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

STANDARD GRADE
STANDAARDGRAAD

OCTOBER/NOVEMBER 2004
OKTOBER/NOVEMBER 2004

304-2/1

Marks: 150
Punte : 150

2 Hours
2 Ure

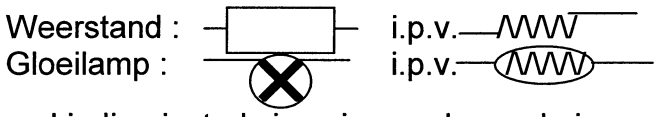
This question paper consists of 14 pages and 2 data sheets.
Hierdie vraestel bestaan uit 14 bladsye en 2 gegewensblaaie.

PHYSICAL SCIENCE SG: Paper 1
Physics

304 2 1 SG

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.

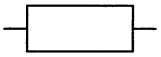
ANTWOORD:

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?

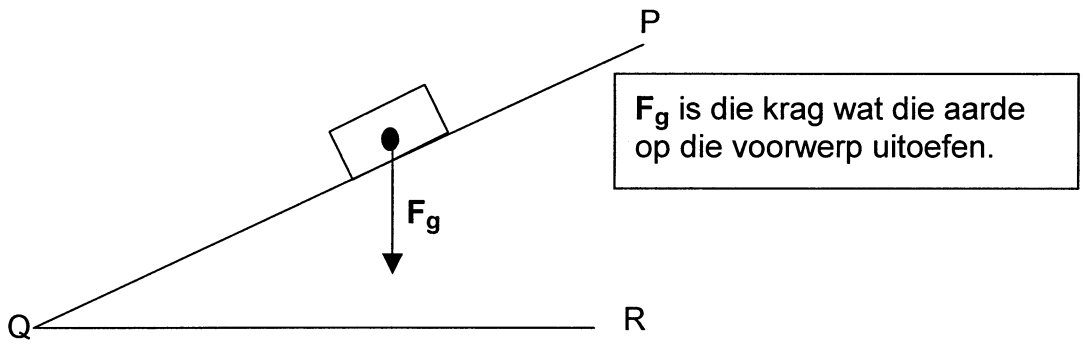
A Jeremy trek 'n blok ooswaarts oor 'n horisontale tafel met 'n krag van 5 N.

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.

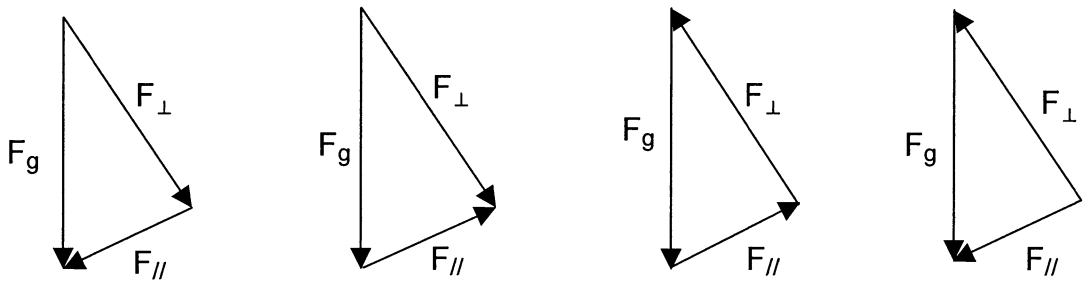
D Tracy gooi 'n bal wat terugbons met 'n verandering in momentum van 12 $kg.m.s^{-1}$, weg van 'n muur af. (3)

1.2 'n Voorwerp met massa **m** is in rus op 'n rowwe skuinsvlak.



$\mathbf{F_g}$ is die krag wat die aarde op die voorwerp uitoefen.

Watter EEN van die volgende vektordiagramme is die korrekte voorstelling van die krag $\mathbf{F_g}$ en die komponente van $\mathbf{F_g}$ wat parallel aan ($F_{//}$) en loodreg op ($F_{\perp}$) die vlak PQ is?



(3)

QUESTION 1

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

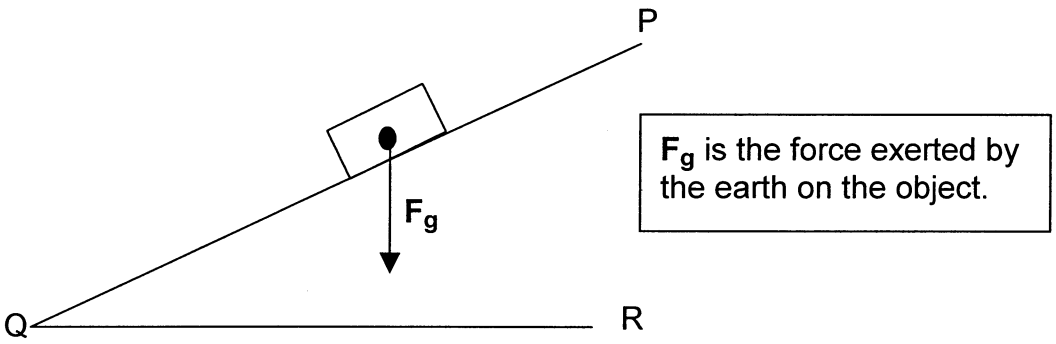
A Jeremy pulls a block eastward across a horizontal table with a force of 5 N.

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

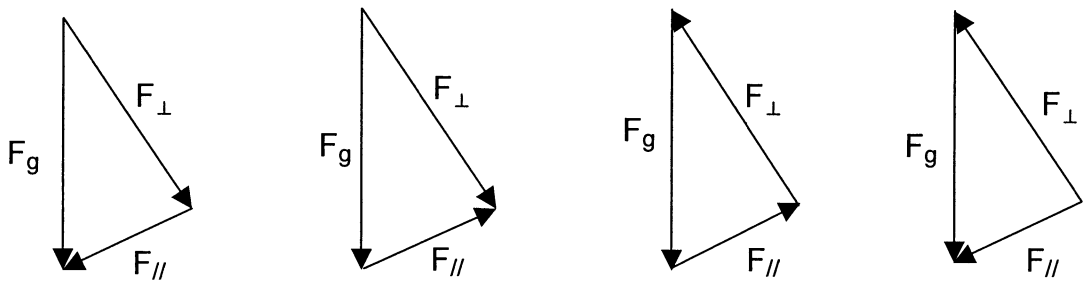
C Sipho drives a car with an acceleration of 3 $m.s^{-2}$ around a circular track.

