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

HIGHER GRADE
HOËR GRAAD

FEBRUARY/MARCH 2005
FEBRUARIE/MAART 2005

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.

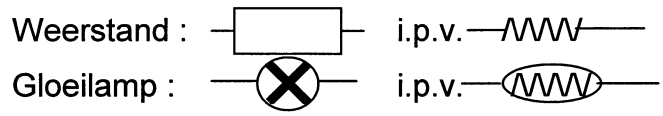
PHYSICAL SCIENCE HG: Paper 1
Physics

304 1 1 HG

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.

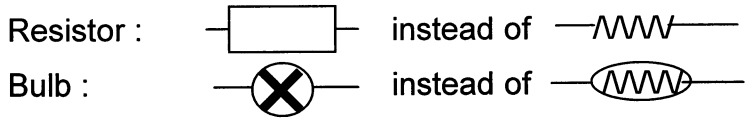
ANTWOORD:

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:

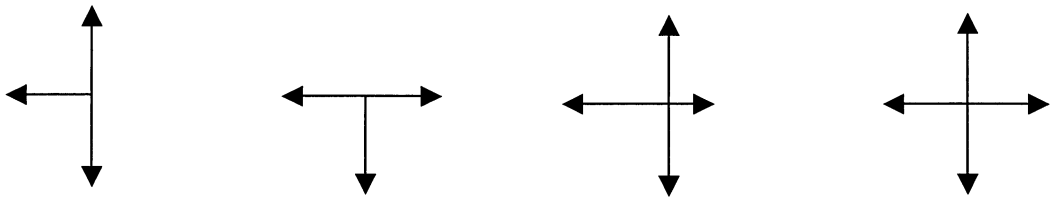
A	B	C	D

[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.

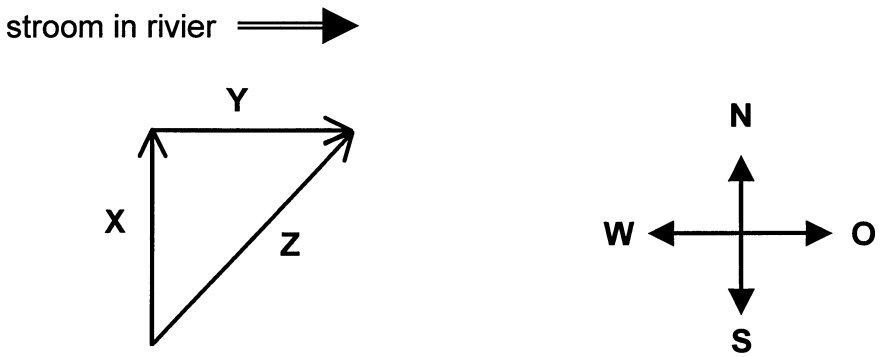
Watter EEN van die volgende vektordiagramme dui al die kragte aan wat op die motor inwerk?



A B C D

(4)

1.2 'n Boot word in 'n noordelike rigting gerig terwyl dit 'n rivier, waarin die water ooswaarts vloei, oorsteek. Die vektordiagram hieronder illustreer drie relatiewe snelhede.



Wat is die geskikste byskrif vir die vektor wat as Z in die diagram gemerk is?

A Snelheid van water relatief tot rivierbedding.

B Snelheid van boot relatief tot water.

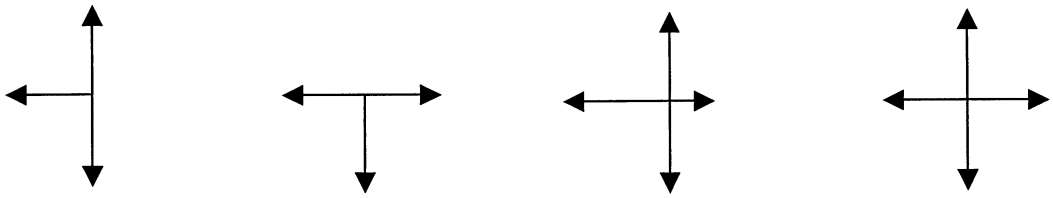
C Snelheid van boot relatief tot rivierbedding.

D Snelheid van water relatief tot boot. (4)

QUESTION 1

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

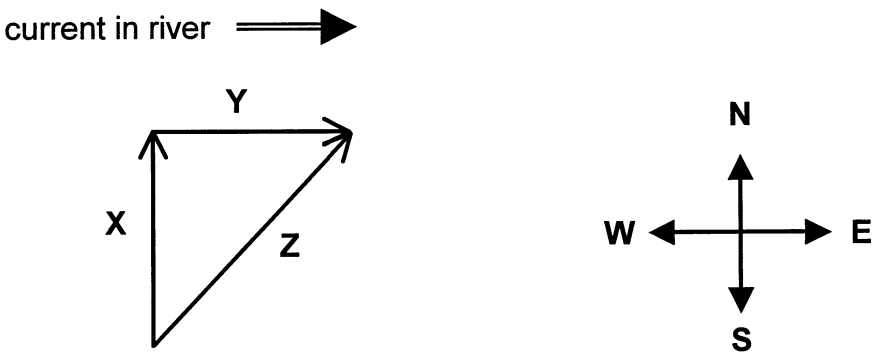
Which ONE of the following vector diagrams indicates all the forces acting on the car?



A B C D

(4)

1.2 A boat is aimed in a northerly direction while crossing a river in which water flows towards the east. The vector diagram below shows three relative velocities.



What is the most appropriate label of the vector marked Z in the diagram?

A Velocity of water relative to river bed.

B Velocity of boat relative to water.

C Velocity of boat relative to river bed.

D Velocity of water relative to boat. (4)

1.3 '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. (4)

1.4 'n Motor versnel konstant uit rus. Nadat dit 'n afstand, **d**, in 'n reguit lyn in **t** sekondes afgelê het, het dit 'n snelheid **v**. Op watter tyd en afstand gedurende die beweging het dit 'n snelheid van $\frac{1}{2}\mathbf{v}$ bereik?

	Tyd	**Afstand**
A	$\frac{t}{4}$	$\frac{d}{4}$
B	$\frac{t}{4}$	$\frac{d}{2}$
C	$\frac{t}{2}$	$\frac{d}{2}$
D	$\frac{t}{2}$	$\frac{d}{4}$

(4)

1.5 Soraya staan op die oppervlak van die aarde en laat val 'n bal. Na die eerste sekonde van die beweging, het dit 'n verplasing **s**. 'n Soortgelyke eksperiment word op die oppervlak van die maan gedoen. Wat sal die verplasing gedurende die eerste sekonde wees as die gravitasieversnelling op die maan $\frac{1}{6}$ van dié van die aarde is? (Ignoreer wrywingseffekte.)

A $\frac{1}{6}\mathbf{s}$

B $\frac{1}{3}\mathbf{s}$

C $\frac{3}{5}\mathbf{s}$

D $\frac{5}{6}\mathbf{s}$ (4)

1.3 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. (4)

1.4 A car accelerates uniformly from rest. After travelling a distance, **d**, in a straight line in **t** seconds, it has a velocity **v**. At what time and distance during its motion did it reach a velocity $\frac{1}{2}\mathbf{v}$?

