education
Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL SENIOR CERTIFICATE

GRADE 11

PHYSICAL SCIENCES P1 (PHYSICS)

COMMON TEST

MARCH 2020

TIME: 1 hour

MARKS: 50

This question paper consists of 8 pages and 1 data sheet.

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INSTRUCTIONS AND INFORMATION TO CANDIDATES

1. Write your name on the **ANSWER BOOK.**

2. This question paper consists of **FIVE** 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.

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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 The statements below refer to vector and scalar quantities.

(i) A vector has magnitude and direction, while a scalar has magnitude only.
(ii) A scalar quantity can always be added to a vector quantity.
(iii) Force is an example of a vector quantity, while distance is an example of a scalar quantity.

Which of the above statements is/are TRUE?

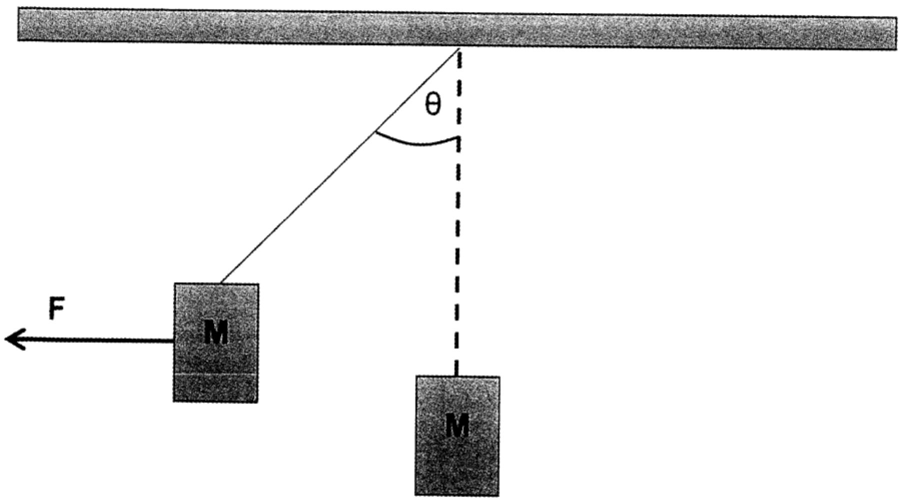
A (i) and (ii) only

B (i) and (iii) only

C (ii) and (iii) only

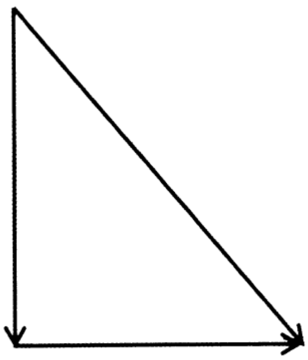
D (i) only (2)

1.2 A force F is used to pull an object of mass **M**, which is suspended from a string, to one side as shown in the diagram below. The object is in equilibrium.

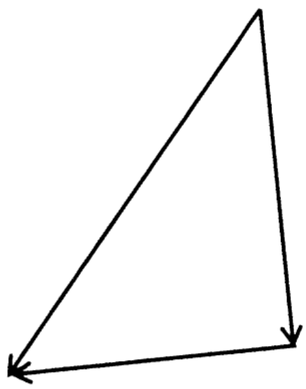


Which ONE of the following vector diagrams CORRECTLY represents all the forces acting on the object?

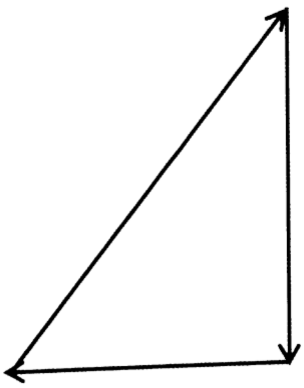
A



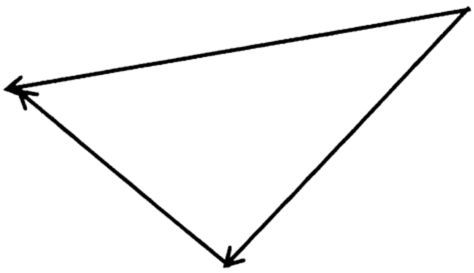
B



C



D



(2)

