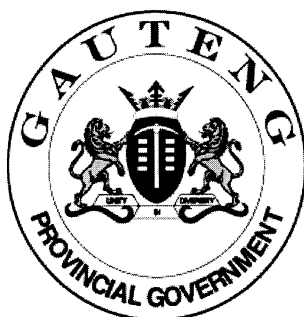


SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN



FEBRUARY / MARCH
FEBRUARIE / MAART

2005

FUNCTIONAL
PHYSICAL SCIENCE

FUNKSIONELE
NATUUR- EN
SKEIKUNDE

(First Paper: Physics)
(Eerste Vraestel: Fisika)



305-2/1

12 pages
12 bladsye

FUNCTIONAL PHYSICAL SCIENCE SG: Paper 1



305 2 1

SG

X05



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GAUTENGSE DEPARTEMENT VAN ONDERWYS
SENIORSERTIFIKAAT-EKSAMEN

FUNKSIONELE NATUUR- EN SKEIKUNDE SG
(Eerste Vraestel: Fisika)

TYD: 2 uur

PUNTE: 150

BENODIGHEDE:

- 'n Goedgekeurde (nie-programmeerbare, wetenskaplike) sakrekenaar. Kandidate moet hulle eie sakrekenaars verskaf.

INSTRUKSIES:

- Skryf jou eksamennommer in die spasies wat voor op die antwoordboek daarvoor voorsien word.
 - Beantwoord ALLE vrae.
 - Beantwoord Vraag 1 op die **antwoordblad** aan die **binnekant** van die **omslag** van jou **antwoordboek**. Trek 'n kruisie (X) oor die letter **A, B, C** of **D** om aan te dui watter letter jy kies.
 - Beantwoord alle ander vrae in die antwoordboek. Indien jy 'n antwoord moet oordoen, moet dit op 'n nuwe bladsy gedoen word. Nommer alle antwoorde duidelik.
 - Begin elke vraag op 'n nuwe bladsy.
 - 'n Inligtingsblad word aan die einde van hierdie vraestel voorsien. Dit bevat formules en konstantes. Die inligting wat voorsien word, mag jou in die beantwoording van die vrae van hulp wees.
 - Rofwerk mag agter in jou antwoordboek op die blanko bladsye gedoen word.
-
-

GAUTENG DEPARTMENT OF EDUCATION
SENIOR CERTIFICATE EXAMINATION

FUNCTIONAL PHYSICAL SCIENCE SG
(First Paper: Physics)

TIME: 2 hours

MARKS: 150

REQUIREMENTS:

- An approved (non-programmable, scientific) calculator. Candidates should supply their own calculators.

INSTRUCTIONS:

- Write your examination number in the spaces provided for this purpose on the front of your answer book.
 - Answer ALL questions.
 - Answer Question 1 on the **answer** sheet on the **inside** cover of your **answer book**. Make a cross (X) over the letter **A, B, C** or **D**, to indicate the letter you have chosen.
 - Answer all other questions in the answer book. If you need to redo an answer, redo it on a new page. Number all answers correctly.
 - Start each question on a new page.
 - An information sheet is provided at the end of this question paper. It contains formulae and constants. The information provided may be useful in answering the questions.
 - Rough work may be done on the blank pages at the back of your answer book.
-
-

VRAAG 1
MEERVOUDIGE KEUSEVRAE

Elke vraag is van vier moontlike antwoorde (A, B, C en D) voorsien. Kies die letter wat na jou mening die korrekte antwoord verteenwoordig en dui dit aan deur 'n kruisie (X) oor die oorstemmende letter op die **antwoordblad** aan die **binnekant van die omslag** van jou **antwoordboek** te maak. Indien daar meer as een kruisie in enige antwoord voorkom, sal GEEN PUNTE toegeken word nie.

VOORBEELD:

By watter temperatuur smelt suiwer ys?