	Time	**Distance**
A	$\frac{t}{4}$	$\frac{d}{4}$
B	$\frac{t}{4}$	$\frac{d}{2}$
C	$\frac{t}{2}$	$\frac{d}{2}$
D	$\frac{t}{2}$	$\frac{d}{4}$

(4)

1.5 Soraya, standing on the surface of the earth, drops a ball. After the first second of its motion, it has a displacement **s**. A similar experiment is done on the surface of the moon. What would the displacement during the first second be if the gravitational acceleration on the moon is $\frac{1}{6}$ of that of the earth? (Ignore the effects of friction.)

A $\frac{1}{6}\mathbf{s}$

B $\frac{1}{3}\mathbf{s}$

C $\frac{3}{5}\mathbf{s}$

D $\frac{5}{6}\mathbf{s}$ (4)

1.6 Tammy reis van die grondvloer na die vyfde vloer van 'n hotel in 'n hysbak. Watter EEN van die volgende stellings is **altyd WAAR** omtrent die krag wat die vloer van die hysbak op Tammy se voete uitoefen?

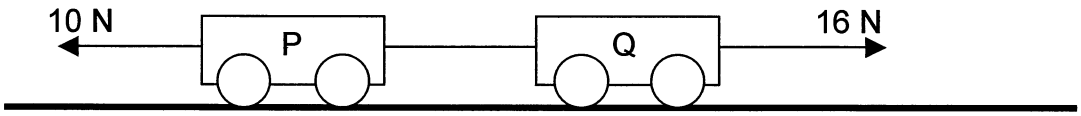
A Dit is groter as die grootte van Tammy se gewig.

B Dit is gelyk in grootte aan die krag wat Tammy se voete op die vloer uitoefen.

C Dit is gelyk aan wat dit sal wees in 'n stilstaande hysbak.

D Dit is groter as wat dit sal wees in 'n stilstaande hysbak. (4)

1.7 Twee trollies, P en Q, met gelyke massa, word aan mekaar gekoppel met 'n ligte, onelastiese tou. 'n Konstante krag van 10 N word na links op P aangewend terwyl 'n konstante krag, met grootte 16 N, na regs op Q aangewend word. Die trollies beweeg op 'n wrywinglose, horisontale oppervlak.



Die spanning in die tou tussen die trollies is gelyk aan ...

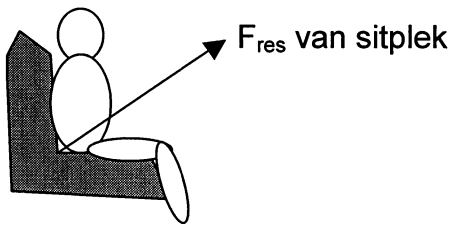
A 26 N.

B 16 N.

C 13 N.

D 6 N. (4)

1.8 Sipho, massa **m**, sit op 'n sitplek in 'n hoëspoedtrein wat horisontaal teen 0,5 **g** versnel, waar **g** die waarde van die versnelling van gravitasie is. Die sitplek oefen kragte op hom uit sodat die resulterende krag deur die sitplek uitgeoefen, is soos aangedui in die skets.



Wat is die grootte van die resulterende krag wat **die sitplek** op Sipho uitoefen?

A $(1 + 0,5)$ **mg**

B $\sqrt{1^2 + (0,5)^2}$ **mg**

C 1,0 **mg**

D 0,5 **mg** (4)

1.6 Tammy travels from the ground floor to the fifth floor of a hotel in a lift. Which ONE of the following statements is **always TRUE** about the force exerted by the floor of the lift on Tammy's feet?

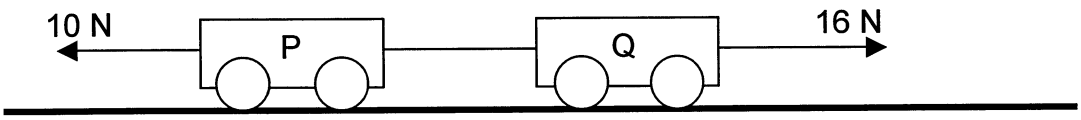
A It is greater than the magnitude of Tammy's weight.

B It is equal in magnitude to the force Tammy's feet exert on the floor.

C It is equal to what it would be in a stationary lift.

D It is greater than it would be in a stationary lift. (4)

1.7 Two trolleys, P and Q, of equal mass, are connected by a light, inelastic rope. A constant force of magnitude 10 N is applied to the left on P while a constant force of magnitude 16 N is applied to the right on Q. The trolleys move on a frictionless, horizontal surface.



The tension in the string between the trolleys is equal to ...

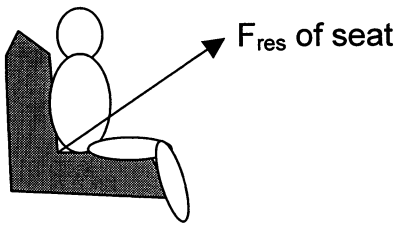
A 26 N.

B 16 N.

C 13 N.

D 6 N. (4)

1.8 Sipho, mass **m**, sits on a seat in a high-speed train which accelerates horizontally at 0,5 **g**, where **g** has the value of the acceleration due to gravity. The seat exerts forces on him such that the resultant force of the seat is as shown in the sketch.



What is the magnitude of the resultant force **of the seat** on Sipho?

A $(1 + 0,5)$ **mg**

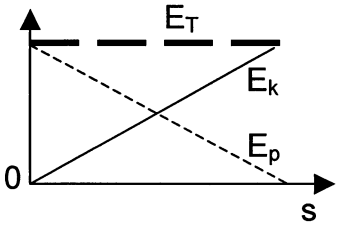
B $\sqrt{1^2 + (0,5)^2}$ **mg**

C 1,0 **mg**

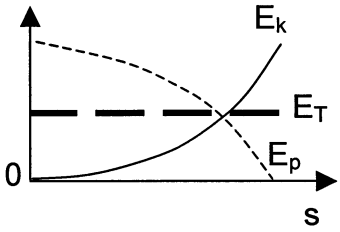
D 0,5 **mg** (4)

1.9 'n Bal word uit rus laat val. Ignoreer lugweerstand. Watter EEN van die volgende grafieke is die beste voorstelling van die verband tussen elk van E_k (kinetiese energie), E_p (gravitasie-potensiële energie) en E_T (totale meganiese energie) as funksies van die verplasing van die bal?

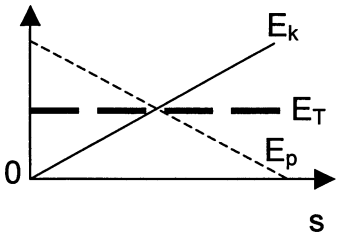
A



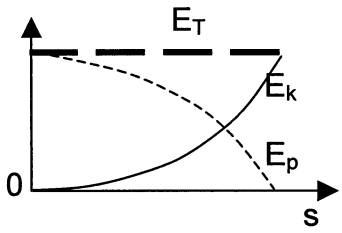
B



C



D



(4)

1.10 'n Vliegtuig versnel uit rus, langs 'n reguit lyn, en ondergaan 'n verplasing **s** in tyd **t**. Die uniforme stukrag van die motore is **F** en die resulterende krag op die vliegtuig is $\mathbf{F_{res}}$. Watter EEN van die volgende verskaf die toename in die kinetiese energie van die vliegtuig as wrywing in ag geneem word?

