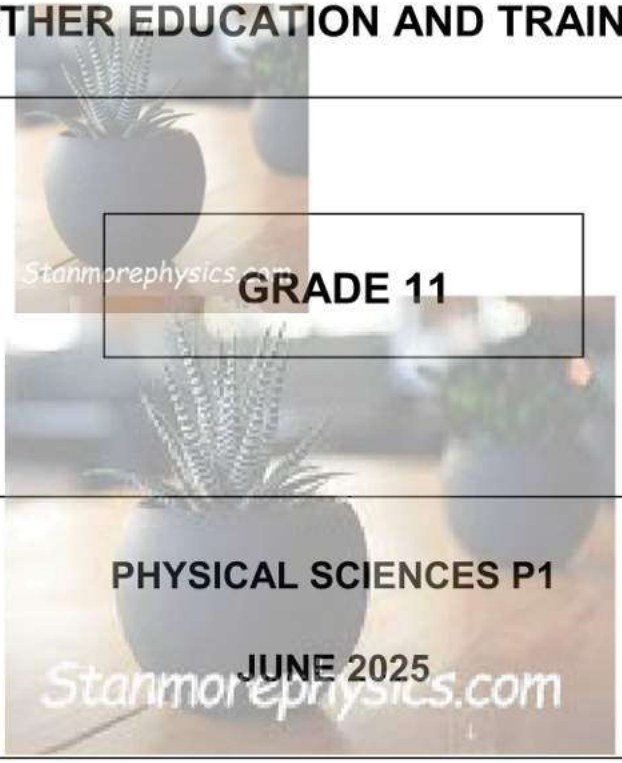
education
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

FURTHER EDUCATION AND TRAINING



GRADE 11

PHYSICAL SCIENCES P1

JUNE 2025

MARKS: 100

TIME: 2 HOURS

This question paper consists of 15 pages that includes 2 data sheets.

INSTRUCTIONS AND INFORMATION

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

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various 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 to 1.7) on the folio paper, e.g. 1.8 E.

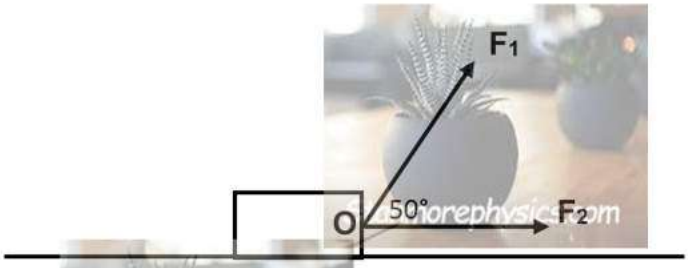
1.1 Which one of the following is NOT a scalar quantity ?

A Electrical current
B Gravitational force
C Mass
D Electrical potential difference (2)

1.2 A lady pushes a shopping trolley across a smooth floor with a force F at an angle with the horizontal. If the weight of the trolley is Fg, the normal force can be represented by . . .

A Fg
B Fg – Fy
C Fg + Fy
D Fg + Fx (2)

1.3 The figure shows two forces, F_1 and F_2 of magnitudes 30 N and 40 N acting on a crate at point O. Initially the angle between the forces is 50º, but is then reduced to 30º.

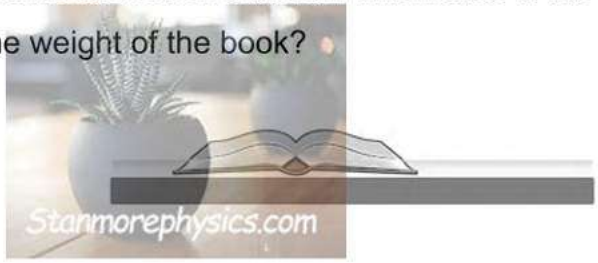


How will the magnitudes of the components of force F_1 and the resultant force change?