- A. -4°C
- B. 0°C
- C. O K
- D. 4°C

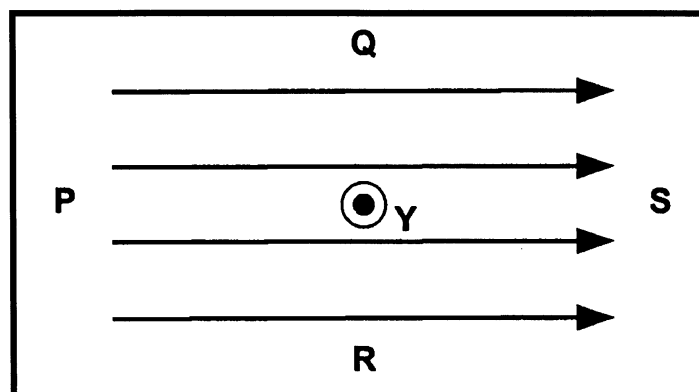
ANTWOORD:

A	B	C	D
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1.1 Watter een van die volgende bewerings is **vals**?

- A. Liggolwe en radiogolwe kan albei gepolariseer word.
- B. Klankgolwe kan gepolariseer word, maar radiogolwe nie.
- C. Beide watergolwe en ultravioletstrale kan gepolariseer word.
- D. Beide X-strale en infra-rooistrale kan gepolariseer word.

1.2 Die skets hieronder toon 'n magneetveld met rigting van links na regs. 'n **Negatiewe** lading beweeg by punt Y in 'n loodregte rigting uit die bladsy uit.



Die lading sal 'n krag in die rigting van _____ ondervind.

- A. P
- B. Q
- C. R
- D. S

QUESTION 1
MULTIPLE-CHOICE QUESTIONS

Each question has four possible answers (A, B, C and D). Choose the letter which in your opinion represents the correct answer and make a cross (X) over the corresponding letter on the **answer sheet** on the **inside cover** of your **answer book**. If more than one cross appears in an answer, NO MARKS will be awarded.

EXAMPLE:

At what temperature does pure ice melt?

- A. -4°C
- B. 0°C
- C. O K
- D. 4°C

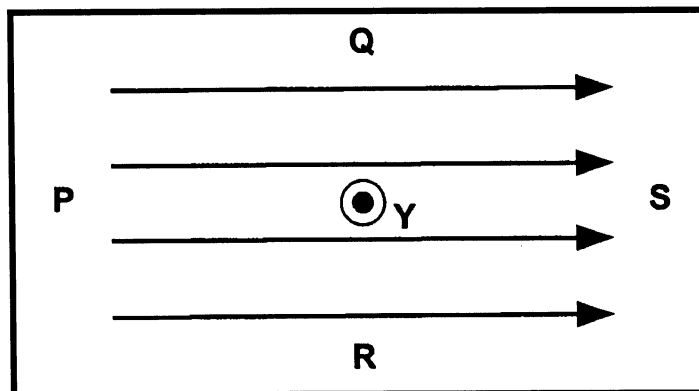
ANSWER:

A	B	C	D
---	--------------	---	---

1.1 Which of the following statements is **false**?

- A. Both light waves and radio waves can be polarised.
- B. Sound waves can be polarised, but not radio waves.
- C. Both water waves and ultraviolet rays can be polarised.
- D. Both X-rays and infra-red rays can be polarised.

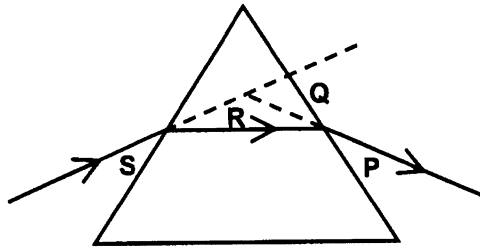
1.2 The sketch below shows a magnetic field with direction from left to right. A **negative** charge moves at point **Y** in a direction perpendicular out of the paper.



The charge will experience a force in the direction of _____.

- A. P
- B. Q
- C. R
- D. S

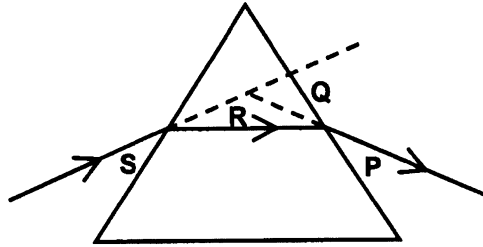
- 1.3 Nellie skyn monochromatiese oranje lig deur 'n 60° glasprisma soos in die skets hieronder aangedui.



Die deviasiehoek is _____.

