DEPARTMENT OF EDUCATION
REPUBLIC OF SOUTH AFRICA

DEPARTEMENT VAN ONDERWYS
REPUBLIEK VAN SUID-AFRIKA

SENIOR CERTIFICATE EXAMINATION - 2004
SENIORSERTIFIKAAT-EKSAMEN - 2004

PHYSICAL SCIENCE P1 : PHYSICS
NATUUR- EN SKEIKUNDE V1 : FISIKA

HIGHER GRADE
HOËR GRAAD

OCTOBER/NOVEMBER 2004
OKTOBER/NOVEMBER 2004

304-1/1

Marks: 200
Punte : 200

2 Hours
2 Ure

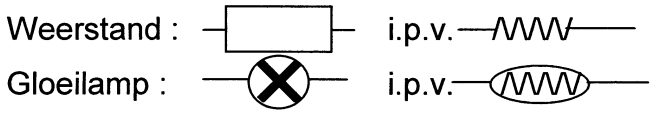
This question paper consists of 15 pages and 2 data sheets.
Hierdie vraestel bestaan uit 15 bladsye en 2 gegewensblaaie.

PHYSICAL SCIENCE HG: Paper 1
Physics

304 1 1 HG

ALGEMENE INSTRUKSIES

1. Skryf jou **eksamennommer** (en **sentrumnommer** indien van toepassing) in die aangewese spasies op die antwoordeboek.
2. Beantwoord **AL** die vrae.
3. Nie-programmeerbare sakrekenaars mag gebruik word.
4. Toepaslike wiskundige instrumente mag gebruik word.
5. 'n Gegewensblad is vir jou gebruik aangeheg.
6. LET WEL! Die volgende stroombaandiagramsimbole word in hierdie vraestel gebruik.



7. Punte kan verbeur word indien instruksies nie gevolg word nie.

VRAAG 1

INSTRUKSIES

1. Beantwoord hierdie vraag op die spesiaal gedrukte **ANTWOORDBLAD.** [LET WEL: Die antwoordblad kan óf 'n afsonderlike blad wees wat as deel van die vraestel verskaf word, óf dit kan as deel van die antwoordeboek gedruk word.] Skryf jou **EKSAMENNOMMER** (en **sentrumnommer** indien van toepassing) in die aangewese spasies, indien 'n afsonderlike antwoordblad verskaf word.
2. Vier moontlike antwoorde, voorgestel deur A, B, C en D, word by elke vraag voorsien. Elke vraag het slegs EEN korrekte antwoord. Kies slegs die antwoord wat na jou mening die korrekte of die beste een is, en merk die toepaslike blokkie op die ANTWOORDBLAD met 'n kruis (X).
3. Moenie enige ander merke op die antwoordblad maak nie. Enige berekenings of skryfwerk wat nodig mag wees wanneer hierdie vraag beantwoord word, moet in die antwoordeboek gedoen word en duidelik met 'n skuins streep oor die bladsy deurgehaal word.
4. Indien meer as een blokkie gemerk is, sal geen punte vir die antwoord toegeken word nie.

VOORBEELD

VRAAG: Die simbool vir die SI-eenheid van tyd is ...

A t.
B h.
C s.
D m.

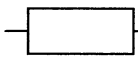
ANTWOORD:

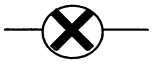
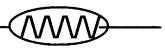
A	B	C	D

[LET WEL: Hierdie uitleg kan verskil, afhangend van die tipe antwoordblad wat die provinsie gebruik.]

GENERAL INSTRUCTIONS

1. Write your **examination number** (and **centre number** if applicable) in the appropriate spaces on the answer book.
2. Answer **ALL** the questions.
3. Non-programmable calculators may be used.
4. Appropriate mathematical instruments may be used.
5. A data sheet is attached for your use.
6. NOTE! The following circuit diagram symbols are used in this paper.

Resistor :  instead of 

Bulb :  instead of 

7. Marks may be forfeited if instructions are not followed.

QUESTION 1

INSTRUCTIONS

1. Answer this question on the specially printed **ANSWER SHEET.** [NOTE: The answer sheet may be either a separate sheet provided as part of your question paper, or printed as part of the answer book.] Write your **EXAMINATION NUMBER** (and **centre number** if applicable) in the appropriate spaces, if a separate answer sheet is used.
2. Four possible answers, indicated by A, B, C and D, are supplied with each question. Each question has only ONE correct answer. Choose only that answer, which in your opinion, is the correct or best one and mark the appropriate block on the ANSWER SHEET with a cross (X).
3. Do not make any other marks on the answer sheet. Any calculations or writing that may be necessary when answering this question should be done in the answer book and must be deleted clearly by means of a diagonal line drawn across the page.
4. If more than one block is marked. no marks will be awarded for that answer.

EXAMPLE
QUESTION: The symbol for the SI unit of time is ...

A t.
B h.
C s.
D m.

ANSWER:

A	B	C	D

[NOTE: This layout may vary, depending on the type of answer sheet used by the province.]

VRAAG 1

1.1 In watter EEN van die volgende situasies is die vektorhoeveelheid **nie volledig** gespesifiseer nie?

A Jeremy trek 'n blok ooswaarts oor 'n horisontale tafel met 'n krag van 5 N.

B Azeez ondergaan 'n verplasing van 50 m in 'n rigting 060°.

C Sipho bestuur 'n motor teen 'n versnelling van 3 $m.s^{-2}$ om 'n sirkelvormige baan.

D Tracy gooi 'n bal wat terugbons met 'n verandering in momentum van 12 $kg.m.s^{-1}$, weg van 'n muur af. (4)

1.2 Die fisiese hoeveelheid voorgestel deur die uitdrukking $\frac{m(v^2 - u^2)}{2s}$ is ekwivalent aan ...

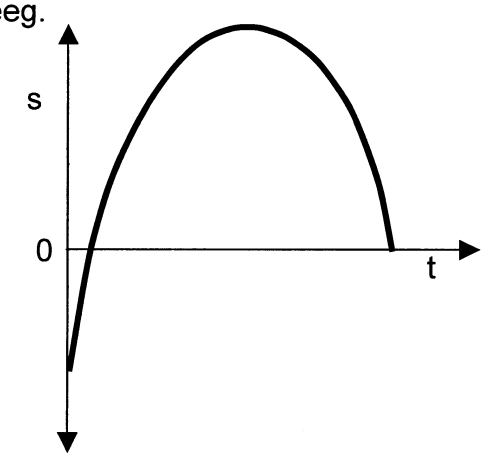
A resulterende krag.

B momentum.

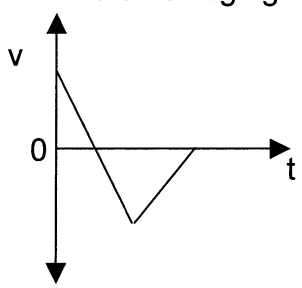
C energie.

D verandering in momentum. (4)

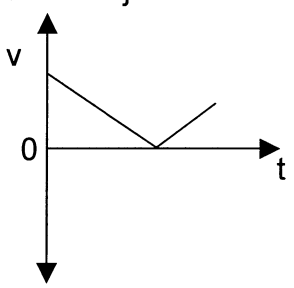
1.3 Die grafiek toon die verandering in die verplasing van 'n deeltjie, teen tyd, wat op 'n reguit spoor beweeg.



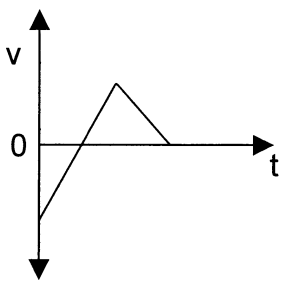
Watter EEN van die volgende snelheid-tydgrafieke is die beste voorstelling vir die beweging van die deeltjie?



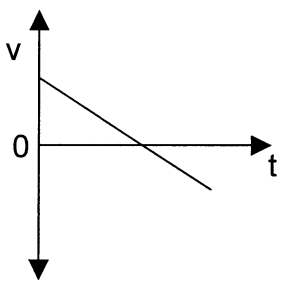
A



B



C



D (4)

QUESTION 1

1.1 In which ONE of the following situations is the vector quantity **not completely** specified?

A Jeremy pulls a block eastwards across a horizontal table with a force of 5 N.

B Azeez undergoes a displacement of 50 m on a bearing 060°.

C Sipho drives a car with an acceleration of 3 $m.s^{-2}$, around a circular track.

D Tracy throws a ball which rebounds and has a change of momentum of 12 $kg.m.s^{-1}$, away from a wall. (4)

1.2 The physical quantity represented by the expression $\frac{m(v^2 - u^2)}{2s}$ is equivalent to …

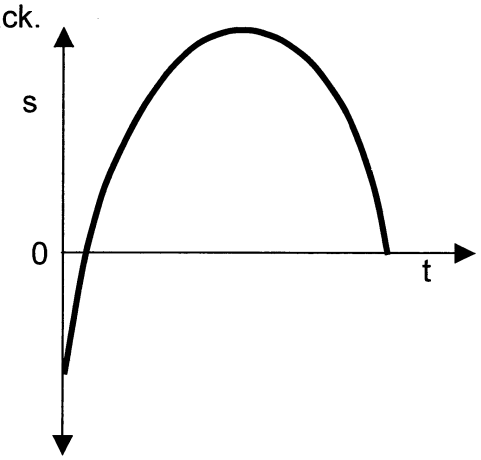
A resultant force.