D Tracy throws a ball which rebounds and has a change of momentum of 12 $kg.m.s^{-1}$, away from a wall. (3)

1.2 An object of mass **m** rests on a rough, inclined plane.



Which ONE of the following vector diagrams is the correct representation of the force F_g and the components of F_g which are parallel ($F_{//}$) and perpendicular ($F_\perp$) to the surface PQ?



A B C D (3)

1.3 'n Motor versnel vanaf 'n beginsnelheid **u** om 'n eindsnelheid **v** te bereik nadat dit 'n verplasing **s** in tyd **t** afgelê het. Watter kombinasie van hierdie fisiese groothede **KAN NIE** gebruik word om die versnelling te bepaal nie, as slegs **een** bewegingsvergelyking gebruik word?

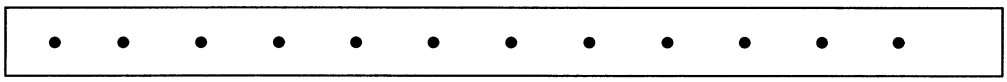
A s, u en t

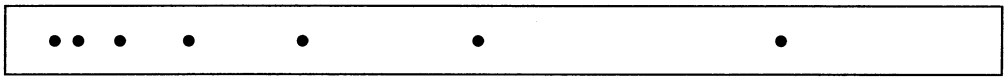
B u, s en v

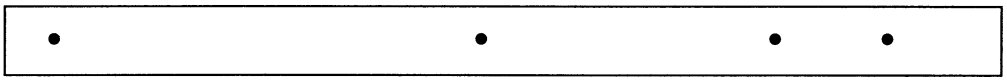
C u, v en t

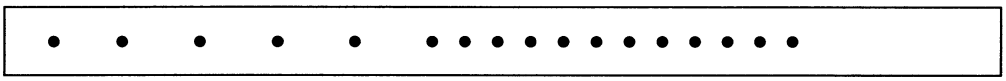
D s, v en t (3)

1.4 Die volgende tikkerlinte is tydens verskillende eksperimente verkry.
Die frekwensie van die tydtikker is konstant gehou vir al vier eksperimente.
Watter EEN van die volgende linte verteenwoordig die **maksimum** grootte versnelling?

A 

B 

C 

D 

(3)

1.5 Beskou die beweging van 'n bal wat vry vanuit rus val. Wattter EEN van die volgende stellings is **WAAR** met betrekking tot die **versnelling** van die bal? Ignoreer lugweerstand.

Die versnelling is ...

A konstant en opwaarts.
B konstant en afwaarts.
C toenemend en opwaarts.
D toenemend en afwaarts. (3)

1.3 A car accelerates from an initial velocity **u** to reach a final velocity **v** after travelling a displacement **s** in time **t**. Which combination of these physical quantities **CANNOT** be used to determine the acceleration, if only **one** equation of motion is used?

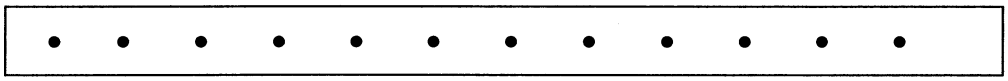
A s, u and t

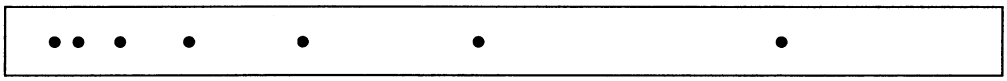
B u, s and v

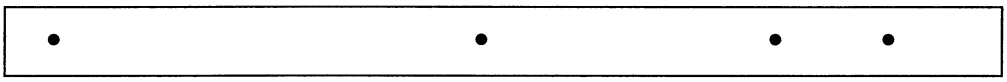
C u, v and t

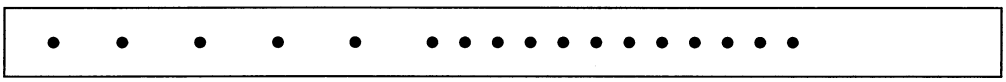
D s, v and t (3)

1.4 The following ticker-tapes were produced during different experiments. The frequency of the ticker-timer remained constant for all four experiments. Which ONE of the following tapes represents the **maximum** magnitude of acceleration?

A 

B 

C 

D  (3)

1.5 Consider the motion of a ball falling freely from rest. Which ONE of the following statements is **TRUE** with reference to the **acceleration** of the ball? Ignore air friction.

The acceleration is …

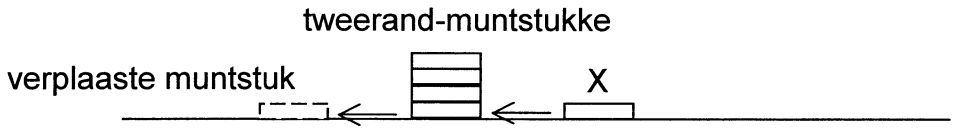
A constant and upwards.

B constant and downwards.

C increasing and upwards.

D increasing and downwards. (3)

1.6 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 al 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 Tweede Bewegingswet
C Wet van Behoud van Momentum
D Wet van Behoud van Energie (3)

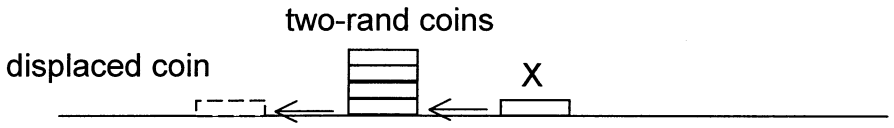
1.7 Die versnelling as gevolg van gravitasie by 'n punt op die oppervlak van die aarde is **g**. Wat sal die gravitasieversnelling op die oppervlak van 'n ander planeet met dieselfde massa, maar dubbel die aarde se deursnee, wees?