	Horizontal component of F_1	**Vertical component of F_1**	**The net / resultant force of F_1 and F_2**
A	decreases	increases	decreases
B	increases	decreases	increases
C	decreases	increases	increases
D	increases	increases	decreases

(2)

1.4 A book is at rest on a table. Which force is the Newton reaction force of the weight of the book?



A The force exerted by the book in the table.

B The force exerted by the table on the book.

C The weight of the table.

D The force exerted by the book on the earth. (2)

1.5 The force between two positively charged objects is F when they are r metres apart. The charges are now moved until the force between them is 16 F.

The distance between the charges is now . . .

A $\frac{1}{4}$ r

B $\frac{3}{4}$ r

C 4 r

D 16 r (2)

1.6 The unit of measurement of the rate of flow of charge in a conductor is . . .

A Watt

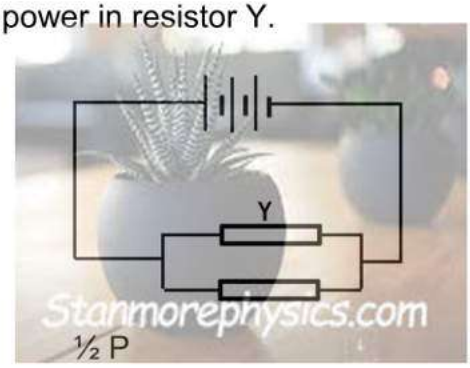
B Ampere

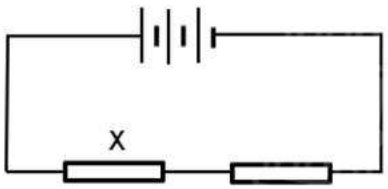
C Volt

D Coulomb (2)

1.7 In the circuit diagrams below the cells are identical. The resistance of the connecting wires as well as the internal resistance of the cells is negligible and can be ignored.

The resistors are all identical. If the power in resistor X is P, determine the power in resistor Y.





A ½ P

B P

C 2 P

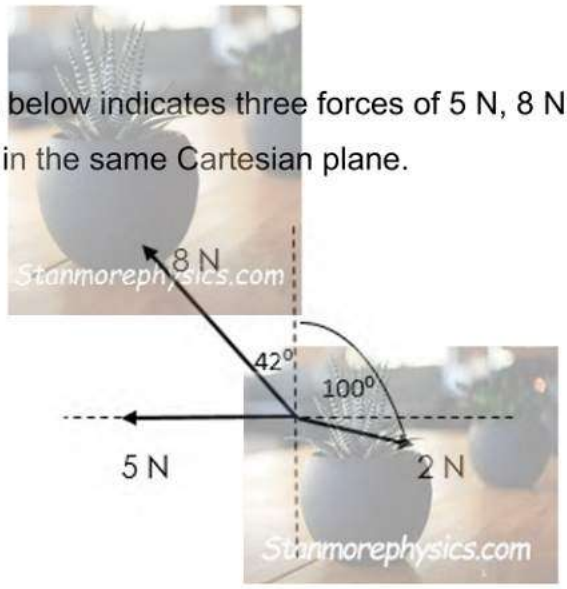
D 4 P (2)

[14]

QUESTION 2

2.1 Peter applies a force of 20 N North on Thomas. At the same time Richard applies a force of 30 N on Thomas in the opposite direction to the one by Peter. Calculate the resultant force exerted by Peter and Richard on Thomas. (3)

2.2 The diagram below indicates three forces of 5 N, 8 N and 2 N acting on an object in the same Cartesian plane.



2.2.1 Define the term resultant force. (2)

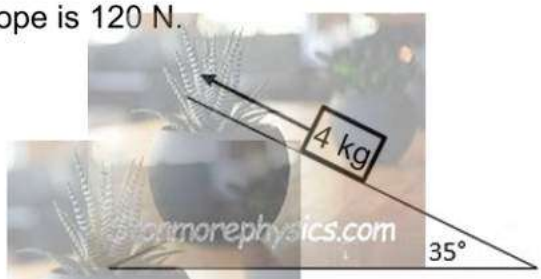
2.2.2 Calculate the magnitude and direction of the resultant force. (7)

[12]

QUESTION 3

A boy drags a crate with a mass of 4 kg at a constant velocity upwards along a rough incline with a rope.