B momentum.

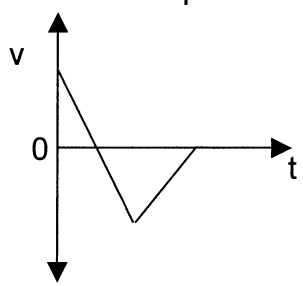
C energy.

D change in momentum. (4)

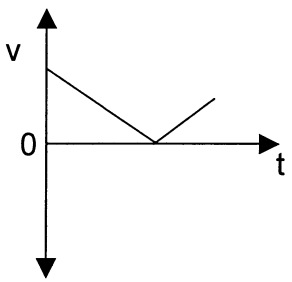
1.3 The graph shows the change in the displacement of a particle, with time, moving on a straight track.



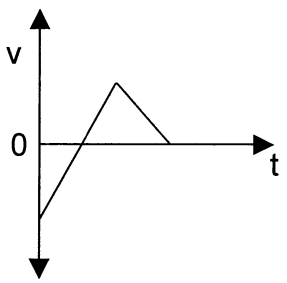
Which ONE of the following velocity-time graphs best represents the motion of the particle?



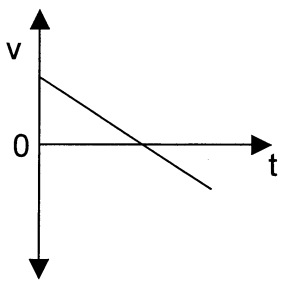
A



B



C



D (4)

1.4 Beskou die formule $s = ut + \frac{1}{2}at^2$ wat van toepassing is op die beweging van 'n uniforme versnelde voorwerp. Die term "ut" verteenwoordig die ...

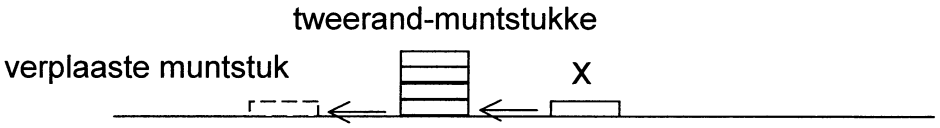
A beginsnelheid by tyd t.

B verplasing, in tyd t, as dit teen konstante snelheid u beweeg.

C verplasing, vanuit rus, in tyd t.

D beginsnelheid as die versnelling zero is. (4)

1.5 Ziyanda plaas 4 tweerand-muntstukke, die een bo-op die ander, op 'n horisontale tafel. Wrywing is weglaatbaar. Sy skiet 'n ander tweerand-muntstuk (X) wat die onderste muntstuk horisontaal tref. Muntstuk X verplaas en vervang die onderste muntstuk terwyl die ander muntstukke op dieselfde plek op die tafel bly.



Watter EEN van die volgende wette verklaar waarom die **boonste drie muntstukke** nie verplaas is nie?

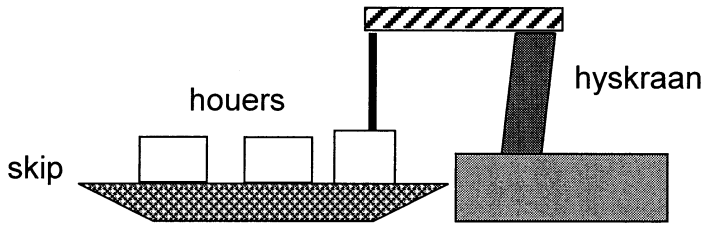
A Newton se Eerste Bewegingswet

B Newton se Derde Bewegingswet

C Wet van Behoud van Momentum

D Wet van Behoud van Energie (4)

1.6 Swaar houers op 'n skip word vertikaal beweeg tydens die op- en aflaaiproses deur 'n staalkabel wat vasgemaak is aan 'n hyskraan.



Die krag wat die staalkabel op 'n houer uitoefen, is 'n **minimum** wanneer die houer ...

A opwaarts versnel.

B afwaarts versnel.

C in rus hang.

D teen konstante snelheid opwaarts of afwaarts beweeg. (4)

1.4 Consider the formula $s = ut + \frac{1}{2}at^2$ which applies to the motion of a uniformly accelerated object. The term "ut" represents the ...

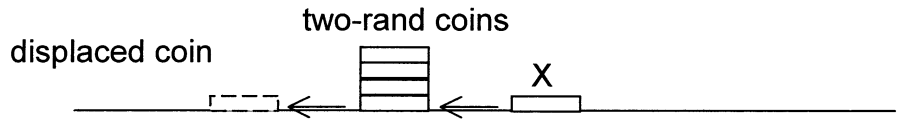
A initial velocity, at time t.

B displacement, in time t, if it travels at constant velocity u.

C displacement, from rest, in time t.

D initial velocity, when the acceleration is zero. (4)

1.5 Ziyanda places 4 two-rand coins, one above the other, on a horizontal table. Friction is negligible. She shoots another two-rand coin (X) which strikes the lowest coin horizontally. Coin X displaces and replaces the lowest coin, while all the other coins remain at the same place on the table.



Which ONE of the following laws explains why the **top three coins** are not displaced?

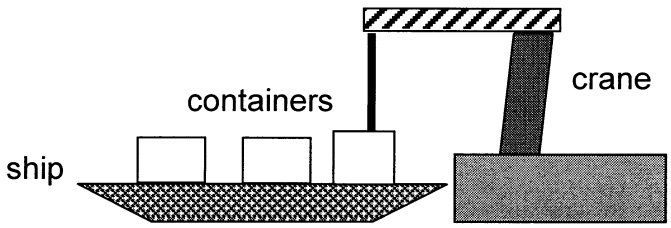
A Newton's First Law of Motion

B Newton's Third Law of Motion

C Law of Conservation of Momentum

D Law of Conservation of Energy (4)

1.6 Heavy containers on a ship are moved vertically during loading and unloading by a steel cable attached to a crane.



The force which the steel cable exerts on a container is a **minimum** when the container is ...

A accelerated upwards.

B accelerated downwards.

C suspended at rest.

D moving either upwards or downwards with constant velocity. (4)

1.7 Die versnelling as gevolg van gravitasie by 'n punt op die oppervlak van die aarde is **g**. Wat sal die gravitasieversnelling op die oppervlak van 'n ander planeet met dieselfde massa, maar dubbel die aarde se deursnee, wees?

A $4\mathbf{g}$

B $2\mathbf{g}$

C $\frac{1}{2}\mathbf{g}$

D $\frac{1}{4}\mathbf{g}$ (4)

1.8 'n Liggaam met massa **m** beweeg teen konstante snelheid **v** en ondergaan 'n verplasing **s** teen 'n konstante wrywingskrag **F**. Hoeveel drywing word benodig om die liggaam in beweging te hou teen hierdie konstante snelheid?

A $\frac{1}{2}\mathbf{Fs}$

B $\mathbf{Fv}$

C $\frac{1}{2}\mathbf{mv^2}$

D 0 (4)

1.9 'n Motor, wat teen konstante snelheid beweeg met kinetiese energie $\mathbf{E_k}$, ondergaan 'n verplasing **x** in tyd **t**. As die motor se kinetiese energie verander na 'n waarde van $2\mathbf{E_k}$, sal dit in dieselfde tyd, teen die nuwe konstante snelheid, 'n verplasing ondergaan van ...

A $4\mathbf{x}$

B $2\mathbf{x}$

C $\sqrt{2}\,\mathbf{x}$

D $\frac{1}{\sqrt{2}}\mathbf{x}$ (4)

1.7 The acceleration due to gravity at a point on the surface of the earth is **g**. What would be the gravitational acceleration on the surface of another planet of the same mass, but which has double the diameter of the earth?

A $4\mathbf{g}$

B $2\mathbf{g}$

C $\frac{1}{2}\mathbf{g}$

D $\frac{1}{4}\mathbf{g}$ (4)

1.8 A body of mass **m** moves at constant velocity **v** through a displacement **s** against a constant, frictional force **F**. What is the power required to keep the body moving at this constant velocity?

A $\frac{1}{2}\mathbf{Fs}$

B $\mathbf{Fv}$

C $\frac{1}{2}\mathbf{mv^2}$

D 0 (4)

1.9 A car, moving at constant velocity with kinetic energy $\mathbf{E_k}$, undergoes a displacement **x** in time **t**. If the car's kinetic energy changes to a value of $2\mathbf{E_k}$, then in the same time, at the new constant velocity, it will undergo a displacement of ...