1.3 A book is at rest on a horizontal table. By Newton's Third Law, the reaction to the gravitational force acting on the book is:

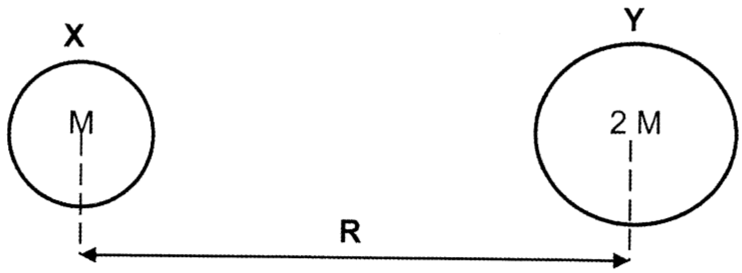
A The force that the book exerts on the earth.

B The force that the table exerts on the book.

C The force that the earth exerts on the book.

D The normal force acting on the book. (2)

1.4 Two bodies, X and Y, of mass M and 2 M respectively exert a force **F** on each other when their centres are **R** metres apart.



The mass of object Y is reduced to 0,5 M and the distance between their centres is reduced to 0,25 R.
What is the new force that the bodies exert on each other, in terms of F?

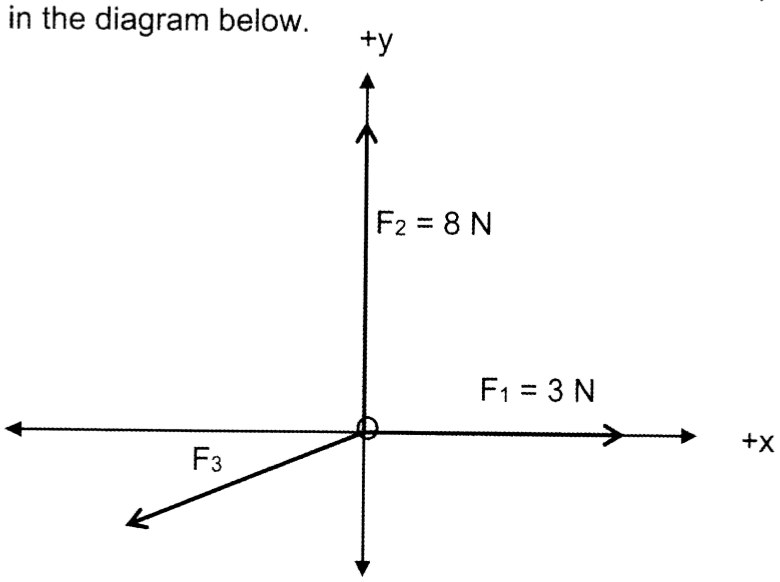
A 16 F
B 8 F
C 4 F
D 2 F

(2)
[8]

QUESTION TWO

2.1 Define Resultant Vector. (2)

2.2 Three forces F_1, F_2, and F_3 act simultaneously at a common point O as shown in the diagram below.



F_1 is a 3 N force, acting at 90^0 and F_2 is a 8N force acting at at 0^0.
F_3 has an x-component of –4 N and a y-component of –3 N.

