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education

Department:
Education
PROVINCE OF KWAZULU-NATAL

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

PHYSICAL SCIENCES: PHYSICS (P1)

COMMON TEST

MARCH 2019

MARKS: 50

TIME : 1 hour

This question paper consists of 6 pages and a 1-page data sheet.

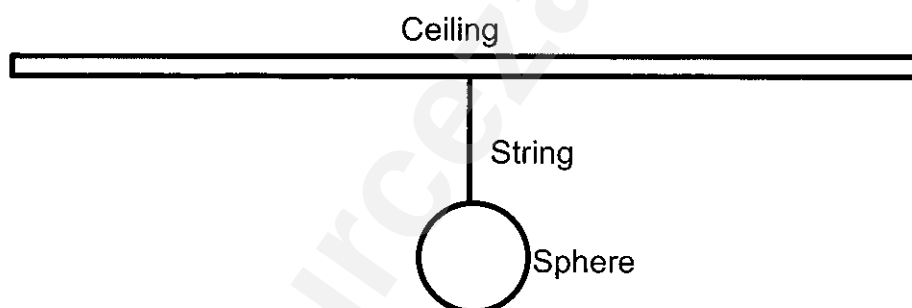
INSTRUCTIONS AND INFORMATION TO CANDIDATES

1. Write your name on the **ANSWER BOOK**.
2. This question paper consists of **FOUR** questions. Answer **ALL** the questions in the **ANSWER BOOK**.
3. Start **EACH** question on a **NEW** page in the **ANSWER BOOK**.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave **ONE** line between two subsections, for example between **QUESTION 2.1** and **QUESTION 2.2**.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached **DATA SHEET**.
9. Show **ALL** formulae and substitutions in **ALL** calculations.
10. Round off your final numerical answers to a minimum of **TWO** decimal places.
11. Give brief motivations, discussions, et cetera where required.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE- CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A - D) next to the question number (1.1 – 1.4) in the ANSWER BOOK, for example 1.5 D.

- 1.1 A ball is fired vertically upwards from the ground. Which statement is TRUE when the ball reaches its MAXIMUM HEIGHT? (Neglect friction)
- A The gravitational force acting on the ball is zero.
B The gravitational force acts downwards on the ball.
C There is no net force acting on the ball.
D The gravitational force is equal to the upward force acting on the ball. (2)
- 1.2 A sphere is attached to a string, which is suspended from a horizontal ceiling, as shown in the sketch below:



- The reaction force to the gravitational force on the sphere, is...
- A The force of the ceiling on the sphere.
B The force of the ceiling on the string.
C The tension force in the string on the sphere
D The gravitational force of the sphere on the Earth. (2)
- 1.3 An astronaut on a strange planet finds that acceleration due to gravity on the surface of this planet is TWICE the acceleration due to gravity on the surface of the Earth.
- From this, it can be deduced that:
- A Both the mass and radius of the planet are twice that of the Earth.
B Radius of the planet is half that of the Earth but the mass is the same as that of the Earth.
C Both the mass and radius of the planet are half that of the Earth.
D Mass of the planet is half that of Earth but radius is same as that of the Earth. (2)

1.4 When an airbag inflates in a car during a collision, the chances of serious injury to a passenger are reduced because the ...

- A Passenger is brought to rest in a shorter period of time.
- B Passenger's change in momentum is reduced.
- C Passenger's change in momentum is increased.
- D Net force acting on the passenger is reduced.

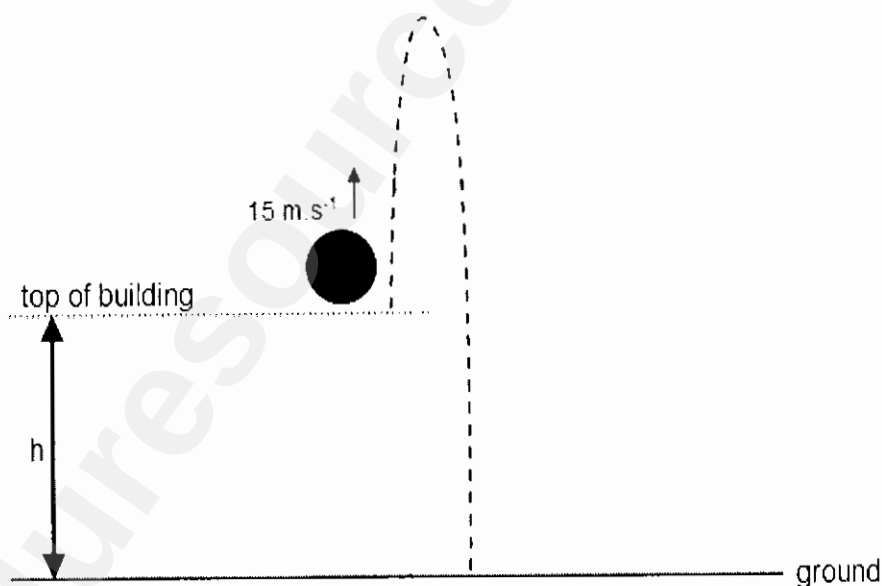
(2)

