education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 11

PHYSICAL SCIENCES: PAPER 1

19 MARCH 2025

Marks: 100

Time: 2 hours

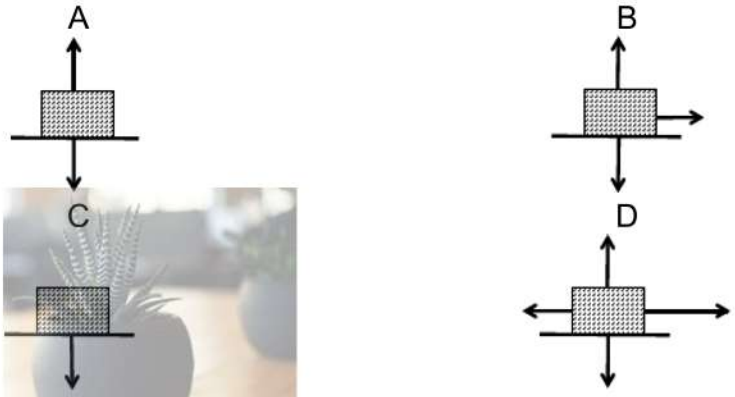
This question paper consists of 9 pages and 2 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name on the answer sheet provided.
2. This question paper consists of SIX questions. Answer ALL the questions in the ANSWER BOOK.
3. You may use a non-programmable calculator.
4. You may use appropriate mathematical instruments.
5. Number the answers correctly according to the numbering system used in this question paper.
6. You are advised to use the attached DATA SHEETS.
7. The formulae and substitutions must be shown in ALL calculations.
8. Give brief motivations, discussions, et cetera where required.
9. Round off your final numerical answers to a minimum of TWO decimal places.
10. Start EACH question on a NEW page.
11. All diagrams are not necessarily drawn according to scale.
12. Write neatly and legibly.

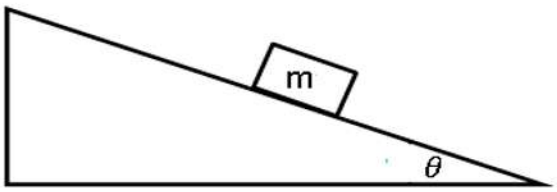
QUESTION 1

1.1 A block is moving with constant velocity to the right on a frictionless surface. Which sketch below correctly illustrates all the forces acting on the block?



(2)

1.2 A block of mass **m** is placed on a smooth inclined plane of inclination **θ** with the horizontal.
What is the magnitude of the normal force exerted by the surface on the block?



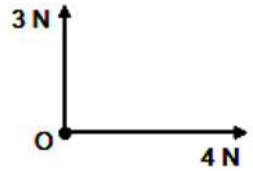
A mg

B mg cos θ

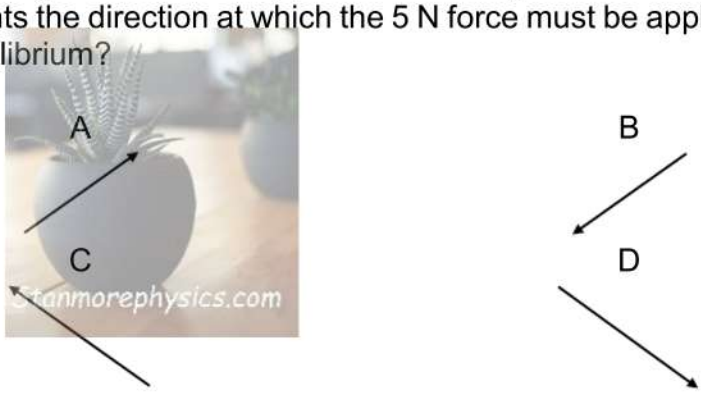
C mg sin θ

D mg tan θ (2)

1.3 The vector diagram shows two forces in the same plane acting on an object **O**.



Another force of magnitude 5 N is applied on the object **O**. Which ONE of the following represents the direction at which the 5 N force must be applied to ensure object **O** is in equilibrium?