A **F.s**

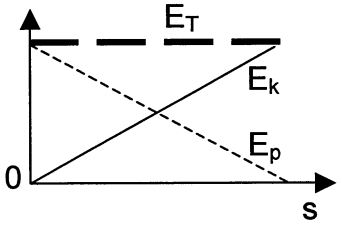
B $\mathbf{F_{res}.s}$

C **F.t**

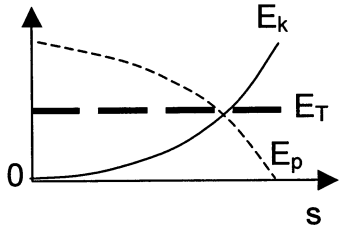
D $\mathbf{F_{res}.t}$ (4)

1.9 A ball is dropped from rest. Ignore air friction. Which ONE of the following graphs best represents the relationship between each of E_k (kinetic energy), E_p (gravitational potential energy) and E_T (total mechanical energy) as functions of the displacement of the ball?

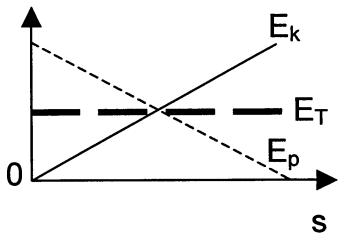
A



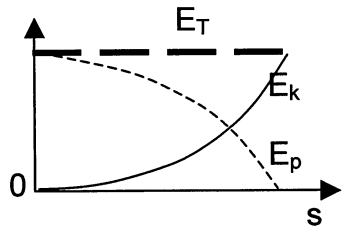
B



C



D



(4)

1.10 An airplane accelerates from rest, along a straight line, and undergoes a displacement **s** during time **t**. The uniform thrust (force) of the engines is **F** and the resultant force on the airplane is $\mathbf{F_{res}}$. Which ONE of the following gives the increase in the kinetic energy of the plane if friction is taken into account?

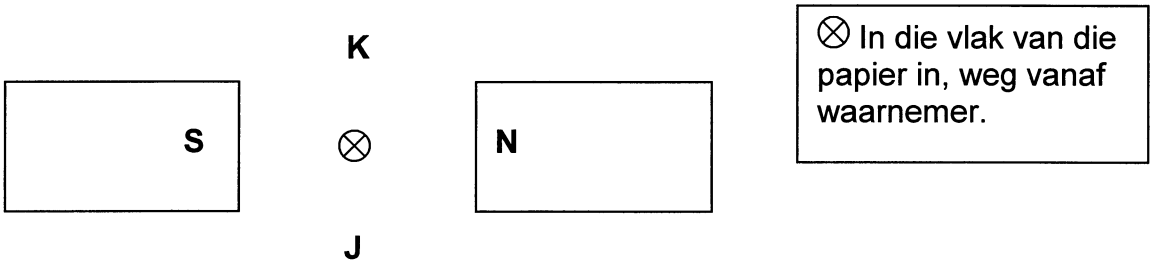
A **F.s**

B $\mathbf{F_{res}.s}$

C **F.t**

D $\mathbf{F_{res}.t}$ (4)

1.11 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 …

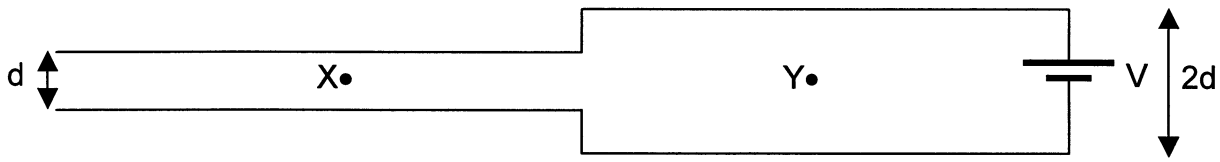
A na J, afwaarts.

B na K, opwaarts.

C na regs (die noordpool van die magneet).

D na links (die suidpool van die ander magneet). (4)

1.12 'n Gelaaide oliedruppel is in rus by X tussen twee teenoorgesteld-gelaaide, parallelle plate. Die afstand tussen die plate is **d** by punt X en 2**d** by punt Y.



Die druppel word van X na Y beweeg. Nadat dit by Y losgelaat is, sal dit …

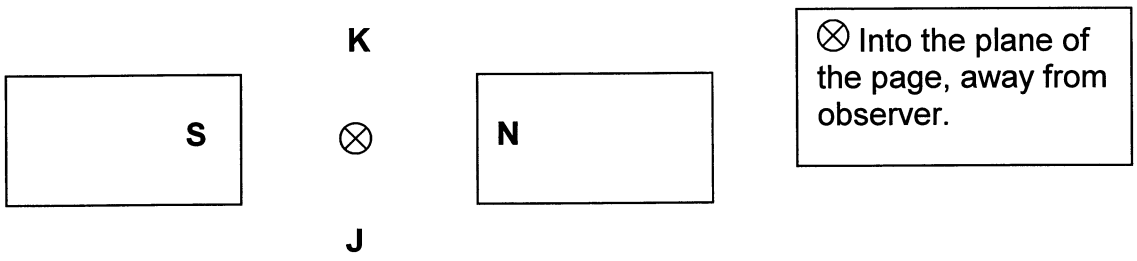
A afwaarts beweeg teen konstante snelheid.

B opwaarts beweeg teen konstante versnelling.

C opwaarts beweeg teen konstante snelheid.

D afwaarts beweeg teen konstante versnelling. (4)

1.11 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 ...

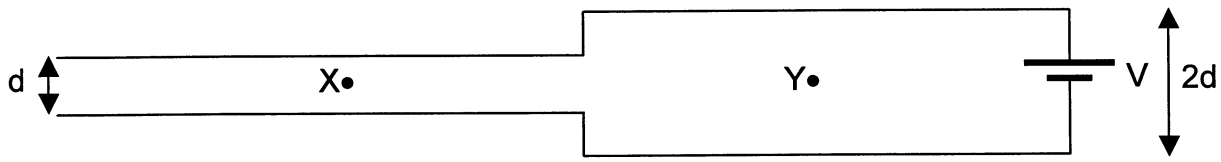
A downwards, towards J.

B upwards, towards K.

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

D to the left (the south pole of the other magnet). (4)

1.12 A charged oil drop is stationary at X between two oppositely charged, parallel plates. The distance between the plates is **d** at point X and 2**d** at point Y.



The drop is moved from X to Y. After being released at Y, it would move ...

A downwards with constant velocity.

B upwards with constant acceleration.

C upwards with constant velocity.

D downwards with constant acceleration. (4)

1.13 Potensiaalverskil kan die beste gedefinieer word as …

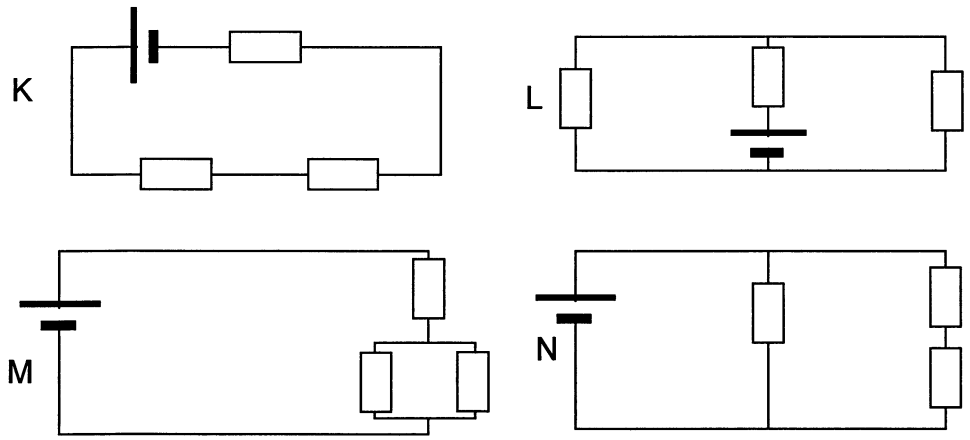
A die arbeid verrig om 'n positiewe lading van 'n punt met lae potensiaal na 'n punt met hoë potensiaal, in 'n elektriese veld, te beweeg.

