DEPARTMENT OF EDUCATION
REPUBLIC OF SOUTH AFRICA

DEPARTEMENT VAN ONDERWYS
REPUBLIEK VAN SUID-AFRIKA

SENIOR CERTIFICATE EXAMINATION - 2005
SENIORSERTIFIKAAT-EKSAMEN - 2005

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

STANDARD GRADE
STANDAARDGRAAD

FEBRUARY/MARCH 2005
FEBRUARIE/MAART 2005

304-2/1

Marks: 150
Punte : 150

2 Hours
2 Ure

This question paper consists of 13 pages and 2 data sheets.
Hierdie vraestel bestaan uit 13 bladsye en 2 gegewensblaaie.

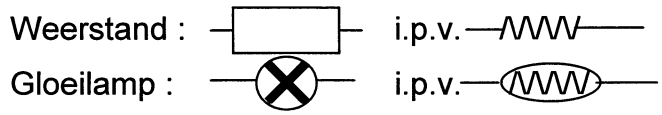
PHYSICAL SCIENCE SG: Paper 1
Physics

304 2 1 SG

X05

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.

PLAAS DIE VOLTOOIDE ANTWOORDBLAD BINNE DIE VOORSTE OMSLAG VAN JOU ANTWOORDEBOEK, INDIEN 'N AFSONDERLIKE ANTWOORDBLAD GEBRUIK IS.

VOORBEELD

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

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

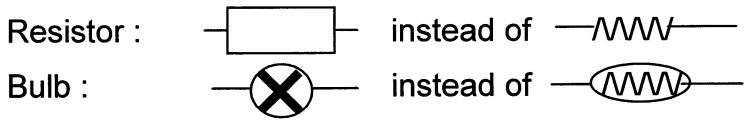
ANTWOORD:

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:



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.

PLACE THE COMPLETED ANSWER SHEET INSIDE THE FRONT COVER OF YOUR ANSWER BOOK, IF A SEPARATE ANSWER SHEET HAS BEEN USED.

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

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

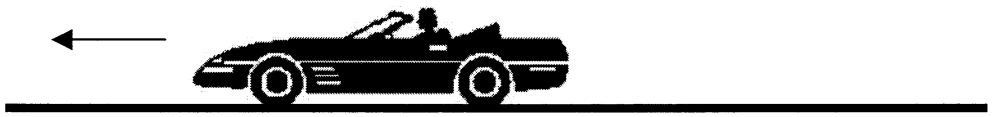
ANSWER:

A	B	C	D

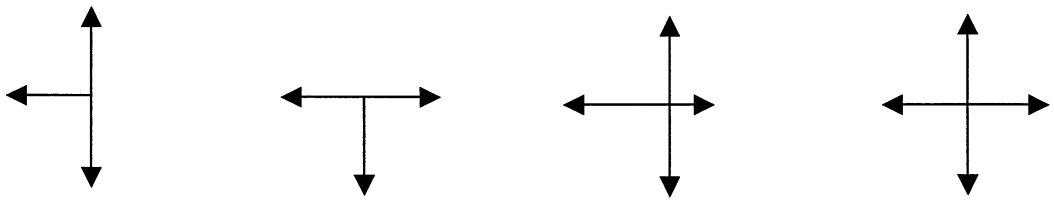
[NOTE: This layout may vary, depending on the type of answer sheet used by the province.]

VRAAG 1

1.1 'n Motor beweeg horisontaal teen 'n konstante snelheid van 60 km.h^{-1}, in die rigting soos getoon.



Watter EEN van die volgende vektordiagramme dui al die kragte aan wat op die motor inwerk?



A B C D

(3)

1.2 Twee onewe kragte werk gelyktydig in op 'n liggaam. Die resulterende krag ...

A is dieselfde as die ekwilibrant.

B hou die liggaam in ewewig.

C het dieselfde effek as wanneer die twee kragte saam inwerk.

D het altyd 'n grootte wat gelyk is aan die som van die groottes van die twee individuele kragte. (3)

1.3 'n Klip val vry vanuit rus en bereik 'n snelheid **v** nadat dit 'n verplasing **x** ondergaan het. Ignoreer wrywingseffekte. Die klip sal 'n snelheid 2**v** bereik nadat dit 'n verplasing ... ondergaan het.

A **4x**

B **2x**

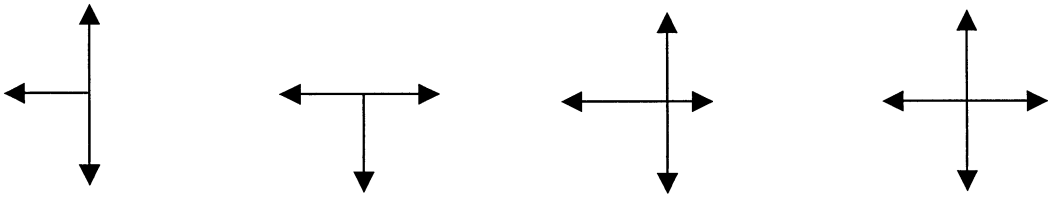
C $\sqrt{2}\mathbf{x}$

D $\sqrt{2\mathbf{x}}$ (3)

QUESTION 1

1.1 A car moves horizontally at a constant velocity of 60 km.h^{-1}, in the direction shown.

Which ONE of the following vector diagrams indicates the forces acting on the car?



A B C D

(3)

1.2 Two unequal forces act simultaneously on a body. The resultant force ...

A is the same as the equilibrant.

B keeps the body in equilibrium.

C has the same effect as the two forces acting together.

D always has a magnitude which is equal to the sum of the magnitudes of the two individual forces. (3)

1.3 A stone falls freely from rest and reaches a velocity **v** after undergoing a displacement **x**. Ignore the effects of friction. The stone will reach a velocity 2**v** after undergoing a displacement ...

A $4\mathbf{x}$.

B $2\mathbf{x}$.

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

D $\sqrt{2\mathbf{x}}$. (3)

1.4 'n Vragmotorbestuurder ry op 'n reguit, horisontale pad met sy leë vragmotor. Hy wend die remme so hard as moontlik (maksimum) aan en bring die vragmotor tot stilstand. Later gedurende die dag ry hy weer op dieselfde pad maar vervoer 'n **vol vrag**. Hy wend die remme dieselfde as voorheen aan. Hoe vergelyk die nuwe remafstand en remtyd met die voriges?