A $4\mathbf{x}$

B $2\mathbf{x}$

C $\sqrt{2}\,\mathbf{x}$

D $\frac{1}{\sqrt{2}}\mathbf{x}$ (4)

1.10 Elektriese veldsterkte by 'n punt in 'n elektriese veld word gedefinieer as die …

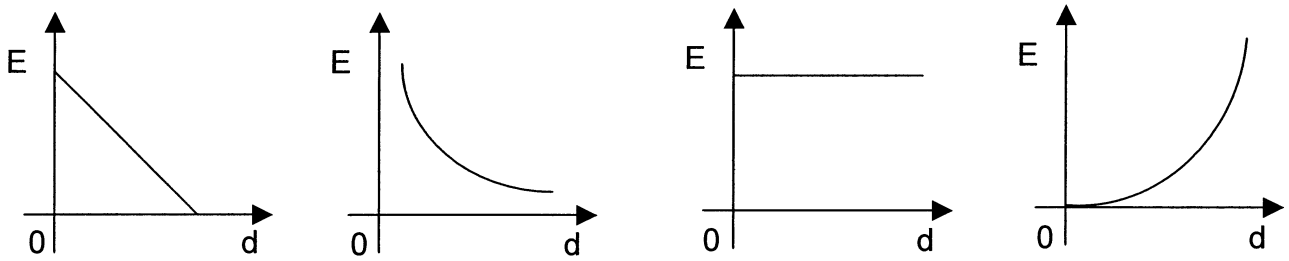
A krag ondervind per positiewe eenheidslading by die punt.

B krag wat 'n lading by die punt ondervind.

C arbeid verrig om 'n positiewe eenheidslading tot by die punt te beweeg.

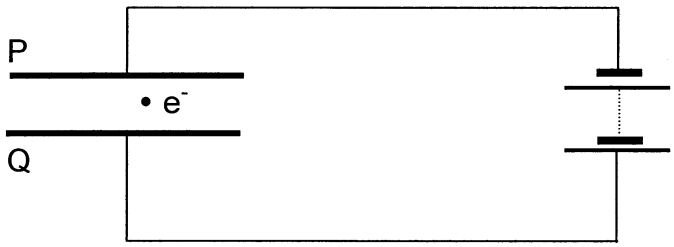
D arbeid verrig om 'n lading tot by die punt te beweeg. (4)

1.11 Watter EEN van die volgende grafieke is die beste voorstelling van die verband tussen die elektriese veldsterkte **E** as gevolg van 'n puntlading, en die afstand **d** vanaf die puntlading?



A B C D (4)

1.12 Beskou 'n elektron geposisioneer tussen twee teenoorgesteld-gelaaide, parallelle plate, P en Q.



Watter EEN van die volgende kombinasies is die korrekte voorstelling van die rigting van die elektriese veld tussen P en Q en die rigting waarin die elektron beweeg?

	Rigting van elektriese veld	**Rigting waarin elektron beweeg**
A	van P na Q	na P toe
B	van Q na P	na P toe
C	van P na Q	na Q toe
D	van Q na P	na Q toe

(4)

1.10 Electric field strength at a point in an electric field is defined as the ...

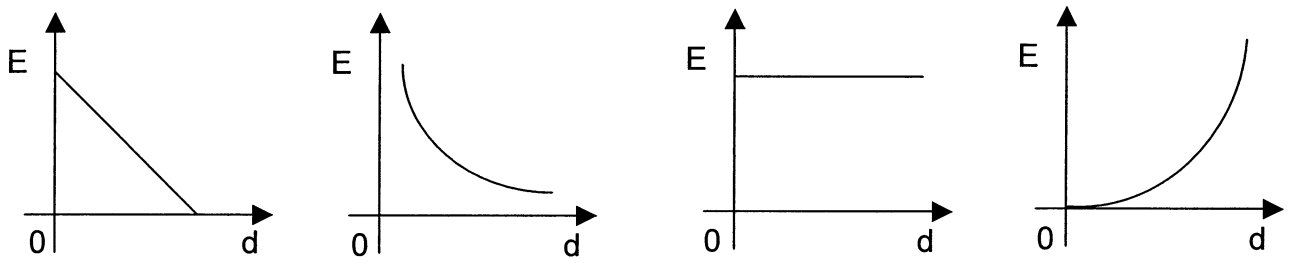
A force experienced per unit positive charge at that point.

B force a charge experiences at that point.

C work done in moving a unit positive charge to that point.

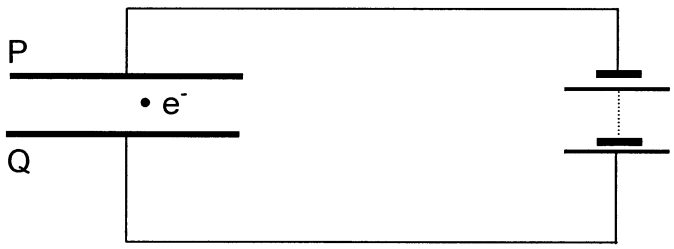
D work done in moving a charge to that point. (4)

1.11 Which ONE of the following graphs is the best representation of the relationship between the electric field strength **E** due to a point charge, and the distance **d** from the point charge?



A B C D (4)

1.12 Consider an electron positioned between two oppositely charged, parallel plates, P and Q.



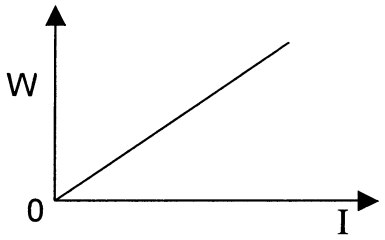
Which ONE of the following combinations correctly represents the direction of the electric field between P and Q and the direction of motion of the electron?

	Direction of electric field	Direction of motion of electron
A	from P to Q	towards P
B	from Q to P	towards P
C	from P to Q	towards Q
D	from Q to P	towards Q

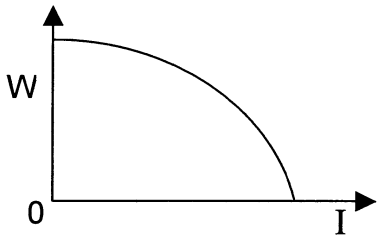
(4)

1.13 As daar 'n konstante stroom **I** in 'n resistor is vir 'n sekere tyd **t**, is die energie oorgedra aan die resistor **W**. Die eksperiment word verskeie kere herhaal met verskillende strome terwyl die weerstand van die resistor en tyd **t** konstant gehou word. Watter EEN van die volgende grafieke is die beste voorstelling van die verband tussen **W** en **I**?

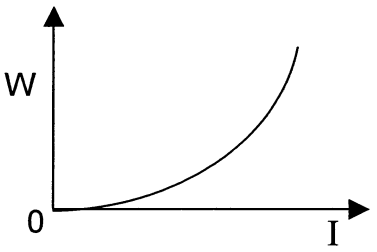
A



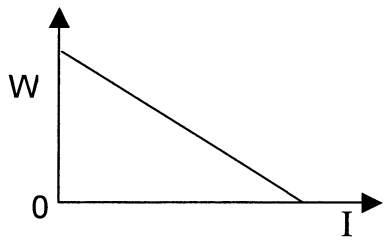
B



C

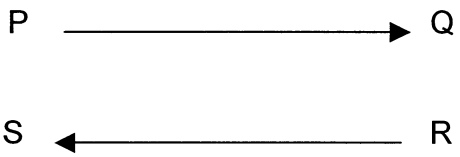


D



(4)

1.14 PQ en RS is twee identiese, parallelle geleiers wat elektriese strome in teenoorgestelde rigtings dra soos aangedui.



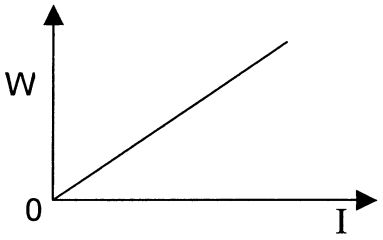
Watter EEN van die volgende kombinasies is die korrekte aanduiding van die tipe krag en die rigting van die krag wat geleier PQ op geleier RS uitoefen?

	Tipe krag	**Rigting van krag**
A	magnetiese krag	aantrekkend
B	magnetiese krag	afstotend
C	elektriese krag	aantrekkend
D	elektriese krag	afstotend

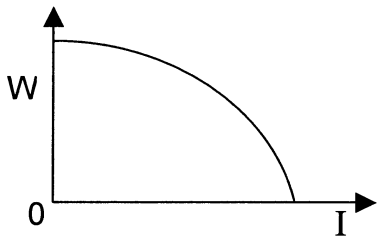
(4)

1.13 If there is a constant current **I** in a resistor for a certain time **t**, the energy transferred to the resistor is **W**. The experiment is repeated several times for different currents while keeping the resistance of the resistor and time **t** constant. Which ONE of the following graphs is the best representation of the relationship between **W** and **I**?

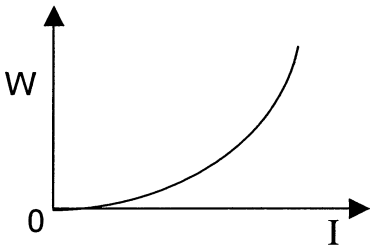
A



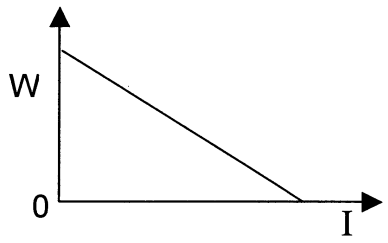
B



C

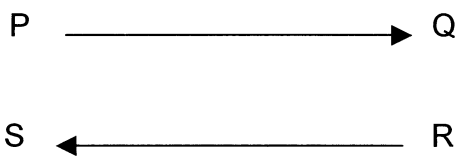


D



(4)

1.14 PQ and RS are two identical, parallel conductors carrying electric currents in opposite directions as shown.

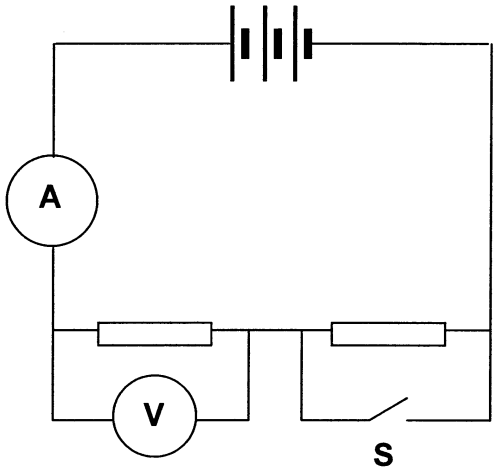


Which ONE of the following combinations correctly indicates the type of force and the direction of the force that conductor PQ exerts on conductor RS?