(2)

1.4 Two hypothetical planets, **X** and **Y**, have the same mass. The diameter of planet **Y** is twice that of planet **X**.
If the acceleration due to gravity on the surface of planet **X** is **g**, then the acceleration due to gravity on the surface of planet **Y** will be …

A $\frac{g}{16}$

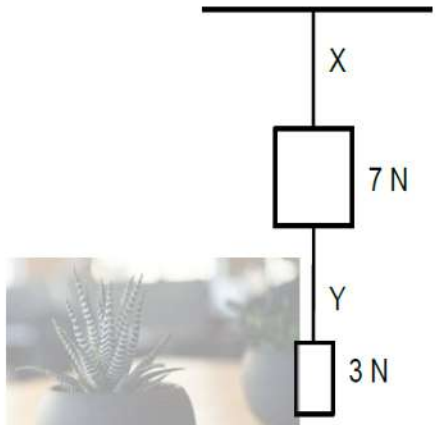
B $\frac{g}{4}$

C $\frac{g}{2}$

D 2g

(2)

1.5 Two blocks of weight 7 N and 3 N are attached to two ropes, **X** and **Y** as shown in the diagram below.



The blocks hang vertically at rest. The masses of the ropes are negligible. What is the tension in rope X and in rope Y?

	TENSION IN **X**	TENSION IN **Y**
A	10 N	10 N
B	10 N	3 N
C	7 N	4 N
D	7 N	7 N

(2)

1.6 Two charges point charges of +2 nC and +2 nC are located on a straight line. S and T are two points that lie on the same straight line as shown in the diagram below.

Which ONE of the following are the correct directions of the resultant electric field at point S and point T due to point charges +2 nC and +2 nC

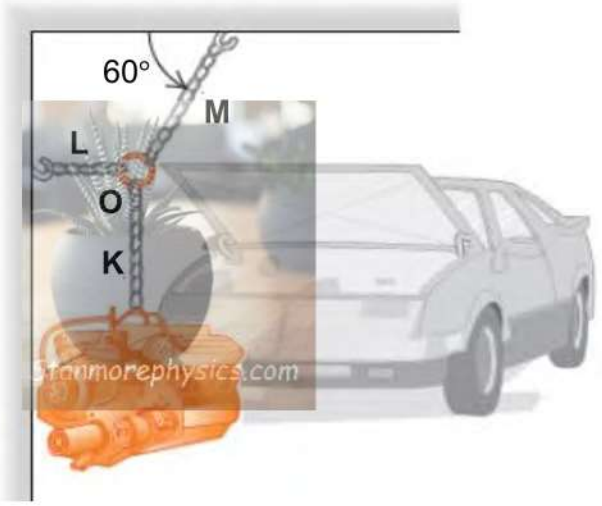
	DIRECTION OF THE RESULTANT ELECTRIC FIELD AT POINT **S**	DIRECTION OF THE RESULTANT ELECTRIC FIELD AT POINT **T**
A	Right	Left
B	Left	Left
C	Right	Right
D	Left	Right

(2)

[12]

QUESTION 2

A car engine with weight **w** hangs from a chain(**K**) that is linked at point **O** to two other chains, one chain(**M**) that is fastened at angle of 60° to the ceiling and the other chain(**L**) to the wall as shown in the diagram below. Tension in **M** is 2540 N when point **O** is at equilibrium.



2.1 Define the term *resultant*. (2)

2.2 What is the magnitude of the resultant force on point **O**. (1)

2.3 Draw a labelled free-body diagram showing ALL the forces acting on point **O**. (3)

2.4 Calculate:

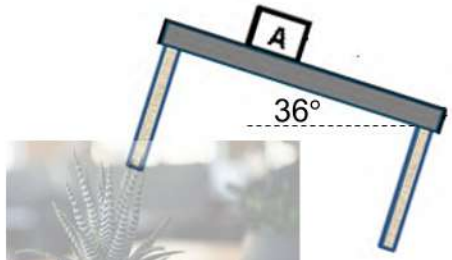
2.4.1 The magnitude of the vertical component of **M**. (2)

2.4.2 Mass of the engine. (3)

2.4.3 Tension in L. (2)
[13]

QUESTION 3

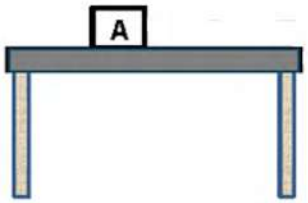
Block **A,** of mass 6 kg is placed on a table. The angle between the surface of the table and the horizontal is 36° as shown in the diagram below. The block is just about to slide and the maximum static frictional force acting on the block is 28,22 N.