A $4\mathbf{g}$
B $2\mathbf{g}$
C $\frac{1}{2}\mathbf{g}$
D $\frac{1}{4}\mathbf{g}$ (3)

1.8 'n Ballon val vertikaal teen 'n konstante snelheid (grenssnelheid). Die ballon ondervind dus ...

A zero resulterende krag.
B geen kragte nie.
C slegs 'n opwaartse, konstante krag.
D slegs 'n afwaartse, konstante krag. (3)

1.6 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 the following laws explains why the **top three coins** are not displaced?

A Newton's First Law of Motion

B Newton's Second Law of Motion

C Law of Conservation of Momentum

D Law of Conservation of Energy (3)

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 $\frac{1}{4}\mathbf{g}$ (3)

1.8 A balloon is falling vertically at a constant velocity (terminal velocity). The balloon therefore experiences …

A zero resultant force.

B no forces at all.

C only an upward, constant force.

D only a downward, constant force. (3)

1.9 'n Motor wat teen 'n snelheid **v** beweeg, het 'n kinetiese energie $\mathbf{E_k}$. As die massa konstant bly en die snelheid word verdubbel, sal die kinetiese energie $\mathbf{E_k}$ gelyk wees aan ...

A $\sqrt{2}\ \mathbf{E_k}$.
B $2\mathbf{E_k}$.
C $4\mathbf{E_k}$.
D $8\mathbf{E_k}$. (3)

1.10 'n Metaalsfeer word vanaf 'n sekere hoogte laat val. Watter EEN van die volgende hoeveelhede, geassosieer met die sfeer, **neem af** met tyd? Wrywingseffekte is weglaatbaar.

A Kinetiese energie
B Gravitasie-potensiële energie
C Meganiese energie
D Verandering in momentum (3)

1.11 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. (3)

1.9 A car travelling with a velocity **v** has a kinetic energy $\mathbf{E_k}$. If its mass remains constant and its velocity is doubled, the kinetic energy $\mathbf{E_k}$ will be ...

A $\sqrt{2}\,\mathbf{E_k}$.

B $2\mathbf{E_k}$.

C $4\mathbf{E_k}$.

D $8\mathbf{E_k}$. (3)

1.10 A metal sphere is dropped from a certain height. Which ONE of the following quantities, associated with the sphere, **decreases** with time?
Effects of friction are negligible.

A Kinetic energy

B Gravitational potential energy

C Mechanical energy

D Change in momentum (3)

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

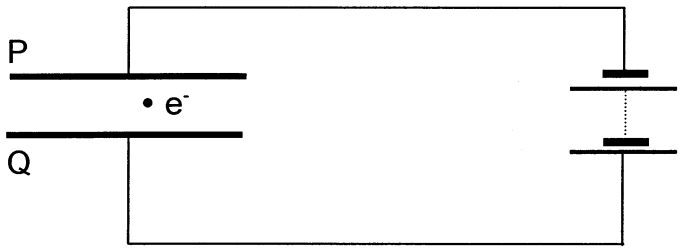
A force experienced per unit positive charge at that point.

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. (3)

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

(3)

1.13 Daar is 'n konstante stroom in 'n resistor vir 'n sekere tyd en die energie daaraan oorgedra is **W**. Die stroom en die weerstand van die resistor bly konstant. In die helfte van die tyd is die energie oorgedra aan die resistor gelyk aan ...

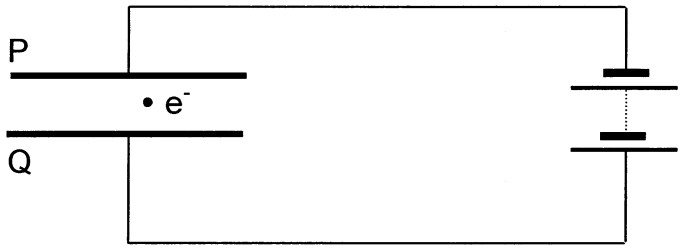
A $\frac{1}{4}$**W**.

B $\frac{1}{2}$**W**.

C 2**W**.

D 4**W**. (3)

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

(3)

1.13 There is a constant current in a resistor for a certain time and the energy transferred to it is **W**. The current and the resistance of the resistor remain constant. In half the time, the energy transferred to the resistor will be ...

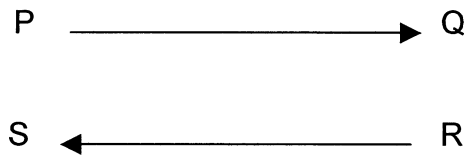
A $\frac{1}{4}$**W**.

B $\frac{1}{2}$**W**.

C 2**W**.

D 4**W**. (3)

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

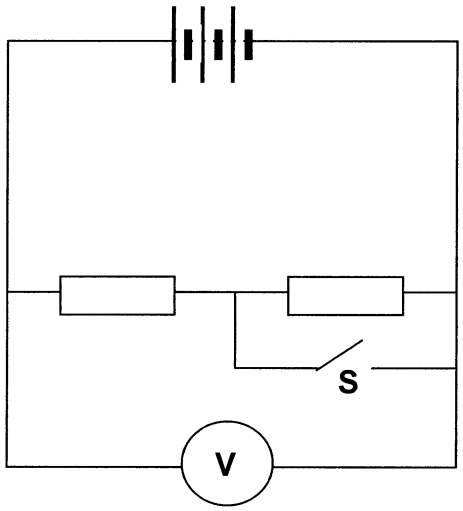


Watter EEN van die volgende kombinasies is die korrekte aanduiding van die tipe krag en die rigting van die krag wat geleier PQ op geleier RS uitoefen?

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

(3)

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



Wanneer die skakelaar gesluit word, sal die lesing op die voltmeter ...

A dieselfde bly.

B toeneem.

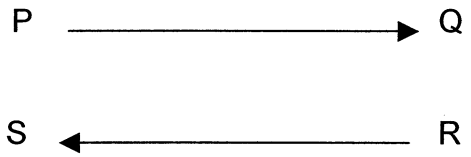
C afneem, maar nie tot zero nie.

D zero word.