[8]

QUESTION 2

An object is projected vertically upwards from the top of the building, of height 'h', with an initial velocity of 15 m.s^{-1} . On its way down the object passes the top of the building and lands on the ground below. The object strikes the ground with a velocity of $71,45 \text{ m.s}^{-1}$.

Ignore the effects of air resistance.



2.1 Define the term *projectile*. (2)

2.2 Calculate:

2.2.1 The time taken for the object to reach the ground. (4)

2.2.2 Height, h, of the building. (4)

- 2.3 Draw a velocity versus time graph for the entire motion of the object. TAKE UPWARDS AS POSITIVE.

On your graph, indicate the following:

- initial velocity
- final velocity
- time taken to reach the ground.

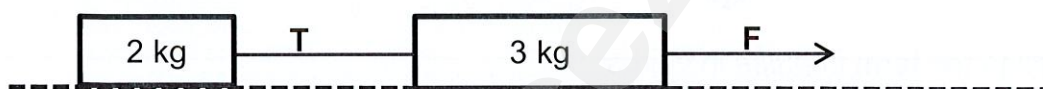
(5)
[15]

QUESTION 3

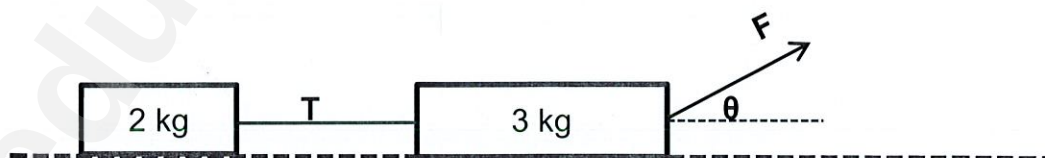
Two blocks, with masses 2 kg and 3 kg, are connected by a light inextensible string as shown below. A horizontal force, F , is applied on the 3 kg block such that the system accelerates to the right at $0,5 \text{ m.s}^{-2}$.

The kinetic frictional force between the floor and the 2 kg block and the 3 kg is 4 N and 6 N respectively.

The tension in the string is T . Ignore the mass of the string.



- 3.1 Draw a fully labeled free-body diagram for the 3 kg block. (5)
- 3.2 Define the term *kinetic frictional force* in words. (2)
- 3.3 Calculate:
- 3.3.1 The magnitude of the tension, T . (4)
- 3.3.2 The magnitude of the force, F . (4)
- 3.4 The force, F , on the 3 kg block now acts at angle θ to the horizontal and the blocks continue moving along the floor.

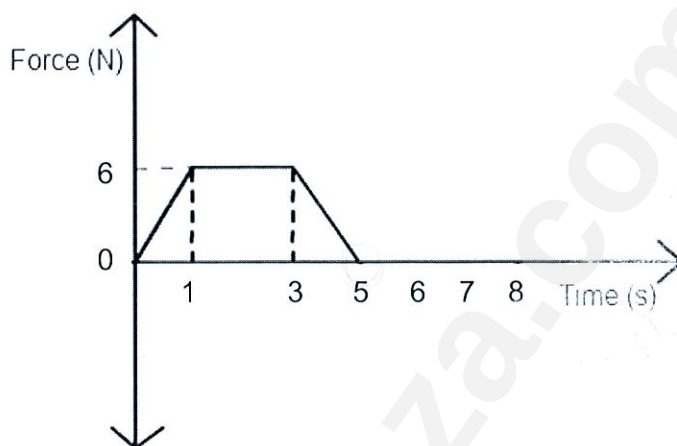


- 3.4.1 How will the magnitude of the kinetic frictional force on the 3 kg block be affected? Write INCREASES, DECREASES OR REMAINS THE SAME. (1)
- 3.4.2 Explain your answer to question 3.4.1 above. (2)

[18]

QUESTION 4

An object of mass 2 kg is travelling at $10\text{ m}\cdot\text{s}^{-1}$ along a smooth horizontal surface when a horizontal force acts on it. The following graph shows the variation of the force with time.