2.2.1 Calculate the magnitude of F_3. (2)

2.2.2 Calculate the magnitude and direction of the resultant force acting at point O. (5)
[9]

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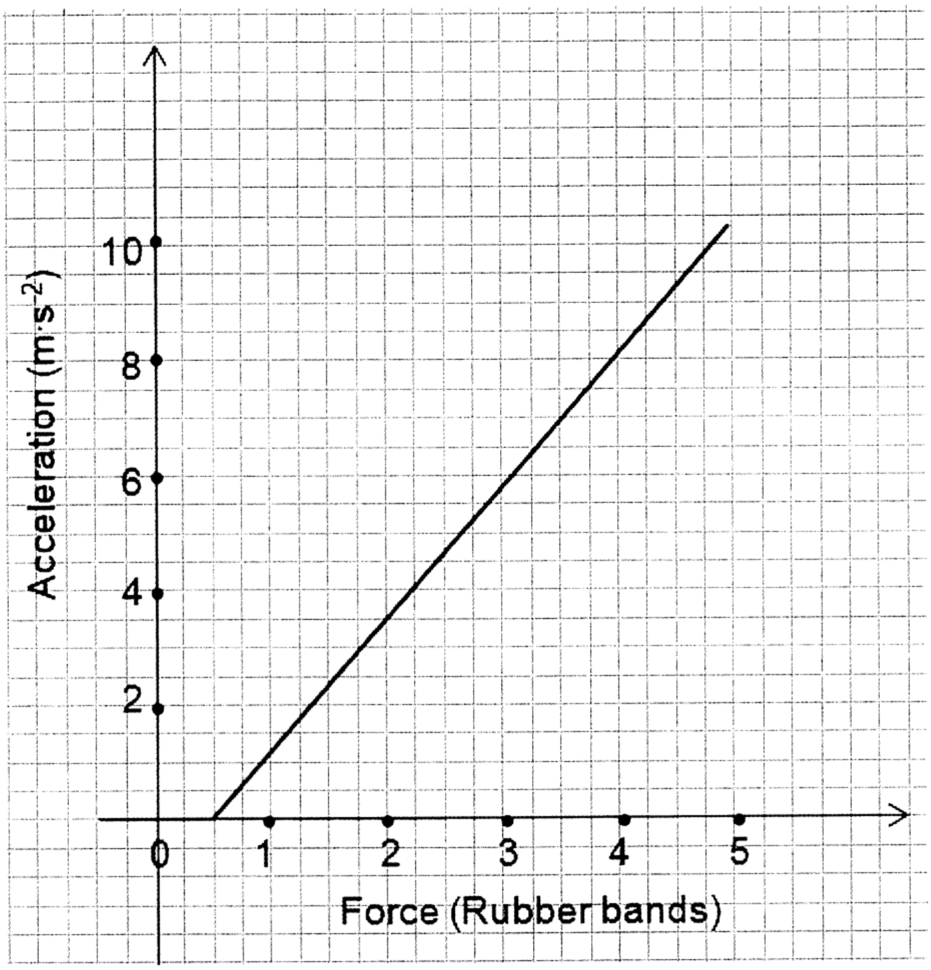
QUESTION THREE

The graph below was obtained from an experiment used to determine a relationship between the acceleration of a trolley and the force applied on the trolley. The mass of the trolley was kept constant during the experiment.



3.1 State Newton's Second Law of motion. (2)

3.2 What is the acceleration of the trolley when two rubber bands are used? (1)

3.3 Why does the graph not start at the origin? (1)

3.4 What is the magnitude of the frictional force acting on the trolley? (2)

3.5 Calculate the mass of the trolley if the gradient of the graph is 2,286. (2)

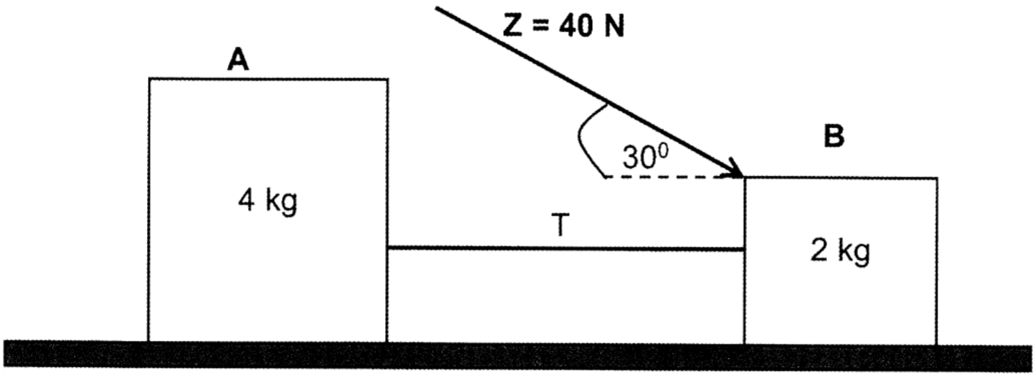
3.6 What change should be made to the experimental setup to verify the relationship between NET FORCE and ACCELERATION? (2)

3.7 The frequency of the ticker timer used in this experiment is 50 Hz. How would the gradient of the graph be affected if the frequency of the ticker-timer was reduced to 20 Hz?
Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

[11]

QUESTION FOUR

Two blocks A and B are connected by a string of negligible mass.
The mass of A is 4 kg and the mass of B is 2 kg.
Block B is pushed by a force Z of magnitude 40 N acting at an angle of 30^0 to the horizontal.
The coefficient of kinetic fiction between block B and the horizontal surface is 0,25. Block A experiences a frictional force of 9,8 N during its motion.
The system accelerates to the right.