	Nuwe remafstand	**Nuwe remtyd**
A	is groter	is dieselfde
B	is dieselfde	is dieselfde
C	is groter	is groter
D	is dieselfde	is groter

(3)

1.5 'n Versnelling van 5 $m.s^{-2}$ kan soos volg verduidelik word:

A Die snelheid verander met 5 $m.s^{-1}$ elke sekonde.

B Die snelheid verander met 5 $m.s^{-1}$ elke opeenvolgende, gelyke tydinterval.

C Die snelheid verander met 5 $m.s^{-1}$ elke opeenvolgende, afnemende tydinterval.

D Die snelheid verander met 5 $m.s^{-1}$ elke opeenvolgende, toenemende tydinterval. (3)

1.6 Jakes lig 'n massa van 200 kg, teen uniforme snelheid, deur 'n sekere hoogte in 2 s. Wat is die grootte van die krag wat hy op die massa uitoefen?

A 4 000 N

B 2 000 N

C 1 000 N

D 400 N (3)

1.7 Die gravitasiekrag wat die aarde op die maan uitoefen is …

A direk eweredig aan die afstand tussen hulle middelpunte.

B omgekeerd eweredig aan die massa van die maan.

C omgekeerd eweredig aan die produk van die massa van die aarde en die massa van die maan.

D omgekeerd eweredig aan die kwadraat van die afstand tussen hulle middelpunte. (3)

1.4 A truck driver is travelling along a straight, horizontal road in his empty truck. He applies his brakes as hard as possible (maximum) and brings the truck to rest. Later in the day he is driving along the same road but is carrying a **full load**. He applies the brakes the same as before. How will the new braking distance and braking time compare with the previous ones?

	New braking distance	**New braking time**
A	is greater	is the same
B	is the same	is the same
C	is greater	is greater
D	is the same	is greater

(3)

1.5 An acceleration of 5 $m.s^{-2}$ can be explained as follows:

A The velocity changes by 5 $m.s^{-1}$ every second.

B The velocity changes by 5 $m.s^{-1}$ every successive, equal time interval.

C The velocity changes by 5 $m.s^{-1}$ every successive, decreasing time interval.

D The velocity changes by 5 $m.s^{-1}$ every successive, increasing time interval. (3)

1.6 Jakes lifts a mass of 200 kg, with uniform velocity, through a certain height in 2 s. What is the magnitude of the force that he exerts on the mass?

A 4 000 N

B 2 000 N

C 1 000 N

D 400 N (3)

1.7 The gravitational force which the earth exerts on the moon is …

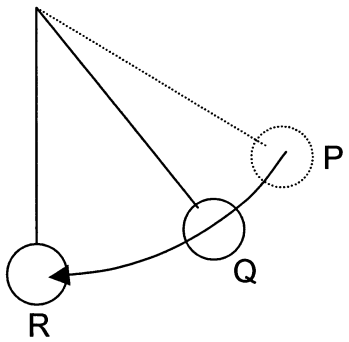
A directly proportional to the distance between their centres.

B inversely proportional to the mass of the moon.

C inversely proportional to the product of the mass of the earth and the mass of the moon.

D inversely proportional to the square of the distance between their centres. (3)

1.8 'n Pendulum swaai vanaf punt P deur Q na punt R. By punt Q het die pendulum 20 J gravitasie-potensiële energie, relatief tot die laagste punt (punt R), en 5 J kinetiese energie.



As die effekte van lugweerstand geïgnoreer word, sal die kinetiese energie van die pendulum by R, die laagste punt van die beweging, gelyk wees aan …

A 5 J.

B 15 J.

C 20 J.

D 25 J. (3)

1.9 Ammaar ry op sy fiets op 'n horisontale pad. Die fiets tref 'n klip en hy val oor die handvatsels. Dit is as gevolg van sy …

A traagheid.

B gewig.

C kinetiese energie.

D gravitasie-potensiële energie. (3)

1.10 Watter EEN van die volgende het dieselfde eenheid as dié van energie?

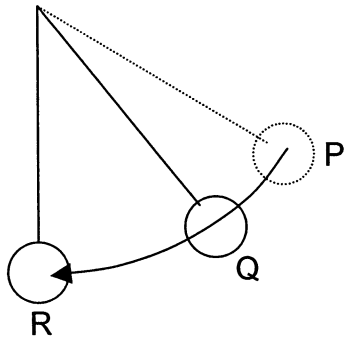
A $W.s^{-1}$

B W.s

C $N.m^{-1}$

D $N.m^{-2}$ (3)

1.8 A pendulum swings from point P through Q to point R. At point Q, the pendulum has a gravitational potential energy of 20 J, relative to its lowest point (point R), and kinetic energy of 5 J.



If the effects of air resistance are ignored, the kinetic energy of the pendulum at R, the lowest point of its motion, will be equal to …

A 5 J.

B 15 J.

C 20 J.

D 25 J. (3)

1.9 Ammaar is riding his bicycle on a horizontal road. The bicycle hits a rock and he falls over the handlebars. This is because of his …

A inertia.

B weight.

C kinetic energy.

D gravitational potential energy. (3)

1.10 Which ONE of the following has the same unit as that of energy?

A $W.s^{-1}$

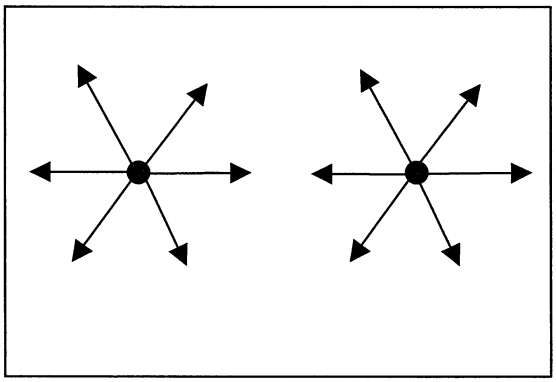
B W.s

C $N.m^{-1}$

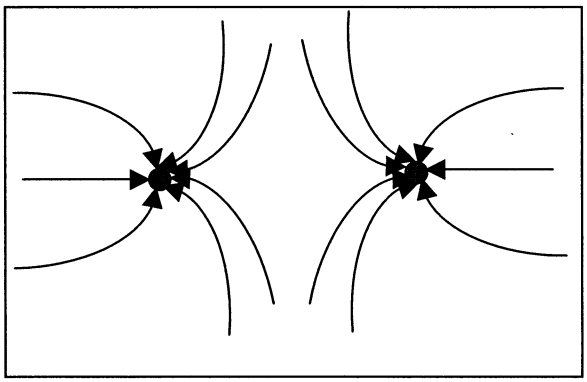
D $N.m^{-2}$ (3)

1.11 Twee identiese, positiewe puntladings word 'n afstand van mekaar geplaas. Watter EEN van die volgende diagramme is die beste voorstelling van die resulterende elektriese veldpatroon wat verkry sal word as gevolg van hierdie twee ladings?

