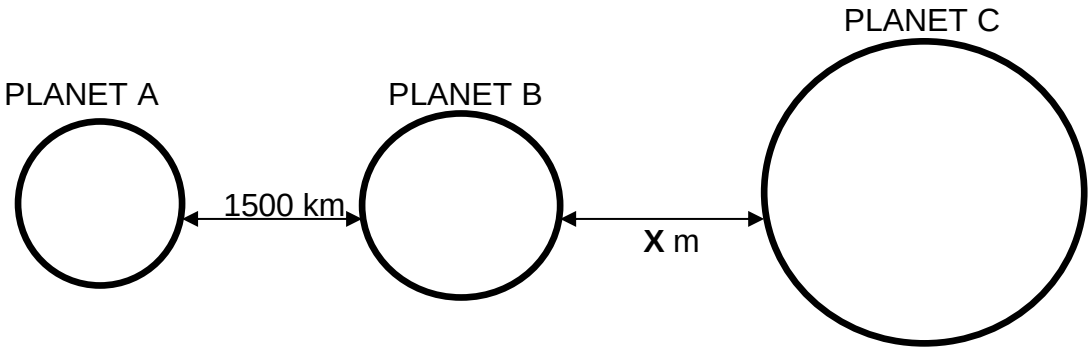
4.3 Calculate the numerical value of **m**. (5)

The magnitude of force $\mathbf{F_1}$ is now changed to $\mathbf{F_2}$ so that the blocks move up the inclined plane at a CONSTANT VELOCITY.

4.4 Calculate the magnitude of $\mathbf{F_2}$. (6)
[17]

QUESTION 5

Consider three planets **A**, **B** and **C** arranged in a straight line as shown in the diagram below.



PLANET	***Mass of planet (kg)***	***Radius of planet (m)***
A	$6,42 \times 10^{23}$	$3,93 \times 10^{6}$
B	$5,98 \times 10^{24}$	$6,38 \times 10^{6}$
C	$1,92 \times 10^{25}$	$7,20 \times 10^{6}$

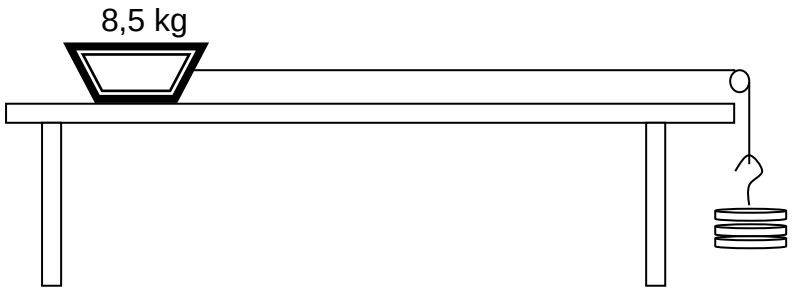
5.1 State Newton's Law of Universal Gravitation in words. (2)

5.2 Calculate the gravitational force exerted by planet **A** on planet **B**. (4)

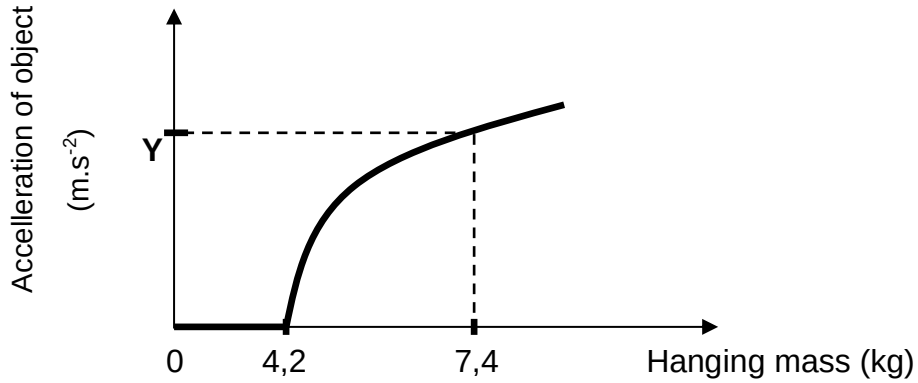
5.3 Planet **B** experiences a zero net force due to planet **A** and planet **C**. Calculate the distance **X** on the diagram above. (6)
[12]

QUESTION 6

In an experiment, an object of mass 8,5 kg, lying stationary on a rough horizontal table, is connected to a mass hanger by means of a light inextensible string passing over a frictionless pulley, as shown in the diagram below. Mass pieces are added to the mass hanger and the acceleration of the crate is measured. The experiment is repeated several times by adding different masses to increase the hanging mass each time. Ignore the effects of air friction.