4.1 Draw a free body diagram to show all the forces acting on the 2 kg block. (5)

4.2 The magnitude of the vertical component of force Z is 20 N. Calculate the magnitude of the kinetic frictional force experienced by block B. (4)

4.3 Calculate the magnitude of the tension T in the string by applying Newton's Second Law of motion SEPARATELY to each of the blocks. (5)
[14]

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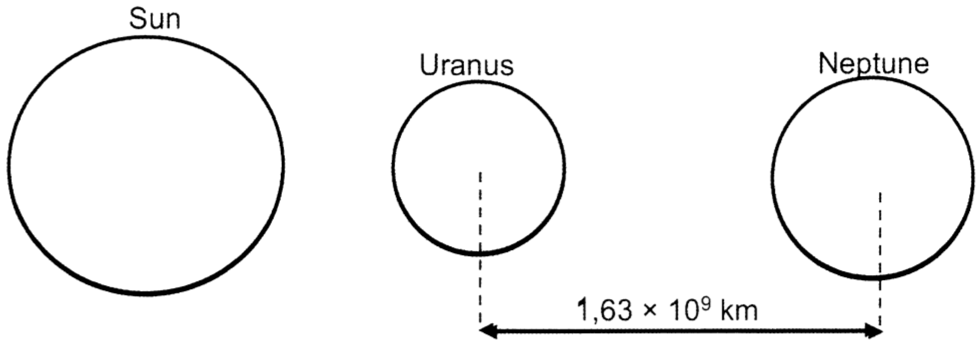
QUESTION FIVE

The diagram below represents the planets Neptune and Uranus, and the Sun in a straight line. Neptune is 1,63 × 10^9 km from Uranus.



The data below provides relevant information concerning the above planetary bodies.

Data Table

Mass of the Sun	1.99×10^{30} kg
Mass of Uranus	8.73×10^{25} kg
Mass of Neptune	1.03×10^{26} kg
Mean distance of Uranus to the Sun	2.87×10^{12} m
Mean distance of Neptune to the Sun	4.50×10^{12} m

5.1 Calculate the magnitude of the force of attraction that Uranus exerts on Neptune. (4)

5.2 Write down the magnitude and direction of the force that Neptune exerts on Uranus. (2)

5.3 The magnitude of the force the Sun exerts on Uranus is 1.41 × 10^{21} N. Calculate the net force experience by Uranus due to the Sun and Neptune. (2)
[8]

TOTAL MARKS: [50]

DATA FOR PHYSICAL SCIENCES GRADE 11
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11
VRAESTEL 1 (FISIKA)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	$9,8\ m \cdot s^{-2}$
Gravitational constant *Swaartekragkonstante*	G	$6,67 \times 10^{-11}\ N \cdot m^2 \cdot kg^{-2}$
Radius of Earth *Straal van Aarde*	R_E	$6,38 \times 10^6\ m$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

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

FORCE/*KRAG*

$F_{net} = ma$	$w = mg$
$F = \frac{Gm_1m_2}{r^2}$	$\mu_s = \frac{f_{s(max)}}{N}$
$\mu_k = \frac{f_k}{N}$	

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MARKING GUIDELINE

This marking guideline consists of 4 pages.