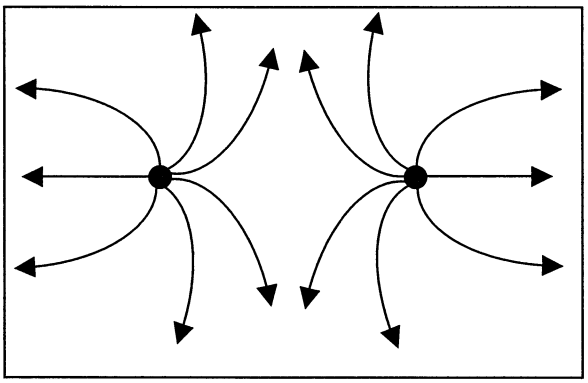
A



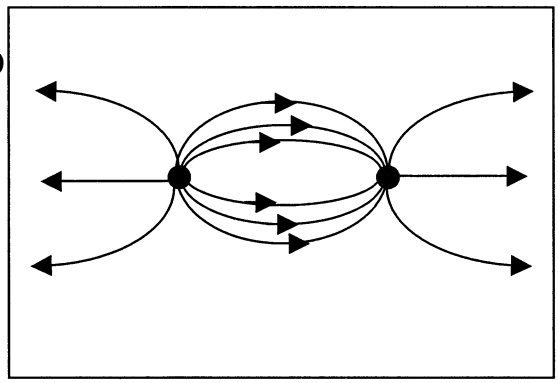
B



C



D



(3)

1.12 Potensiaalverskil kan die beste gedefinieer word as …

A die arbeid verrig om 'n positiewe lading van 'n punt met lae potensiaal na 'n punt met hoë potensiaal, in 'n elektriese veld, te beweeg.

B die krag aangewend om 'n positiewe lading van 'n punt met lae potensiaal na 'n punt met hoë potensiaal, in 'n elektriese veld, te beweeg.

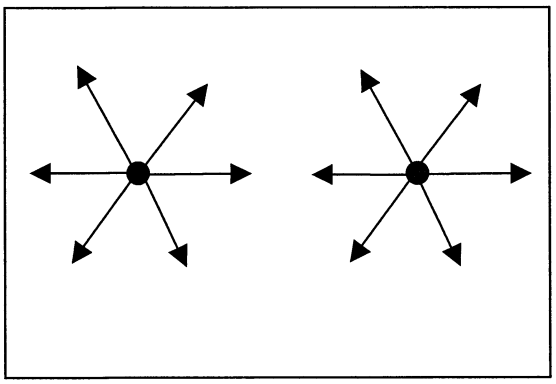
C die arbeid verrig om 'n positiewe eenheidslading van 'n punt met lae potensiaal na 'n punt met hoë potensiaal, in 'n elektriese veld, te beweeg.

D die krag aangewend om 'n positiewe eenheidslading van 'n punt met lae potensiaal na 'n punt met hoë potensiaal, in 'n elektriese veld, te beweeg.

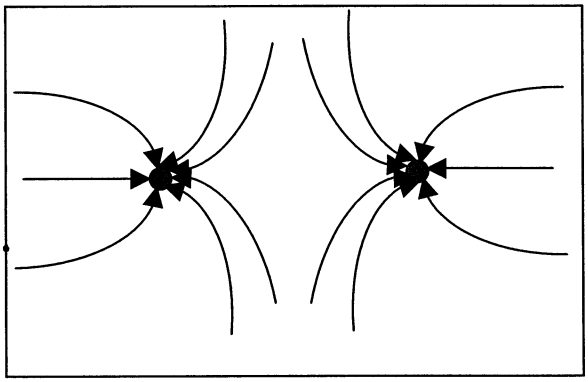
(3)

1.11 Two identical, positive point charges are placed a distance apart.
Which ONE of the following diagrams best represents the resultant electric field pattern which will be obtained due to these two charges?

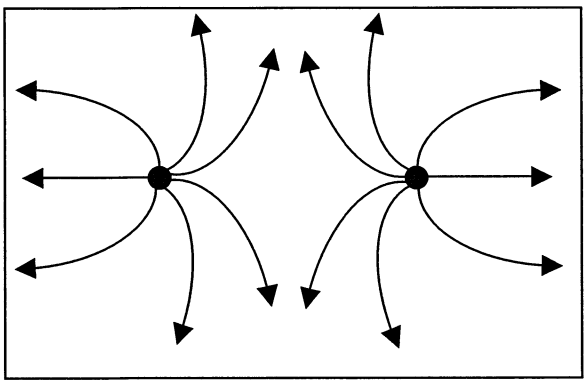
A



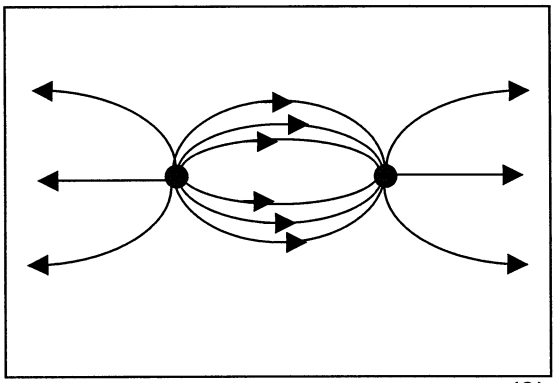
B



C



D



(3)

1.12 Potential difference can best be defined as …

A the work done in moving a positive charge from a point of low potential to a point of high potential in an electric field.

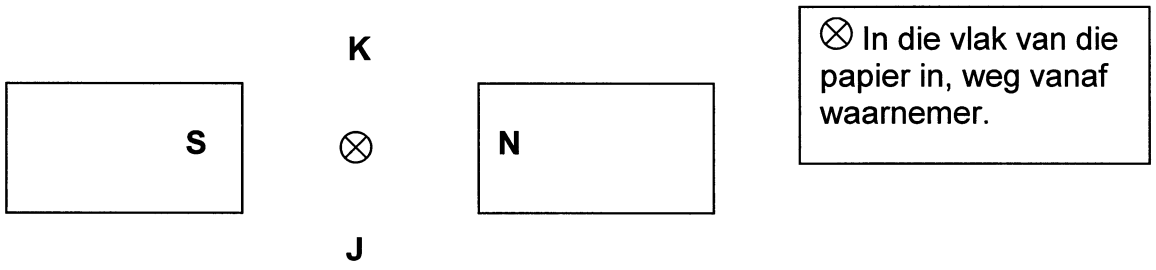
B the force applied in moving a positive charge from a point of low potential to a point of high potential in an electric field.