3.1 Define *frictional force*. (2)

3.2 Calculate the co-efficient of static friction between the block and the surface of the table. (4)

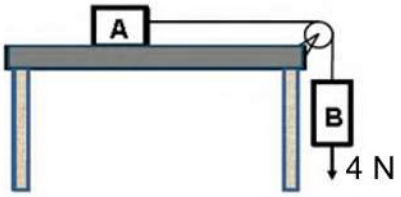
The table is now placed horizontal as shown in the diagram below.



3.3 How will the value calculated in QUESTION 3.2 be affected? Write only INCREASES, DECREASES or REMAINS THE SAME. (1)

3.4 Explain the answer in QUESTION 3.3. (1)

Block **A,** is now connected by a massless string passing over a frictionless pulley, to block **B** of mass 4 kg. A downwards force of 4 N is applied to block **B** as shown in the diagram below. The kinetic frictional force between Block **A** and the table is 23,52 N. Block A accelerates to the right.



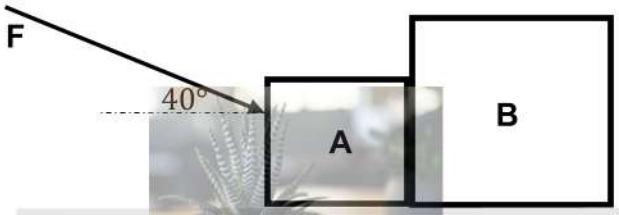
3.5 Draw a labelled free-body diagram for block **B**. (3)

3.6 Calculate the magnitude of the tension in the rope. (6)

[17]

QUESTION 4

An athlete trains by pushing a heavy box **A** of mass 23 kg, which is in contact with another identical box **B** of mass 31 kg, across a ROUGH surface of a field as shown in the diagram below. The athlete exerts a force **F** at an angle of 40° to the horizontal on box **A**. Each box experiences a frictional force of 45 N. The magnitude of the normal force acting on box **A** is 303,8 N. The boxes accelerate horizontally to the right as a system.



4.1 State Newton's First Law of Motion in words. (2)

4.2 Draw a labelled force diagram showing ALL the forces acting on box **A**. (5)

4.3 The magnitude of the force that box **A** exerts on box **B** is the same as the magnitude of the force that box **B** exerts on box **A**.

Which Newton's Law of Motion explains this statement. (1)

4.4 Calculate the magnitude of the:

4.4.1 Force **F**, acting on box **A**. (3)

4.4.2 Acceleration of the boxes. (5)

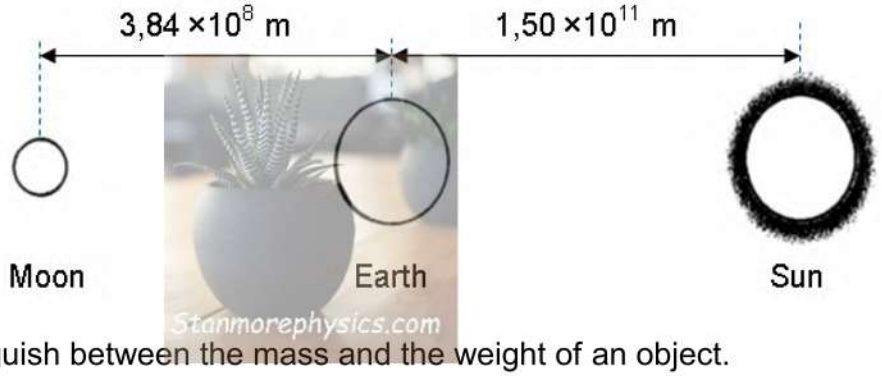
4.4.3 Force that box **B** exerts on box **A**. (2)

4.5 Use a relevant formula(e) to explain why the two boxes experience the same frictional force. (4)

[22]

QUESTION 5

During a lunar eclipse, the Earth, the Moon, and the Sun are aligned on the same plane such that the distance between the center of Moon and the Earth is $3,84 \times 10^8$ m and the distance between the Sun and the Earth is $1,50 \times 10^{11}$ m as shown in the diagram below. The masses of the Moon and the Sun are $7,35 \times 10^{22}$ kg and $1,99 \times 10^{30}$ kg respectively.



