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.

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Please Turn Over

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.

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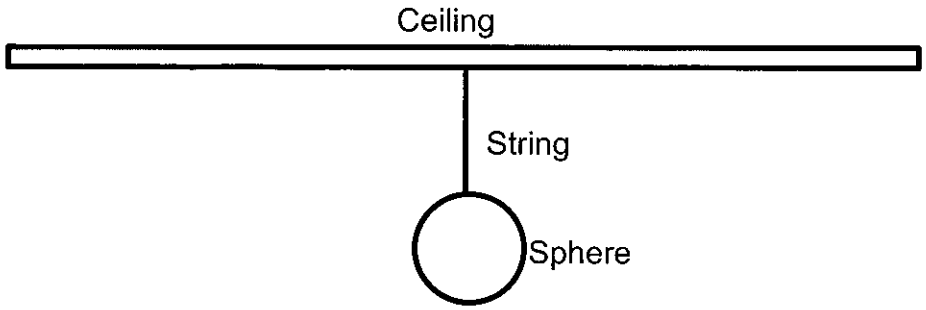
QUESTION 1: MULTIPLE- CHOICE QUESTIONS

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)

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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.

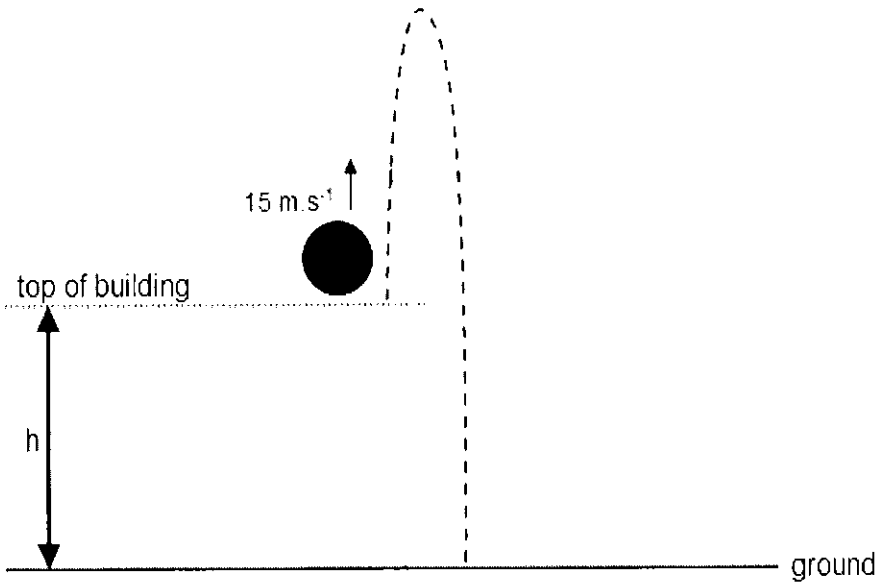
(2)

[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 $m.s^{-1}$.

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)

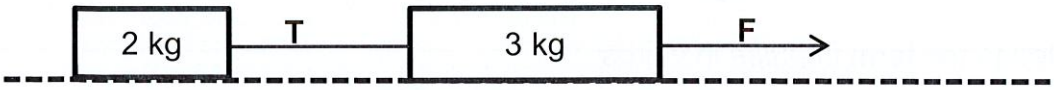
[15]

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 $m.s^{-2}$.

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)

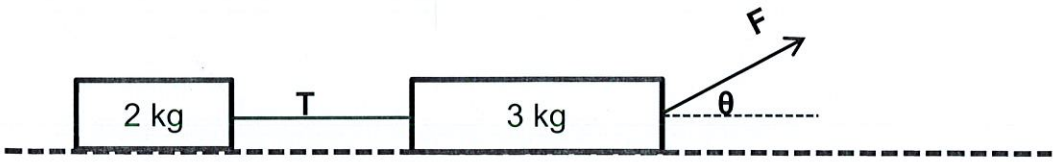
3.2 Define the term *kinetic frictional force* in words. (2)

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.



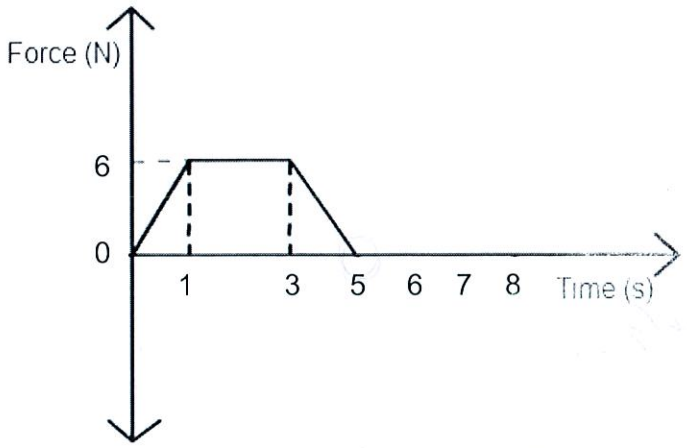
3.4.1 How will the magnitude of the kinetic frictional force on the 3 kg block be affected? Write INCREASES. DECREASES OR REMAINS THE SAME. (1)

3.4.2 Explain your answer to question 3.4.1 above. (2)

[18]

QUESTION 4

An object of mass 2kg is travelling at 10 $m.s^{-1}$ 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]

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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 $m \cdot s^{-2}$
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* $\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$
$K = E_k = \frac{1}{2}mv^2$	

FORCE/*KRAG*

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

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PHYSICAL SCIENCES P1

MEMORANDUM

COMMON TEST

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GRADE 12

This memorandum consists of 5 pages including this page.