(3)

(15 x 3) [45]

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

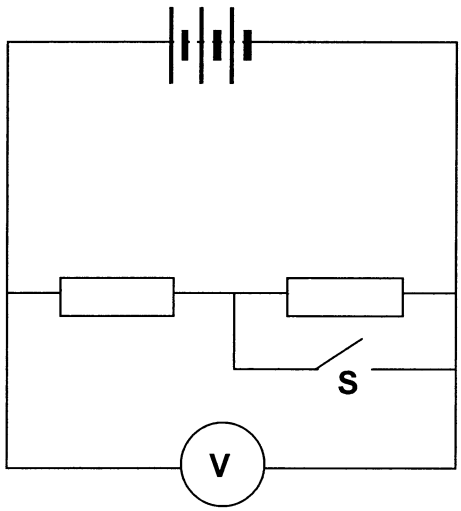


Which ONE of the following combinations correctly indicates the type of force and the direction of the force that conductor PQ exerts on conductor RS?

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

(3)

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



When the switch is closed, the reading on the voltmeter will ...

A remain the same.

B increase.

C decrease, but not to zero.

D become zero.

(3)

(15 x 3) [45]

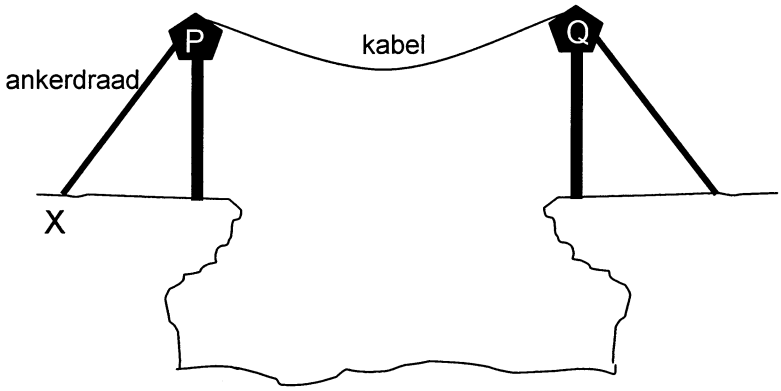
BEANTWOORD VRAAG 2 TOT 8 IN DIE ANTWOORDEBOEK.

INSTRUKSIES

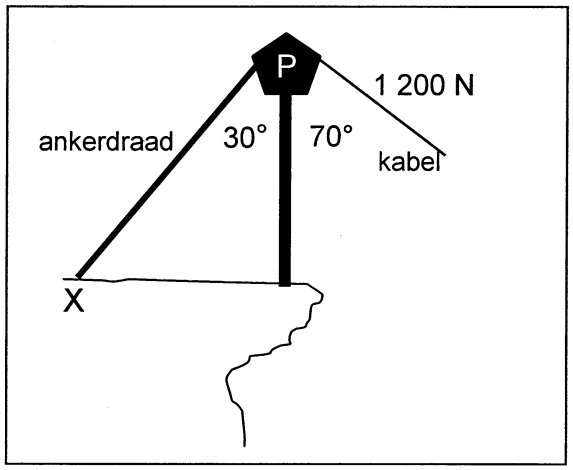
1. Begin elke vraag op 'n **skoon bladsy** in die ANTWOORDEBOEK.
2. Laat 'n reël oop tussen onderafdelings, byvoorbeeld 2.1 en 2.2.
3. Toon AL die formules, sowel as bewerkings, insluitende vervangings (substitusies).
4. Nommer die antwoorde presies soos die vrae genommer is.

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 1 200 N. Die kabel maak 'n hoek van 70° met die vertikaal by paal P en die ankerdraad maak 'n hoek van 30° met die vertikaal by paal P (Figuur 2). Ignoreer die massas van die kabel en die ankerdraad.



Figuur 1



Figuur 2

2.1 Drie kragte werk in op die bopunt van paal P. Noem die DRIE kragte. (3)

2.2 Wanneer die drie kragte genoem in VRAAG 2.1 hierbo as 'n vektordiagram, kop-by-stert, geteken word, vorm hulle 'n geslote figuur.

2.2.1 Waarom vorm die kragte 'n geslote figuur? (2)

2.2.2 Teken 'n benoemde driehoek van kragte vir die drie kragte wat op die bopunt van paal P inwerk. Dui ten minste EEN hoek aan. (3)

2.3 Bepaal, óf deur akkurate konstruksie (1 cm stel 200 N voor) óf deur berekening, die grootte van die krag in die ankerdraad. (4)
[12]

ANSWER QUESTIONS 2 TO 8 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 1 200 N. The cable makes an angle of 70° with the vertical at pole P and the stay wire makes an angle of 30° with the vertical at pole P (Figure 2). Disregard the masses of the cable and the stay wire.

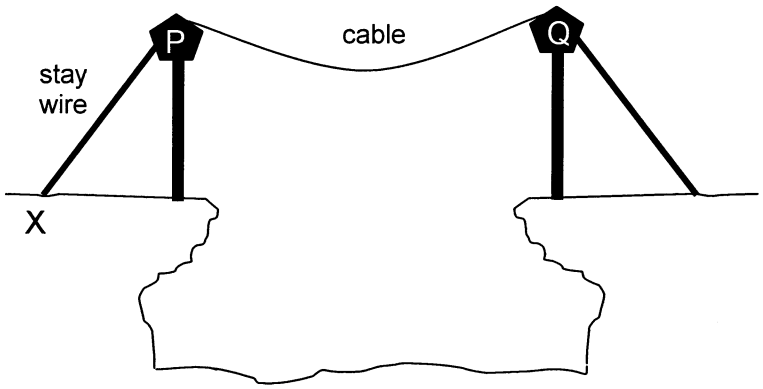


Figure 1

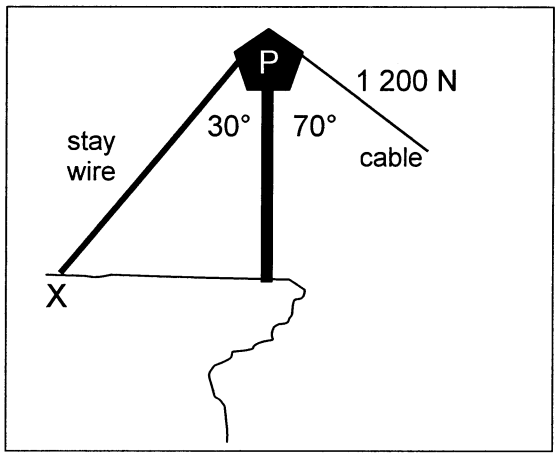


Figure 2

2.1 Three forces act at the top of pole P. Name these THREE forces. (3)

2.2 When the three forces mentioned in QUESTION 2.1 above are drawn as a vector diagram, head to tail, they form a closed figure.