- A. P
 - B. Q
 - C. R
 - D. S
- 1.4 Die rede vir die verskil tussen die rooi hemel (lug) met sonsopkoms of – ondergang en 'n blou (lug) hemel in die middeldagson is a.g.v. _____.
- A. die verskil in atmosferiese temperatuur
 - B. die hoek waarteen sonlig deur die atmosfeer breek
 - C. die verskil in atmosferiese druk
 - D. die persentasie atmosferiese vogtigheid
- 1.5 'n Kapasitor _____.
- A. kan as 'n potensiaalverdeler optree
 - B. kan stroom opgaar
 - C. kan as 'n ladingstoorder optree
 - D. kan as 'n stroomverdeler optree
- 1.6 'n _____ is 'n voorbeeld van 'n wisselstroombron.
- A. Dinamo met 'n kommutator
 - B. Dinamo met twee glyringe
 - C. Diodebuis
 - D. Motorbattery
- 1.7 Lynspektra _____.
- A. word verkry wanneer wit lig deur 'n prisma skyn
 - B. is 'n bewys van die elektromagnetiese aard van lig
 - C. is die fisiese identifikasie van vlamkleure van onbekende metale
 - D. word verkry wanneer wit lig deur 'n enkelspleet gediffrakteer word

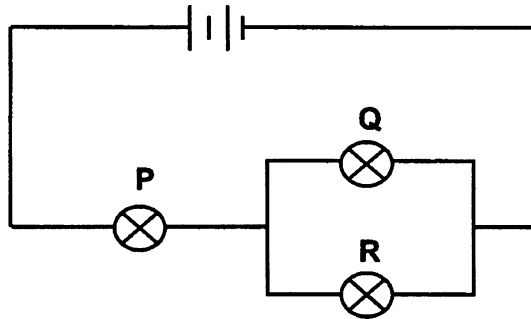
- 1.3 Nellie shines monochromatic orange light through a 60° glass prism as shown in the sketch below.



The angle of deviation is _____.

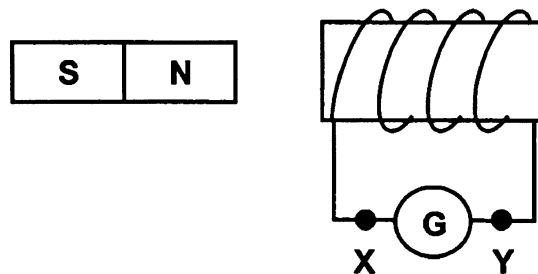
- A. P
B. Q
C. R
D. S
- 1.4 The reason for the difference between a red sky at dawn (sunrise) or dusk (sunset) and a blue sky at midday is _____.
- A. the atmospheric temperature difference
B. the angle at which sunlight is refracted through the atmosphere
C. the atmospheric pressure difference
D. the percentage of atmospheric humidity
- 1.5 A capacitor _____.
- A. acts as a potential divider
B. stores current
C. stores charges
D. acts as a current divider
- 1.6 A _____ is an example of a source of alternating current.
- A. dynamo with a commutator
B. dynamo with two sliprings
C. diode tube
D. car battery
- 1.7 Line spectra _____.
- A. occur when white light shines through a prism
B. are evidence of the electromagnetic nature of light
C. enable the identification of the flame colours of unknown metals.
D. occur when white light is diffracted through a single slit.

- 1.8 **P**, **Q** en **R** is drie identiese gloeilampe wat almal brand wanneer hulle in die onderstaande kring geskakel word.



Wat sal met gloeilampe **P** en **R** gebeur indien gloeilamp **Q** uit die stroombaan verwyder word?

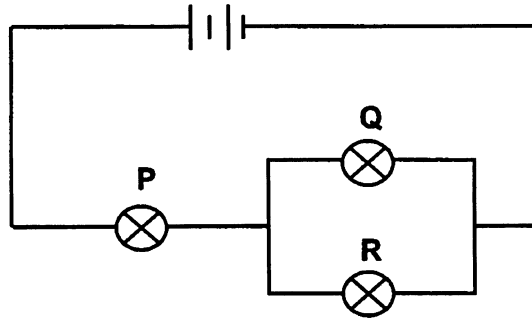
- A. **P** sal helderder brand en **R** sal helderder brand.
 - B. **P** sal dowwer brand en **R** sal dowwer brand.
 - C. **P** sal helderder brand en **R** sal dowwer brand.
 - D. **P** sal dowwer brand en **R** sal helderder brand.
- 1.9 Rednaz wil 'n potensiaalverskil oor die onderstaande solenoïed induseer sodat 'n elektronstroom slegs vanaf **X** na **Y** deur die galvanometer vloei.