5.1 Distinguish between the mass and the weight of an object. (2)

5.2 State *Newton's law of universal gravitation* in words. (2)

5.3 Calculate the magnitude of the gravitational force exerted by the Sun on the Earth. (4)

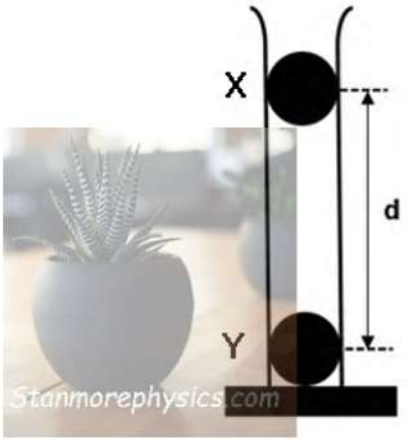
The gravitational force exerted by the Earth on the Moon is 1.99×10^{20} N

5.4 Write down the magnitude of the force that the Moon exert on the Earth. (1)

5.5 Calculate the net force experience by Earth due to the Moon and the Sun. (3)
[12]

QUESTION 6

A polystyrene ball **Y** carrying a charge of $+30 \times 10^{-9}$ C is covered with a thin layer of graphite and placed in a glass cylinder. An identical ball **X** of mass 40 g, carrying a charge of $+100 \times 10^{-9}$ C is now placed in the measuring cylinder and is pushed away to a height **d** as shown in the diagram below.

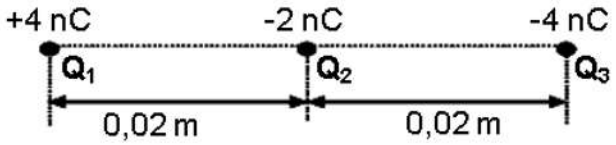


6.1 State *Coulomb's Law* in words. (2)

6.2 Draw a labelled free-body diagram showing ALL the forces acting on ball **X**. (2)

6.3 Calculate the distance **d** in mm, between ball **X** and **Y**. (6)

In the diagram below, Q_1, Q_2 and Q_3 are three stationary point charges placed along a straight line. The charges on Q_1, Q_2 and Q_3 are +4 nC, -2 nC and -4 nC respectively. The distance between Q_1 and Q_2 is 0,02 m and that between Q_2 and Q_3 is also 0,02 m.



6.4 Define the term *electric field at a point* in words. (2)

6.5 Draw the net electric field pattern due to charges Q_1 and Q_3. (3)

6.6 Calculate the net force exerted by Q_2 and Q_3 on Q_1. (6)

6.7 Calculate the net electric field experinced by Q_1. (3)

[24]

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•s^{-2}
Universal gravitational constant / *Universelegravitasiekonstant*	G	6,67 × 10^{-11} N•m^2•kg^{-2}
Speed of light in a vacuum / *Spoed van lig in 'n vakuum*	c	3,0 × 10^8 m•s^{-1}
Planck's constant / *Planck se konstante*	h	6,63 × 10^{-34} J•s
Coulomb's constant / *Coulomb se konstante*	k	9,0 × 10^9 N•m^2•C^{-2}
Charge on electron / *Lading op elektron*	e	-1,6 × 10^{-19} C
Electron mass / *Elektronmassa*	m_e	9,11 × 10^{-31} kg
Mass of earth / *Massa op aarde*	M	5,98 × 10^{24} kg
Radius of earth / *Radius van aarde*	R_E	6,38 × 10^3 km

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*

$F_{net} = ma$	$w = mg$
$F = \frac{Gm_1m_2}{d^2}$	$\mu_s = \frac{f_s^{max}}{N}$
$\mu_k = \frac{f_k}{N}$	