The results obtained were used to draw the sketch graph below.



6.1 Define the term *static friction*. (2)

6.2 Draw a labelled free-body diagram showing ALL the HORIZONTAL forces acting on the object JUST BEFORE it starts moving. (2)

6.3 Calculate the:

6.3.1 Coefficient of static friction (μ_s). (4)

6.3.2 Magnitude of the acceleration represented by **Y** on the graph if the coefficient of kinetic friction between the object and the table is 0,40. (6)

6.4 A 5 kg block is now placed on top of the object and the experiment is repeated.
How will this affect the maximum static frictional force now experienced by the object?
Choose from INCREASES, DECREASES or REMAINS THE SAME.
Give a reason for the answer. (2)
[16]

PAPER TOTAL: 100 MARKS

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11
(FISIKA)
DATA FOR PHYSICAL SCIENCES GRADE 11
(PHYSICS)

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

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
Charge on electron *Lading op elektron*	e^-	$-1,6 \times 10^{-19}$ C
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}$ kg
Radius of earth *Radius van aarde*	R_E	$6,38 \times 10^{3}$ km
Universal gravitational constant *Universelegravitasiekonstant*	G	$6,67 \times 10^{-11}$ $N \cdot m^2 \cdot kg^{-2}$
Mass of earth *Massa op aarde*	M	$5,98 \times 10^{24}$ kg
Coulomb's constant *Coulomb se konstante*	k	$9,0 \times 10^{9}$ $N \cdot m^2 \cdot C^{-2}$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

$v_f = v_i + a\Delta t$	$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$	$\Delta x = \left(\frac{v_f + v_i}{2} \right) \Delta t$

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

$K = E_k = \frac{1}{2} mv^2$	$U = E_P = mgh$
$E_M = E_k + E_p$ or/of $E_M = K + U$	

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

$v = f\lambda$	$T = \frac{1}{f}$
$E = hf$ or/of $E = h\frac{c}{\lambda}$	

ELECTROSTATICS/*ELEKTROSTATIKA*

$n = \frac{Q}{e}$	$Q = \frac{Q_1 + Q_2}{2}$
$E = \frac{F}{q}$	$E = \frac{kQ}{r^2}$

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$R = \frac{V}{I}$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + ...$
$R_s = R_1 + R_2 + ...$	$Q = I\Delta t$
$V = \frac{W}{Q}$	$\Phi = BA\cos\theta$
	$\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$

PHYSICAL SCIENCE
GRADE 11
CONTROLLED TEST
2026 TERM 1
MARKING GUIDELINES

QUESTION 1 **Reason:**

1.1 A ✓✓ Newton 1 (2)

1.2 B ✓✓ (2)

1.3 D ✓✓ (2)

1.4 A ✓✓ (2)

1.5 A ✓✓ Pythagoras (2)

1.6 A ✓✓ (2)

1.7 B ✓✓ (2)

1.8 C ✓✓ (2)

[16]

QUESTION 2

2.1 A physical quantity that has both magnitude and direction. ✓✓ (2)

2.2.1 $F_{P_x} = F_P cos\theta$ ✓
$= 300cos20°$ ✓
$= 281{,}91\ N$ ✓ (3)

2.2.2 $F_{G_x} = F_P cos\theta$
$= 500cos50°$ ✓
$= 321{,}39\ N$ ✓ (2)

2.3 $F_{x(net)} = F_{M(x)} + F_{P(x)} + F_{G(x)}$
$266{,}94$✓ $= F_{M(x)} + 281{,}91 + (-321{,}39)$✓
$F_{M(x)} = 306{,}42\ N$

$F_{M(x)} = F_M cos\theta$
$306{,}42 = F_M cos60°$
$M = 612{,}84\ N$✓ (3)

