education

DEPARTMENT: EDUCATION

MPUMALANGA PROVINCE

GRADE 12

PHYSICAL SCIENCES MONTHLY TEST

APRIL 2020

TOPIC: WORK, ENERGY& POWER

QUESTION PAPER

MARKS: 55

TIME: 1:10 HOURS

This question paper consists of 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

1.1 A net force **F** accelerates two isolated objects, **P** and **Q**, from rest on a straight line for time **t** as shown below. Object **P** experiences an acceleration of **a** and object **Q** an acceleration of **2a.**

If the amount of work done by net force **F** on object **P** equals **W**, the amount of work done on **Q** will be …

A W. (2)

B ½ W.

C 2 W.

D 4 W.

1.2 Which one of the following forces is a conservative force?

A Friction

B Weight

C Normal force

D Applied force (2)

1.3 The speed of a bicycle increases from 2 $m \cdot s^{-1}$ to 8 $m \cdot s^{-1}$. Its kinetic energy Increases by a factor of….

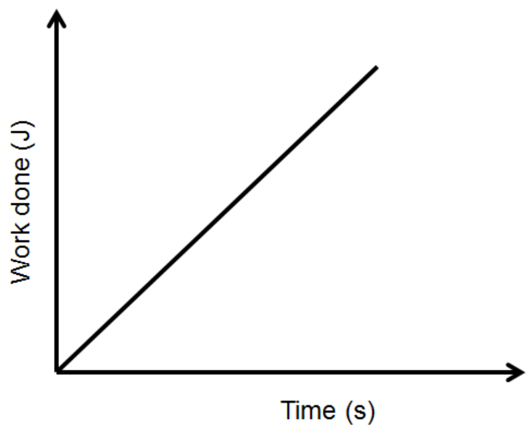
A 4

B 6

C 8

D 16 (2)

1.4 The graph below represents the relationship between the work done on an object and the time taken for this work to be done.



The gradient of the graph represents the …

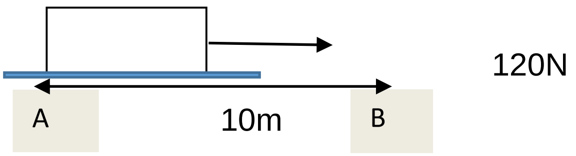
A power
B momentum
C kinetic energy
D potential energy (2)

1.5 The work done by a constant force F applied to an object to increase the object's speed from v to 2v is W. The work done by the same force to increase the speed of the object from 0 to v will be...

A $\frac{1}{3}W$
B $\frac{1}{2}W$
C 2W
D 3W (2)

QUESTION 2

Dlamini pulls a box horizontally on a rough surface. He applies a 60N force over a distance of 10m.A friction force of 16N acts on the box during its motion.



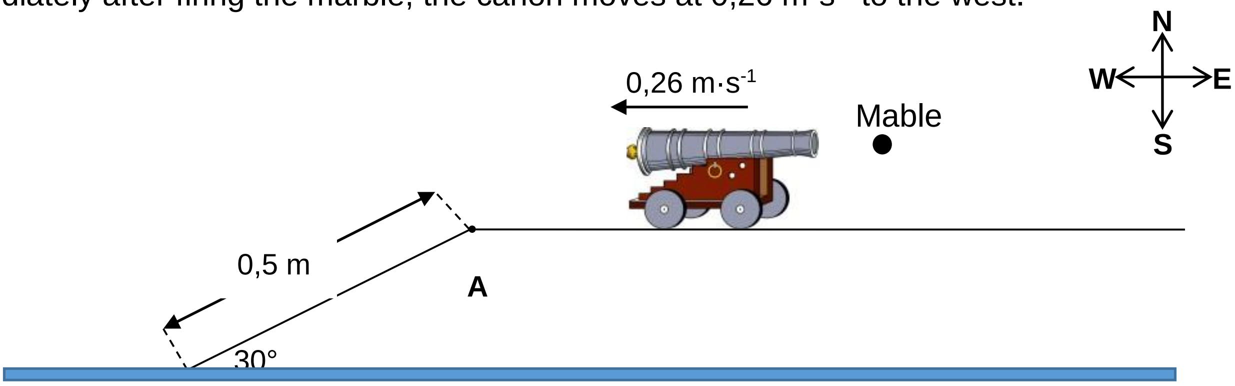
2.1 Draw a free body diagram showing all the forces acting on the box. (4)
2.2 Calculate the work done by each horizontal force acting on the box. (4)
2.3 Calculate the net force acting on the box (3)