ELECTROSTATICS/*ELEKTROSTATIKA*

$F = \frac{kQ_1Q_2}{r^2}$ (k = 9,0 x 10^9 N.m^2.C^{-1})	$E = \frac{F}{q}$
$E = \frac{kQ}{r^2}$ (k = 9,0 x 10^9 N.m^2.C^{-1})	$n = \frac{Q}{q_e}$

ELECTROMAGNETISM/ *ELEKTROMAGNETISME*

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

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$I = \frac{Q}{\Delta t}$	$R = \frac{V}{I}$
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$	$R_s = R_1 + R_2 + \ldots$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$

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PROVINCIAL ASSESSMENT
PROVINSIALE ASSESSERING

GRADE/GRAAD 11

PHYSICAL SCIENCES: PAPER 1
FISIESE WETENSKAPPE: VRAESTEL 1

19 MARCH/ MAART 2025

Marking Guidelines/ Merkriglyne

Marks/ Punte: 100

Time/ Tyd: 2 hours/ uur

These marking guidelines consists of 8 pages.
Hierdie merkriglyne bestaan uit 8 bladsye

Please turn over/ Blaai asseblief om

QUESTION/ VRAAG 1

1.1 A ✓✓ (2)

1.2 B ✓✓ (2)

1.3 B ✓✓ (2)

1.4 B ✓✓ (2)

1.5 B ✓✓ (2)

1.6 D ✓✓ (2)

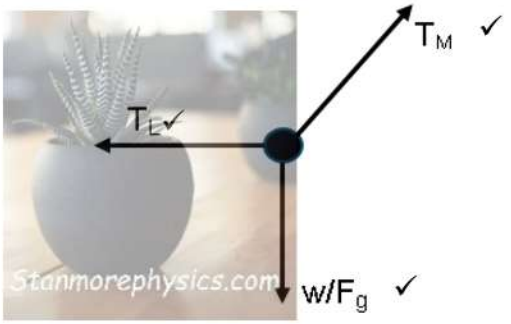
[12]

QUESTION/ VRAAG 2

2.1 Resultant is a single vector having the same effect as two or more vectors together / the vector sum of two or more vectors. ✓✓
Resultant is 'n enkele vektor wat dieselfde effek het as twee of meer vektore saam/ die som van twee of meer vektore. ✓✓ (2)

2.2 Zero/ Nul/ 0N ✓ (1)

2.3



(3)

2.4.1 $T_{yM} = 2540\sin 60$ ✓
$T_{yM} = 2199{,}70$ N ✓ (2)

2.4.2

OPTION/ OPSIE 1	OPTION/ OPSIE 2
$T_{yM} - mg = 0$ ✓ $2199{,}70 - m\times 9{,}8$ ✓ $= 0$ $m = 224{,}45$ kg ✓	$\sin 60 = \frac{m\times 9{,}8}{2199{,}70}$ ✓✓ $m = 224{,}45$ kg ✓

(3)

2.4.3 $\cos 60 = \frac{T_L}{2199{,}70}$ ✓
$T_L = 1270$ N ✓ (2)
[13]

QUESTION/ VRAAG 3

3.1 It is the force that opposes the motion of an object and which acts parallel to the surface.✓✓ (2)
Is die krag wat die beweging van 'n voorwerp teenstaan en werk parallel tot die oppervlak in. ✓✓

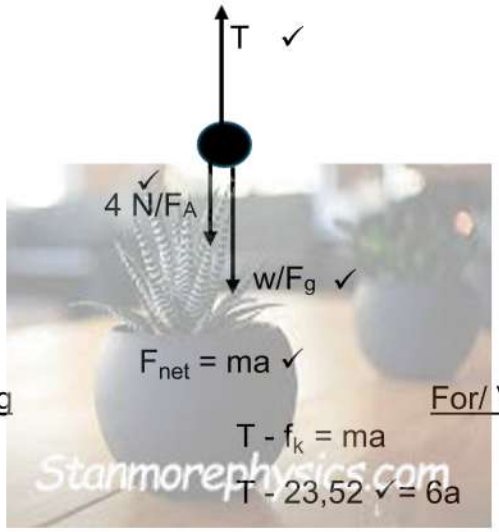
3.2 $N = mg\cos 36$
$N = 6 \times 9{,}8\cos 36$ ✓
$N = 47{,}5702$