2.4 The single force that has the same effect as two or more forces acting together on an object. ✓✓ (2)

2.5 $F_{y(net)} = F_{M(y)} + F_{P(y)} + F_{G(y)}$
$= F_M sin\theta + F_P sin\theta + F_G sin\theta$
$= 612{,}84(sin60°)✓ + 300(sin20°)✓ - 500(sin50°)✓$
$= 250{,}33\ N$

$F_{RES}^2 = (266{,}94)^2 + (250{,}33)^2✓$
$F_{RES} = 387{,}09\ N✓$ (5)

2.6 NO ✓✓ (2)

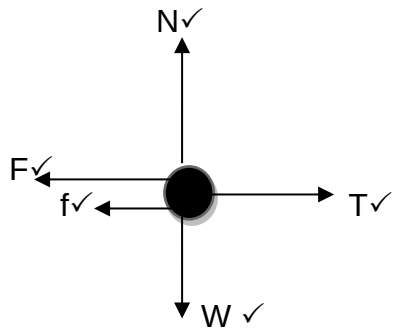
2.7 $F_{net} \neq 0\ N$ ✓✓ (2)

[21]

QUESTION 3

3.1 When a resultant/net force acts on an object, the object will accelerate in the direction of the resultant/net force with an acceleration that is directly proportional to the resultant/net force and inversely proportional to the mass of the object.✓✓ (2)

3.2



(5)

3.3.1 $f_k = \mu_k N$ ✓
$= 0{,}2(8)(9{,}8)$ ✓
$= 15{,}68\ N$ ✓ (3)

3.3.2 Consider the 8 kg mass. (Choose to the right and downwards as positive.)

$F_{net} = ma✓$
$-F - f_k + T = 0✓$
$-76 - 15{,}6 + T = 0$
$T = 91{,}6\ N$

Consider the ***m*** kg mass.

$F_{net} = ma$
$F_g - T = 0$
$m(9{,}8) - 91{,}6 = 0$ ✓
$m = 9{,}35\ kg$ ✓ (4)

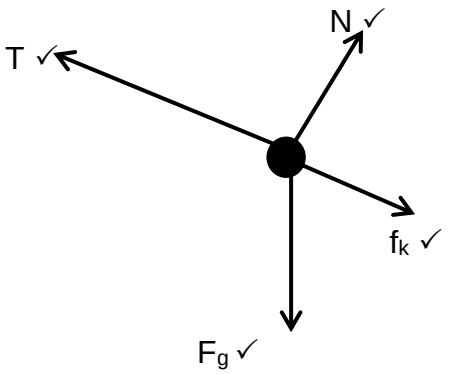
3.4.1 REMAIN THE SAME ✓ (1)

3.4.2 DECREASE ✓
Normal force decreases ✓
$N = F_g - F\sin\theta$; f_k α N ✓ / $f_k = \mu_k N$ (3)

[18]

QUESTION 4

4.1



(4)

4.2 The rate of change of velocity. ✓✓ (2)

4.3 Consider the ***m*** kg block.
$F_{net} = ma$✓
$T - f_k - F_{g\parallel} = ma$
$18 - \mu_k N - mg\sin\theta = ma$
$18 - (0{,}45)(m)(9{,}8)(\cos 30°)$✓ $- (9{,}8)(m)\sin 30°$✓ $= m(5{,}72)$✓
$m = 1{,}25\ kg$✓ (5)

4.4 Consider the ***m*** kg (1,25 kg) block.
$F_{net} = ma$
$T - f_k - F_{g\parallel} = 0$
$T - 0{,}45(1{,}25)(9{,}8)\cos 30°$✓ $- 1{,}25(9{,}8)\sin 30°$✓ $= 0$✓
$T = 10{,}9\ N$

Consider the 2 kg block.