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. (4)

1.14 Oorweeg die stroombane voorgestel deur die volgende stroombaandiagramme, K, L, M en N, wat identiese selle en resistors bevat.



Watter EEN van die volgende pare het dieselfde effektiewe weerstand?

A Stroombane K en L

B Stroombane M en N

C Stroombane K en N

D Stroombane L en M (4)

1.13 Potential difference can best be defined as ...

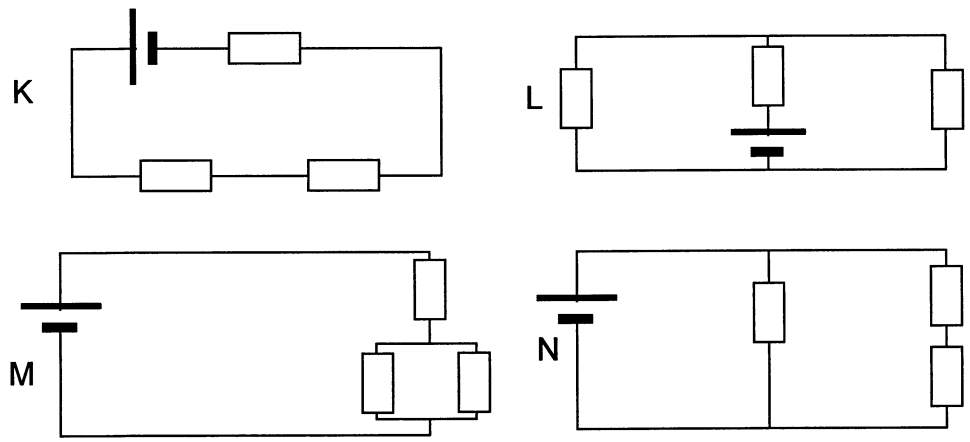
A the work done in moving a positive charge from a point of low potential to a point of high potential in an electric field.

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. (4)

1.14 Consider the circuits represented by the following circuit diagrams, K, L, M and N, containing identical cells and resistors.



Which ONE of the following pairs has the same effective resistance?

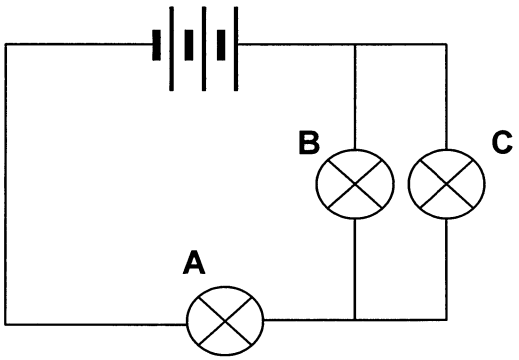
A Circuits K and L

B Circuits M and N

C Circuits K and N

D Circuits L and M (4)

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



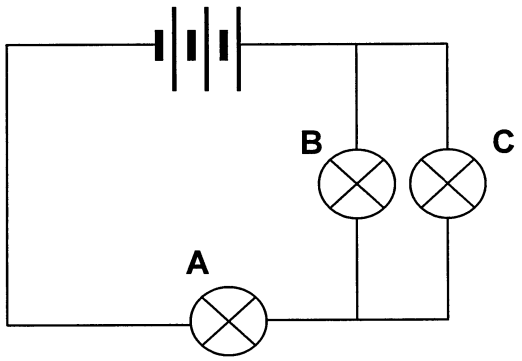
Watter EEN van die volgende kombinasies is die korrekte voorstelling van die helderheid van gloeilampe A en B, in vergelyking met hulle oorspronklike helderheid, as gloeilamp C verwyder word?

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

(4)

(15 x 4) [60]

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	brighter
B	brighter	dimmer
C	brighter	brighter
D	dimmer	dimmer

(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.

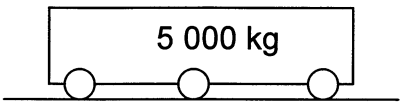
2. Laat 'n reël oop tussen onderafdelings, byvoorbeeld 2.1 en 2.2.

3. Toon AL die formules, sowel as bewerkings, insluitende vervangings (substitusies).

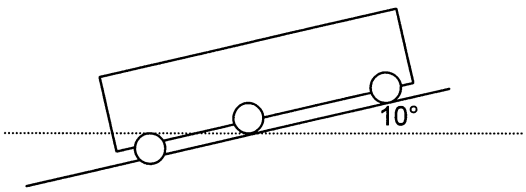
4. Nommer die antwoorde presies soos die vrae genommer is.

VRAAG 2 [BEGIN OP 'N SKOON BLADSY]

'n Spoorwegtrok, massa 3 500 kg, vol gelaai met mielies, massa 1 500 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 10° 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 groottes van die komponente van die gravitasiekrag (parallel aan en loodreg op die skuinsvlak) **voor** die klap oopgemaak word. (5)

*Spesifikasies van die vervaardigers bepaal dat die maksimum wrywingskrag tussen die wiele en die spoor, wat die **leë trok** sal verhoed om teen die skuinsvlak te begin afgly met die handrem gekoppel, 15 890 N is.*

2.3 Bereken die maksimum hoek waarteen die spoor gekantel kan word voordat die leë spoorwegtrok, met die handrem gekoppel, teen die spoor begin afgly. (4)
[13]

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

QUESTION 2 [START ON A NEW PAGE]

A railway truck, mass 3 500 kg, fully laden with mealies, mass 1 500 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).

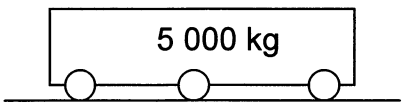


Figure 1

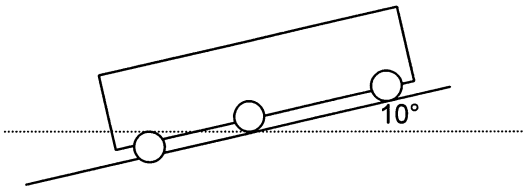


Figure 2

When the track is tilted 10° 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 magnitudes of the components of the gravitational force (parallel and perpendicular to the inclined track) **before** the tailgate was opened. (5)

