Ekurhuleni North D6

DISTRICT COMMON TEST

2025

GRADE 11

PHYSICAL SCIENCES
March Test

MARKS: 100

TIME: 2 hours

This question paper consists of 12 pages including 2 data sheets

INSTRUCTIONS AND INFORMATION

1. Write your NAME at the TOP of every ANSWER BOOK.
2. Answer ALL the questions in the ANSWER BOOK.
3. You may use a non-programmable calculator.
4. You may use appropriate mathematical instruments.
5. YOU ARE ADVISED TO USE THE ATTACHED DATA SHEETS.
6. Number the answers correctly according to the numbering system used in this question paper.
7. Give brief motivations, discussions, et cetera where required.
8. Round off your final numerical answers to a minimum of TWO decimal places.
9. Write neatly and legibly

Question 1 – Multiple choice

Four options are provided as possible answers to the following questions.

Each question has only ONE correct answer. Choose the answer and write only the letter (A– D) next to the question number (1.1–1.5) in the ANSWER BOOK

1.1 Which one of the following statements is true:

(i) A vector is a quantity with both magnitude and direction.

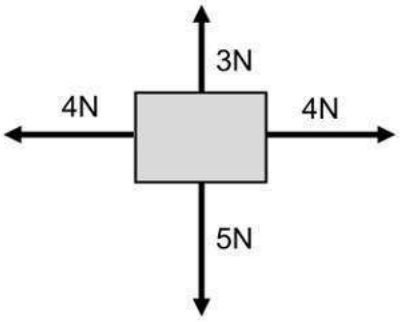
(ii) Displacement is the magnitude and direction of the straight line drawn from the starting point to the end of the motion.

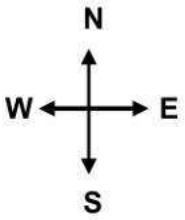
(iii) Displacement and distance are vectors.

A (i) and (ii)
B (ii) and (iii)
C (i) and (iii)
D (i) , (ii) and (iii)

2

1.2 Four forces act on a body as shown in the diagram:



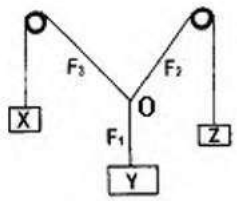


What is the magnitude and direction of the resultant force?

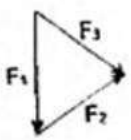
A 16N south
B 2N south
C 8N east
D 8N south

2

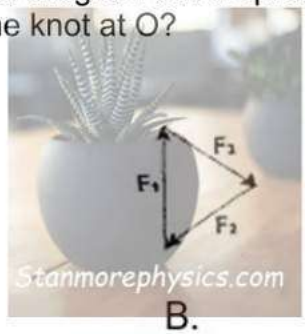
1.3 Three objects X, Y and Z hang from strings knotted together at O, as shown in the diagram.



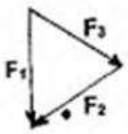
Which vector diagram best represents the relationship of the forces acting on the knot at O?



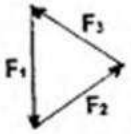
A.



B.

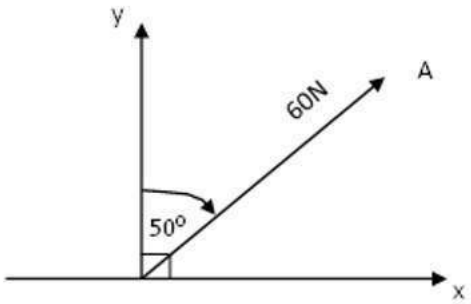


C.



D. 2

1.4 The magnitude of a force A is 60N at an angle of 50^0 to the vertical as shown in the diagram.



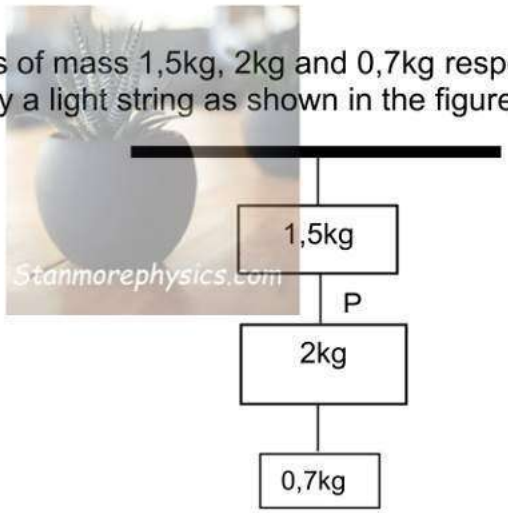
The vertical component of force A is…

A 45,95N
B 38,57N
C 21,43N
D 14,03N 2

1.5 Which of the following statements correctly explains why a passenger in a car who is not restrained by a seat belt, continues to move forward when the brakes are applied suddenly?