C the work done in moving a positive unit charge from a point of low potential to a point of high potential in an electric field.

D the force applied in moving a positive unit charge from a point of low potential to a point of high potential in an electric field.

(3)

1.13 Die suidpool van 'n magneet word aan die linkerkant geplaas en die noordpool van 'n ander magneet aan die regterkant. 'n Geleier wat tussen die twee magneetpole geplaas word, dra konvensionele stroom in die vlak van die papier in, soos in die diagram hieronder getoon.



Die geleier sal 'n krag ondervind …

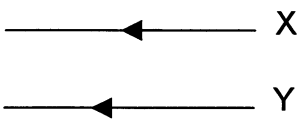
A na J, afwaarts.

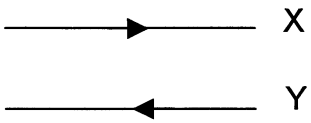
B na K, opwaarts.

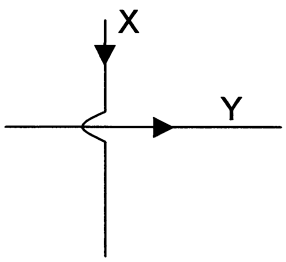
C na regs (die noordpool van die magneet).

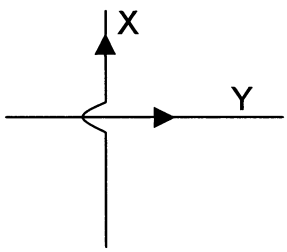
D na links (die suidpool van die ander magneet). (3)

1.14 Twee geleiers, X en Y, dra elektriese stroom op vier verskillende maniere in die rigtings soos aangedui. In watter EEN van die volgende gevalle sal geleier X 'n aantrekkingskrag as gevolg van geleier Y ondervind?

A 

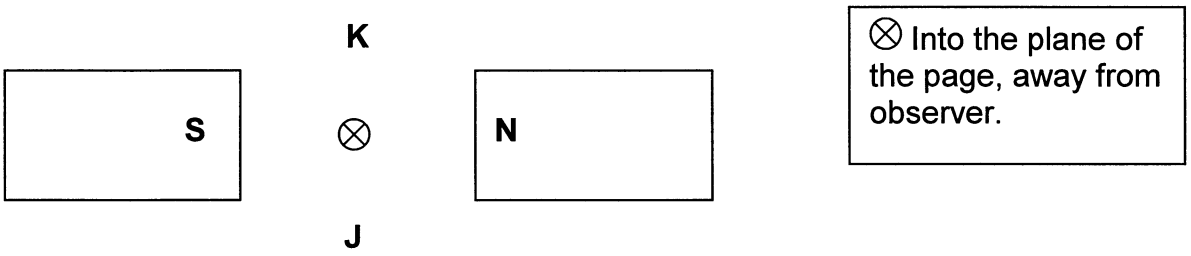
B 

C 

D 

(3)

1.13 The south pole of a magnet is placed on the left-hand side and the north pole of another magnet on the right-hand side. A conductor, placed between the two magnetic poles, carries conventional current into the plane of the page, as shown in the diagram below.



The conductor would experience a force …

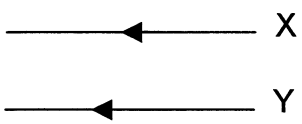
A towards J, downwards.

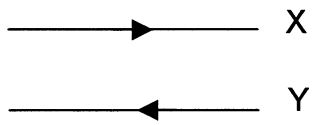
B towards K, upwards.

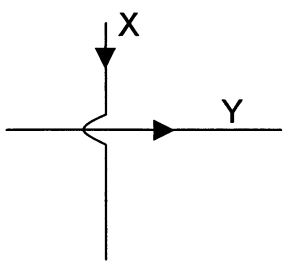
C to the right (the north pole of the magnet).

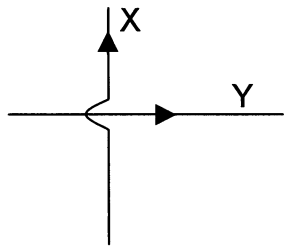
D to the left (the south pole of the other magnet). (3)

1.14 Two conductors, X and Y, carry electric currents in four different arrangements, in the directions as shown. In which ONE of the following cases will conductor X experience a force of attraction due to conductor Y?

A 

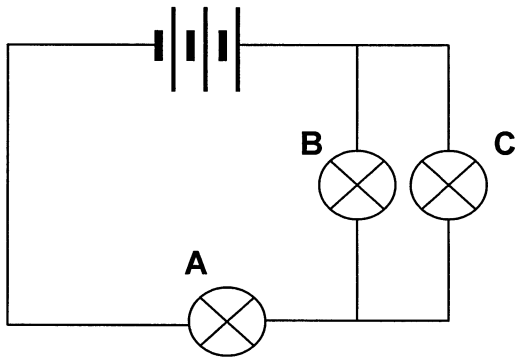
B 

C 

D 

(3)

1.15 Drie identiese gloeilampe, A, B en C, word aan 'n battery verbind. Aanvaar dat die battery weglaatbare interne weerstand het.



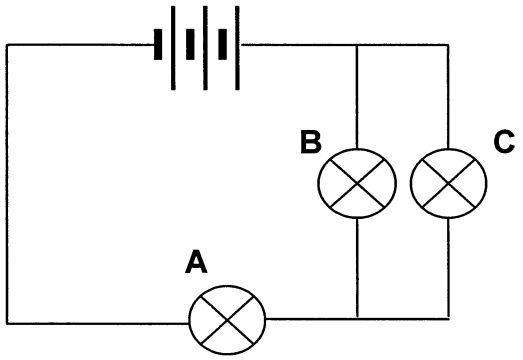
Watter EEN van die volgende kombinasies is die korrekte voorstelling van die helderheid van gloeilampe A en B, in vergelyking met hulle oorspronklike helderheid, as gloeilamp C verwyder word?

	Nuwe helderheid van gloeilamp A	**Nuwe helderheid van gloeilamp B**
A	dowwer	dowwer
B	helderder	dowwer
C	helderder	helderder
D	dowwer	helderder

(3)

(15 x 3) [45]

1.15 Three identical bulbs, A, B and C, are connected to a battery. Assume the battery has negligible internal resistance.



