education

DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

GRADE 12

PHYSICAL SCIENCES MONTHLY TEST

APRIL 2020

TOPIC: NEWTON'S LAWS

QUESTION PAPER

MARKS: 55

TIME: 1:10 HOURS

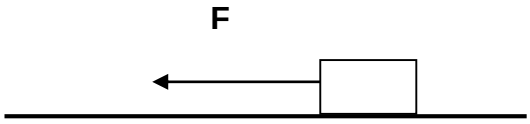
This question paper consists of 6 pages

INSTRUCTIONS:

1. Attempt ALL questions.
2. Round off your final answers to a minimum of TWO decimal places
3. Write neatly and legibly.

QUESTION 1: Multiple-choice questions

1.1 A block, being pulled by a force **F**, and moving to the left on a rough horizontal surface, is slowing down.



The directions of the resultant force and the acceleration are …

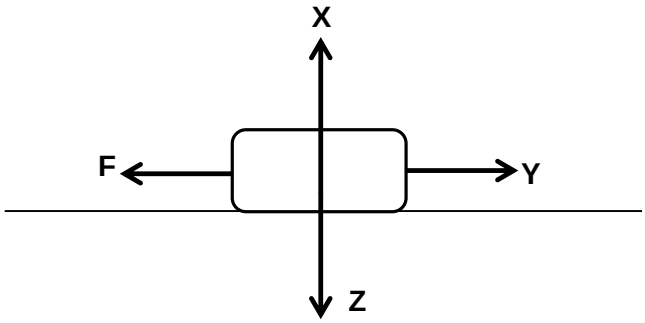
	direction of resultant force	**direction of acceleration**
A	to the right	to the left
B	to the right	to the right
C	to the left	to the left
D	to the left	to the right

(2)

1.2 The magnitude of the gravitational force exerted by one body on another body is *F*. When the distance between the centres of the two bodies is doubled, the magnitude of the gravitational force, in terms of *F*, will now be …

A ¼ F
B ½ F
C 2 F
D 4 F (2)

1.3 A learner pulls a block at a CONSTANT SPEED over a rough horizontal surface with a force **F**. The force diagram below shows all the forces acting on the block.



Which ONE of the following relationships between the magnitudes of the forces **F**, **X**, **Y** and **Z** is true?

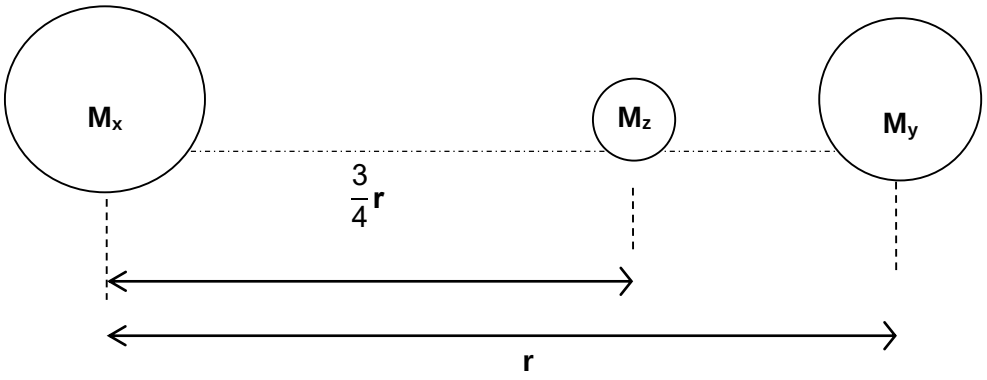
A F > Y and X = Z

B F > Y and X < Z

C F = Y and X = Z

D F = Y and X < Z (2)

1.4 Two masses $\mathbf{M_x}$ and $\mathbf{M_y}$ are placed at a distance **r** apart. A third mass $\mathbf{M_z}$ experiences a ZERO resultant horizontal gravitational force when it is placed $\frac{3}{4}\mathbf{r}$ from $\mathbf{M_x}$ on the line between $\mathbf{M_x}$ and $\mathbf{M_y}$.



The ratio of the two masses $\mathbf{M_x}$: $\mathbf{M_y}$ is:

A 3 : 1

B 4 : 3

C 9 : 1

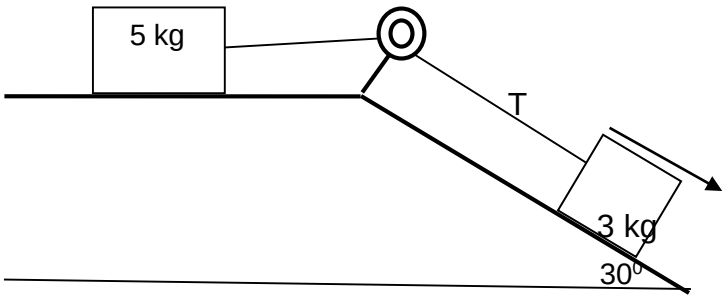
D 16 :1 (2)

1.5 When a spaceship moves at constant velocity, it means that the resultant force acting on the body is zero. This phenomenon is best explained by

A Newton's First Law.
B Newton's Second Law.
C Newton's Third Law.
D Newton's Universal Gravitational Law. (2)

QUESTION 2

Two blocks of masses 5 kg and 3 kg respectively are connected by a light inextensible string that runs over a light frictionless pulley as shown in the diagram below. The 5 kg block experience a frictional force of 8 N and the coefficient of kinetic friction between the 3 kg block and the surface of the inclined plane is 0,15.