A The braking force applied to the car exerts an equal and opposite force on the passenger.
B The braking force (called inertia) acts on the passenger.
C A resultant forward force acts on the passenger.
D A zero resultant force acts on the passenger. 2

1.6 Three objects of mass 1,5kg, 2kg and 0,7kg respectively, are suspended by a light string as shown in the figure.



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What is the magnitude of the force in string P?

A 15N
B 42N
C 27N
D 35N 2

1.7 According to Newton's Third law, when a rocket is launched vertically upwards, the "action force" is represented by…

A the gravitational force of the earth on the rocket downwards.
B the force of the rocket on the exploding gases, downwards.
C the force of the exploding gas on the rocket downwards.
D The gravitational force of the rocket on the earth upwards. 2

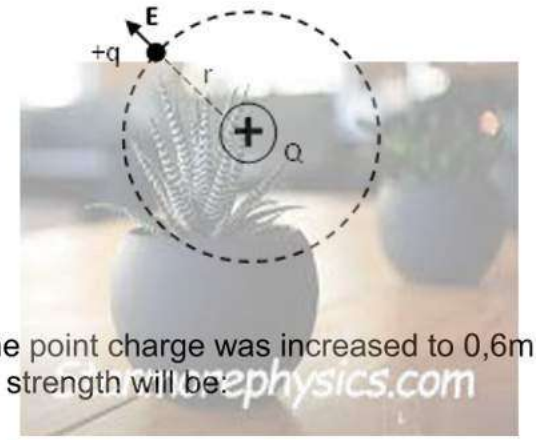
1.8 A 2,5 kg object weighs 24,5 N on Earth. What would be the object's mass (in Kg) on planet Mars if the acceleration due to gravity on Mars is 3,71 $m \cdot s^{-2}$.

A 9,28
B 7,42
C 2,5
D 6,6 2

1.9 The distance between two charges, Q_1 and Q_2 is r. The force exerted by the spheres on each other is F. Both charges are now doubled without changing the distance between them. The magnitude of the new electrostatic force on Q_1 will be:

A 4F
B ¼ F
C 2F
D ½ F 2

1.10 The figure below shows the electric field around a point charge q, placed at a distance of 0,3m away from another charge Q. The electric field strength measured is 800N.C^{-1}.



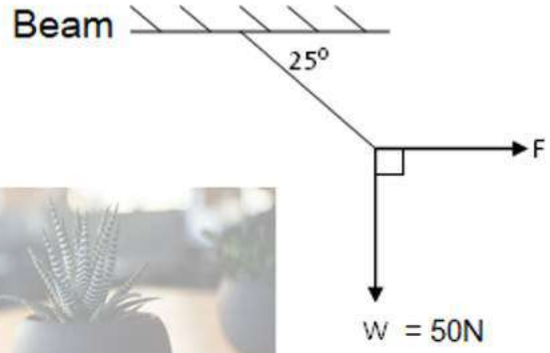
If the distance of the point charge was increased to 0,6m away from Q, the electric field strength will be:

A 1600N.C^{-1}
B 200N.C^{-1}
C 400N.C^{-1}
D 800N.C^{-1} 2

[10 x 2 = 20]

Question 2

The figure below represents a weight W (50N), hanging from a cable, attached to a horizontal beam. A force (F) is applied at 90^0 to the weight. The angle between the cable and the beam is 25^0.