Which ONE of the following combinations correctly represents the brightness of bulbs A and B, compared to their original brightness, if bulb C is removed?

	New brightness of bulb A	**New brightness of bulb B**
A	dimmer	dimmer
B	brighter	dimmer
C	brighter	brighter
D	dimmer	brighter

(3)

(15 x 3) [45]

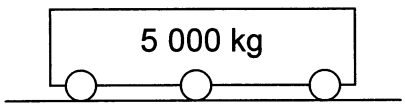
BEANTWOORD VRAAG 2 TOT 8 IN DIE ANTWOORDEBOEK.

INSTRUKSIES

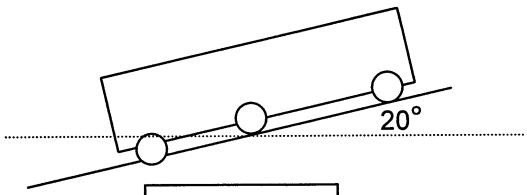
1. Begin elke vraag op 'n **SKOON BLADSY** in die ANTWOORDEBOEK.
2. Laat 'n reël oop tussen onderafdelings, byvoorbeeld 2.1 en 2.2.
3. Toon AL die formules, sowel as bewerkings, insluitende vervangings (substitusies).
4. Nommer die antwoorde presies soos die vrae genommer is.

VRAAG 2 [BEGIN OP 'N SKOON BLADSY]

'n Spoorwegtrok, vol gelaai met mielies (totale massa 5 000 kg), is in rus op 'n horisontale spoor met die handrem gekoppel (Figuur 1). Om die mielies van die trok af te laai, word die spoor teen 'n hoek met die horisontaal gekantel (Figuur 2).



Figuur 1



Figuur 2

Wanneer die spoor teen 'n hoek van 20° met die horisontaal gekantel is, kan die klap oopgemaak word en die mielies kan vrygelaat word terwyl die trok steeds stil staan.

2.1 Teken 'n benoemde vektorkragtediagram (**nie 'n driehoek van kragte nie**), wat die **gravitasiekrag** van die aarde op die trok en die **komponente** daarvan, parallel aan en loodreg op die skuinsvlak, aandui. Dui ook ten minste EEN hoek in jou vektordiagram aan. (4)

2.2 Bepaal, óf met behulp van 'n akkurate konstruksie (1 cm stel 10 000 N voor) óf 'n berekening, die **grootte en rigting** van die wrywingskrag wat die trok verhinder om teen die skuinsvlak af te gly. (Handrem steeds gekoppel en mielies nog nie afgelaai nie.) (5)
[9]

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 calculations, including substitutions.
4. Number the answers exactly as the questions are numbered.

QUESTION 2 [START ON A NEW PAGE]

A railway truck, fully laden with mealies (total mass 5 000 kg), rests on a horizontal track with the handbrake engaged (Figure 1). In order to offload the mealies from the truck, the track is tilted at an angle to the horizontal (Figure 2).

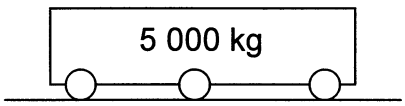


Figure 1

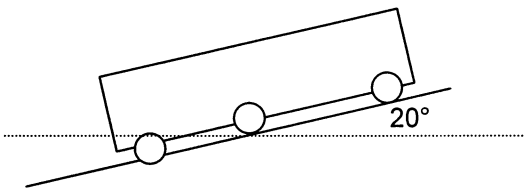


Figure 2

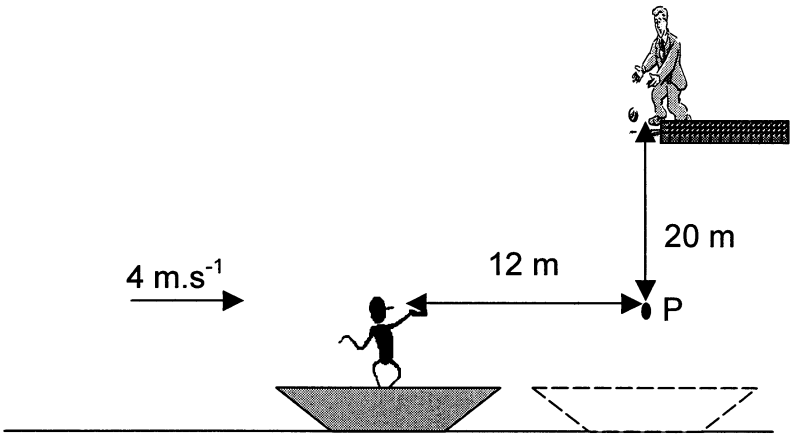
When the track is tilted 20° to the horizontal, the tailgate can be opened and the mealies can be released while the truck remains stationary.

2.1 Draw a labelled force vector diagram (**not a triangle of forces**) which shows the **gravitational force** of the earth acting on the truck and its **components** parallel and perpendicular to the inclined track. Also indicate at least ONE angle in your vector diagram. (4)

2.2 Determine, either by accurate construction (1 cm represents 10 000 N) or by calculation, the **magnitude and direction** of the frictional force which prevents the truck from sliding down the slope. (Handbrake still engaged and mealies not offloaded.) (5)
[9]

VRAAG 3 [BEGIN OP 'N SKOON BLADSY]

'n Man staan op 'n brug, 20 m bo die vlak waar die kaptein van 'n naderende boot 'n pakkie moet vang. Die man laat val die pakkie van die kant van die brug af (sien diagram) wanneer die kaptein 12 m vanaf punt P, direk onder die pakkie, is.
Die boot beweeg teen 'n konstante snelheid van 4 $m.s^{-1}$ terwyl die kaptein in rus bly relatief tot die boot. Ignoreer die effek van lugweerstand.



3.1 Bereken die tyd wat dit die pakkie neem om punt P te bereik. (5)

3.2 Bereken die grootte van die snelheid van die pakkie by punt P. (3)

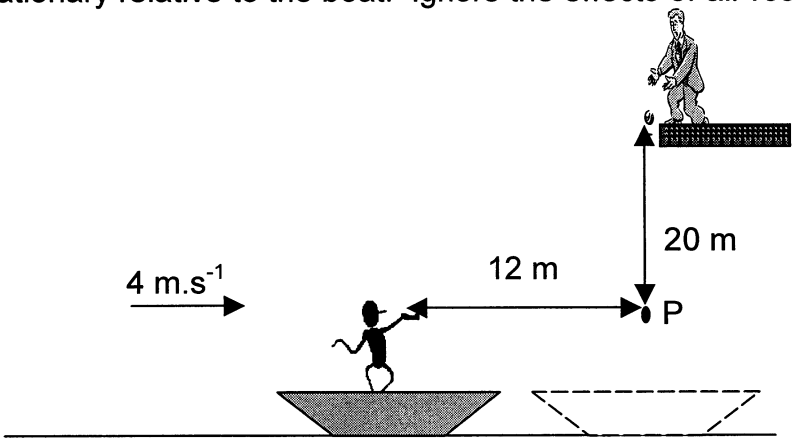
3.3 Die kaptein sal punt P egter nie betyds bereik nie. Verduidelik dit met behulp van 'n berekening. (3)

Om te verseker dat die pakkie gevang word, moet die kaptein die boot versnel vanaf die oomblik dat die pakkie laat val word.