The tension in the rope is 120 N.



3.1 Draw a fully labelled free force diagram indicating all the forces acting on the crate. (4)

3.2 Calculate the parallel component of the gravitational force. (2)

3.3 State Newton's first law of motion. (2)

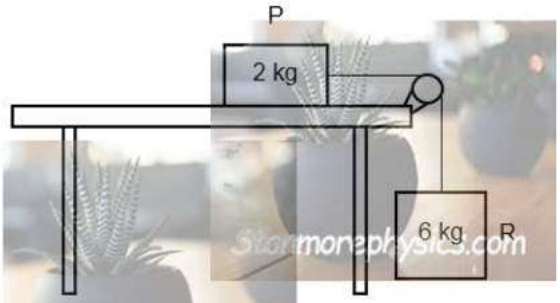
3.4 Calculate the magnitude of the frictional force. (3)

3.5 Calculate the coefficient of kinetic friction. (4)

[15]

QUESTION 4

Blocks P and R of masses 2 kg and 6 kg respectively, are connected with a light inextensible string. The string runs over a frictionless pully as shown in the diagram. The 2 kg block experiences a frictional force of 3 N.

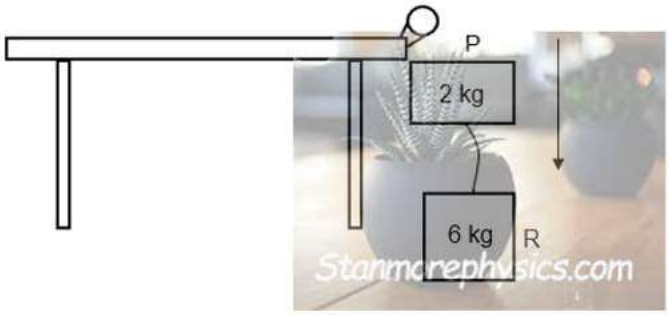


4.1 Define the term kinetic frictional force in words. (2)

4.2 Calculate the magnitude of the tension in the string. (6)

4.3 A learner presents the following argument:
The force that P exerts on the string is equal in magnitude but opposite in direction to the force by R on the string. Since they are equal, they will cancel each other.
Is the learner correct? Explain the answer. (2)

4.4 The 2 kg block then slides over the pulley and both blocks fall to the ground as indicated.



How does the acceleration of block P compare to that of block R?
Write down only GREATER THAN, SMALLER THAN or EQUAL TO.
Explain your answer. (2)

[12]

QUESTION 5

Two electrons are placed 0,3 μm apart.

5.1 State Newton's Universal law of gravitation. (2)

5.2 Calculate the gravitational force that exists between the two electrons. (4)

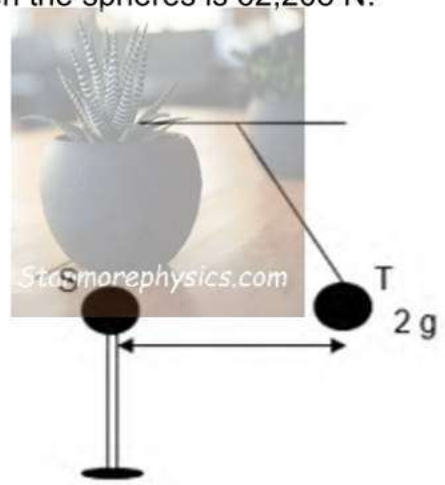
5.3 How will the gravitational force between the two masses change if the distance between them is halved? (1)

[7]

QUESTION 6

A learner hangs a graphite covered polystyrene ball T from the ceiling with a very light, non-elastic rope. The sphere carries a charge of 4,8 µC and has a mass of 2 g.

The learners now bring a charged sphere, S, of 3,6 µC on an isolated stand closer to T. Sphere T comes to rest in a position so that the Electrostatic force of repulsion between the spheres is 62,208 N.