Rednaz moet die magneet _____.

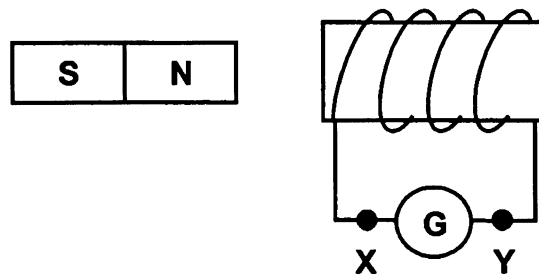
- A. in die solenoïed (spoel) plaas
 - B. vinnig na links beweeg
 - C. vinnig na regs beweeg
 - D. deur die solenoïed (spoel) beweeg
- 1.10 Wat is die funksie van 'n transformator?
- A. Om gelykstroom te lewer
 - B. Om wisselstroom te lewer
 - C. Om wisselspanning te verhoog of te verlaag
 - D. Om wisselstroom in gelykstroom te verander

- 1.8 **P**, **Q** and **R** are three identical bulbs which glow when they are connected in the circuit shown below.



What will happen to bulbs **P** and **R** if bulb **Q** is removed from the circuit?

- A. **P** will glow brighter and **R** will glow brighter.
 - B. **P** will glow dimmer and **R** will glow dimmer.
 - C. **P** will glow brighter and **R** will glow dimmer.
 - D. **P** will glow dimmer and **R** will glow brighter.
- 1.9 Rednaz wants to induce a potential difference across the solenoid which causes an electron current only to flow from **X** to **Y** through the galvanometer.



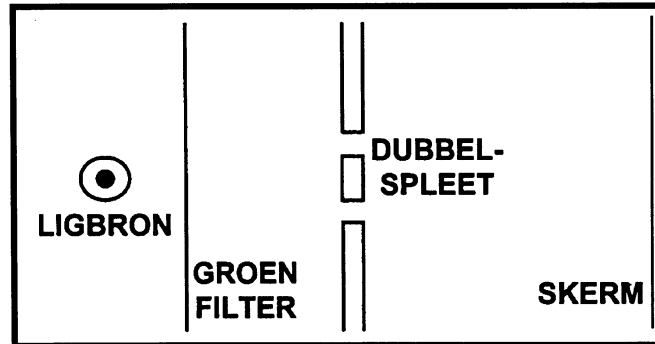
Rednaz must _____.

- A. place the magnet inside the solenoid
 - B. move the magnet suddenly to the left
 - C. move the magnet suddenly to the right
 - D. pass the magnet through the solenoid
- 1.10 What is the function of a transformer?
- A. To generate direct current
 - B. To generate alternating current
 - C. To increase or decrease alternating voltage
 - D. To change alternating current into direct current

1.11 Die energie van 'n foton is direk verwant aan sy _____.

- A. snelheid
- B. intensiteit
- C. lading
- D. frekwensie

1.12 Die eksperimentele opstelling in die meegaande skets word gebruik om interferensiestrepe op die skerm waar te neem.



Hoe kan die afstand tussen die waargenome interferensiestrepe vergroot word?

- A. Vervang die groen filter met 'n blou filter.
- B. Skuif die skerm verder van die splete af.
- C. Vergroot die wydte van elke spleet.
- D. Vergroot die afstand tussen die splete.

1.13 Lenor skyn blou lig op 'n sekere metaal en foto-elektrone word vrygestel. Wat sal gebeur indien sy die intensiteit van die blou lig halveer?

- A. Dieselfde aantal foto-elektrone sal vrygestel word, maar met minder energie.
- B. Minder foto-elektrone sal vrygestel word, maar met dieselfde energie.
- C. Die foto-elektrone sal hoegenaamd nie beïnvloed word nie.
- D. Geen foto-elektrone sal vrygestel word nie.

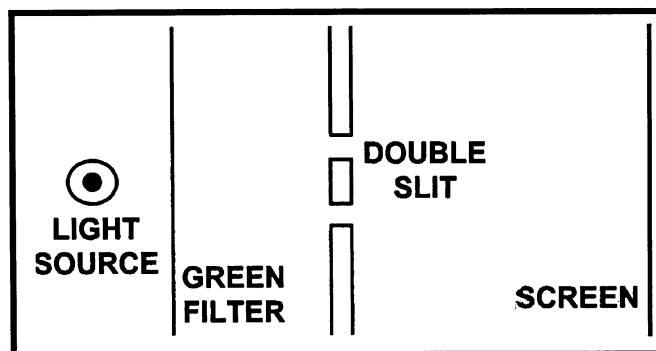
1.14 Annèl veroorsaak golwe in 'n golftenk. 'n Watergolf se _____ wanneer die golf van vlak na dieper water beweeg.