	Type of force	**Direction of force**
A	magnetic force	attraction
B	magnetic force	repulsion
C	electric force	attraction
D	electric force	repulsion

(4)

1.15 In die stroombaan hieronder voorgestel, is die interne weerstand van die battery weglaatbaar klein.



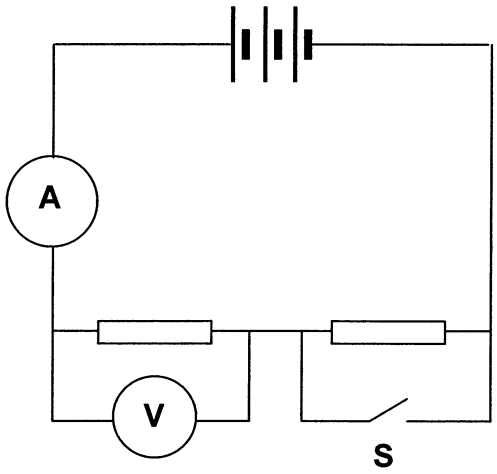
Watter EEN van die volgende kombinasies is die korrekte voorstelling van die verandering in die lesings op die voltmeter (V) en die ammeter (A) as skakelaar S gesluit word?

	Voltmeterlesing	**Ammeterlesing**
A	toeneem	toeneem
B	toeneem	afneem
C	afneem	afneem
D	afneem	toeneem

(4)

(15 x 4) [60]

1.15 In the circuit represented below, the internal resistance of the battery is negligible.



Which ONE of the following combinations correctly represents the change in the readings on the voltmeter (V) and the ammeter (A) when switch S is closed?

	Voltmeter reading	**Ammeter reading**
A	increases	increases
B	increases	decreases
C	decreases	decreases
D	decreases	increases

(4)

(15 x 4) [60]

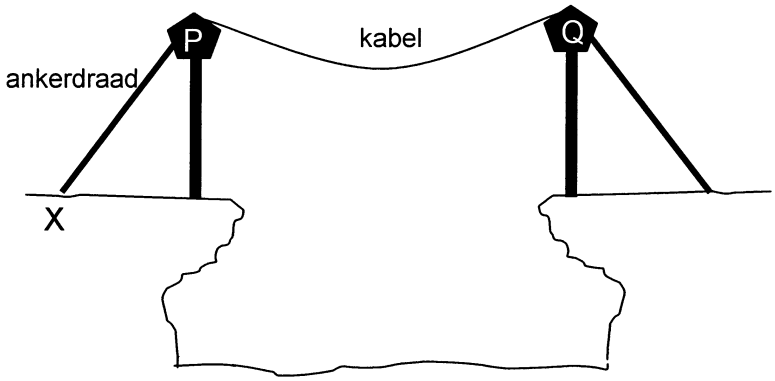
BEANTWOORD VRAAG 2 TOT 10 IN DIE ANTWOORDEBOEK.

INSTRUKSIES

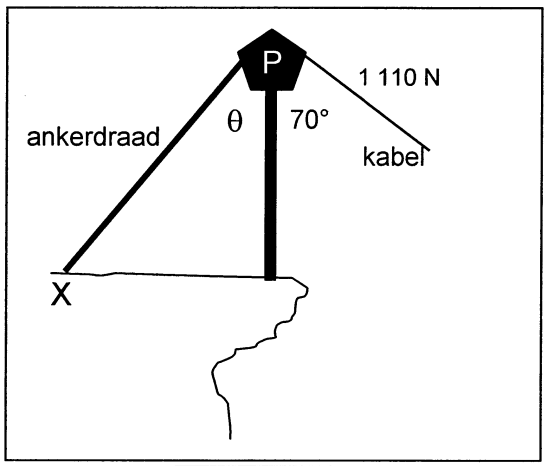
1. Begin elke vraag op 'n **skoon bladsy** in die antwoordeboek.
2. Laat 'n reël oop tussen onderafdelings, byvoorbeeld 2.1 en 2.2.
3. Toon AL die formules, sowel as bewerkings, insluitende vervangings (substitusies).
4. Nommer die antwoorde presies soos die vrae genommer is.

VRAAG 2 **[BEGIN OP 'N SKOON BLADSY]**

Tony wil graag 'n kloof oorsteek. Hy gebruik 'n kabel wat tussen twee vertikale staalpale, gemonteer op die rotse aan weerskante van die kloof (verwys na Figuur 1), gespan is. Om paal P vertikaal en die paal en kabel in ewewig te hou, word 'n ankerdraad by X geanker. Halfpad tydens sy oorgang is die spanning in die kabel naby paal P gelyk aan 1 110 N en die kabel maak 'n hoek van 70° met die vertikaal by paal P (Figuur 2). Die ankerdraad breek as die spanning daarin 2 000 N oorskrei. Ignoreer die massas van die kabel en die ankerdraad.



Figuur 1



Figuur 2

2.1 Bepaal die grootte van die horisontale komponent van die krag wat die kabel op die bopunt van paal P uitoefen. (4)

2.2 Die horisontale komponent van die krag uitgeoefen deur die ankerdraad is van dieselfde grootte as die horisontale komponent van die kabelkrag. Wat is die grootte van die horisontale komponent van die krag uitgeoefen deur die bopunt van paal P op die kabel en die ankerdraad afsonderlik? (2)

2.3 Bepaal die minimum hoek θ wat die ankerdraad met die vertikaal kan maak net voor die ankerdraad breek. (3)

2.4 As die paal 'n massa van 150 kg het, bereken die vertikale krag wat die paal op die rotse uitoefen as die ankerdraad geanker is teen die hoek θ soos bereken in VRAAG 2.3 hierbo. (7)

[16]

ANSWER QUESTIONS 2 TO 10 IN THE ANSWER BOOK.

INSTRUCTIONS

1. Start each question on a **new page** in the answer book.
2. Leave a line between subsections, for example 2.1 and 2.2.
3. Show ALL the formulae, as well as the calculations, including substitutions.
4. Number the answers exactly as the questions are numbered.

QUESTION 2 [START ON A NEW PAGE]

Tony would like to cross a gorge. He uses a cable suspended between two vertical steel poles, mounted on the rocks on either side of the gorge (refer to Figure 1). To keep pole P vertical and the pole and cable in equilibrium, a stay wire is anchored at X. Halfway during his crossing, the tension in the cable near to pole P is 1 110 N and the cable makes an angle of 70° with the vertical at pole P (Figure 2). The stay wire breaks if its tension exceeds 2 000 N. Disregard the masses of the cable and the stay wire.

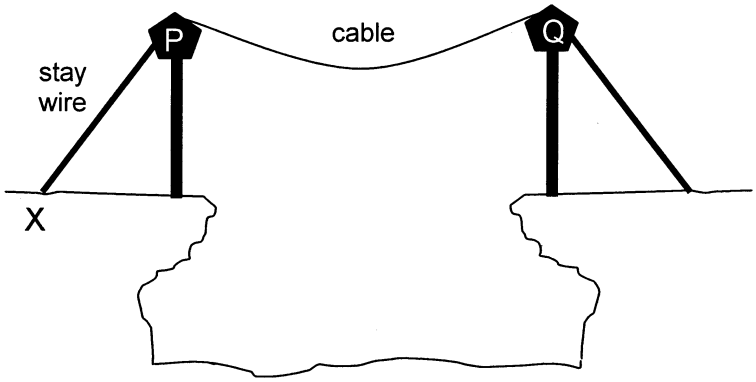


Figure 1

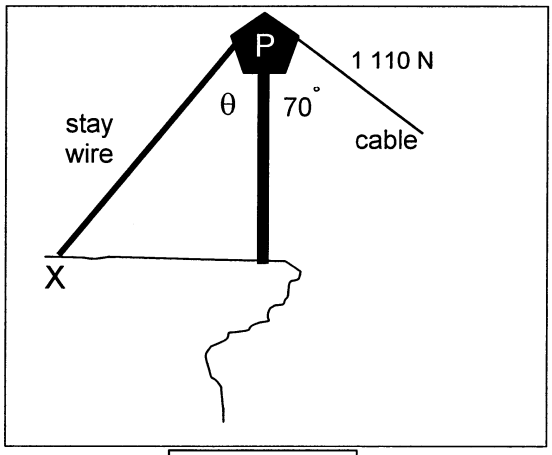


Figure 2

2.1 Determine the magnitude of the horizontal component of the force which the cable exerts on the top of pole P. (4)

2.2 The horizontal component of the force exerted by the stay wire is of the same magnitude as the horizontal component of the cable force. What is the magnitude of the horizontal component of the force exerted by the top of pole P on the cable and stay wire separately? (2)