6.1 Draw a free force diagram to indicate all the forces acting on sphere T. (3)

6.2 State Coulomb's law in words. (2)

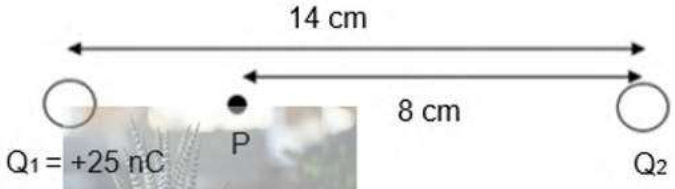
6.3 Calculate the distance between sphere S and T when they are at rest. (4)

6.4 Calculate the angle of the rope with the vertical. (2)

[11]

QUESTION 7

The net electric field strength at point P in the diagram is 8500 $N.C^{-1}$ to the right.



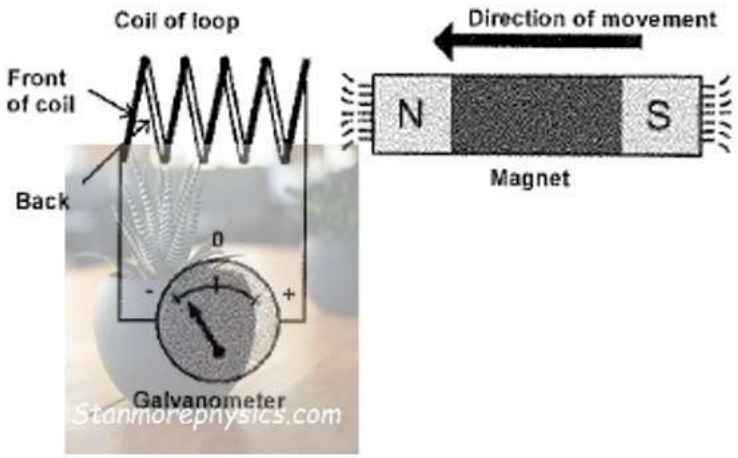
7.1 Define the term electric field at a point. (2)

7.2 Calculate the magnitude and nature (positive or negative) of the charge on Q_2. (6)

[8]

QUESTION 8

A magnet is brought near a solenoid or coil as shown in the diagram below.



8.1 State Faraday's law of Electromagnetic induction in words. (2)

8.2 What rule can be used to predict the direction of the induced current? (1)

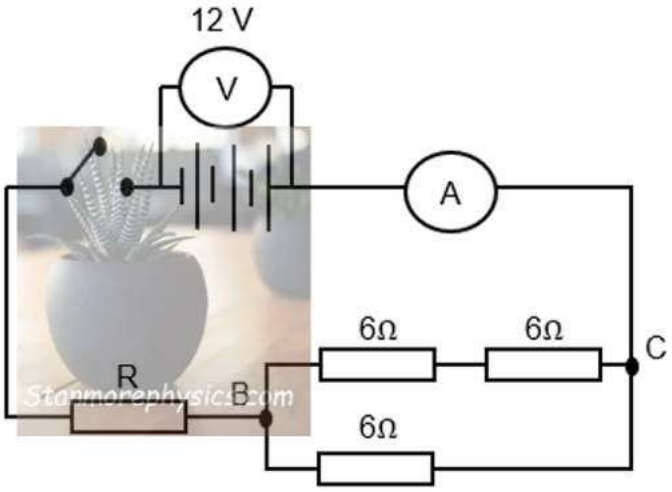
8.3 Give two ways in which the strength of the induced current can be increased. (2)

8.4 A coil with 200 windings (turns) is rotated so that the magnetic flux linkage with each winding charges from 5×10^{-4} Wb to 1×10^{-4} Wb in 0,2 s. Calculate the induced emf in the coil. (3)

[8]

QUESTION 9

In the circuit diagram below the emf of the battery is 12 V. The internal resistance of the battery is negligible.