2.1 Using the triangle of forces, draw a fully labelled vector diagram (not to scale). 4

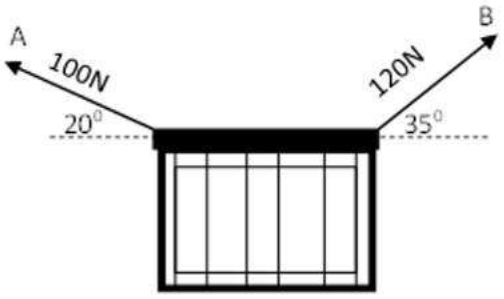
2.2 Calculate the magnitude of the applied force F. 3

2.3 Calculate the tension force of the cable. 3

[10]

Question 3

A crate is connected to two ropes as shown in the diagram. Rope A exerts a force of 100N at an angle of 20^0 to the horizontal. Rope B exerts a force of 120N at an angle of 35^0 to the horizontal.



3.1 Define the term vector component. 2

3.2 Calculate the x component for rope A and rope B. 4

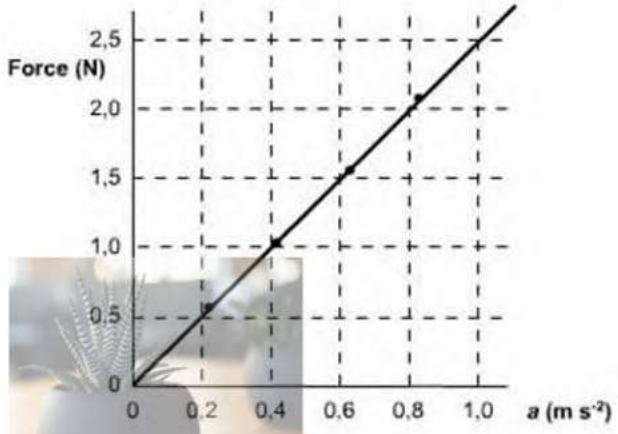
3.3 Calculate the y component for rope A and rope B. 4

3.4 Calculate the magnitude of the resultant force of Rope A and Rope B. 5

[15]

Question 4

4.1 The graph was obtained in an investigation of the relationship between force and acceleration, on a surface which is friction-compensated.



Based on the graph, answer the questions that follow.

4.1.1 What is the acceleration when a force of 2,5 N is applied? 1

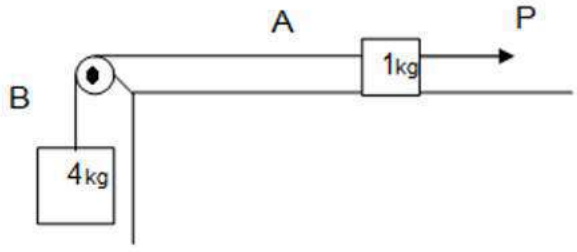
4.1.2 What is the relationship between the two quantities plotted? 1

4.1.3 What force must be applied to obtain an acceleration of 0,5 m s^{-2} ? 1

4.1.4 How will the graph differ if the same surface was used, but friction is not compensated for? 2

4.1.5 State Newton's second law of motion in words. 2

4.2 Two masses of 1kg and 4kg are attached to a light string AB that passes over a pulley as shown. The 1kg mass rests on a frictionless table. A constant horizontal force P is applied to the 1kg mass to accelerate in the direction of force P.



If the tension in string AB is 48N, calculate:

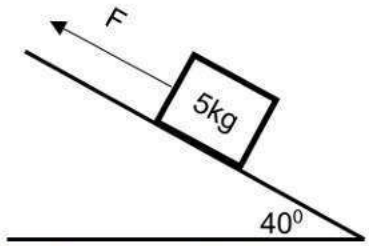
4.2.1 The acceleration of the 4kg mass. 4

4.2.2 The magnitude of force P. 4

[15]

Question 5

A 5kg block is being pulled up a rough incline plane of angle 40^0 to the horizontal by a constant force F. the block moves up the plane at a constant speed.



5.1 State Newton's first law. 2

5.2 Draw a labelled free body diagram for the 5 kg mass. 4

5.3 The kinetic frictional force between the block and the inclined surface is 19,78N.

Calculate the magnitude of force F.

5

[11]

Question 6

Two identical spheres with unequal masses m_1 and m_2, which are released simultaneously from rest, fall freely from a height h above the surface of the earth. The two spheres reach the ground at the same time.