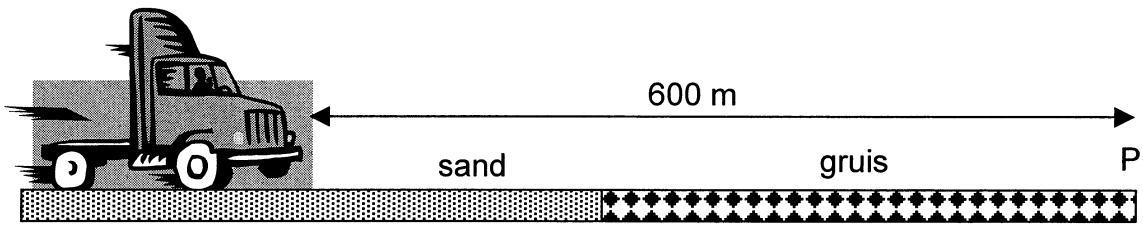
2.3 Determine the minimum angle θ which the stay wire can make with the vertical just before the stay wire breaks. (3)

2.4 If the pole has a mass of 150 kg, calculate the vertical force which the pole exerts on the rocks when the stay wire is anchored at the angle θ calculated in QUESTION 2.3 above. (7)

[16]

VRAAG 3 [BEGIN OP 'N SKOON BLADSY]

Terwyl dit teen 'n afdraand afbeweeg, weier 'n vragmotor se remme. Aan die onderpunt van die afdraand beweeg dit op 'n horisontale vangput wat dit stadiger laat beweeg. Die vangput bestaan uit 'n sandgedeelte en 'n gruisgedeelte (sien diagram).



By 'n sekere punt, wanneer die vragmotor reeds in die sandgedeelte is, is dit 600 m vanaf die verste punt, P, van die vangput. Die tyd wat dit neem om die 600 m af te lê, word elke 5 s deur 'n apparaat genoteer. Die notering vir die eerste 30 s word hieronder gegee.

Tyd (s)	0	5	10	15	20	25	30
Afstand vanaf punt van vangput (m)	600	510	440	390	355	330	315

3.1 Bereken die grootte van die gemiddelde snelheid van die vragmotor gedurende die eerste 5 sekondes. (4)

3.2 As die grootte van die gemiddelde snelheid van die vragmotor gedurende die volgende 5 sekondes (tussen 5 en 10 sekondes) gelyk is aan 14 $m.s^{-1}$, bereken die grootte en rigting van die versnelling van die vragmotor gedurende die eerste 10 s. (Neem aan dat die versnelling konstant is oor hierdie interval.) (6)

3.3 Bereken die grootte van die vragmotor se snelheid by 11,5 s. (5)

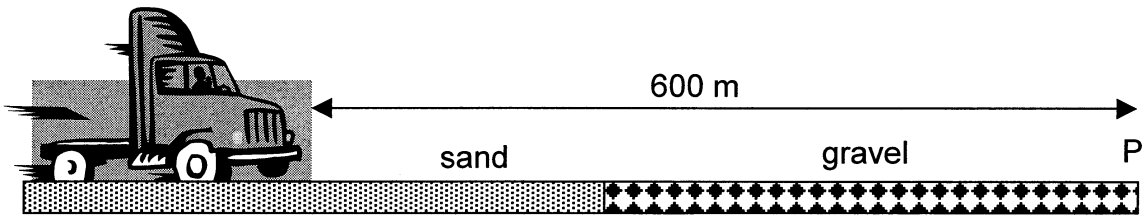
Die snelheid by 30 s is 2 $m.s^{-1}$.

3.4 Teken, op dieselfde assestelsel, 'n rowwe snelheid-tydgrafiek vir die beweging van die vragmotor en toon slegs die eerste 7,5 s en die laaste 7,5 s, maar nie die 15 s tussen-in nie. (4)

[19]

QUESTION 3 [START ON A NEW PAGE]

While moving down an incline, a truck's brakes fail. At the bottom of the incline it moves onto a horizontal trap, which causes it to slow down. The trap consists of a sand section and a gravel section (see diagram).



At a certain point, when the truck is already in the sand section, it is 600 m from the far end, point P, of the trap. The time taken to cover the 600 m is recorded by a tracking device in 5 s intervals. The recordings of the first 30 s are given below.

Time (s)	0	5	10	15	20	25	30
Distance from end of the gravel trap (m)	600	510	440	390	355	330	315

3.1 Calculate the magnitude of the average velocity of the truck during the first 5 seconds. (4)

3.2 If the magnitude of the average velocity of the truck for the next 5 seconds (between 5 and 10 seconds) is equal to 14 $m.s^{-1}$, calculate the magnitude and direction of the acceleration of the truck during the first 10 s. (Assume the acceleration to be constant over this interval.) (6)

3.3 Calculate the magnitude of the velocity of the truck at 11,5 s. (5)

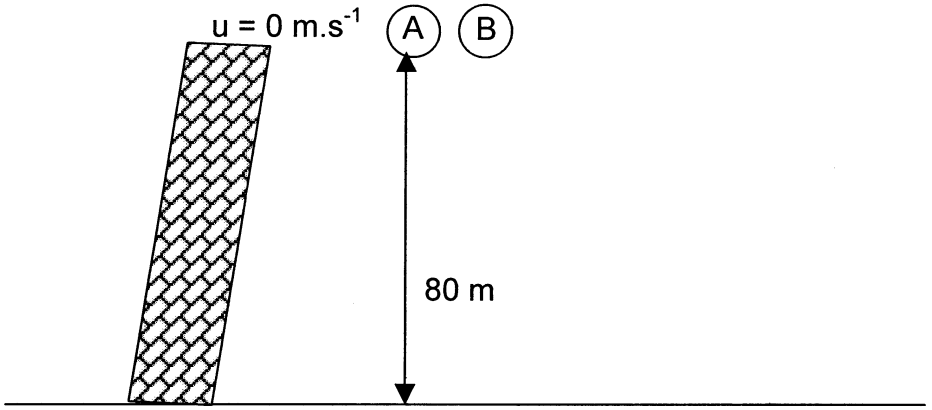
The velocity at 30 s is 2 $m.s^{-1}$.

3.4 Draw, on the same system of axes, a rough velocity-time graph for the motion of the truck, showing only the first 7,5 s and the last 7,5 s, but not the 15 s in between. (4)

[19]

VRAAG 4 [BEGIN OP 'N SKOON BLADSY]

Oorweeg 'n eksperiment wat ooreenstem met 'n eksperiment wat Galileo waarskynlik vanaf die leunende toring van Pisa gedoen het. Bal A word uit rus laat val vanaf 'n hoogte van 80 m. Ignoreer lugweerstand.



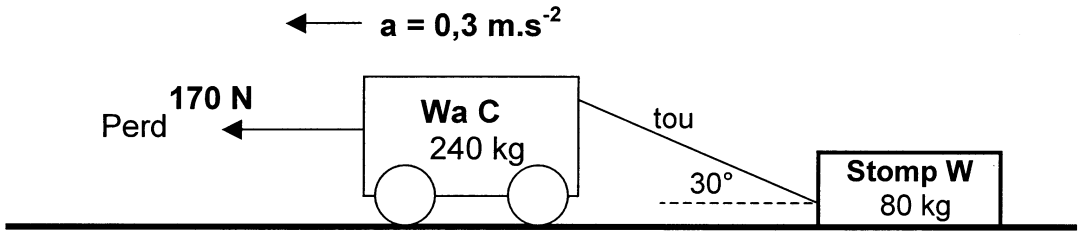
4.1 Bereken die tyd wat dit A neem om die grond te bereik. (5)

Bal B word 1,5 sekondes nadat A laat val is, vanaf dieselfde hoogte afwaarts gegooi.

4.2 Bereken die grootte van die snelheid waarmee B afwaarts gegooi moet word om die grond op dieselfde oomblik as A te bereik. (6)
[11]

VRAAG 5 [BEGIN OP 'N SKOON BLADSY]

'n Perd trek 'n wa, C, massa 240 kg, wat vasgemaak is aan 'n houtstomp, W, massa 80 kg, op 'n horisontale pad. W is vasgemaak aan die agterkant van C met behulp van 'n onrekbare tou wat 'n hoek van 30° met die horisontaal maak. Die perd oefen 'n krag van 170 N op wa C uit en die sisteem versnel teen 0,3 m.s^{-2} na links. Die wrywingskrag op wa C is 40 N. Die tou se massa is weglaatbaar klein.