- A. golflengte vermeerder
- B. spoed bly konstant
- C. frekwensie neem toe
- D. spoed neem af

1.11 The energy of a photon is proportional to its _____.

- A. velocity
- B. intensity
- C. charge
- D. frequency

1.12 The experimental set-up shown in the sketch below is used to observe interference fringes on the screen.



How can the distance between the observed interference fringes be increased?

- A. Replace the green filter with a blue one.
- B. Move the screen further from the slits.
- C. Increase the width of each slit.
- D. Increase the distance between the slits.

1.13 Lenor shines blue light onto a certain metal and photo-electrons are liberated. What will happen if she halves the intensity of the blue light?

- A. The same number of photo-electrons, but with less energy, will be liberated.
- B. Fewer photo-electrons will be liberated with the same energy.
- C. The photo-electrons will not be influenced in any way.
- D. No photo-electrons will be liberated.

1.14 Annèl produces waves in a ripple tank. A water wave's _____ when the water wave moves from shallow water to deep water.

- A. wavelength increases
- B. speed remains constant
- C. frequency increases
- D. speed decreases

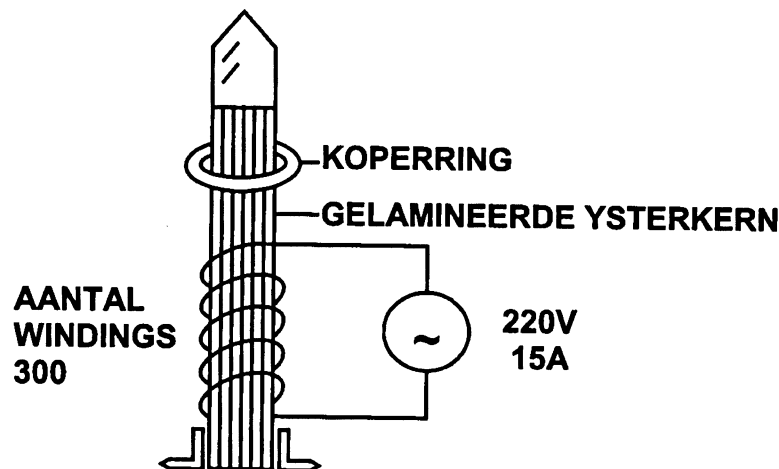
- 1.15 Lig vanaf 'n gasontladingsbuis wat waterstof onder lae druk bevat, word in 'n donker vertrek deur 'n spektroskop beskou. Watter een van die volgende word die duidelikste waargeneem?
- 'n Kontinue spektrum
 - 'n Paar gekleurde strepe
 - 'n Absorpsiespektrum
 - Helder en donker lyne ewewydig gespaseer

15x3=[45]

Beantwoord die volgende vrae in jou antwoordboek. Toon al die nodige vergelykings en berekeninge, asook die formules wat gebruik is in die beantwoording van die vrae.

VRAAG 2 TRANSFORMATORS

'n Wetenskaponderwyser stel 'n demonstrasietransformatorstel in werking met 'n koperring oor die gelamineerde ysterkern wat uitstaan vanuit die stroomdraende spoel soos in die skets voorgestel.



- Verklaar waarom die koperring halfpad teen die gelamineerde ysterkern bly hang sodra die stroom aangeskakel word. Verduidelik waarom dit gebeur. (4)
- Watter tipe transformator is hierdie? (1)
- Bereken die potensiaalverskil wat in die koperring geïnduseer word. (5)
- Bereken die stroomsterkte in die koperring. (3)
- Verduidelik waarom 'n gelamineerde ysterkern in transformators gebruik word. (5)
- Verklaar waarom die koperring so warm word. Gebruik die antwoord op Vraag 2.4 om jou antwoord te verklaar. (3)

[21]