3.4 Bereken die grootte van die versnelling van die boot sodat die kaptein die pakkie kan vang. (5)
[16]

QUESTION 3 [START ON A NEW PAGE]

A man, standing on a bridge, is 20 m above the level at which the captain of an approaching boat must catch a package. The man drops the package from the side of the bridge (see diagram) when the captain is 12 m away from point P, directly below the package. The boat travels at a constant velocity of 4 $m.s^{-1}$ while the captain remains stationary relative to the boat. Ignore the effects of air resistance.



3.1 Calculate the time taken for the package to reach point P. (5)

3.2 Calculate the magnitude of the velocity of the package at point P. (3)

3.3 The captain, however, will not reach point P in time. Explain this by means of a calculation. (3)

In order for the package to be caught, the captain needs to accelerate the boat from the instant the package is dropped.

3.4 Calculate the magnitude of the acceleration of the boat in order for the captain to catch the package. (5)
[16]

VRAAG 4 [BEGIN OP 'N SKOON BLADSY]

'n Helikopter, besig met 'n brandbestrydingsoperasie, lig 'n sak water met behulp van 'n tou vertikaal opwaarts teen 'n konstante versnelling van 0,4 $m.s^{-2}$. Die massa van die water en die sak is saam 750 kg.

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

4.2 Bereken die grootte van die **resulterende** krag op die sak water. (4)

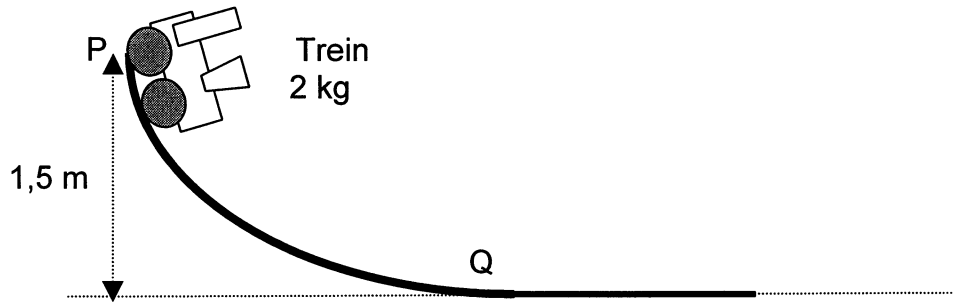
4.3 Bereken die grootte van die krag wat die tou op die sak water uitoefen terwyl dit opwaarts versnel. (5)

4.4 Nadat die sak met water gelig is, versnel die helikopter vertikaal afwaarts. Noem of die krag wat deur die tou op die sak uitgeoefen word, sal **toeneem**, **afneem** of **dieselfde bly**. (2)

[14]

VRAAG 5 [BEGIN OP 'N SKOON BLADSY]

'n Speelgoedtrein met massa 2 kg word ontwerp om langs 'n baan te beweeg soos hieronder getoon.



Die trein word by punt P, hoogte 1,5 m bo grondvlak, losgelaat en dit beweeg langs die baan na punt Q op grondvlak.

5.1 Stel, in woorde, die **beginsel van behoud van meganiese energie**. (3)

5.2 Bereken die gravitasie-potensiële energie van die trein by punt P, relatief tot die grondvlak. (4)

5.3 Deur gebruik te maak van die beginsel van behoud van meganiese energie, wat sal die kinetiese energie by punt Q wees? (2)

5.4 Daar word egter gevind dat die kinetiese energie by punt Q minder is as die gegewe waarde in VRAAG 5.3.

5.4.1 Verduidelik waarom die kinetiese energie minder is. (2)

5.4.2 Is die beginsel van behoud van meganiese energie dus geldig in hierdie situasie? (1)

[12]

QUESTION 4 [START ON A NEW PAGE]

A helicopter on a fire-fighting mission, lifts a bag of water with the help of a rope vertically upwards at a constant acceleration of 0,4 $m.s^{-2}$. The mass of the water and the bag together is 750 kg.

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

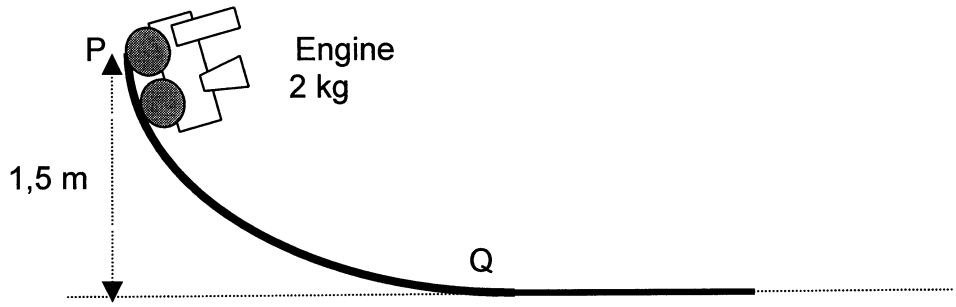
4.2 Calculate the magnitude of the **resultant** force on the bag of water. (4)

4.3 Calculate the magnitude of the force which the rope exerts on the bag of water while it is accelerating upwards. (5)

4.4 After the bag of water has been lifted, the helicopter accelerates vertically downwards. State whether the force exerted by the rope on the bag will **increase**, **decrease** or **remain the same**. (2)
[14]

QUESTION 5 [START ON A NEW PAGE]

A toy engine of mass 2 kg is designed to run down and along a track as shown below.



The engine is released at point P, height 1,5 m above ground level, and it travels along the track to point Q at ground level.