9.1 Define the term emf in words. (2)

9.2 Calculate the total effective resistance between B and C. (2)

9.3 When the switch is closed, the ammeter reads 2,57 A.
Calculate

9.3.1 the resistance of resistor R. (4)

9.3.2 the current through the 6 Ω resistor in the bottom branch. (2)

A learner connects a conducting wire with negligible resistance directly between B and C.

9.4 How will the power dissipated by resistor R be affected?
Choose from INCREASE, DECREASE or REMAIN THE SAME.
Explain your answer. (3)

[13]

GRAND TOTAL 100

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	$6,38 \times 10^{6}\ m$
Coulomb's constant *Coulomb se konstante*	K	$9,0 \times 10^{9}\ N{\cdot}m^2{\cdot}C^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10^{8}\ m{\cdot}s^{-1}$
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}\ kg$
Mass of the earth *Massa van die Aarde*	M	$5,98 \times 10^{24}\ kg$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

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

FORCE/*KRAG*

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

WAVES, SOUND AND LIGHT/*GOLWE, KLANK EN LIG*

$v = f\lambda$	$T = \frac{1}{f}$
$n_i \sin\theta_i = n_r \sin\theta_r$	$n = \frac{c}{v}$

ELECTROSTATICS/*ELEKTROSTATIKA*

$F = \frac{kQ_1Q_2}{r^2}$ $(k = 9{,}0 \times 10^9\ N{\cdot}m^2{\cdot}C^{-2})$	$E = \frac{F}{q}$
$E = \frac{kQ}{r^2}$ $(k = 9{,}0 \times 10^9\ N{\cdot}m^2{\cdot}C^{-2})$	$n = \frac{Q}{e}$

ELECTROMAGNETISM/*ELEKTROMAGNETISME*

$\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$	$\Phi = BA\cos\theta$

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$I = \frac{Q}{\Delta t}$	$R = \frac{V}{I}$
$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + \ldots$	$R = r_1 + r_2 + r_3 + \ldots$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$

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FURTHER EDUCATION AND TRAINING
VERDERE ONDERWYS EN OPLEIDING

GRADE/GRAAD 11

PHYSICAL SCIENCES/FISIESE WETENSKAPPE

JUNE/JUNIE 2025

MARKING GUIDELINES/NASIENRIGLYNE

MARKS / PUNTE 100

This marking guideline consists of 11 pages.

Hierdie nasienriglyn bestaan uit 11 bladsye.

QUESTION / VRAAG 1

1.1 B ✓✓ (2)

1.2 C ✓✓ (2)

1.3 B ✓✓ (2)

1.4 D ✓✓ (2)

1.5 A ✓✓ (2)

1.6 B ✓✓ (2)

1.7 D ✓✓ (2)

[14]

QUESTION / VRAAG 2

2.1

Take North as positive. / Neem Noord as positief.	**Take South as positive. / Neem Suid as positief.**
$F_{net} = F_{Peter} + F_{Richard}$	$F_{net} = F_{Peter} + F_{Richard}$
$= 20 + (-30)$ ✓	$= -20 + 30$ ✓
$= -10$	$= 10$ N ✓ South / Suid. ✓
$= 10$ N ✓South / Suid. ✓	

(3)

2.2.1 The vector sum of two or more vectors
Die vektorsom van twee of meer vektore. ✓✓
OR/ OF
The single vector having the same effect as two or more vectors together / Die enkele vektor wat dieselfde effek het as twee of meer vektore tesame. ✓✓ (2)