2.2.1 Why do the forces form a closed figure? (2)

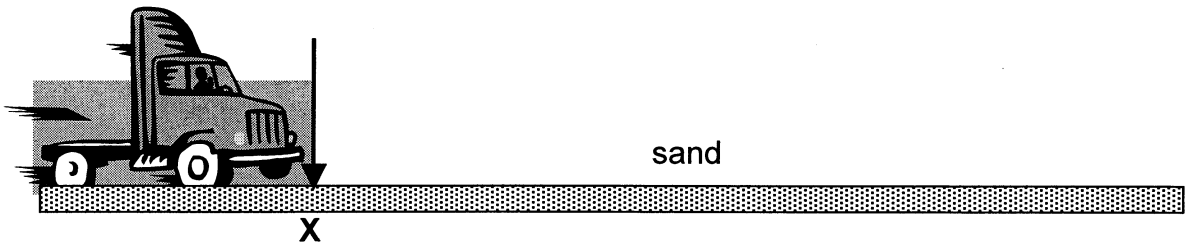
2.2.2 Draw a labelled triangle of forces for the three forces acting at the top of pole P. Indicate at least ONE angle. (3)

2.3 Determine, either by accurate construction (1 cm represents 200 N) or by calculation, the magnitude of the force in the stay wire. (4)

[12]

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 deel van die pad en gaan 'n sandput binne wat dit stadiger laat beweeg teen konstante versnelling.



By 'n sekere punt, wanneer die vragmotor reeds in die sandput is, word die verplasing vanaf punt X en verder elke 5 s deur 'n apparaat genoteer. Die notering vir die eerste 15 s word hieronder gegee.

Tyd (s)	0	5	10	15
Verplasing vanaf punt X (m)	0	70	120	150

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 10 $m.s^{-1}$, bereken die grootte en rigting van die versnelling van die vragmotor gedurende die eerste 10 s. (6)

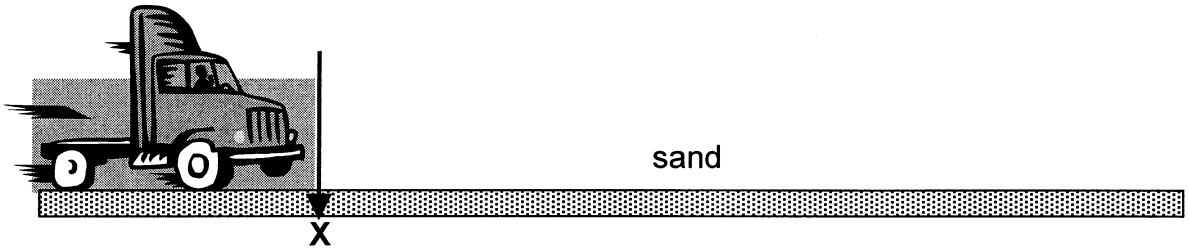
3.3 Bereken die grootte van die snelheid van die vragmotor by punt X. (5)

3.4 Bereken die verplasing van die vragmotor vanaf punt X totdat dit tot stilstand gekom het. (5)

[20]

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 piece of road and enters a sand trap, which causes it to slow down with uniform acceleration.



At a certain point, when the truck is already in the sand trap, its displacement from point X and beyond is recorded by a tracking device in 5 s intervals. The recordings of the first 15 s are given below:

Time (s)	0	5	10	15
Displacement from point X (m)	0	70	120	150

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

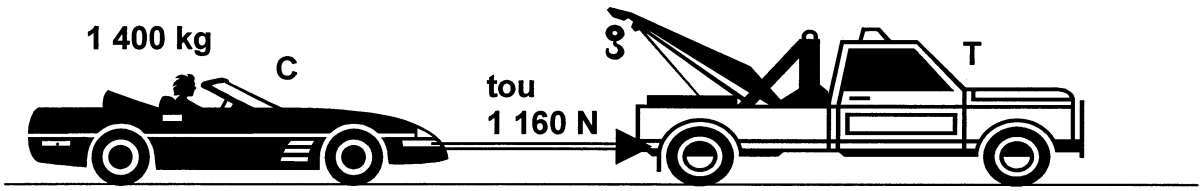
3.2 If the magnitude of the average velocity of the truck for the next 5 seconds (between 5 and 10 seconds) is equal to 10 $m.s^{-1}$, calculate the magnitude and direction of the acceleration of the truck during the first 10 s. (6)

3.3 Calculate the magnitude of the velocity of the truck at point X. (5)

3.4 Calculate the displacement of the truck from point X, until it has come to rest. (5)
[20]

VRAAG 4 **[BEGIN OP 'N SKOON BLADSY]**

'n Insleepvoertuig, T, trek 'n motor, C, deur gebruik te maak van 'n ligte, onelastiese tou, soos in die diagram hieronder getoon. Die twee voertuie beweeg op 'n reguit, horisontale pad na regs.



4.1 Stel, in woorde, **Newton se Tweede Bewegingswet**. (3)

Soos hulle uit rus begin, oefen die tou 'n horisontale krag van 1 160 N op die motor uit. Die massa van die motor is 1 400 kg. Die wrywingskrag op motor C, wanneer dit begin beweeg, is 600 N.