5.1 State, in words, the **principle of conservation of mechanical energy**. (3)

5.2 Calculate the gravitational potential energy of the engine at point P, relative to ground level. (4)

5.3 Using the principle of conservation of mechanical energy, what would be the kinetic energy at Q? (2)

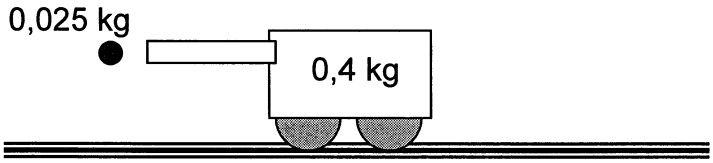
5.4 However, it is found that the kinetic energy at point Q is actually less than this value given in QUESTION 5.3.

5.4.1 Explain why the kinetic energy is less. (2)

5.4.2 Is the principle of conservation of mechanical energy therefore valid in this situation? (1)
[12]

VRAAG 6 [BEGIN OP 'N SKOON BLADSY]

'n Speelgoedkanon (geweer), massa 0,4 kg, is in rus op 'n horisontale tafel. Die kanon skiet 'n soliede rubberbal, massa 0,025 kg, horisontaal uit. Onmiddellik na die skoot gevuur is, beweeg die kanon terug teen 'n snelheid van 0,2 $m.s^{-1}$ en kom dan tot rus.



6.1 Noem en stel, in woorde, die beginsel wat jou in staat stel om die snelheid waarmee die rubberbal geskiet word, te bereken. (4)

6.2 Bereken die grootte van die snelheid waarmee die bal geskiet word. (5)

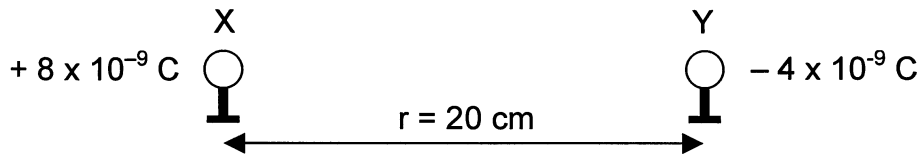
6.3 In watter rigting sal die versnelling van die kanon wees, nadat die bal afgevuur is, terwyl dit terugwaarts (na regs) beweeg? (2)

6.4 As die grootte van die versnelling van die kanon, nadat dit die rubberbal afgevuur het, 0,05 $m.s^{-2}$ is, bereken die grootte en rigting van die wrywingskrag wat die tafel op die wiele van die kanon uitoefen. (4)

[15]

VRAAG 7 [BEGIN OP 'N SKOON BLADSY]

Twee identiese, baie klein, gelaaide sfere, X en Y, op geïsoleerde staanders, word 20 cm van mekaar geplaas, soos in die diagram getoon. X het 'n lading van + 8 x 10^{-9} C en Y het 'n lading van – 4 x 10^{-9} C.



7.1 Stel **Coulomb se wet** in woorde. (4)

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

7.3 Bereken die grootte van die elektriese veldsterkte wat sfeer Y veroorsaak by die punt waar sfeer X is. (4)

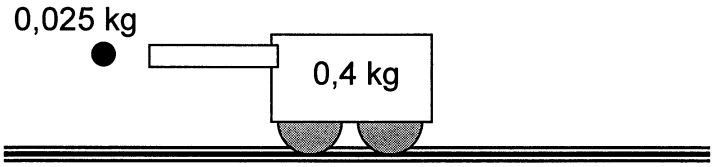
Die gelaaide sfeer Y word nader aan X gebring om kontak met X te maak. Sfeer Y word dan terugbeweeg na sy oorspronklike posisie wat 20 cm vanaf X is.

7.4 Bereken die nuwe ladings op X en Y nadat hulle aan mekaar geraak het en toe weer van mekaar geskei is. (3)

[17]

QUESTION 6 [START ON A NEW PAGE]

A toy cannon (gun), mass 0,4 kg, is resting on a horizontal table. The cannon shoots out a solid rubber ball, mass 0,025 kg, horizontally. Immediately after firing the shot, the cannon rolls back with a velocity of 0,2 $m.s^{-1}$ and then comes to rest.



6.1 Name and state, in words, the principle which will enable you to calculate the velocity with which the rubber ball is fired. (4)

6.2 Calculate the magnitude of the velocity with which the ball is fired. (5)

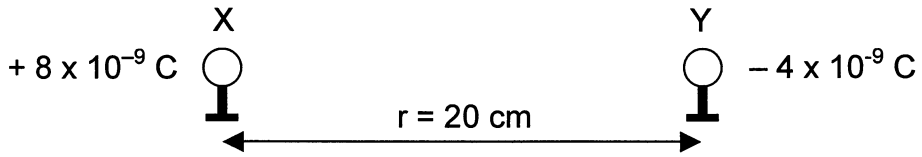
6.3 In which direction will the acceleration of the cannon be, after the ball has been fired, while it is rolling backwards (to the right)? (2)

6.4 If the magnitude of the acceleration of the cannon, after firing the rubber ball, is 0,05 $m.s^{-2}$, calculate the magnitude and direction of the frictional force which the table exerts on the wheels of the cannon. (4)

[15]

QUESTION 7 [START ON A NEW PAGE]

Two identical, very small, charged spheres, X and Y, on insulated stands, are placed 20 cm apart, as indicated in the diagram. X has a charge of + 8 x 10^{-9} C and Y has a charge of – 4 x 10^{-9} C.



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

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

7.3 Calculate the magnitude of the electric field strength that sphere Y sets up at the point where sphere X is positioned. (4)

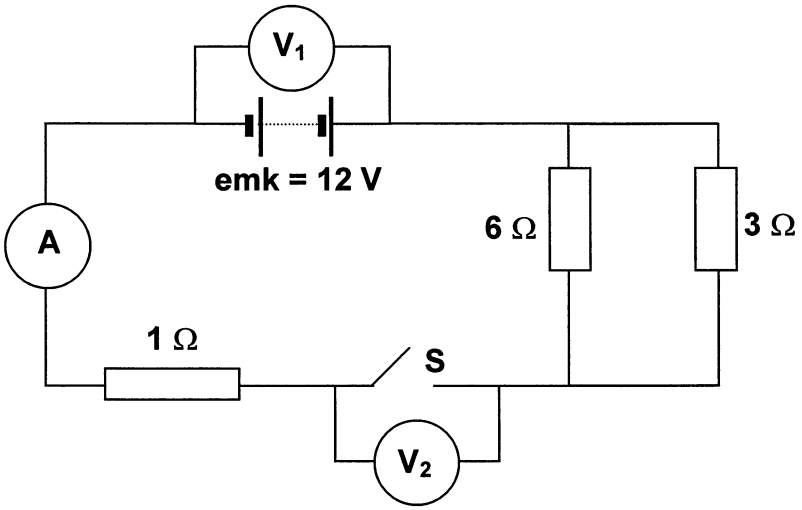
The charged sphere Y is brought closer towards X and is made to touch X. Sphere Y is then moved back to its original position which is 20 cm from X.