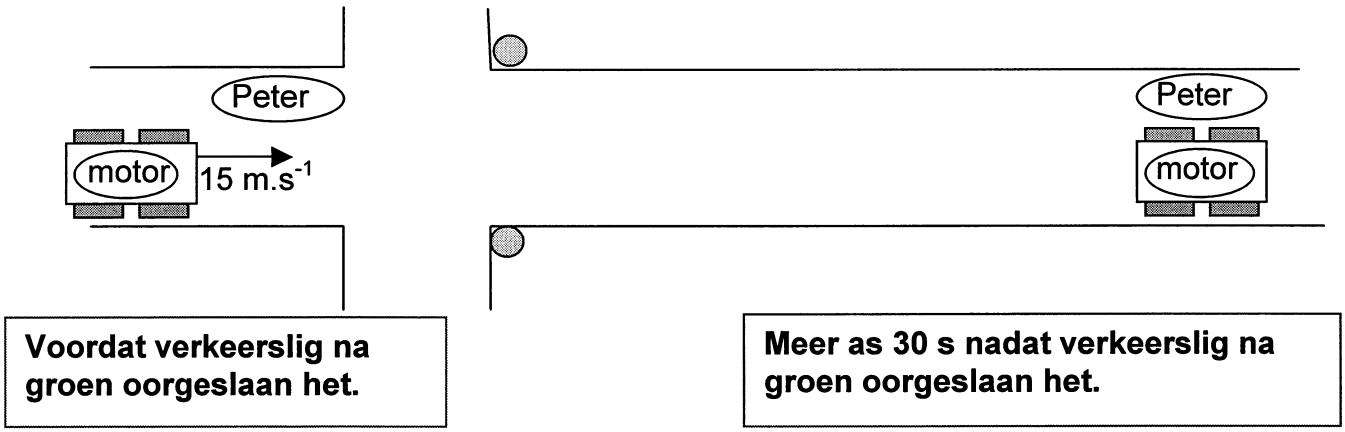
*Specifications from the manufacturers establish that the maximum frictional force between the wheels and the track, that will keep the **empty truck** from starting to slide along the track, with the handbrake on, is 15 890 N.*

2.3 Calculate the maximum angle that the track can be tilted before the empty railway truck, with the handbrake on, begins to slide down the track. (4)

[13]

VRAAG 3 [BEGIN OP 'N SKOON BLADSY]

Peter, 'n verkeersman, wag op sy motorfiets by 'n verkeerslig sodat die rooi lig na groen moet oorslaan. Die bestuurder van 'n motor, wat teen 'n konstante snelheid van 15 $m.s^{-1}$ beweeg, stop nie by die verkeerslig nie, steek Peter van agter verby en beweeg voort teen dieselfde snelheid. Ses sekondes nadat hy verbygesteek is, slaan die verkeerslig oor na groen en Peter begin uit rus om die motor te volg. Hy versnel uniform teen 0,8 $m.s^{-2}$ vir 30 s, bereik 'n maksimum snelheid, wat hy dan behou totdat hy langs die motor is.



Voordat verkeerslig na groen oorgeslaan het.

Meer as 30 s nadat verkeerslig na groen oorgeslaan het.

3.1 Bereken die grootte van die maksimum snelheid wat Peter gedurende die 30 s periode van versnelling bereik. (4)

3.2 Bereken die afstand tussen Peter en die motor, 30 s nadat Peter weggetrek het. (7)

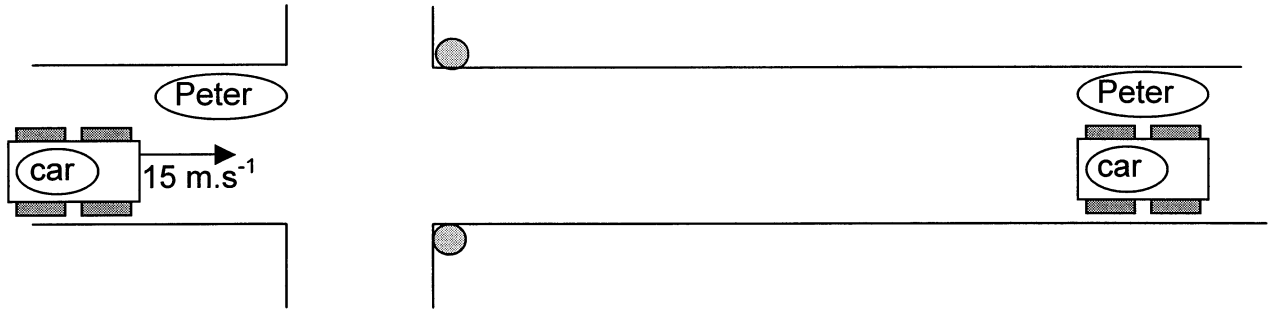
3.3 Bereken hoeveel sekondes Peter nóg nodig het om langs die motor te kom. (5)

3.4 Bereken Peter se totale verplasing **vandat hy weggetrek het** totdat hy langs die motor is. (4)

3.5 Teken 'n rowwe verplasing-tydgrafiek vir die beweging van die **motor en Peter**, op dieselfde assestelsel, vanaf die oomblik dat die motor Peter verbysteek tot die oomblik wanneer hulle langs mekaar is. Dui duidelik ALLE byskrifte **en** die tyd- en verplasingswaardes vir die motor en Peter by die kritiese punte aan. (7)
[27]

QUESTION 3 [START ON A NEW PAGE]

Peter, a traffic policeman, is waiting on his motorbike at a traffic light for the red light to turn green. The driver of a car, travelling at a constant velocity of 15 $m.s^{-1}$, does not stop at the traffic light, passes Peter from behind and continues with the same velocity. Six seconds after being passed, the traffic light turns green and Peter starts from rest to follow the car. He accelerates uniformly at 0,8 $m.s^{-2}$ for 30 s, reaches a maximum velocity, which he then maintains until he is alongside the car.



Before traffic light turned green.

More than 30 s after traffic light turned green.

3.1 Calculate the magnitude of the maximum velocity which Peter attains during the 30 s period of acceleration. (4)

3.2 Calculate the distance that separates Peter and the car, 30 s after Peter started moving. (7)

3.3 Calculate how many more seconds Peter needs in order to be alongside the the car. (5)

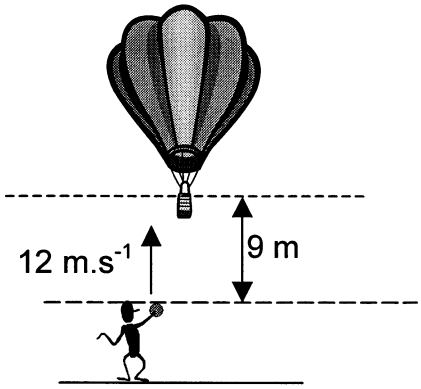
3.4 Calculate Peter's total displacement from **his start** until he is alongside the car. (4)

3.5 Draw a rough displacement-time graph for the motion of the **car and Peter**, on the same set of axes, from the instant the car passes Peter up to the instant when they are alongside each other. Clearly indicate ALL labels **and** the time and displacement values of the car and Peter at the critical points. (7)

[27]

VRAAG 4 [BEGIN OP 'N SKOON BLADSY]

Leila, in die mandjie van 'n warmlugballon, is in rus op 'n hoogte van 9 m bo die vlak vanwaar haar vriend, Bongi, 'n bal sal gooi. Bongi beplan om die bal opwaarts te gooi en Leila, in die mandjie, moet doen **daal** (afwaarts beweeg) om die bal op die maksimum hoogte te vang.



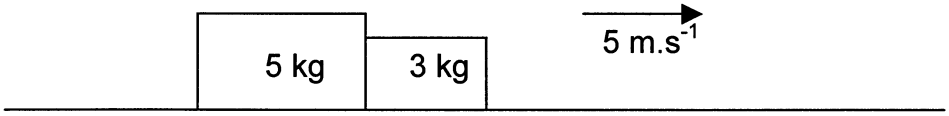
Bongi gooi die bal opwaarts met 'n snelheid van 12 m.s^{-1}. Leila begin haar daling op dieselfde oomblik as wat die bal opwaarts gegooi word, deur lug uit die ballon te laat ontsnap, wat dit afwaarts laat versnel. Ignoreer die effek van lugweerstand op die bal.