4.2 Bereken:

4.2.1 Die grootte en rigting van die **resulterende** krag wat die motor aan die begin ondervind (3)

4.2.2 Die grootte van die versnelling van die motor aan die begin (4)

Na 'n rukkie beweeg die insleepvoertuig en die motor teen 'n konstante snelheid. Op daardie stadium is die krag wat deur die tou op die motor uitgeoefen word, gelyk aan 450 N.

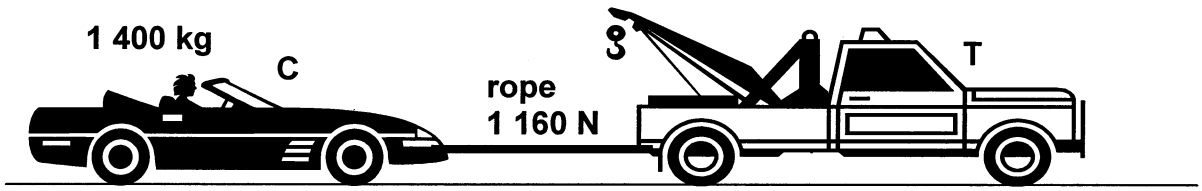
4.3 Wat is die grootte en rigting van die wrywingskrag op die motor nou? (2)

Om met 'n tou te sleep kan gevaarlik wees. Dit is veral waar indien die insleepvoertuig se remme skielik aangewend word terwyl die motor vorentoe beweeg.

4.4 Noem die relevante **fisiese eienskap** wat van toepassing is op die motor in hierdie situasie. (2)
[14]

QUESTION 4 [START ON A NEW PAGE]

A breakdown truck, T, pulls a car, C, using a light, inelastic rope, as shown in the diagram below. The two vehicles move on a straight, horizontal road to the right.



4.1 State, in words, **Newton's Second Law of Motion**. (3)

As they start from rest, the rope exerts a horizontal force of 1 160 N on the car. The mass of the car is 1 400 kg. The force of friction on car C, as it starts to move, is 600 N.

4.2 Calculate:

4.2.1 The magnitude and direction of the **resultant** force which the car experiences at the start (3)

4.2.2 The magnitude of the acceleration of the car at the start (4)

After a while the breakdown truck and the car travel at constant velocity. At that stage, the force exerted by the rope on the car, is 450 N.

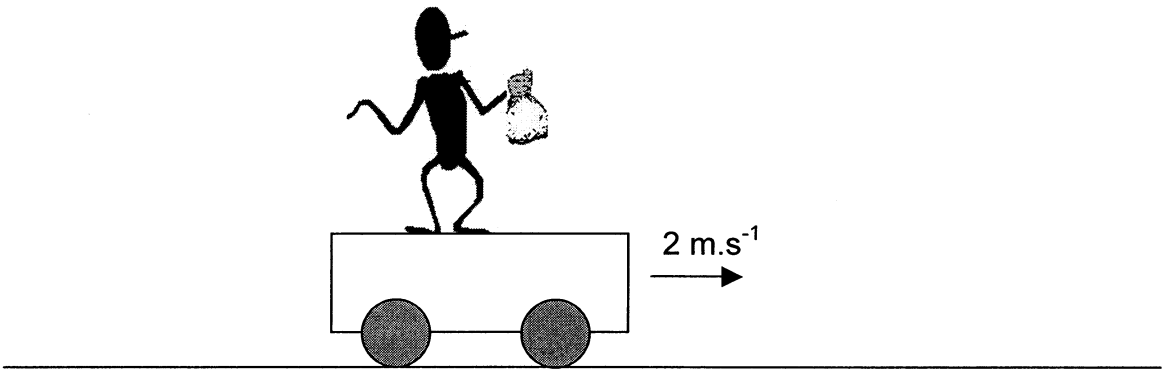
4.3 What is the magnitude and direction of the force of friction on the car now? (2)

Towing with a rope can be dangerous. This is especially true in the event of the breakdown truck applying its brakes suddenly, while the car continues moving forward.

4.4 Name the relevant **physical property** that is applicable to the car in this situation. (2)
[14]

VRAAG 5 [BEGIN OP 'N SKOON BLADSY]

John staan op 'n trollie wat horisontaal na regs beweeg teen 'n konstante snelheid van 2 $m.s^{-1}$. Die gesamentlike massa van John en die trollie is 140 kg. Daarbenewens, dra hy 'n sak aartappels met 'n massa van 5 kg. Ignoreer wrywing.



5.1 Definieer, in woorde, die **Wet van Behoud van Momentum**. (3)

Hy gooi die sak aartappels horisontaal om die trollie stadiger te laat beweeg.

5.2 In watter rigting moet hy die sak gooi om die trollie stadiger te laat beweeg? (Kies slegs **voorwaarts** of **terugwaarts**.) (2)

5.3 Bereken die grootte van die snelheid waarmee die sak aartappels gegooi moet word sodat die trollie se snelheid verminder na 1,5 $m.s^{-1}$, maar steeds beweeg in die oorspronklike bewegingsrigting van die trollie. (6)
[11]

VRAAG 6 [BEGIN OP 'N SKOON BLADSY]

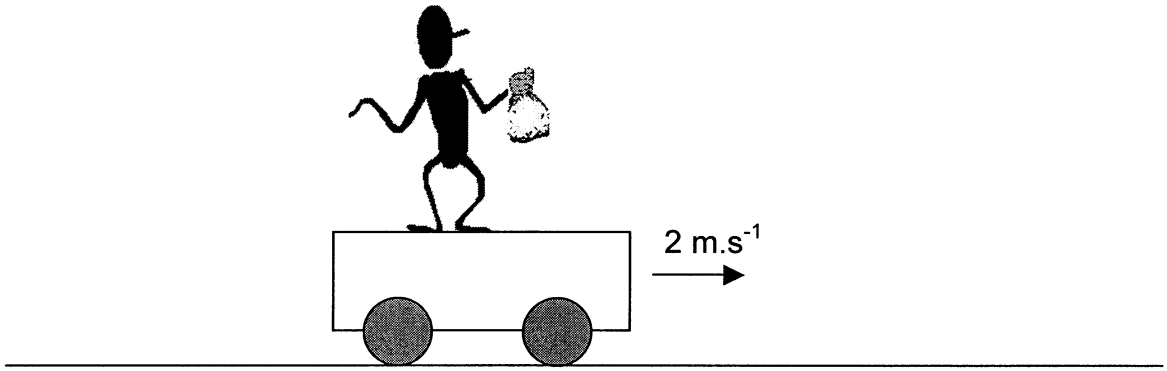
'n Motor, massa 800 kg, beweeg teen 30 $m.s^{-1}$ op 'n horisontale pad. Die bestuurder besluit om die spoed te verminder tot 12 $m.s^{-1}$ as gevolg van swak weer.