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QUESTION ONE

1.1 B ✓✓
1.2 C ✓✓
1.3 A ✓✓
1.4 B ✓✓

4 x 2 = [8]

QUESTION TWO

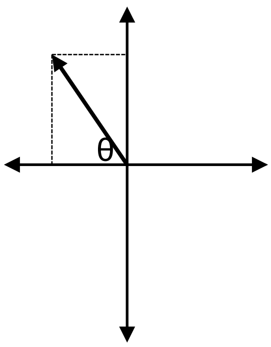
2.1 It is a single vector that can represent a number of vectors acting on an object in both magnitude and direction. ✓✓ (2 or 0)
OR
It is a single vector which has the same effect as all the other vectors acting together. ✓✓ (2 or 0) (2)

2.2.1 $F_3^2 = (-4)^2 + (-3)^2$ ✓
$F_3 = 5$ N ✓ (2)

2.2.2

$F_{NET}x = \Sigma Rx = 3 + (-4)$ ✓
$= -1$ N

$F_{NET}y = \Sigma Ry = 8 + (-3)$ ✓
$= 5$ N



$F_{net}^2 = (-1)^2 + (5)^2$ ✓ (5)

$F_{net} = 5{,}10$ N ✓

tanθ =

–

θ = 78,69° wrt – x -axis ✓ **OR**

θ = 101,31° wrt the +x axis **OR**

[9]

QUESTION THREE

3.1 If a non zero NET force acts on an object, then the object accelerates in the direction of the NET force where the acceleration of the object is directly proportional to the NET force✓ and inversely proportional to the mass of the object. ✓ (2)

3.2 3,5 m·s-2. ✓ (1)

3.3 Friction has not been compensated for. ✓ **OR**
The runway is not adequately inclined. (1)

3.4 0,5 N✓✓ (2)

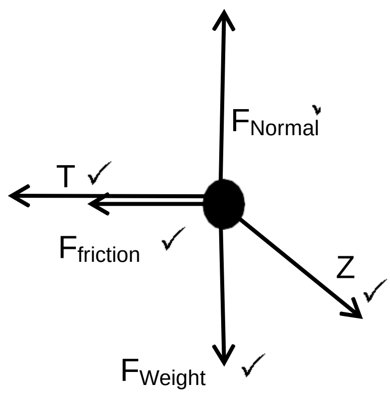
3.5 Gradient = 1/m **OR** 2,286 = 1/m ✓
m = 0,437 (0,44) kg. ✓ (2)

3.6 Incline the runway ✓so that the frictional force is equal to the component of the gravitational force down the runway. ✓ **OR**
Incline the runway ✓so that the trolley rolls down the runway at constant velocity. ✓ (2)

3.7 REMAINS THE SAME✓✓ (1)
[11]

QUESTION FOUR

4.1



(5)

4.2 $F_N = mg + F_y$
$= (2)(9.8) + 20$ ✓
$= 39,6$ N

$F_f = \mu_K \cdot F_N$ ✓
$= (0,25)\cdot(39,6)$ ✓
$= 9,90$ N ✓ (4)

4.3 **Positive marking from Q 4.1**
Take the motion of the system to the right as Positive
2 kg
$F_{NET} = m \bullet a$
$F_{ZX} + (-F_T) + (-Ff_K) = m \bullet a$ } ✓ (any one)
$40\cos 30^0 + (-F_T) + (-9,9)$ ✓ $= (2)a$ ✓
$24,741 - F_T = 2a$ ………(1)

4 kg
$F_{NET} = m \bullet a$
$F_T + (-Ffk) = m \bullet a$
$F_T + (-9,8) = (4)a$ ✓
$F_T = 4a + 9,8$………(2)

Equating (1) and (2), $F_T = 19,76$ N ✓ (5)

[14]

QUESTION FIVE

5.1 ✓

$= \frac{6,67x10^{-11} \times 8,73x10^{25} \times 1,03x10^{26}}{(1,63\ x10^{12})^2}$ ✓ ✓
$= 2.26\ x10^{17}$ N ✓ (4)

5.2 **Positive marking from Q 5.1**
$2.26\ x10^{17}$ N ✓ towards Neptune ✓ / to the right (Accept East) (2)

5.3 **Positive marking from Q 5.1**
Let the direction of Uranus towards Neptune be positive.

$F_{net} = -1,41x10^{21} + 2,26x10^{17}$ ✓
$= -1,41x10^{21}$ N , (2)
$= 1,41x10^{21}$ N , towards the Sun ✓

[8]

TOTAL: [50]

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