- 4.1 Define the term *impulse* in words. (2)
- 4.2 Use the graph to calculate:
- 4.2.1 The magnitude of the impulse of the object. (3)
- 4.2.2 The magnitude of the velocity of the object at 5 seconds. (3)
- 4.3 What happens to the momentum of the object after 5 seconds?
(Choose from INCREASES; DECREASES or REMAINS THE SAME) (1)

[9]**TOTAL : [50]**

DATA FOR PHYSICAL SCIENCES (PHYSICS) GRADE 12

GEGEWENS VIR FISIESE WETENSKAPPE (FISIKA) GRAAD 12

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIESE KONSTANTES

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Acceleration due to gravity Swaartekragversnelling	g	9,8 m·s ⁻²
Universal gravitational constant	G	6,67 x 10 ⁻¹¹ N·m ² ·kg ⁻²

TABLE 2: FORMULAE/TABEL 2: FORMULES

MOTION/BEWEGING

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

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$F_{\text{net}} = ma$	$p = mv$
$F_{\text{net}} \Delta t = \Delta p = mv_f - mv_i$	$F_g = mg$
$F = \frac{Gm_1m_2}{r^2}$	
$f_s^{\text{max}} = \mu_s N$	$f_k = \mu_k N$

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PHYSICAL SCIENCES P1

MEMORANDUM

COMMON TEST

MARCH 2019

**NATIONAL
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GRADE 12

This memorandum consists of 5 pages including this page.

MARKS: 50

TIME : 1 hour

PHYSICAL SCIENCES PAPER ONE

QUESTION 1

- 1.1 B✓✓ (2)
 1.2 D✓✓ (2)
 1.3 C✓✓ (2)
 1.4 D ✓✓ (2)
[8]

QUESTION 2

- 2.1 An object upon which the only force acting is the force of gravity. ✓✓ (2)

NB: IF MOTION IS BROKEN DOWN FOR QUESTIONS 2.2.1 AND 2.2.2 INTO PARTS ACCEPT THE ANSWERS

- 2.2.1
- | | |
|--|---|
| <p>Upward is positive</p> $v_f = v_i + a\Delta t \checkmark$ $-71,45 \checkmark = 15 + (-9,8)\Delta t \checkmark$ $\Delta t = 8,82 \text{ s } \checkmark$ | <p>Upward is negative</p> $v_f = v_i + a\Delta t \checkmark$ $71,45 \checkmark = -15 + 9,8\Delta t \checkmark$ $\Delta t = 8,82 \text{ s } \checkmark$ |
|--|---|
- (4)

POSITIVE MARKING FROM 2.2.1

2.2.2 OPTION 1

Upward is positive $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$ $= (15)(8,82) \checkmark + \frac{1}{2} (-9,8)(8,82)^2 \checkmark$ $= -248,88$ $h = 248,88 \text{ m } \checkmark$	Upward is negative $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$ $= (-15)(8,82) \checkmark + \frac{1}{2} (9,8)(8,82)^2 \checkmark$ $= 248,88 \text{ m}$ $h = 248,88 \text{ m } \checkmark$
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OPTION 2

Upward is positive $v_f^2 = v_i^2 + 2a\Delta y \checkmark$ $(-71,45)^2 \checkmark = 15^2 + 2(-9,8) \Delta y \checkmark$ $\Delta y = -248,98$ $h = 248,98 \text{ m } \checkmark$	Upward is negative $v_f^2 = v_i^2 + 2a\Delta y \checkmark$ $(71,45)^2 \checkmark = (-15)^2 + 2(9,8) \Delta y \checkmark$ $\Delta y = 248,98$ $h = 248,98 \text{ m } \checkmark$
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(4)