6.1 Toon deur berekening dat die arbeid verrig deur die remstelsel om die motor se spoed van 30 $m.s^{-1}$ tot 12 $m.s^{-1}$ te verminder, gelyk is aan 302 400 J. (4)

6.2 Bereken die afstand afgelê terwyl die motor se spoed verminder van 30 $m.s^{-1}$ tot 12 $m.s^{-1}$ as die gemiddelde "remkrag" gelyk is aan 2 016 N. (4)
[8]

QUESTION 5 [START ON A NEW PAGE]

John stands on a trolley which is moving horizontally to the right at a constant velocity of 2 $m.s^{-1}$. The combined mass of John and the trolley is 140 kg. In addition, he carries a bag of potatoes of mass 5 kg. Ignore friction.



5.1 Define, in words, the **Law of Conservation of Momentum.** (3)

He throws the bag of potatoes horizontally to slow down the trolley.

5.2 In which direction must he throw the bag to slow down the trolley? (Choose either **forwards** or **backwards**.) (2)

5.3 Calculate the magnitude of the velocity with which the bag of potatoes must be thrown so that the trolley slows down to a velocity of 1,5 $m.s^{-1}$, but still moves in the original direction of motion of the trolley. (6)
[11]

QUESTION 6 [START ON A NEW PAGE]

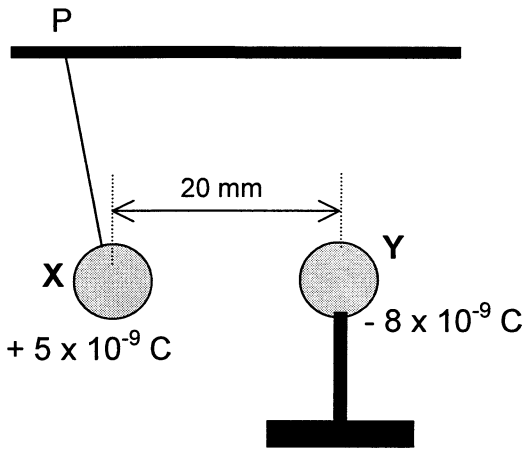
A car, mass 800 kg, is travelling at 30 $m.s^{-1}$ on a horizontal road. The driver decides to reduce the speed to 12 $m.s^{-1}$ due to bad weather.

6.1 Show by calculation that the work done by the braking system to slow the car down from 30 $m.s^{-1}$ to 12 $m.s^{-1}$, is equal to 302 400 J. (4)

6.2 Calculate the distance covered while the car slows down from 30 $m.s^{-1}$ to 12 $m.s^{-1}$ if the average "braking" force is equal to 2 016 N. (4)
[8]

VRAAG 7 [BEGIN OP 'N SKOON BLADSY]

'n Klein, geleidende sfeer, X, met 'n lading van + 5 x 10^{-9} C 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 gebring totdat hulle middelpunte 20 mm van mekaar is.



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

7.2 Stel, in woorde, **Coulomb se wet**. (4)

7.3 Bereken die grootte van die elektrostatiese krag wat sfeer Y op sfeer X uitoefen. (5)

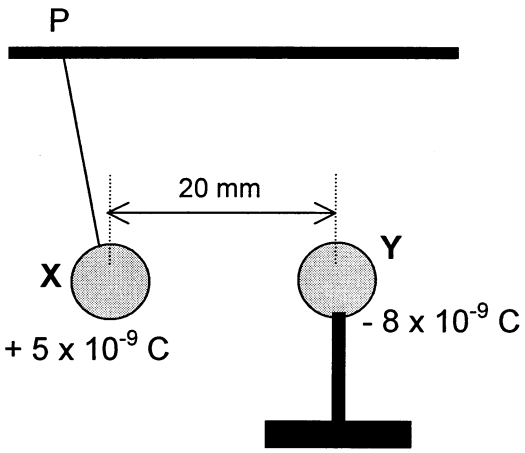
Sfeer Y word nou nader gebring en maak kontak met sfeer X waarna X afgestoot word.

7.4 Bereken die nuwe lading op sfeer X nadat hulle kontak gemaak het en toe weer van mekaar geskei is. (3)

[16]

QUESTION 7 [START ON A NEW PAGE]

A small, conducting sphere, X, with a charge of + 5 x 10^{-9} C 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 brought closer to X until their centres are 20 mm apart.



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

7.2 State, in words, **Coulomb's law**. (4)

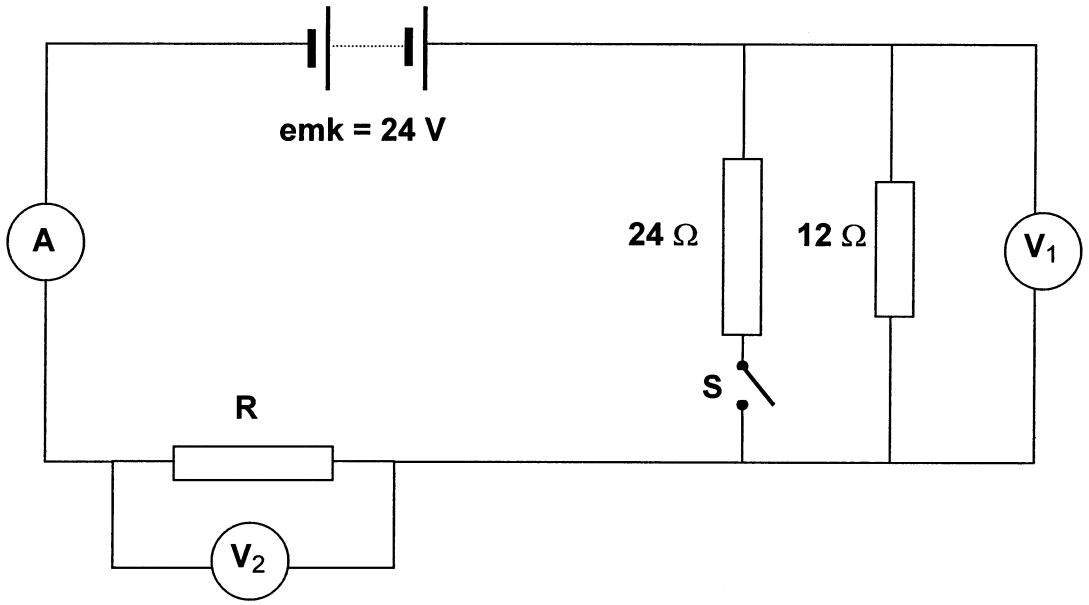
7.3 Calculate the magnitude of the electrostatic force that sphere Y exerts on sphere X. (5)