5.1 Teken 'n kragtediagram vir wa C en dui en benoem **al** die kragte wat daarop inwerk. (4)

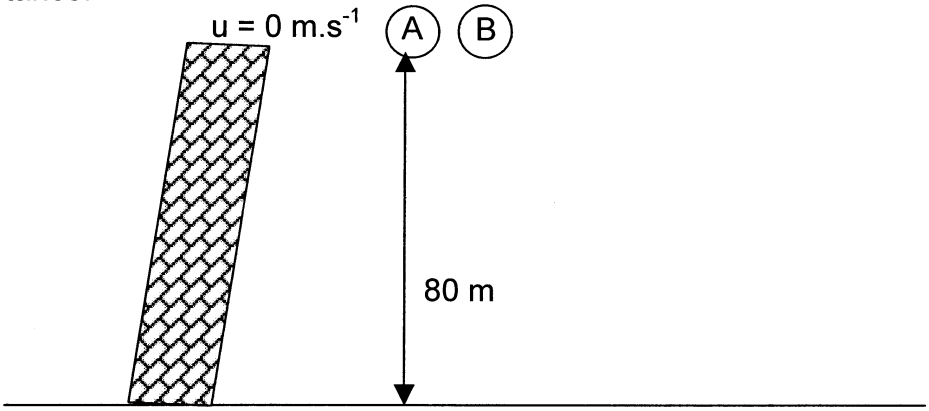
5.2 Bereken:

5.2.1 Die grootte van die krag wat die tou op C uitoefen (8)

5.2.2 Die wrywingskrag op W (6)
[18]

QUESTION 4 [START ON A NEW PAGE]

Consider an experiment which resembles an experiment Galileo is thought to have done from the leaning tower of Pisa. Ball A is dropped from rest from a height of 80 m. Ignore air resistance.



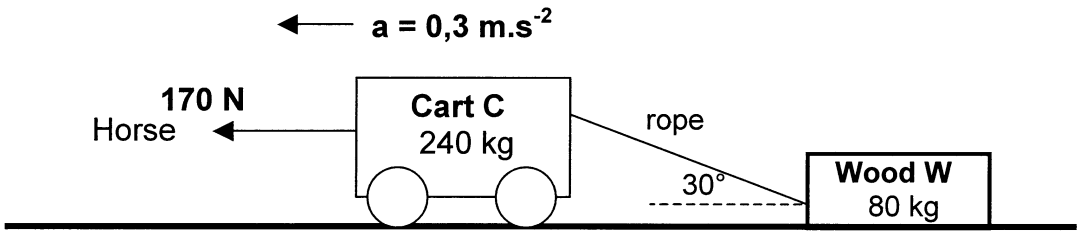
4.1 Calculate the time taken for A to reach the ground. (5)

Ball B is thrown down from the same height 1,5 s after ball A is released.

4.2 Calculate the magnitude of the velocity with which B must be thrown downwards in order to reach the ground at the same instant as A. (6)
[11]

QUESTION 5 [START ON A NEW PAGE]

A horse pulls a cart, C, mass 240 kg, attached to a log of wood, W, mass 80 kg, on a horizontal road. W is tied to the back of C by means of an inelastic rope, which is inclined at 30° to the horizontal. The horse applies a force of 170 N on cart C and the system accelerates at 0,3 m.s^{-2} to the left. The force of friction on cart C is 40 N. The rope has negligible mass.



5.1 Draw a force diagram for cart C, indicating and labelling **all** the forces acting on it. (4)

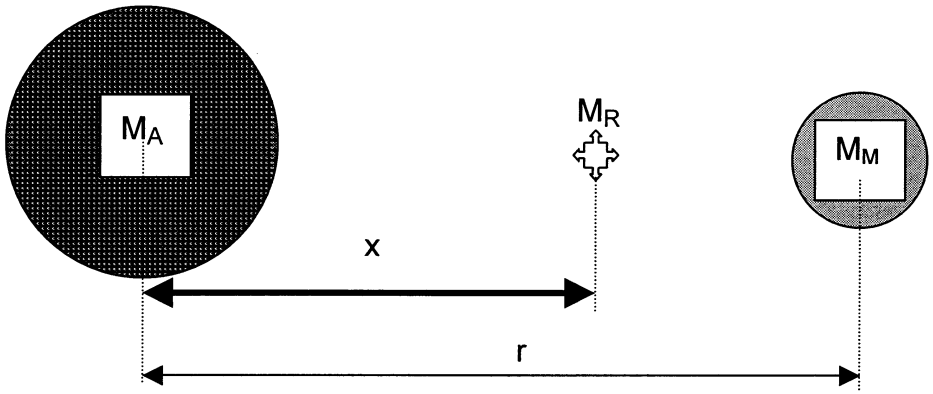
5.2 Calculate:

5.2.1 The magnitude of the force which the rope exerts on C (8)

5.2.2 The force of friction on W (6)
[18]

VRAAG 6 [BEGIN OP 'N SKOON BLADSY]

'n Ruimtetuig, massa M_R, is op pad maan toe vanaf die aarde. By 'n spesifieke punt van die reis is die aarde, ruimtetuig en maan almal in 'n reguit lyn. Die massa van die aarde word gegee as M_A en die massa van die maan as M_M. Die middelpunt van die maan is 'n afstand **r** vanaf die middelpunt van die aarde.



6.1 Stel, in woorde, **Newton se Universele Gravitasiewet**. (4)

Op 'n sekere afstand **x** *vanaf die aarde, ondervind die ruimtetuig zero resulterende krag.*

6.2 Deur slegs die maan en die aarde in ag te neem, formuleer 'n vergelyking wat aandui dat die afstand **x**, vanaf die aarde, **onafhanklik** is van die massa van die ruimtetuig, M_R. 'n Finale manupilasie om **x** die onderwerp van die formule te maak is nie nodig nie. (4)
[8]

VRAAG 7 [BEGIN OP 'N SKOON BLADSY]

'n Krieketbal, massa 175 g, word direk na 'n speler gegooi teen 'n snelheid van 12 $m.s^{-1}$. Dit word teruggeslaan in die teenoorgestelde rigting teen 'n snelheid van 30 $m.s^{-1}$. Die bal is vir 'n periode van 0,05 s in kontak met die kolf.

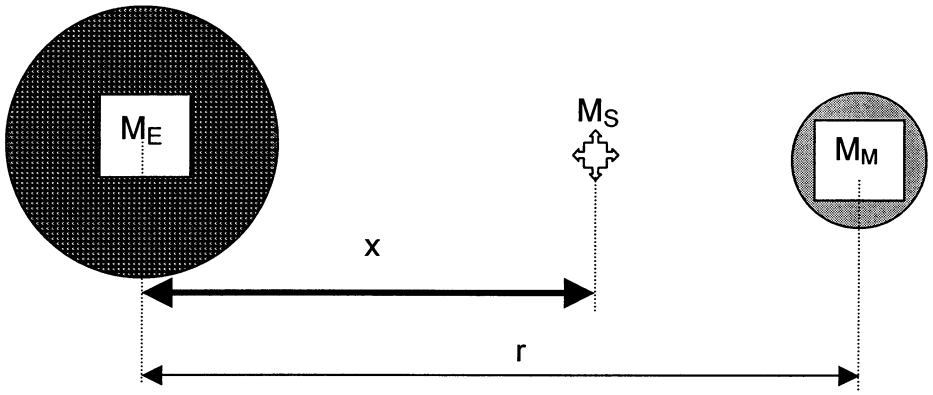
7.1 Definieer, in woorde, die term **impuls**. (2)

7.2 Bereken die impuls van die bal. (5)

7.3 Bereken die grootte van die krag wat die kolf op die bal uitoefen. (3)
[10]

QUESTION 6 [START ON A NEW PAGE]

A spaceship, mass M_S, is on its way to the moon from the earth. At a specific point of its journey the earth, spaceship and moon are all in a straight line. The mass of the earth is given as M_E and the mass of the moon is given as M_M. The centre of the moon is a distance **r** from the centre of the earth.



6.1 State, in words, **Newton's Law of Universal Gravitation**. (4)

At a certain distance **x** *from the earth, the spaceship experiences zero resultant force.*

6.2 Taking into account the moon and the earth only, formulate an equation which indicates that the distance **x**, from the earth, is **independent** of the mass of the spaceship, M_S. A final manipulation to make **x** the subject of the formula is **not** required. (4)
[8]

QUESTION 7 [START ON A NEW PAGE]

A cricket ball, mass 175 g, is thrown directly towards a player at a velocity of 12 $m.s^{-1}$. It is hit back in the opposite direction with a velocity of 30 $m.s^{-1}$. The ball is in contact with the bat for a period of 0,05 s.

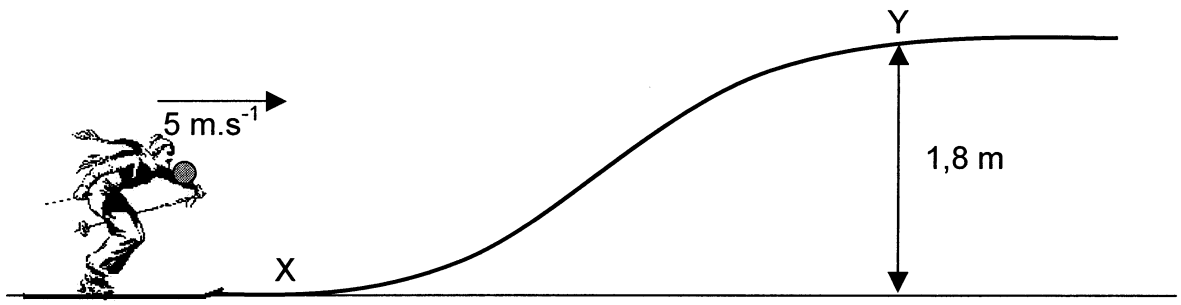
7.1 Define, in words, the term **impulse**. (2)

7.2 Calculate the impulse of the ball. (5)

7.3 Calculate the magnitude of the force exerted by the bat on the ball. (3)
[10]

VRAAG 8 [BEGIN OP 'N SKOON BLADSY]

Lindi ski na regs in die rigting van punt X aan die onderpunt van 'n sneeuhelling wat 1,8 m hoog is, terwyl sy 'n pakkie van 10 kg dra. Haar snelheid is 5 $m.s^{-1}$ en die totale massa van Lindi, haar ski's en die pakkie is 80 kg.