4.1 Bereken die maksimum hoogte wat die bal bereik. (5)

4.2 Bereken die grootte van die minimum gemiddelde versnelling wat die ballon moet hê om Leila in staat te stel om die bal te vang, indien dit die bal 1,2 s neem om die maksimum hoogte te bereik. (5)
[10]

VRAAG 5 [BEGIN OP 'N SKOON BLADSY]

'n Sisteem, bestaande uit twee blokke in kontak met mekaar, beweeg teen 'n konstante snelheid van 5 m.s^{-1} na regs op 'n wrywinglose, horisontale oppervlak.



'n Remkrag van 2 N word dan horisontaal op die 3 kg-blok aangewend.

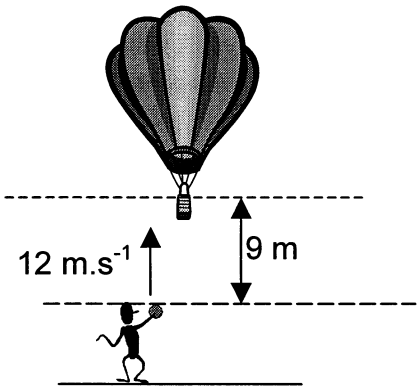
5.1 Bereken die grootte van die versnelling van die sisteem. (3)

5.2 Bereken die resulterende krag op die 3 kg-blok. (3)

5.3 Bereken die grootte van die krag uitgeoefen deur die 5 kg-blok op die 3 kg-blok. (4)
[10]

QUESTION 4 [START ON A NEW PAGE]

Leila, in the basket of a hot-air balloon, is stationary at a height of 9 m above the level from where her friend, Bongi, will throw a ball. Bongi intends throwing the ball upwards and Leila, in the basket, needs to **descend** (move downwards) to catch the ball at its maximum height.



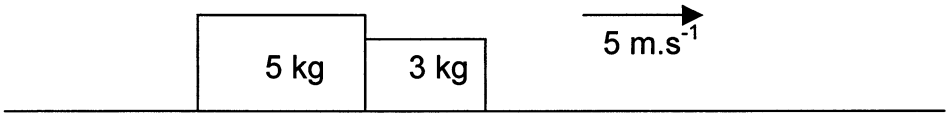
Bongi throws the ball upwards with a velocity of 12 m.s^{-1}. Leila starts her descent at the same instant the ball is thrown upwards, by letting air escape from the balloon, causing it to accelerate downwards. Ignore the effect of air friction on the ball.

4.1 Calculate the maximum height reached by the ball. (5)

4.2 Calculate the magnitude of the minimum average acceleration the balloon must have in order for Leila to catch the ball, if it takes 1,2 s for the ball to reach its maximum height. (5)
[10]

QUESTION 5 [START ON A NEW PAGE]

A system of two blocks, in contact with each other, is moving at a constant velocity of 5 m.s^{-1} to the right on a frictionless, horizontal surface.



A retarding force of 2 N is then applied horizontally to the 3 kg block.

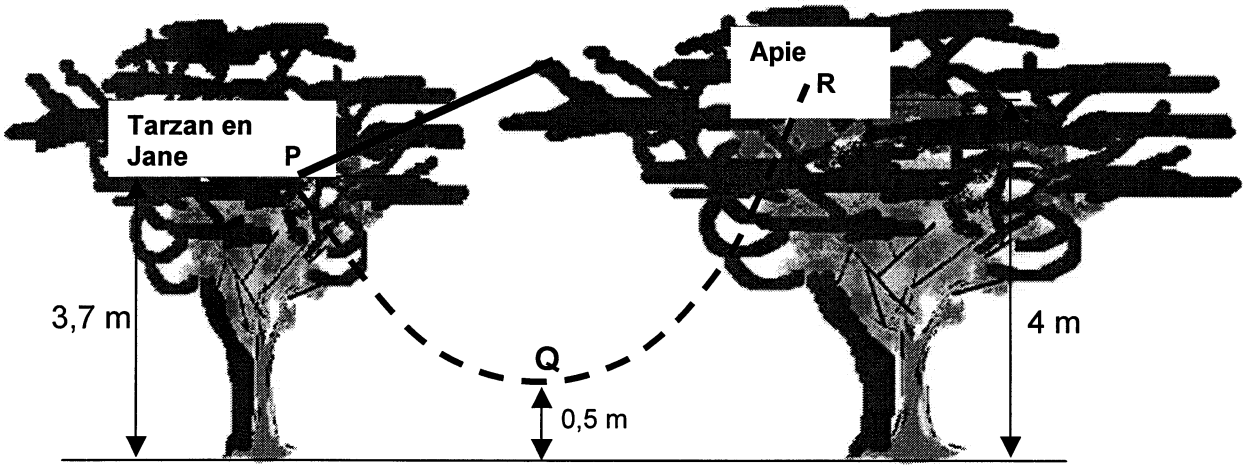
5.1 Calculate the magnitude of the acceleration of the system. (3)

5.2 Calculate the resultant force on the 3 kg block. (3)

5.3 Calculate the magnitude of the force exerted by the 5 kg block on the 3 kg block. (4)
[10]

VRAAG 6 [BEGIN OP 'N SKOON BLADSY]

Tarzan en Jane is in 'n boom, by punt P, 3,7 m bo die grond. Tarzan sien 'n siek apie in 'n boom oorkant hulle, by punt R op 'n hoogte van 4 m, wat hy graag wil red. Tarzan het 'n massa van 80 kg en Jane het 'n massa van 50 kg. Ignoreer lugweerstand.



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

6.2 Jane hou aan Tarzan vas en hulle swaai af vanaf P. Toon dat die grootte van die snelheid waarmee hulle deur die laagste punt, Q, swaai, gelyk aan 8 $m.s^{-1}$ is. Punt Q is 0,5 m bo die grond. (5)

Jane besef dat hulle die apie nie saam sal bereik nie. Sy besluit om by punt Q te laat los en Tarzan 'n stamp te gee wanneer sy los. Sy doen dit en beweeg op daardie oomblik steeds horisontaal na regs, by punt Q, teen 'n snelheid van 6,4 $m.s^{-1}$.

6.3 Bereken die spoed waarteen Tarzan punt Q verlaat nadat Jane hom gestamp het. (6)

6.4 Bepaal, met toepaslike berekeninge, of Tarzan die apie sal bereik of nie. (6)
[20]

VRAAG 7 [BEGIN OP 'N SKOON BLADSY]

'n Vuurpyl moet vertikaal opwaarts gelanseer word. Nadat die brandstof in die vuurpyl aan die brand gesteek is, word die vuurpyl vir 2 s teruggehou om genoeg stukrag vir die lansering te ontwikkel.