2.4 Calculate the net work done on the box (4)

[15]

QUESTION 3

A toy canon, mass 1,6 kg, is at rest on a rough horizontal surface as shown in the diagram. A steel marble, mass 0,8 kg, is fired horizontally to the east from the canon. Immediately after firing the marble, the canon moves at 0,26 $m \cdot s^{-1}$ to the west.



3.1 Calculate the speed of the steel marble immediately after firing the marble. (4)

3.2 The steel marble experiences a force **F** during the firing. Explain in terms of **F** how the force experienced by the CANON compares with that experienced by the steel marble. (3)

The canon reaches point **A** with a speed of 0,2 $m \cdot s^{-1}$ and then moves down a rough

0,5m a long a slope AB.

3.3 Define the term none conservative force. (2)

3.4 Explain why this is NOT a closed system. (1)

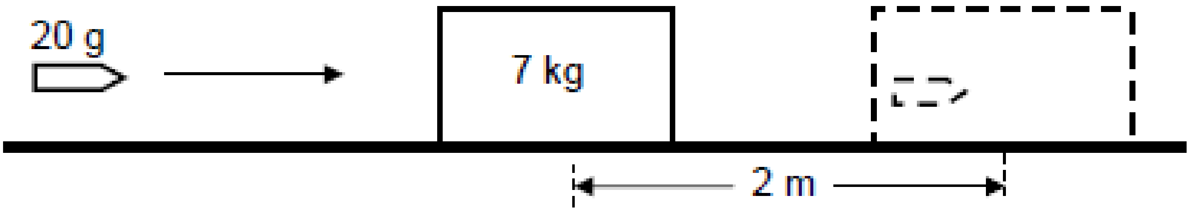
3.5 Calculate the kinetic frictional force experienced by the canon as it moves from **A** to **B** if the coefficient of kinetic friction (μ_k) is 0,12. (3)

3.6 Using ENERGY PRINCIPLES only, calculate the velocity of the canon at point **B**. (4)

[17]

QUESTION 4

The diagram below shows a bullet of mass 20 g that is travelling horizontally. The bullet strikes a stationary 7 kg block and becomes embedded in it. The bullet and the block together travel on a rough horizontal surface a distance of 2 m before coming to a stop.



4.1 State work energy theorem in words (2)

4.2 Use the work-energy theorem to calculate the magnitude of the velocity of the bullet-block system immediately after the bullet strikes the block, given that the frictional force between the block and the surface is 10 N. (5)

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

4.4 Calculate the magnitude of the velocity with which the bullet hits the block. (4)

[13]

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·s^{-2}
Speed of light in a vacuum	c	3,0 x 10^{8} m·s^{-1}
Planck's constant	h	6,63 x 10^{-34} J·s
Gravitational constant	G	6,67 x 10^{-11} N·m^{2}·kg^{-2}
Coulombs constant	k	9,0 x 10^{9} N·m^{2}·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

$F_{net} = ma$	$p = mv$
$f_{s(max)} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = \dfrac{Gm_1 m_2}{r^2}$	$g = \dfrac{Gm}{r^2}$

TABLE 4: WORK, ENERGY AND POWER

$W = F\Delta x \cos\theta$	$U = mgh$ 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 $W_{nc} = \Delta E_k + \Delta E_p$	$P = \dfrac{W}{\Delta t}$
$P_{av} = F \cdot v_{av}$ / $P_{gem} = F \cdot v_{gem}$	