6.1 State Newton's Law of Gravitation in words. 2

6.2 Use formulae to show that the gravitational acceleration of any object near the earth's surface irrespective of its mass, can be given by

$$g = \frac{GM}{r^2}$$

Where M = mass of the earth
r = radius of the earth 3

6.3 An object undergoing free fall on the planet Mars, experiences a gravitational acceleration of magnitude 3,8 $m.s^{-2}$. The mass of Mars is 6,4 x 10^{23}kg. Calculate the radius of the planet Mars in metres. 4

[9]

Question 7

7.1 Charges A, B and C are placed in a straight line, as shown in the diagram below.

7.1.1 Define Coulomb's law of electrostatics. 2

7.1.2 Draw the electric field pattern between Q_A and Q_c. 2

7.1.3 Calculate the electrostatic force between Q_A and Q_B. 4

7.1.4 Calculate the net electrostatic force on Q_A as a result of Q_B and Q_C. 4

7.2 A point charge Q has an electric field surrounding it.

7.2.1 Explain what is meant by the term electric field strength at a point. 2

7.2.2 Calculate the magnitude of the electric field strength 0,1m from Q if the charge of Q is -3×10^{-9}C. 3

7.2.3 If a small point charge q ($+6,4 \times 10^{-19}$ C) is placed in the field of Q, calculate the force exerted on q by Q. 3

[20]

END OF PAPER
TOTAL = 100 Marks

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
VRAESTEL 1 (FISIKA)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	$9,8\ m{\cdot}s^{-2}$
Universal gravitational constant *Universele gravitasiekonstant*	G	$6,67 \times 10^{-11}\ N{\cdot}m^2{\cdot}kg^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10^{8}\ m{\cdot}s^{-1}$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}\ J{\cdot}s$
Coulomb's constant *Coulomb se konstante*	k	$9,0 \times 10^{9}\ N{\cdot}m^2{\cdot}C^{-2}$
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}\ kg$

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

FORCE/*KRAG*

$F_{net} = ma$	$p = mv$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$

ELECTROSTATICS/*ELEKTROSTATIKA*

$F = \frac{kQ_1Q_2}{r^2}$	$E = \frac{kQ}{r^2}$
$E = \frac{V}{d}$	$E = \frac{F}{q}$
$V = \frac{W}{q}$	

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GRADE 11

PHYSICAL SCIENCES

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Marking Memorandum

Question 1 – Multiple choice

1.1 A ✓✓ 2

1.2 B ✓✓ 2

1.3 D ✓✓ 2

1.4 B ✓✓ 2

1.5 D ✓✓ 2

1.6 C ✓✓ 2

1.7 A ✓✓ 2

1.8 C ✓✓ 2

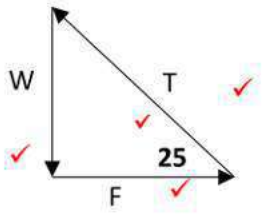
1.9 A ✓✓ 2

1.10 B ✓✓ 2

[10 x 2 = 20]

Question 2

2.1 4



2.2 $\tan 25^0$ ✓ = $\frac{50}{F}$ ✓ or $\tan 65^0$ ✓ = $\frac{F}{50}$ ✓ 3

$F = 107,23N$ ✓ $F = 107,23N$ ✓

2.3 $T^2 = W^2 + F^2$ ✓ or $\sin 25^0$ ✓ = $\frac{50}{T}$ ✓ 3

$= (50)^2 + (107,23)^2$ ✓

$T = 118,31N$ ✓ $T = 118,31N$ ✓

[10]

Question 3

3.1 The components of a vector are vectors that together have the same effect as the original vector. ✓✓ 2

3.2 4

Rope A
Cos 20^0 = X / 100 ✓
X =93,97N ✓

Rope B
Cos 35^0 = X / 120 ✓
X = 98,30N ✓

3.3 4

Rope A
sin 20^0 = X / 100 ✓
X =34,20N ✓

Rope B
Sin 35^0 = X / 120 ✓
X = 68,83N ✓

3.4

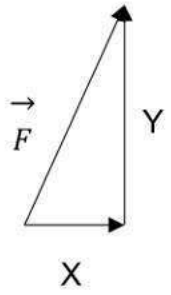
X component = -93,97+98,30 = 4,33N ✓

Y component = -34,20 +68,83 = 34,63N ✓

$\vec{F}^{\,2} = X^2 + Y^2$

$\vec{F}^{\,2} = (4,33)^2 + (34,63)^2$ ✓

$\vec{F} = 34,89N$ ✓



5

[15]