$f_s^{max/maks} = \mu_s N$ ✓
$28{,}22 = \mu_s \times 47{,}5702$ ✓
$\mu_s = 0{,}59$ ✓ (4)

3.3 REMAINS THE SAME/ BLY DIESELFDE. ✓ (1)

3.4 The type of material in contact is the same/was not changed/coefficient of friction depends on the type of material in contact. ✓ (1)
Die tipe materiaal is dieselfde/ was nie verander nie/ wrywingskoëffisiënt is afhanklik van die tipe materiaal. ✓

3.5



(3)

3.6 $F_{net} = ma$ ✓

For/ Vir 4 kg	For/ Vir 6 kg
$mg + f_k - T = ma$	$T - f_k = ma$
$4 \times 9{,}8 + 4 - T$ ✓$= 4a$	$T - 23{,}52$ ✓$= 6a$
$T = 43{,}2 - 4a$	$T = 6a + 23{,}52$

$43{,}2 - 4a = 6a + 23{,}52$

$a = 1{,}968\ m\cdot s^{-2}$ ✓

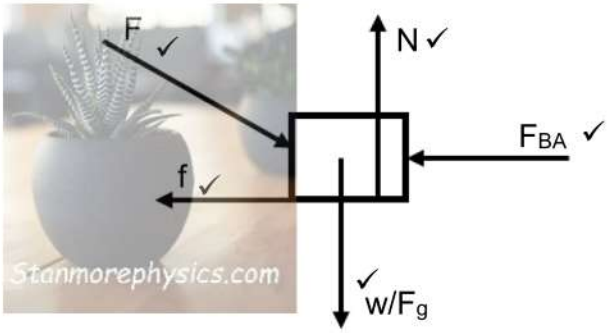
$T = 43{,}2 - 4(1{,}968)$ ✓	$T = 6(1{,}968) + 23{,}52$ ✓
$T = 35{,}33$ N ✓	$T = 35{,}33$ N ✓

(6)
[17]

QUESTION/ VRAAG 4

4.1 When a resultant/net force acts on an object, the object will accelerate in the direction of the force at an acceleration directly proportional to the force and inversely proportional to the mass of the object. ✓✓ (2)
Wanneer 'n resulante/ netto krag op 'n voorwerp inwerk, versnel die voorwerp in die rigting van die krag teen 'n versnelling wat direk eweredig is aan die krag en omgekeerd eweredig is aan die massa van die voorwerp. ✓✓

4.2



(5)

4.3 Newton's third law of motion/ Newton se derde bewegingswet. ✓ (1)

4.4.1 N = mg + Fsin40

<u>303,8 = 23 × 9,8 + Fsin40</u> ✓✓

F = 121,97 N ✓ (3)

4.4.2

<u>For object/ Vir voorwerp A</u>	<u>For object / Vir voorwerpB</u>
$F_{net} = ma$ ✓	
$121,97\cos 40 - 45 - F_{BA} = 23a$ ✓	$F_{AB} - 45 = 31a$ ✓
$F_{BA} = 48,43 - 23a$	$F_{AB} = 31a - 45$

$48,43 - 23a = 31a - 45$ ✓

$a = 0,06\ m\cdot s^{-2}$ ✓ (5)

4.4.3

$F_{BA} = 48,43 - 23(0,06)$ ✓	$F_{AB} = 31(0,06) - 45$ ✓
$F_{BA} = 47,05$ N✓	$F_{AB} = 47,17$ N✓

(2)

4.5 $N = mg$
$N = 31 \times 9,8 = 303,8\ N$ ✓
$f_k = \mu N$ ✓
Both boxes experiences same magnitude of the Normal force. ✓
Boxes are identical and are placed on the same surface therefore will same coefficient of kinetic friction. ✓ (4)
Beide bokse ervaar dieselfde grootte Normaalkrag. ✓
Bokse is identies en is op dieselfde oppervlak, daarom dieselfde wrywingskoëffisiënt. ✓

[22]