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

2.2 Draw a labelled free-body diagram to indicate all the forces acting on the 3 kg block. (3)

2.3 Calculate the:

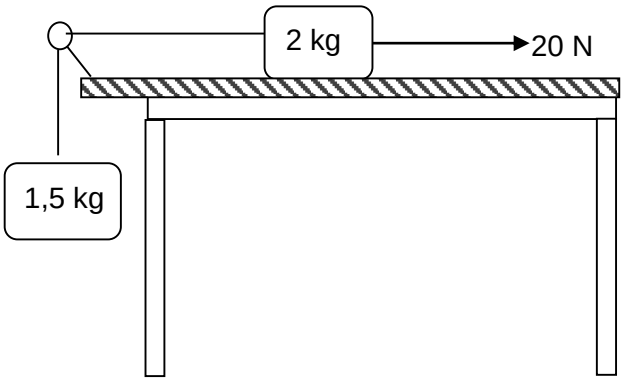
2.3.1 Magnitude of the frictional force acting between the 3 kg block and the surface of the inclined plane (3)

2.3.2 Magnitude of the tension **T** in the string (6)

[14]

QUESTION 3

A block of mass 2 kg is at rest on a rough horizontal surface. The block is connected to another block of mass 1,5 kg by means of a light inextensible string which hangs over a frictionless pulley. The 2 kg block experiences a constant frictional force of 3,1 N when a force of 20 N is applied to the block as shown in the diagram below. Ignore the effects of air friction.



3.1 Define the term *kinetic frictional force*. (2)

3.2 Draw a labelled free-body diagram indicating ALL the forces acting on the **2 kg block**. (5)

3.3 Apply Newton's Second Law to each of the blocks and calculate the magnitude of the acceleration of the blocks. (6)

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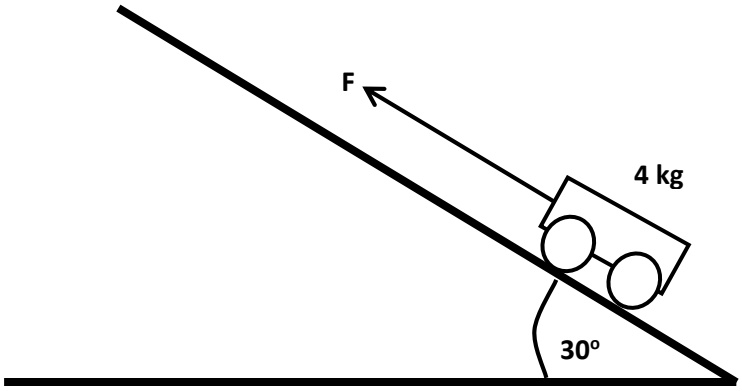
QUESTION 4

4.1 A 4 kg trolley is at rest on a rough inclined surface, which makes an angle of 30^o with the horizontal. A constant force is applied, causing the trolley to accelerate up the incline for 2m at 0, 43 $m{\cdot}s^{-2}$. (Ignore the rotation effects of the wheels and air friction.)



4.1.1 State, in words, Newton's Second Law of Motion. (2)

4.1.2 Draw a labelled free body diagram showing ALL the forces acting on the trolley as it moves up the slope. (4)

4.1.3 If the coefficient of kinetic friction along the incline μ_k is 0,2, calculate the:

(a) Frictional force on the trolley as it moves up the slope (3)
(b) Applied force F (5)

4.2 A spaceship, mass 2 000 kg, is moving towards Earth. Calculate the magnitude of the gravitational force that the spaceship will experience when it is 100 km above the Earth's surface. (4)

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TOTAL: 55

DATA FOR PHYSICAL SCIENCES P1 GRADE 12 CAPS

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	9,8 $m \cdot s^{-2}$
Speed of light in a vacuum	c	3,0 x 10^8 $m \cdot s^{-1}$
Planck's constant	h	6,63 x 10^{-34} $J \cdot s$
Gravitational constant	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Coulombs constant	k	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
Charge on electron	e	-1,6 x 10^{-19} C
Electron mass	m_e	9,11 x 10^{-31} kg

TABLE 2: MOTION

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

TABLE 3: FORCE

$F_{net} = ma$	$p = mv$
$f_{s(max)} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = \frac{Gm_1m_2}{r^2}$	$g = \frac{Gm}{r^2}$