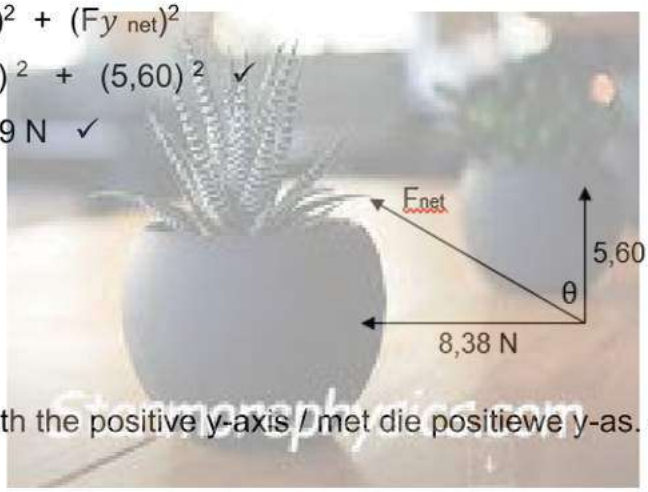
2.2.2 **Take right as positive/ Neem regs as positief**

$F_{x\ net} = F \cos\theta$
$= -8 \cos 48° + 2 \cos 10° - 5$ ✓
$= -8,38$ N
$= 8,38$ N Left / Links ✓

$F_{y\ net} = F \sin\theta$
$= 8 \sin 48° - 2 \sin 10°$ ✓
$= 5,60$ N Up / Op ✓

$(F_{net})^2 = (F_{x\ net})^2 + (F_{y\ net})^2$
$= (-8,38)^2 + (5,60)^2$ ✓
$\therefore F_{net} = 10,079$ N ✓

$\tan\theta = \frac{F_{x\ net}}{F_{y\ net}}$
$= \frac{8,38}{5,60}$

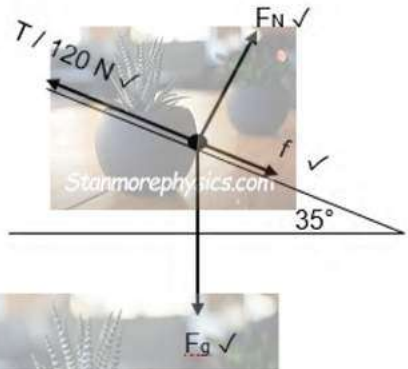


$\therefore \theta = 56,25°$ with the positive y-axis / met die positiewe y-as. ✓

(7)
[12]

QUESTION / VRAAG 3

3.1



Acceptable labels / Aanvaarbare benoemings	
F_N	N / Normal / F_{normal} / $F_{normaal}$ / Normaal
f	(kinetic) friction / F_f / f_k / (kinetiese) wrywing / F_w
F_g	w / F_w / weight / gewig / mg / 39,2 N / gravitational force / krag
T	F_T / F_{string} / tension / spanning / F_{tou} / 120 N

Notes

- Mark is awarded for label and arrow. / Punt word toegeken vir byskrif en pyltjie.
- Do not penalise for length of arrows. /Moonie vir die lengte van die pyltjies penaliseer nie.
- If arrows do not touch the dot / Indien pyle nie die kolletjie raak nie: Max/Maks $\frac{3}{4}$
- Any other additional force(s) / Enige ander addisionele krag(te): Max/Maks $\frac{3}{4}$
- If everything is correct, but no arrows. / Indien alles korrek, maar geen pyltjies word getoon: Max/Maks $\frac{3}{4}$

(4)

3.2 $F_{g\parallel} = F \sin \theta$

$= 4\ (9,8) \sin 35°$ ✓

$= 22,48$ N parallel down the incline ✓ / langs die skuinsvlak af. (2)

3.3 A body will remain in its state of rest or motion at constant velocity unless a resultant / net force acts on it. ✓✓

'n Liggaam sal in rus bly of teen 'n konstante snelheid bly voortbeweeg, tensy 'n resultante / netto krag daarop inwerk. (2)

3.4 $F_{net} = ma$ } Any one ✓

$T + F_{g\parallel} + f = ma$

$120 - 22,48 - f = 4\ (0)$ ✓

$\therefore f = 97,52$ N ✓ (3)

3.5 $f_k = \mu_k F_N$ ✓

$97,52 = \mu_k F_{g\perp}$ ✓

$97,52 = \mu_k\ 4(9,8) \cos 35°$ ✓

$\mu_k = 3,037$ ✓ (4)

[15]

QUESTION / VRAAG 4

4.1 The force that opposes the motion of a moving object relative to a surface. ✓✓
'n Krag wat die beweging van 'n voorwerp teenwerk, relatief tot die oppervlak.