$F_{net} = ma$

$F_2 - f_k - F_{g\parallel} - T = 0$

$F_2 - 0{,}15(2)(9{,}8)cos30° + 2(9{,}8)sin30° - 10{,}9\checkmark = 0\ \checkmark$

$F_2 = 3{,}65\ N\checkmark$ (6)

[17]

QUESTION 5

5.1 Each body in the universe attracts every other body with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centres. ✓✓ (2)

5.2 $F_{AB} = \frac{Gm_Am_B}{r^2}\ \checkmark$

$F_{AB} = \frac{6{,}67\times10^{-11}(6{,}42\times10^{23})(5{,}98\times10^{24})\ \checkmark}{(3{,}93\times10^{6}+1500\times10^{3}+6{,}38\times10^{6})^2\ \checkmark}$

$F_{AB} = 1{,}84 \times 10^{24} N\ \checkmark$ (4)

5.3 $F_{BC} = \frac{Gm_Bm_C}{r^2}\checkmark$

$F_{BC} = \frac{6{,}67\times10^{-11}(1{,}92\times10^{25})(5{,}98\times10^{24})}{(d)^2}\ \checkmark$

$F_{BC} = \frac{7{,}658\times10^{39}}{(d)^2}$

$F_{net} = F_{BC} - F_{AB}$

$0 = \frac{7{,}658\times10^{39}}{(d)^2} - 1{,}84 \times 10^{24}\checkmark$

$d = 6{,}45 \times 10^{7}\ m\ \checkmark$

$X = 6{,}45 \times 10^{7} - 6{,}38 \times 10^{6} - 7{,}2 \times 10^{6}\checkmark$

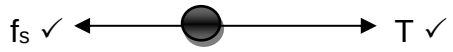
$X = 5{,}09 \times 10^{7}\ m\ \checkmark.$ (6)

[12]

QUESTION 6

6.1 The force that opposes the tendency of motion of a stationary object relative/parallel to a surface. ✓✓ (2)

6.2



(2)

6.3.1 $f_s^{max} = T = F_{g(hanging\ masses)}$
$f_s^{max} = m_{hanging}g$ ✓
$\mu_s N = 4{,}2(9{,}8)$
$\mu_s(8{,}5)(9{,}8)$ ✓ $= 4{,}2(9{,}8)$✓
$\mu_s = 0{,}49$ ✓ (4)

6.3.2 <u>For the object.</u>
$F_{net} = ma$ ✓
$T - f_k = ma$
$T - \mu_k mg = ma$
$T - 0{,}4(8{,}5)(9{,}8)$✓ $= 8{,}5a$✓ .....[a]
<u>For the hanging masses.</u>
$F_{net} = ma$
$mg - T = ma$
$7{,}4(9{,}8) - T$✓ $= 7{,}4a$ ✓.....[b]
$Y = a = 2{,}47\ m.s^{-2}$✓
(6)

6.4 INCREASES ✓ $f_{s_{max}}$ α N ✓
OR $f_{s_{max}}$ α m
OR $f_{s_{max}} = \mu_s N$
OR the normal force acting on the crate increases
OR increase in mass/weight of crate (increases the normal force) (2)

[16]

PAPER TOTAL: 100 MARKS

TAXONOMY LEVELS					
GRADE 11					
PHYSICAL SCIENCES					
Control Test - TERM 1 - 2026					
MARKS: 100					
QUESTION	**RECALL**	**COMPREHENSION**	**ANALYSIS APPLICATION**	**EVALUATION SYNTHESIS**	**TOTAAL**
DESIRED %	**15%**	**35%**	**40%**	**10%**	**100%**
1.1		2			2
1.2	2				2
1.3	2				2
1.4		2			2
1.5		2			2
1.6		2			2
1.7	2				2
1.8		2			2
2.1	2				2
2.2.1			3		3
2.2.2			2		2
2.3			3		3
2.4	2				2
2.5			5		5
2.6		2			2
2.7		2			2
3.1	2				2
3.2				5	5
3.3.1			3		3
3.3.2			4		4
3.4.1		1			1
3.4.2		3			3
4.1				4	4
4.2	2				2
4.3			5		5
4.4			6		6
5.1	2				2
5.2			4		4
5.3			6		6
6.1	2				2

6.2				2	2
6.3.1			4		4
6.3.2			6		6
6.4		2			2
Total	**18**	**20**	**51**	**11**	**100**
Actual %	**18**	**20**	**51**	**11**	**100**
Desired %	**15%**	**35%**	**40%**	**10%**	**100**