Sphere Y is now moved closer and makes contact with sphere X after which X is repelled.

7.4 Calculate the new charge on sphere X after they have made contact and have been separated again. (3)
[16]

VRAAG 8 [BEGIN OP 'N SKOON BLADSY]

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



8.1 Stel, in woorde, **Ohm se wet**. (3)

Skakelaar S is oop.

8.2 Bereken die lesing op voltmeter V_1, as die lesing op die ammeter gelyk is aan 1,5 A. (4)

8.3 Bereken die weerstand van resistor R. (4)

Skakelaar S word nou gesluit.

8.4 Bereken die effektiewe weerstand van die parallelle kombinasie van resistors. (4)

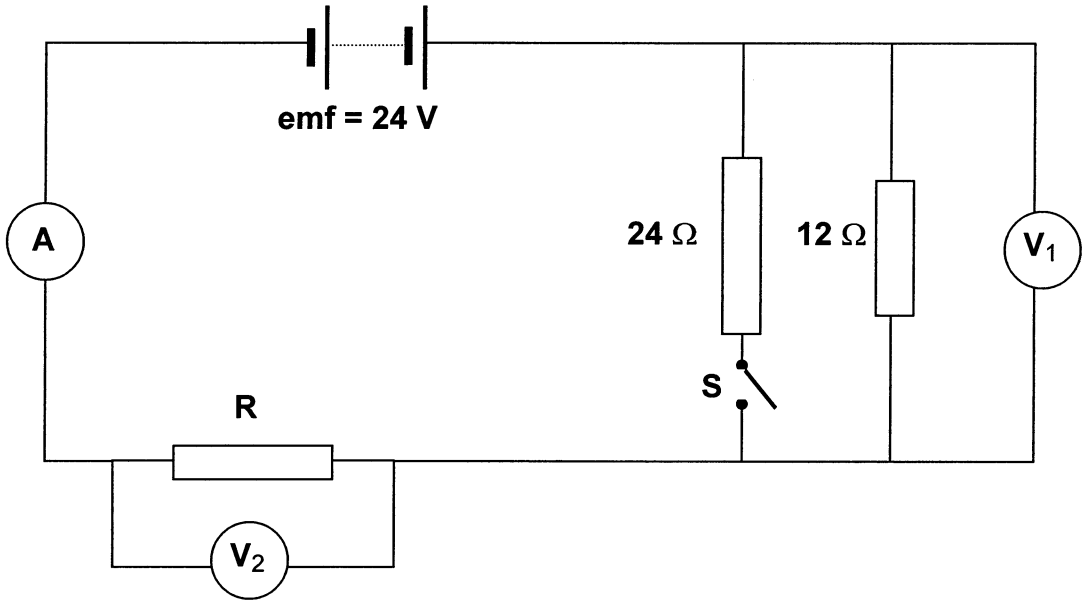
8.5 Bereken die nuwe lesing op die ammeter. (4)

8.6 Bereken die hoeveelheid energie oorgedra in resistor R in 2 minute. (5)
[24]

TOTAAL VRAAG 1 : 45
TOTAAL VRAAG 2 – 8 : 105
GROOTTOTAAL : 150

QUESTION 8 [START ON A NEW PAGE]

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



8.1 State, in words, **Ohm's law**. (3)

Switch S is open.

8.2 Calculate the reading on voltmeter V_1, if the reading on the ammeter is equal to 1,5 A. (4)

8.3 Calculate the resistance of resistor R. (4)

Switch S is now closed.

8.4 Calculate the effective resistance of the parallel combination of resistors. (4)

8.5 Calculate the new reading on the ammeter. (4)

8.6 Calculate the amount of energy transferred in resistor R in 2 minutes. (5)
[24]

TOTAL QUESTION 1 : 45
TOTAL QUESTIONS 2 - 8: 105
GRAND TOTAL : 150

DEPARTMENT OF EDUCATION
DEPARTEMENT VAN ONDERWYS

SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN

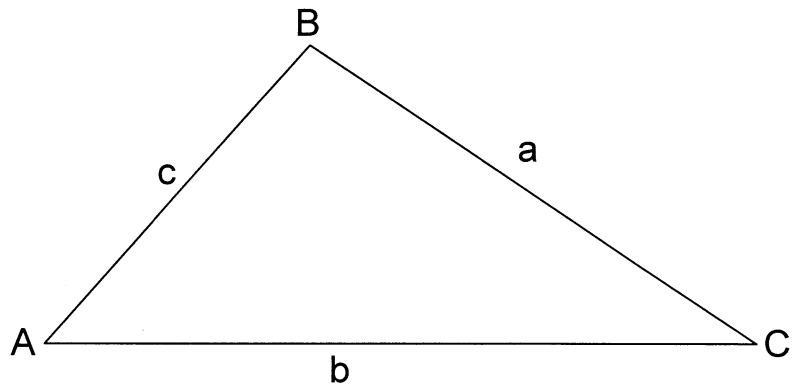
DATA FOR PHYSICAL SCIENCE
PAPER I (PHYSICS)

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