QUESTION/ VRAAG 5

5.1 Weight is the gravitational force exerted by the Earth on an object✓. Mass as the amount of matter in a body. ✓ (2)
Gewig is die gravitasiekrag uitgeoefen deur die Aarde op 'n voorwerp. ✓ Massa is die hoeveelheid materie wat 'n voorwerp besit. ✓

5.2 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. ✓✓ (2)
Elke liggaam in die ruimte trek elke ander liggaam aan met 'n gravitasiekrag wat direk eweredig is aan die produk van hul massas en omgekeerd eweredig is aan die kwadraat van die afstand tussen hulle middelpunte. ✓✓

5.3 $F_{SE} = \frac{Gm_S m_E}{d^2}$ ✓

$F_{SE} = \frac{6,67 \times 10^{-11} \times 1,999 \times 10^{30} \times 5,98 \times 10^{24}}{(1,50 \times 10^{11})^2}$ ✓ ✓

$F_{SE} = 3,53 \times 10^{22}$ N ✓ (4)

5.4 1.99×10^{20} N ✓ (1)

5.5 $F_{net} = 3,53 \times 10^{22} - 1.99 \times 10^{20}$ ✓

$F_{net} = 3,51 \times 10^{22}$ N towards the sun/ na die son ✓ (3)

[12]

QUESTION/ VRAAG 6

6.1 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. ✓✓ (2)
Die grootte van die elektrostatiese krag uitgeoefen deur twee puntladings op mekaar is direk eweredig aan die produk van die grootte van hul ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle. ✓✓

6.2

(2)

6.3

$$F_E = \frac{kQ_YQ_X}{d^2}$$ ✓ w = mg

w = 0,04 × 9,8 ✓

$$F_E = \frac{9 \times 10^9 \times 30 \times 10^{-9} \times 100 \times 10^{-9}}{d^2}$$ ✓ w = 0,392 N

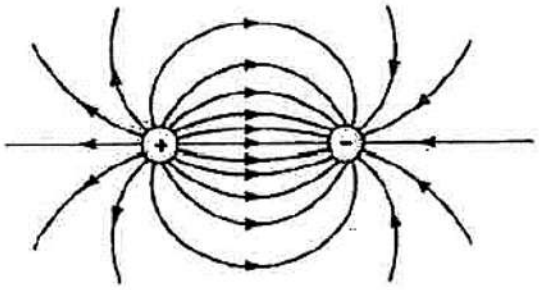
$$\frac{9 \times 10^9 \times 30 \times 10^{-9} \times 100 \times 10^{-9}}{d^2} = 0,392$$ ✓

d = 0,008 m ✓

d = 8 mm ✓ (6)

6.4 It is the electrostatic force experienced per unit positive charge placed at that point. ✓✓ (2)
Dit is die elektrostatiese krag ervaar per eenheid positiewe lading by 'n punt. ✓✓

6.5



(3)

Criteria/ Kriteria	Marks/ Punte
Correct direction of the field lines./ Korrekte rigting van veldlyne	✓
Correct shape of the field lines between the charges and outside the charges./ Korrekte vorm van die veldlyne tussen die ladings en rondom die ladings	✓
No field lines crossing each other. Field lines must touch the charge but must not go inside the charge./ Geen veldlyne kruis mekaar.	✓

6.6 $F_{21}=\frac{kQ_2Q_1}{d_{21}^2}$ ✓ $F_{31}=\frac{kQ_3Q_1}{d_{31}^2}$

$F_{21}=\frac{9\times10^9\times2\times10^{-9}\times4\times10^{-9}}{(0,02)^2}$ ✓ $F_E=\frac{9\times10^9\times4\times10^{-9}\times4\times10^{-9}}{(0.04)^2}$ ✓

F_{21}=0,00018 N F_{21}=0,0009 N

F_{net} = 0,00018 + 0,0009 ✓

F_{net} = 0,00027 N ✓ Right/ Regs ✓ (6)

6.7 $E_{net}=\frac{F_{net}}{q}$ ✓

$E_{net}=\frac{0,00027}{4\times10^{-9}}$ ✓

E_{net} = 67500 N·C^{-1} Right/ Regs ✓ (3)

[24]