7.4 Calculate the new charges on X and Y after they have made contact and been separated again. (3)

[17]

VRAAG 8 [BEGIN OP 'N SKOON BLADSY]

In die stroombaan hieronder voorgestel, het die battery 'n **emk van 12 V** en weglaatbare interne weerstand. Voltmeter V_1 is oor die battery geskakel en voltmeter V_2 is oor die oop skakelaar, S, geskakel. Die weerstand van die geleidingsdrade en die ammeter kan geïgnoreer word.



Skakelaar S is oop.

8.1 Wat is die lesing op V_1? (2)

8.2 Wat is die lesing op V_2? (2)

Skakelaar S word dan gesluit.

8.3 Voltmeters V_1 en V_2 registreer óf **0 V**, **12 V** óf 'n **lesing** iewers **tussen 0 V en 4 V**. Kies **EEN** van hierdie moontlike lesings **en gee 'n verduideliking** vir jou keuse van die lesing op:

8.3.1 V_1 (3)

8.3.2 V_2 (3)

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

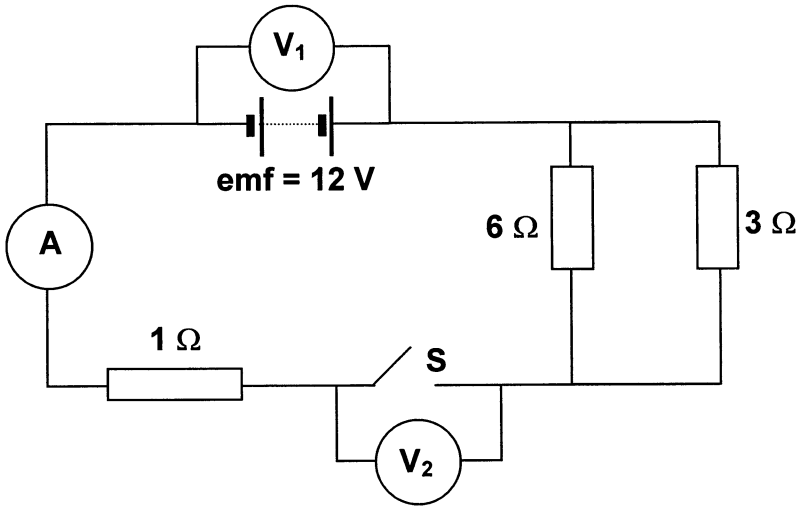
8.5 Bereken die lesing op die ammeter. (4)

8.6 Bereken die energie oorgedra in die 1 Ω-resistor in 1,5 minute. (4)
[22]

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 12 V** and negligible internal resistance. Voltmeter V_1 is connected across the battery and voltmeter V_2 is connected across the open switch S. The resistance of the connecting wires and the ammeter can be ignored.



Switch S is open.

8.1 What is the reading on V_1? (2)

8.2 What is the reading on V_2? (2)

Switch S is then closed.

8.3 Voltmeters V_1 and V_2 can register either **0 V, 12 V** or **a reading somewhere between 0 V and 4 V.** Choose **ONE** of these possible readings **and give an explanation** for your choice of the reading on:

8.3.1 V_1 (3)

8.3.2 V_2 (3)

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

8.5 Calculate the reading on the ammeter. (4)

8.6 Calculate the energy transferred in the 1 Ω resistor in 1,5 minutes. (4)
[22]

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

DEPARTMENT OF EDUCATION
DEPARTEMENT VAN ONDERWYS

SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN

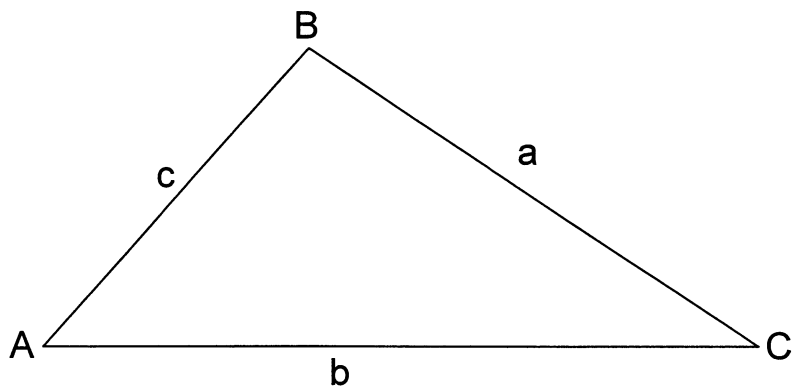
DATA FOR PHYSICAL SCIENCE
PAPER I (PHYSICS)

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



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

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

DEPARTMENT OF EDUCATION
DEPARTEMENT VAN ONDERWYS

SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN

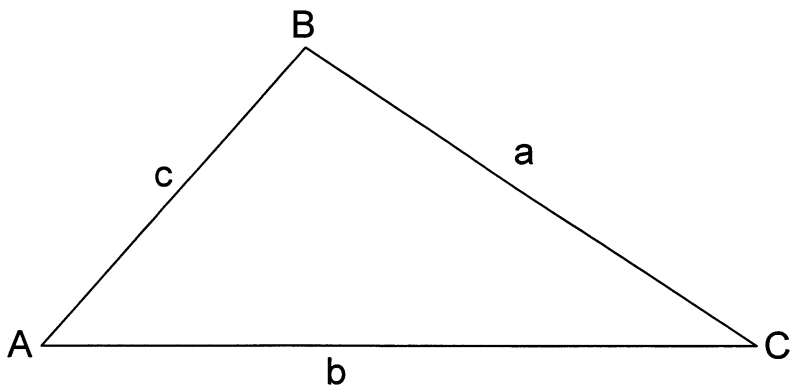
DATA FOR PHYSICAL SCIENCE
PAPER I (PHYSICS)

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

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

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

$Q = It$	$emf/emk = I(R + r)$
$R = r_1 + r_2 + r_3 + \ldots$	$F = \frac{kI_1 I_2 \ell}{d}$ $(k = 2 \times 10^{-7}\ N.A^{-2})$
$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + \ldots$	$W = VIt = I^2Rt = \frac{V^2t}{R}$
$R = \frac{V}{I}$	$P = VI = I^2R = \frac{V^2}{R}$