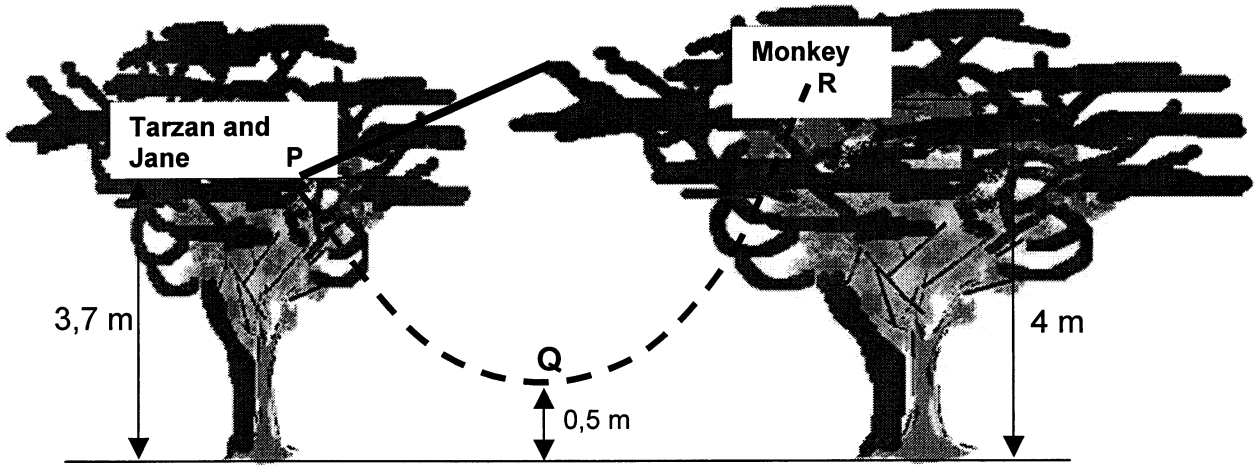
7.1 Hoeveel arbeid word op die vuurpyl gedurende hierdie 2 s-tydinterval verrig? (2)

7.2 Teken benoemde kragtediagramme en dui die rigtings aan van die twee aksie-reaksiepare wat van toepassing is op hierdie situasie, **kort na lansering**. Die relatiewe lengtes van die vektore moet die groottes van die kragte korrek voorstel. (6)

7.3 Bereken die grootte van die krag wat direk na lansering deur die vuurpylmotor ontwikkel word indien die vuurpyl se versnelling 4,5 $m.s^{-2}$ opwaarts is, en die massa 500 kg is. (6)
[14]

QUESTION 6 [START ON A NEW PAGE]

Tarzan and Jane are in a tree, at point P, 3,7 m above the ground. Tarzan sees a sick monkey in a tree opposite to them, at point R at a height of 4 m, which he would like to rescue. Tarzan has a mass of 80 kg and Jane has a mass of 50 kg. Ignore air friction.



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

6.2 Jane holds on to Tarzan and they swing down from P. Show that the magnitude of the velocity with which they swing through the lowest point, Q, is equal to 8 $m.s^{-1}$. Point Q is 0,5 m above the ground. (5)

Jane realises that they will not reach the monkey together. She decides to let go at point Q and to give Tarzan a push as she releases. She does this and continues moving horizontally to the right, at point Q, with a velocity of 6,4 $m.s^{-1}$ at that instant.

6.3 Calculate the speed with which Tarzan leaves point Q, after Jane has pushed him. (6)

6.4 Determine, with relevant calculations, whether Tarzan will be able to reach the monkey . (6)

[20]

QUESTION 7 [START ON A NEW PAGE]

A rocket is to be launched vertically upwards. After the fuel in the rocket is ignited, the rocket is held back for 2 s to develop sufficient thrust (force) for the launch.

7.1 How much work is done on the rocket during this 2 s time interval? (2)

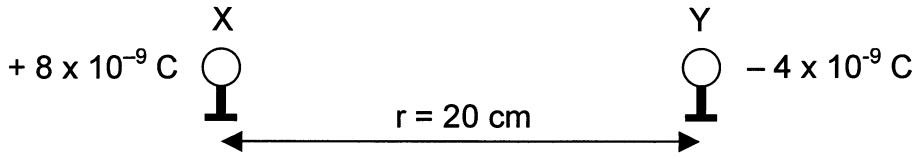
7.2 Draw labelled force diagrams and indicate the directions of the two action-reaction pairs relevant to this situation, **shortly after take-off**. The relative lengths of the vectors should correctly represent the magnitudes of the forces. (6)

7.3 Calculate the magnitude of the force developed by the rocket engine immediately after take-off if the rocket's acceleration is 4,5 $m.s^{-2}$ upwards and its mass is 500 kg. (6)

[14]

VRAAG 8 [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.



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

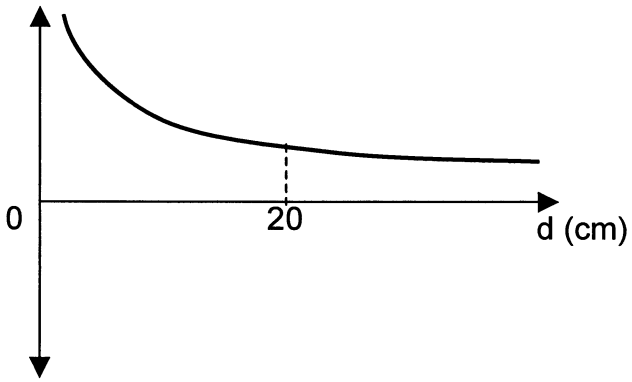
8.2 Bereken die grootte van die elektrostatiese krag wat X op Y uitoefen. (5)

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.

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

8.4 Is die nuwe krag wat X op Y uitoefen **groter** of **kleiner** as die oorspronklike krag en met watter faktor? (3)

8.5 Die assestelsel hieronder toon die grafiek van die grootte van die krag wat die sfere op mekaar uitoefen soos sfeer Y nader aan sfeer X gebring is voor kontak.

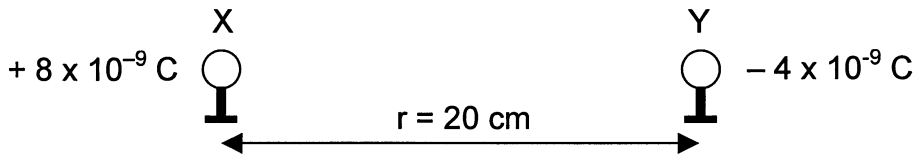


Teken bostaande asse en grafiek oor in jou antwoordeboek. Voeg dan die grafiek by wat die verandering in die krag aandui wat die sfere op mekaar uitoefen as 'n funksie van die afstand, soos hulle na kontak van mekaar wegbeweeg, terug na hulle oorspronklike posisies. Die grafiek moet duidelik die verskil in die grootte van die kragte aandui wanneer X en Y 20 cm van mekaar is. Benoem die vertikale as sodat die aard van die kragte, voor en na kontak, duidelik is. (5)

[20]

QUESTION 8 [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.



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

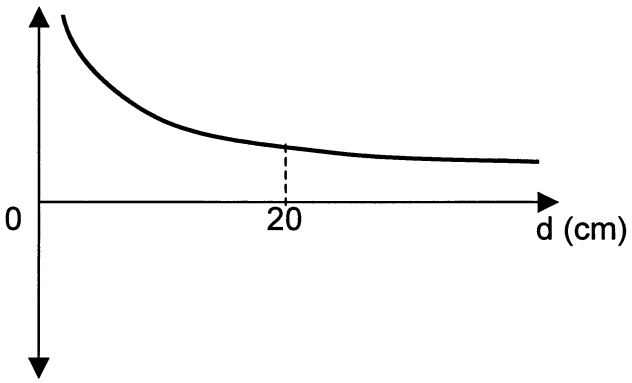
8.2 Calculate the magnitude of the electrostatic force which X exerts on Y. (5)

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.