Voordat sy die begin van die helling bereik, is sy onseker of sy punt Y, aan die bopunt van die helling, sal bereik indien sy die pakkie bly vashou. Aangesien sy 'n Fisikastudent is, besluit sy om die pakke horisontaal met 'n snelheid **v** te gooi om haar voorwaartse spoed te vermeerder. Ignoreer alle wrywing.

8.1 In watter rigting moet Lindi die pakkie gooi om haar voorwaartse spoed te ondersteun? (2)

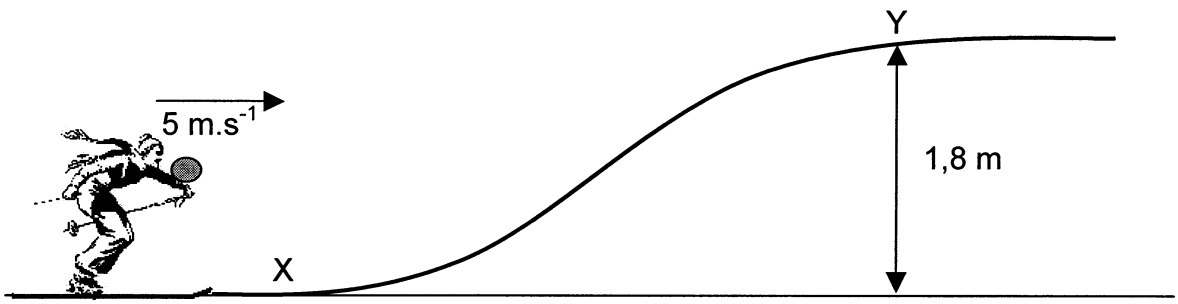
8.2 Noem die TWEE beginsels/wette wat Lindi kan toepas om haar nuwe voorwaartse spoed te bereken. (2)

8.3 Bereken die grootte van die minimum snelheid waarmee sy die pakkie moet gooi om punt Y aan die bopunt van die helling te bereik. (9)

[13]

QUESTION 8 [START ON A NEW PAGE]

Lindi is skiing to the right towards point X at the bottom of a snow slope which is 1,8 m high, carrying a 10 kg parcel. Her velocity is 5 $m.s^{-1}$ and the total mass of Lindi, her skis and the parcel is 80 kg.



Before she reaches the beginning of the slope, she is uncertain whether she will reach point Y, at the top of the slope, while still holding the parcel. Being a Physics student, she decides to throw the parcel horizontally with a velocity **v** to increase her forward speed. Ignore all friction.

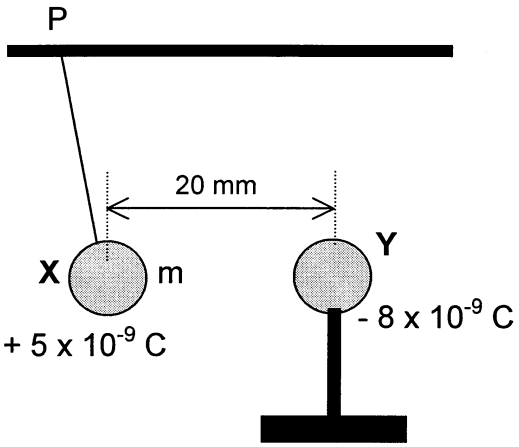
8.1 In which direction must Lindi throw the parcel to assist her forward speed? (2)

8.2 Name the TWO principles/laws Lindi can apply to calculate her new forward speed. (2)

8.3 Calculate the magnitude of the minimum velocity with which she must throw the parcel in order to reach the top of the slope at point Y. (9)
[13]

VRAAG 9 [BEGIN OP 'N SKOON BLADSY]

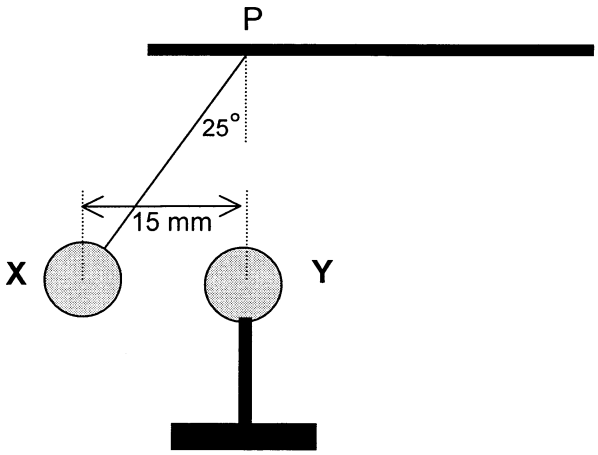
'n Klein, geleidende sfeer, X, met 'n lading van + 5 x 10^{-9} C en met onbekende massa, **m**, word aan 'n onelastiese tou, met weglaatbare massa en wat vas is by punt P, gehang. 'n Ander klein, geleidende sfeer, Y, op 'n geïsoleerde staander, met 'n lading van - 8 x 10^{-9} C, word nader aan X beweeg totdat hulle middelpunte 20 mm van mekaar is.



9.1 Teken die resulterende elektriese veldpatroon geproduseer deur sfere X en Y. (4)

9.2 Bereken die grootte en rigting van die elektrostatiese krag wat sfeer Y op sfeer X uitoefen. (6)

Sfeer Y word nou nader gebring en maak kontak met sfeer X. Sfeer X word afgestoot en kom tot rus sodat die middelpunte van die sfere 15 mm van mekaar is. Sfeer Y bly by 'n punt direk onder P sodat sfere X en Y op dieselfde horisontale vlak is. Die tou maak 'n hoek van 25° met die vertikaal. (Sien onder.)



9.3 Bereken die nuwe lading op sfeer X nadat hulle kontak gemaak het. (3)

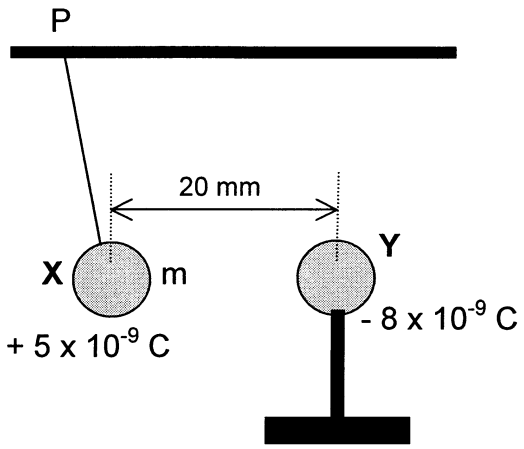
9.4 Teken 'n benoemde driehoek van kragte vir sfeer X wanneer dit in die finale ewewigposisie is. Dui ten minste EEN hoek in jou driehoek aan. (4)

9.5 Gebruik jou diagram om die massa van sfeer X te bereken as die grootte van die elektrostatiese krag wat sfeer Y op sfeer X uitoefen, gelyk is aan 9 x 10^{-5} N. (6)

[23]

QUESTION 9 [START ON A NEW PAGE]

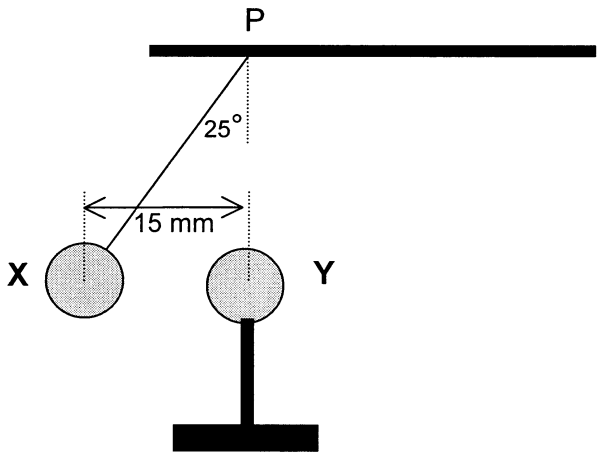
A small, conducting sphere, X, with a charge of + 5 x 10^{-9} C and with an unknown mass, **m**, is suspended by an inelastic thread of negligible mass which is tied to point P. Another small, conducting sphere, Y, on an insulated stand, with a charge of - 8 x 10^{-9} C, is moved towards X until their centres are 20 mm apart.



9.1 Draw the resultant electric field pattern produced by spheres X and Y. (4)

9.2 Calculate the magnitude and direction of the electrostatic force that sphere Y exerts on sphere X. (6)

Sphere Y is now moved closer and makes contact with sphere X. Sphere X is repelled and comes to rest with the centres of the spheres 15 mm apart. SphereY remains at a point directly below P such that spheres X and Y are on the same horizontal level. The thread makes an angle of 25° with the vertical. (See below.)