(2)

4.2

Horizontally / Horisontaal	Vertically / Vertikaal
$F_{net} = ma$ ✓	$F_{net} = ma$
$T - f = 2a$	$F_g - T = 6a$
$\underline{T - 3 = 2a}$ ✓	$6(9{,}8) - T = 6a$
	$\underline{58{,}8 - T = 6a}$ ✓

$\therefore 55{,}8 = 8a$

$a = 6{,}975\ m.s^{-2}$ ✓

$\therefore T - 3 = 2(6{,}975)$ ✓

$\therefore T = 16{,}95\ N$ ✓

(6)

4.3 No. ✓ According to Newton's 3rd Law - the force that M exerts on the string must be equal to the force that the string exerts on M. ✓
Nee. Volgens Newton se 3de Wet – die krag wat M op die tou uitoefen moet gelyk wees aan die krag wat die tou op M uitoefen.
OR String on N, and N on string. OF Tou op N, en N op die tou.
OR Involves 2 objects. OF 2 Voorwerpe betrokke.
OR/OF The force that N exerts on the string is not in the same plane as the force that M exerts on the string. OF Die krag wat N op die tou uitoefen is nie in dieselfde vlak as die krag wat M op die tou uitoefen nie.

(2)

4.4 EQUAL TO. ✓ Both (blocks) experience gravitational acceleration. ✓
GELYK AAN. Beide (blokke) ervaar gravitasie versnelling.

(2)

[12]

QUESTION / VRAAG 5

5.1 Each particle in the universe attracts every other particle with a gravitational force ✓ that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centres. ✓

Elke deeltjie in die heelal trek 'n ander deeltjie aan met 'n gravitasiekrag wat direk eweredig is aan die produk van hul massas en omgekeerd eweredig aan die kwadraat van die afstand tussen hul middelpunte. (2)

5.2 $F_g = \frac{G m_1 m_2}{r^2}$ ✓

$= \frac{6,67 \times 10^{-11} \left(9,11 \times 10^{-31}\right)\left(9,11 \times 10^{-31}\right)}{(0,3 \times 10^{-6})^2}$ ✓ ✓

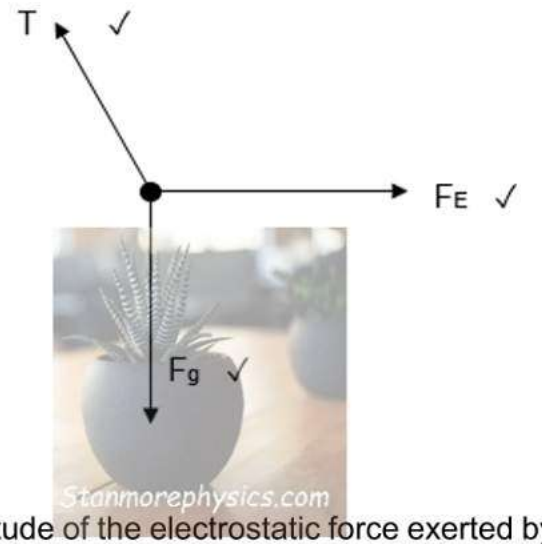
$= 6 \times 10^{-58}$ N ✓ (4)

5.3 4 times more / $2,4 \times 10^{-57}$ N ✓
4 keer meer / $2,4 \times 10^{-57}$ N (1)

[7]

QUESTION / VRAAG 6

6.1



(3)

6.2 The magnitude of the electrostatic force exerted by two point charges on each other ✓ is directly proportional to the product of the magnitudes of the charges and inversely proportional to the square of the distance between them. ✓

Die grootte van die elektrostatiese krag wat twee puntladings op mekaar uitoefen is direk eweredig aan die produk van die grootte van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle.