OPTION 3

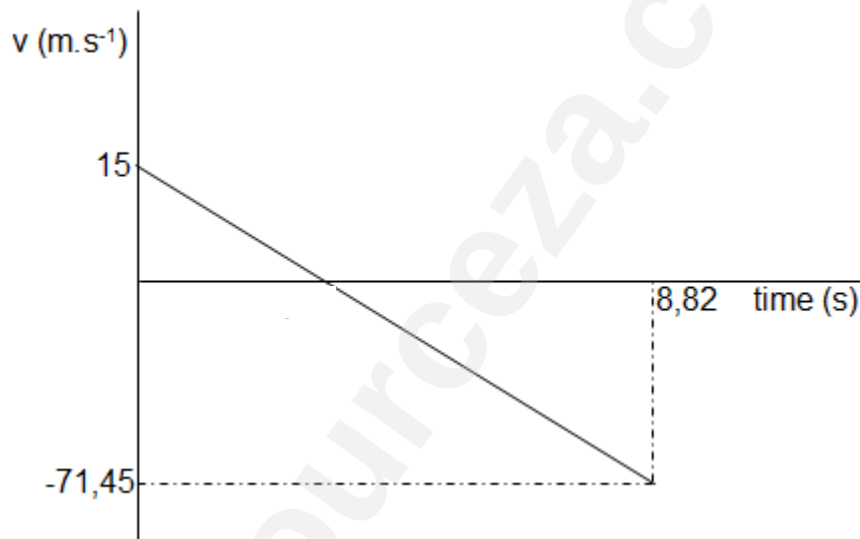
$$\Delta y = \left(\frac{V_f + V_i}{2} \right) \Delta t$$

$$\Delta y = \left(\frac{-71,45 + 15}{2} \right) 8,82$$

$$\Delta y = 248,88 \text{ m}$$

$$h = 248,88 \text{ m} \quad \checkmark$$

2.3

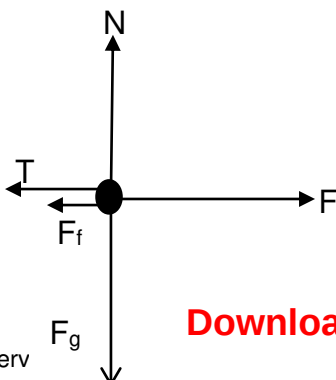
**Criteria**

- Starts at 15 m.s^{-1} ✓
- Ends at $-71,45 \text{ m.s}^{-1}$ ✓
- Time to reach ground (8,82s) ✓
- Straight line (shape) ✓
- Line below time axis longer than line above ✓
- **If upwards is negative: maximum 3/5**

(5)
[15]

QUESTION 3

3.1



Notes : Accepted Labels		Mark
w	weight / F_G / F_g	✓
F_f	frictional force / friction	✓
F	applied force	✓
N	normal force	✓
T	Tension in string	✓
	Any additional force: deduct 1 mark	
	Subtract one mark if lines do not touch the dot	
	Subtract one mark if arrows are not shown	

(5)

3.2 A force that opposes the motion ✓ of a moving object relative to a surface. ✓

(2)

3.3.1

$$\begin{array}{l}
 F_{\text{net}} = ma \\
 T + f = ma \quad \} \checkmark \\
 T - 4 \checkmark = (2)(0,5) \checkmark \\
 T = 5 \text{ N } \checkmark
 \end{array}$$

(4)

3.3.2 Positive marking from QUESTION 3.3.1

$$\begin{array}{l}
 F_{\text{net}} = ma \\
 F + (-f) + (-T) = ma \quad \} \checkmark \\
 F - 6 - 5 \checkmark = (3)(0,5) \checkmark \\
 F = 12,50 \text{ N } \checkmark
 \end{array}$$

(4)

3.4.1 Decrease ✓

(1)

3.4.2 $f_k \propto \cos \theta$ ✓

$\cos \theta$ decreases with increasing value of θ ✓

or

As θ increases, ✓ normal force decreases ✓

(2)

[18]

QUESTION 4

4.1 The product of the resultant/net force acting on an object and the time the resultant / net force acts on the object. ✓✓ (2)

4.2.1

total impulse = area under the graph ✓ $= \frac{1}{2}(1)(6) + (3-1)(6) + \frac{1}{2}(5-3)(6)$ ✓ $= 21 \text{ N.s}$ ✓ NB: if the first step is not there allocate 2 marks in the 2 nd step.	total impulse = area under the graph ✓ $= \frac{1}{2}(5+2)(6)$ ✓ $= 21 \text{ N.s}$ ✓ NB: if the first step is not there allocate 2 marks in the 2 nd step.
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(3)

4.2.2 Positive marking from QUESTION 4.2.1

$$F_{\text{net}}\Delta t = m(v_f - v_i) \checkmark$$

$$\frac{21}{2} = 2(v_f - 10) \checkmark$$

$$v_f = 20,5 \text{ m.s}^{-1} \checkmark$$

(3)

4.3 Remains the same ✓

(1)

[9]**Total Marks: 50**