9.3 Calculate the new charge on sphere X after they have touched. (3)

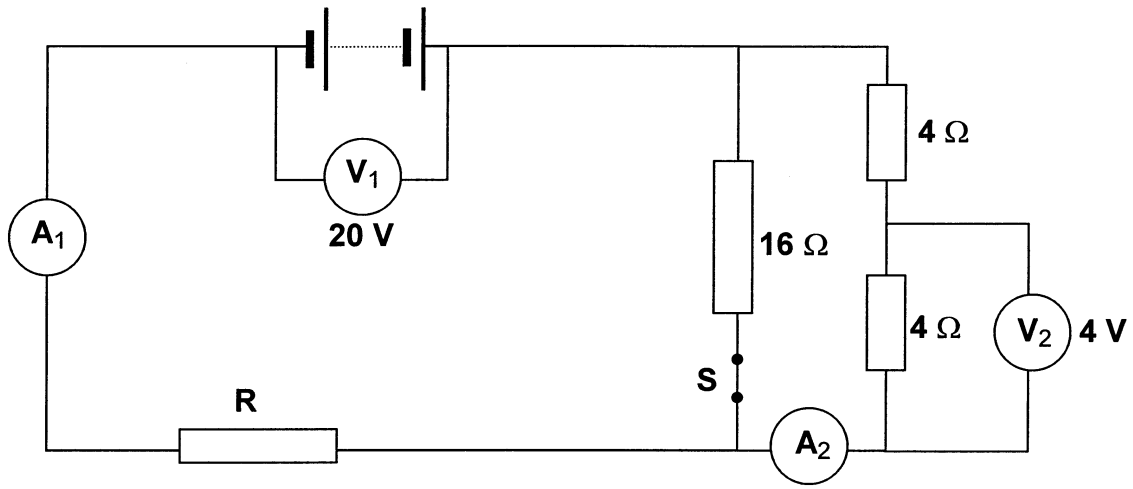
9.4 Draw a labelled triangle of forces for sphere X when it is in the final equilibrium position. Indicate at least ONE angle in your triangle. (4)

9.5 Use your diagram to calculate the mass of sphere X if the magnitude of the electrostatic force that sphere Y exerts on sphere X is equal to 9 x 10^{-5} N. (6)

[23]

VRAAG 10 [BEGIN OP 'N SKOON BLADSY]

In die stroombaan hieronder voorgestel, het die battery 'n **emk van 24 V**. Die ammeter en die geleidingsdrade het weglaatbare weerstand.



*As skakelaar **S gesluit is**, registreer voltmeter V_1 20 V en V_2 registreer 4 V.*

10.1 Bereken die lesing op ammeter A_2. (4)

10.2 Bepaal die lesing op ammeter A_1. (3)

10.3 Bereken die weerstand van resistor R. (4)

10.4 Bereken die interne weerstand van die battery (korrek tot 1 desimale syfer). (5)

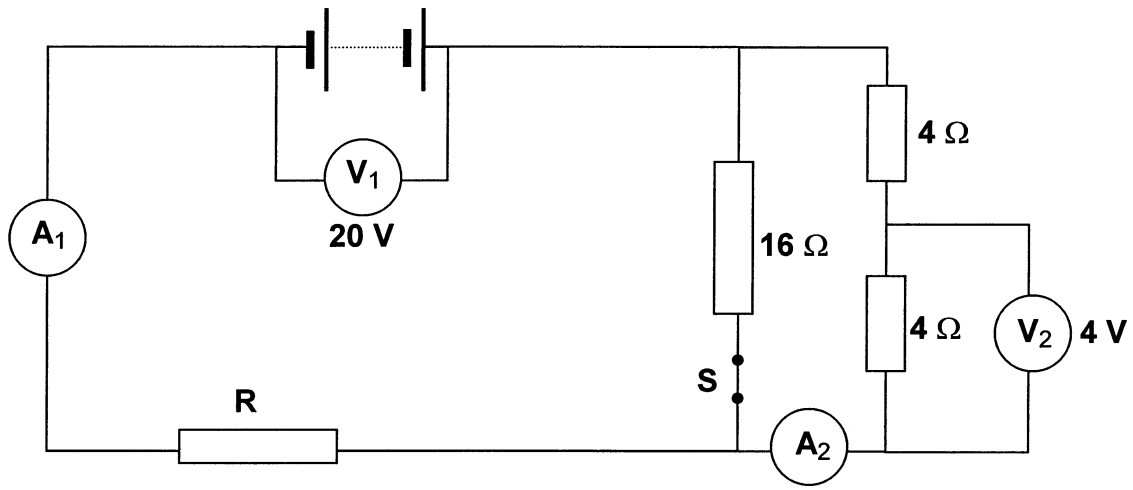
10.5 Bereken die energie oorgedra in resistor R in 10 minute. (4)

10.6 Skakelaar **S word nou oopgemaak**. Noem of die lesing op V_1 **TOENEEM**, **AFNEEM** of **DIESELFDE BLY**. (2)
[22]

TOTAAL VRAAG 1 : 60
TOTAAL VRAE 2 – 10 : 140
GROOTTOTAAL : 200

QUESTION 10 [START ON A NEW PAGE]

In the circuit represented below, the battery has an **emf of 24 V**. The ammeter and the connecting wires have negligible resistance.



*When switch **S is closed,** voltmeter V_1 registers 20 V and V_2 registers 4 V.*

10.1 Calculate the reading on ammeter A_2. (4)

10.2 Calculate the reading on ammeter A_1. (3)

10.3 Calculate the resistance of resistor R. (4)

10.4 Calculate the internal resistance of the battery (correct to 1 decimal place). (5)

10.5 Calculate the energy transferred in resistor R in 10 minutes. (4)

10.6 Switch **S is now opened**. State whether the reading on V_1 will **INCREASE**, **DECREASE** or **REMAIN THE SAME**. (2)

[22]

TOTAL QUESTION 1 : 60
TOTAL QUESTION 2 – 10 : 140
GRAND TOTAL : 200

DEPARTMENT OF EDUCATION
DEPARTEMENT VAN ONDERWYS

SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN

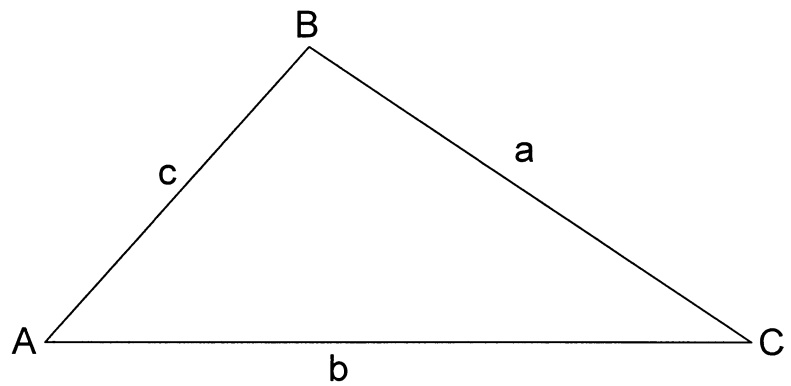
DATA FOR PHYSICAL SCIENCE
PAPER I (PHYSICS)

GEGEWENS VIR NATUUR- EN SKEIKUNDE
VRAESTEL I (FISIKA)

TABLE 1: PHYSICAL CONSTANTS
TABEL 1: FISIESE KONSTANTE

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Acceleration due to gravity Swaartekragversnelling	***g***	$10\ m.s^{-2}$
Gravitational constant Swaartekragkonstante	***G***	$6,7 \times 10^{-11}\ N.m^2.kg^{-2}$
Charge on electron Lading van elektron	e^-	$-1,6 \times 10^{-19}\ C$

MATHEMATICAL AIDS/WISKUNDIGE HULPMIDDELS



$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

$$c^2 = a^2 + b^2 - 2ab\cos C$$

TABLE 2: FORMULAE
TABEL 2: FORMULES

MOTION/BEWEGING

$v = u + at$	$s = ut + \frac{1}{2}at^2$
$v^2 = u^2 + 2as$	$s = \left(\frac{u+v}{2}\right)t$

FORCE/KRAG

$F_{res} = ma$	$p = mv$
$F = \frac{Gm_1m_2}{r^2}$	$F\Delta t = \Delta p = mv - mu$

WORK, ENERGY AND POWER/ARBEID, ENERGIE EN DRYWING

$W = Fs$	$E_p = mgh$
$P = \frac{W}{t}$	$E_k = \frac{1}{2}mv^2$

ELECTROSTATICS/ELEKTROSTATIKA

$F = \frac{kQ_1Q_2}{r^2}$ $(k = 9 \times 10^9\ N.m^2.C^{-2})$	$V = \frac{W}{Q}$
$E = \frac{F}{q}$	$W = QEs$
$E = \frac{kQ}{r^2}$ $(k = 9 \times 10^9\ N.m^2.C^{-2})$	$E = \frac{V}{d}$

CURRENT ELECTRICITY/STROOMELEKTRISITEIT

$Q = It$	emf/emk $= I(R + r)$
$R = r_1 + r_2 + r_3 + \ldots$	$F = \frac{kI_1I_2\ell}{d}$ $(k = 2 \times 10^{-7}\ N.A^{-2})$
$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + \ldots$	$W = VIt = I^2Rt = \frac{V^2t}{R}$
$R = \frac{V}{I}$	$P = VI = I^2R = \frac{V^2}{R}$