(2)

6.3

$$F_E = \frac{kQ_1Q_2}{r^2} \quad ✓$$

$$62{,}208 \quad ✓ = \frac{9 \times 10^9 \,(4{,}8 \times 10^{-6})(3{,}6 \times 10^{-6})}{(r)^2} \quad ✓$$

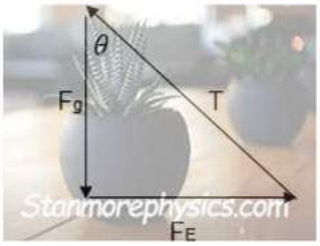
$$\therefore r = 0{,}05 \text{ m} \quad ✓$$

(4)

6.4 $\text{Tan } \theta = \frac{F_E}{F_g}$

$$= \frac{62{,}208}{(2)(9{,}8)} \quad ✓$$

$$\therefore \theta = 72{,}51° \quad ✓$$



sketch indicating θ

skets moet θ insluit

(2)

[11]

QUESTION / VRAAG 7

7.1 The electrostatic force experienced per unit positive charge placed at that point. ✓✓

Die elektrostatiese krag ondervind per eenheids positiewe lading wat by daardie punt geplaas word. (2)

7.2 Take right as positive / Neem regs as positief

$E_{net} = EQ_1 + EQ_2$

$E_{net} = \frac{k\,Q}{r^2} + \frac{k\,Q}{r^2}$ ✓

8500 ✓ $= \frac{9 \times 10^9 \ (25 \times 10^{-9})}{(6 \times 10^{-2})^2}$ ✓ $- \frac{9 \times 10^9\ Q}{(8 \times 10^{-2})^2}$ ✓

$\therefore Q = +$ ✓ $3{,}84 \times 10^{-8}$ C ✓ (6)

[8]

QUESTION / VRAAG 8

8.1 The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓✓

Die grootte van die geïnduseerde emk oor die ente van 'n geleier is direk eweredig aan die tempo van verandering in magnetiese vloed met die geleier. (2)

8.2 The right-hand solenoid rule. ✓ / Die regterhand solenoïde reël. (1)

8.3 Move the magnet faster. ✓ / Beweeg die magnet vinniger.
Use a stronger magnet. ✓ / Gebruik 'n sterker magneet.
Increase the number of windings on the solenoid.
Vermeerder die aantal windings op die solenoïde (any two/enige twee) (2)

8.4 $\varepsilon = \frac{-N\,\Delta\emptyset}{\Delta t}$ ✓

$= \frac{-200(1 \times 10^{-4} - 5 \times 10^{-4})}{0,2}$ ✓

$= 0,4$ V ✓ (3)

[8]

QUESTION / VRAAG 9

9.1 EMF is the maximum amount of energy that a battery can supply to move 1 coulomb of charge. ✓✓

EMK is die maksimum hoeveelheid energie wat 'n battery kan verskaf om 1 coulomb lading te beweeg. (2)

9.2 $R_p = \frac{R_1 \times R_2}{R_1 + R_2}$

$= \frac{12 \times 6}{12+6}$ ✓

$= 4\ \Omega$ ✓ (2)

9.3

9.3.1 $R_{total} = \frac{V}{I}$ ✓

$R_{total} = \frac{12}{2,57}$ ✓

$= 4,67\ \Omega$ ✓

$R = 4,67 - 4 = 0,67\ \Omega$ ✓ (4)

9.3.2 Use ratio of resistors 1 : 2 (6 Ω :12 Ω)

$I_{\text{bottom branch}} = \frac{2}{3}\ x\ 2,57$ ✓

$\therefore I = 1,71$ A ✓ (2)

9.4 INCREASE. ✓ / TOENEEM

If R_{total} decrease, I_{total} will increase. ✓

As R_{totaal} afneem, sal I_{totaal} toeneem.

According to $P = I^2 R$ ✓ Power will increase, when R remains constant.

Volgens $P = I^2 R$ Drywing sal toeneem, mits R konstant bly. (3)

[13]

GRAND TOTAL /GROOTTOTAAL 100