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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

Upward is positive

$v_f = v_i + a\Delta t$ ✓
$-71,45$✓ $= \underline{15 + (-9,8)\Delta t}$ ✓
$\Delta t = 8,82$ s ✓

Upward is negative

$v_f = v_i + a\Delta t$ ✓
$71,45$✓ $= \underline{-15 + 9,8\Delta t}$ ✓
$\Delta t = 8,82$ s ✓

(4)

POSITIVE MARKING FROM 2.2.1

2.2.2 **OPTION 1**

Upward is positive

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$= (15)(8,82)$✓$+\frac{1}{2}(-9,8)(8,82)^2$✓
$= -248,88$
$h = 248,88$m✓

Upward is negative

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$= (-15)(8,82)$✓$+\frac{1}{2}(9,8)(8,82)^2$✓
$= 248,88$ m
$h = 248,88$m✓

OPTION 2

Upward is positive

$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$(-71,45)^2$ ✓$= \underline{15^2 + 2(-9,8)\ \Delta y}$ ✓
$\Delta y = -248,98$
$h = 248,98$m✓

Upward is negative

$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$(71,45)^2$ ✓$= \underline{(-15)^2 + 2(9,8)\ \Delta y}$ ✓
$\Delta y = 248,98$
$h = 248,98$m✓

(4)

OPTION 3

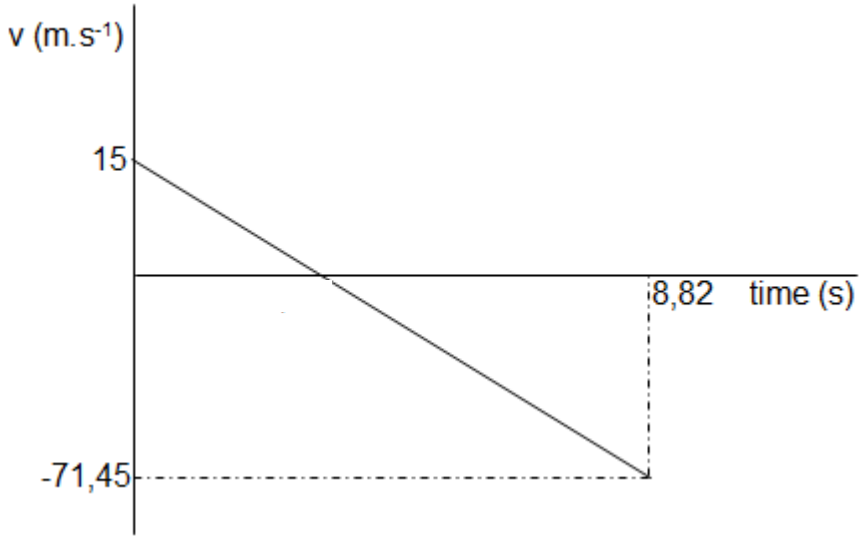
$$\Delta y = \left(\frac{Vf + Vi}{2}\right)\Delta t$$

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

Δy = 248,88 m

h = 248,88m ✓

2.3



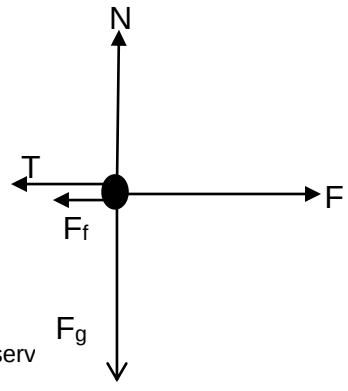
Criteria

- Starts at 15m.s^{-1}✓
- Ends at -71,45m.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

$F_{net} = ma$
$T + f = ma$ } ✓
$T - 4$ ✓$= (2)(0,5)$ ✓
$T = 5$ N ✓

(4)

3.3.2 **Positive marking from QUESTION 3.3.1**

$F_{net} = ma$
$F + (-f) + (-T) = ma$ } ✓
$F - \underline{6 - 5}$ ✓$= (3)(0,5)$ ✓
$F = 12,50$ N ✓

(4)

3.4.1 Decrease ✓ (1)

3.4.2 $f_k \alpha \cos\theta$ ✓
$\cos\theta$ 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 ✓ = ½(1)(6) + (3-1)(6) + ½(5-3)(6) ✓ = 21 N.s ✓ NB: if the first step is not there allocate 2 marks in the 2nd step.	total impulse = area under the graph ✓ = ½(5+2)(6) ✓ = 21 N.s ✓ NB: if the first step is not there allocate 2 marks in the 2nd step.

(3)

4.2.2 **Positive marking from QUESTION 4.2.1**

$F_{net}\Delta t = m(v_f - v_i)$ ✓
$\underline{21 = 2(v_f - 10)}$ ✓
$v_f = 20{,}5\ m.s^{-1}$ ✓

(3)

4.3 Remains the same ✓ (1)

[9]

Total Marks: 50

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