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

8.4 Is the new force which X exerts on Y, **bigger** or **smaller** than the original force and by what factor? (3)

8.5 The system of axes below shows the graph of the magnitude of the force the spheres exerted on each other as sphere Y was moved closer towards sphere X before contact.

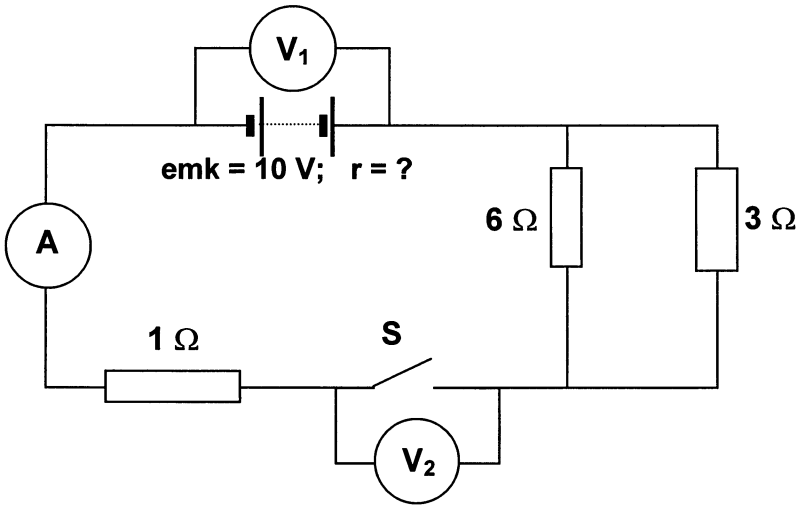


Redraw the above axes and graph in your answer book. Then add the graph which shows the variation of the force the spheres exert on each other as a function of the distance as they are moved apart, after contact, back to their original positions. The graph should clearly indicate the difference in the magnitude of the forces when X and Y are 20 cm apart. Label the vertical axis such that the nature of the forces, before and after contact, is clear. (5)

[20]

VRAAG 9 [BEGIN OP 'N SKOON BLADSY]

In die stroombaan hieronder voorgestel, het die battery 'n emk van 10 V en 'n onbekende 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 ammeter kan geïgnoreer word.



Skakelaar S is oop.

9.1 Wat is die lesing op V_1? (2)

9.2 Wat is die lesing op V_2? (2)

Wanneer skakelaar S gesluit word, val die lesing op V_1 na 7,5 V.

9.3 Wat is die lesing op V_2? (2)

9.4 Bereken die lesing op die ammeter. (8)

9.5 Bereken die interne weerstand van die battery. (5)
[19]

VRAAG 10 [BEGIN OP 'N NUWE BLADSY]

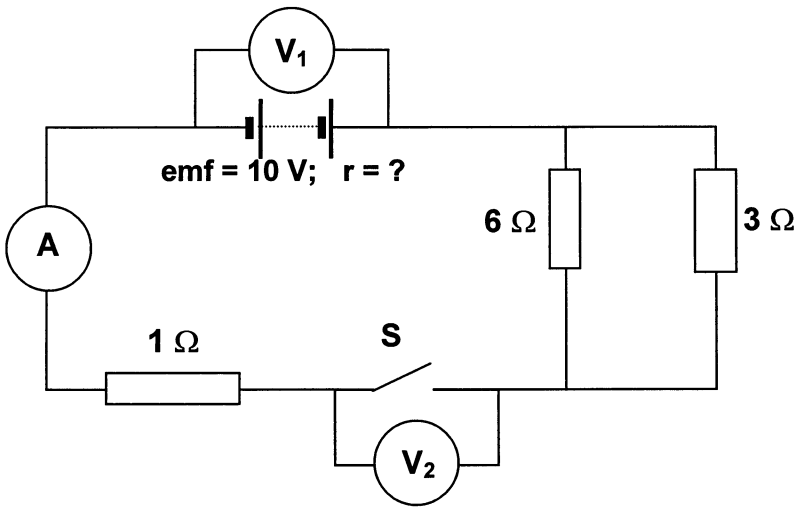
'n Motorlampie is gemerk 12 V, 60 W.

Bereken die hoeveelheid elektriese lading wat deur enige punt in die lampie in 2 minute beweeg as dit volgens bogenoemde spesifikasies funksioneer. **[7]**

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

QUESTION 9 [START ON A NEW PAGE]

In the circuit represented below, the battery has an emf of 10 V and an unknown 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 ammeter can be ignored.



Switch S is open.

9.1 What is the reading on V_1? (2)

9.2 What is the reading on V_2? (2)

When switch S is closed, the reading on V_1 drops to 7,5 V.

9.3 What is the reading on V_2? (2)

9.4 Calculate the reading on the ammeter. (8)

9.5 Calculate the internal resistance of the battery. (5)

[19]

QUESTION 10 [START ON A NEW PAGE]

A car lamp is marked '12 V, 60 W'.

Calculate the quantity of electrical charge that passes through any point in the lamp in 2 minutes when operating according to the above-mentioned specifications. **[7]**

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

DEPARTMENT OF EDUCATION
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SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN

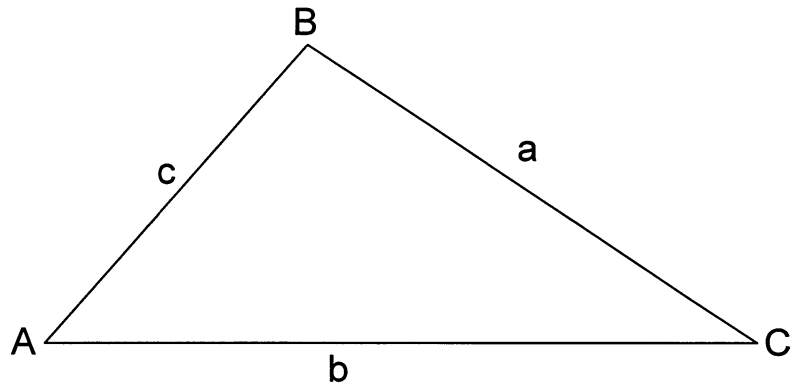
DATA FOR PHYSICAL SCIENCE
PAPER I (PHYSICS)

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



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

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

SENIOR CERTIFICATE EXAMINATION - MARCH 2005

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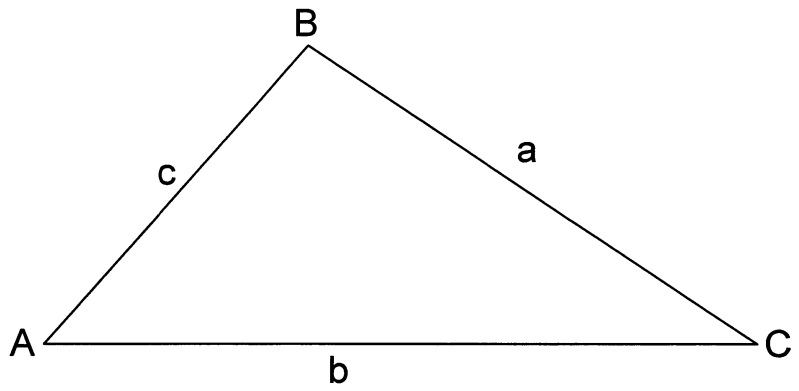

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TABLE 2: FORMULAE
TABEL 2: FORMULES

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

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$R = \frac{V}{I}$	$P = VI = I^2R = \frac{V^2}{R}$