Question 4

4.1.1 $1m.s^{-2}$ ✓ 1

4.1.2 a ∞ Fnet ✓ 1

4.1.3 1,25N ✓ 1

4.1.4 It will not pass through the origin. ✓✓ 2

4.1.5 An object will accelerate in the direction of a net force. The acceleration is directly proportional the net force and inversely proportional to the mass. ✓✓ 2

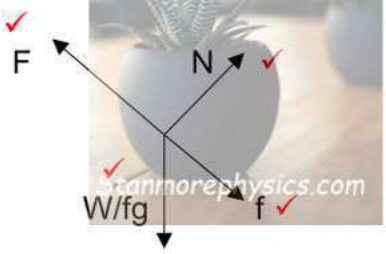
4.2.1 T – W = Fnet (ma) ✓
48 – (4)(9,8) ✓ = 4a✓
a =2,2$m.s^{-2}$ ✓ 4

4.2.2 Fnet = ma✓
P – T = ma
P – 48✓ = (1)(2,2) ✓
P = 50,2N✓ 4

[15]

Question 5

5.1 A body will remain in its state of rest or continue in its state of uniform motion, unless acted upon by an unbalance force ✓✓ 2

5.2 

4

5.3 Fnet = ma ✓
Fnet = 0
F - fk - Fg∥ = ma
F – 19,78 ✓ - (5)(9,8)sin 40^0 ✓ = 0✓
F - 19,78 - 31,50 = 0
F = 51,28N ✓ 5

[11]

Question 6

6.1 Every particle in the universe will attract every other particle with a force that is directly proportional to the product of their masses and is inversely proportional to the square of the distance between them. ✓✓ 2

6.2 W = mg …1 Fg = $\frac{GmM}{r^2}$ ….2 ✓ 3

(1)=(2)
mg = $\frac{GmM}{r^2}$ ✓✓ g = $\frac{G\,M}{r^2}$

6.3 g = $\frac{G\,M}{r^2}$ ✓ 4

3,8✓ = $\frac{(6,67 \times 10^{-11})\,(6,4 \times 10^{23})}{r^2}$ ✓

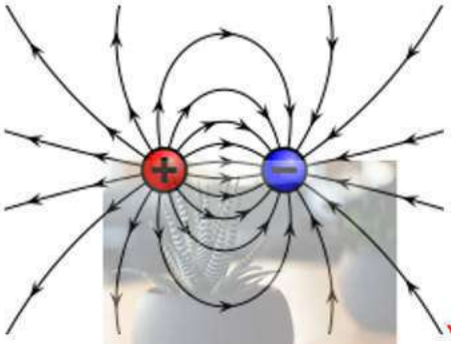
r = 3351668,87m ✓

[9]

Question 7

7.1.1 The force between two charges at rest is directly proportional to the prroduct of the charges and inversely proportional to the square of the distance between them. ✓✓ 2

7.1.2



✓✓ 2

7.1.3 $F = \frac{KQ_1Q_2}{r^2}$ ✓ $= \frac{(9 \times 10^9)(8 \times 10^{-9})(12 \times 10^{-9})}{(0,0006)^2}$ ✓ = 0,024N attr✓ 4

7.1.4 $F = \frac{KQ_1Q_2}{r^2} = \frac{(9 \times 10^9)(8 \times 10^{-9})(10 \times 10^{-9})}{(0,012)^2}$ ✓ ✓ = 0,005N ✓

Fnet = + 0,024 – 0,005 = 0,019N left ✓ 4

7.2.1 Force exerted per unit positive charge. ✓✓ 2

7.2.2 $E = \frac{KQ}{r^2}$ ✓ $= \frac{(9 \times 10^9)(3 \times 10^{-9})}{(0,1)^2}$ ✓ = 2700N.C^{-1}✓ 3

7.2.3 F = Eq ✓= (2700)(6,4 x 10^{-19}) ✓= 1,73 x 10^{-15}N✓ 3

[20]

THE END

TOTAL = 100 Marks