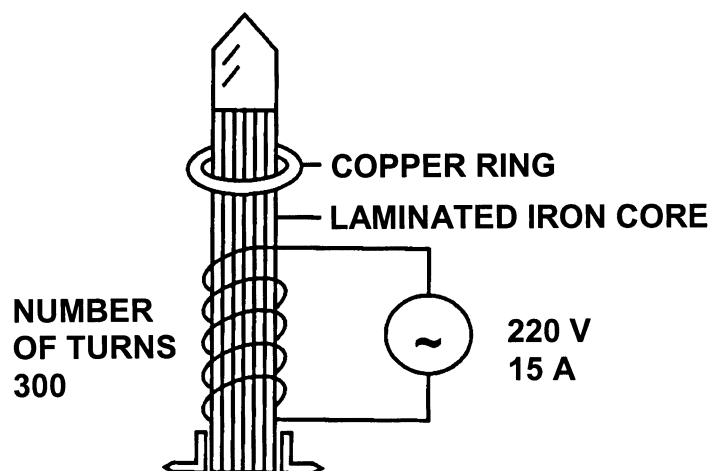
- 1.15 Light from a gas discharge tube, which contains hydrogen at low pressure, is observed through a spectroscope in a dark room. Which one of the following is observed most clearly?
- A. A continuous spectrum
 - B. A few coloured lines
 - C. An absorption spectrum
 - D. Evenly spaced bright and dark lines

15x3=[45]

Answer the following questions in the answer book. Show all the necessary equations and calculations as well as the formulae you have used in answering the questions.

QUESTION 2
TRANSFORMERS

A Science teacher sets up a demonstration transformer with a copper ring over the laminated iron core protruding from the current-carrying coil.



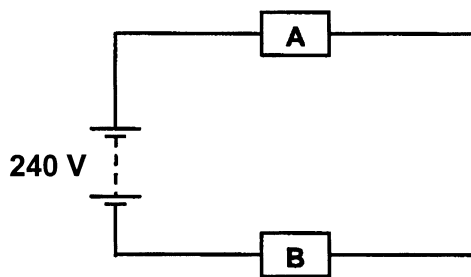
- 2.1 Explain why the copper ring hangs halfway along the laminated iron core when the current is turned on. Explain why this occurs. (4)
- 2.2 What type of transformer is this? (1)
- 2.3 Calculate the potential difference that is induced in the copper ring. (5)
- 2.4 Calculate the current in the copper ring. (5)
- 2.5 Explain why laminated iron cores are used in transformers. (3)
- 2.6 Explain why the copper ring becomes so hot. Use the answer to Question 2.4 to support your answer. (3)

[21]

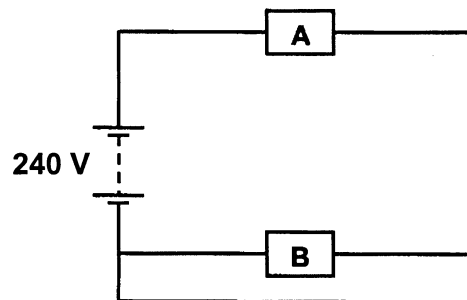
VRAAG 3
OHM SE WET

'n Elektriese verwamer het twee identiese verhittingselemente **A** en **B**, elk met 'n weerstand van 50Ω . Deur 'n geskikte samestelling van skakelaars en drade kan die twee elemente op verskillende maniere aan die elektriese kragtoevoer geskakel word om drie verstellings op die verwamer moontlik te maak: laag, medium en hoog. Die drie verskillende skakelings van die verhittingselemente word in die skets as stroombaan **X**, **Y** en **Z** voorgestel.

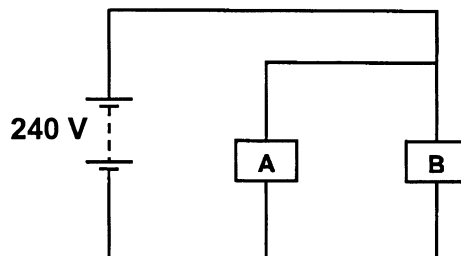
Stroombaan X



Stroombaan Y



Stroombaan Z



- 3.1 By watter stroombaan is die twee verhittingselemente
- 3.1.1 in serie geskakel? (1)
- 3.1.2 parallel geskakel? (1)
- 3.2 Bereken die stroomsterkte in elk van die volgende stroombane:
- 3.2.1 X (5)
- 3.2.2 Y (4)
- 3.2.3 Z (6)
- 3.3 Watter stroombaan word gebruik om die
- 3.3.1 hoogste hitteverstelling te verkry? (1)
- 3.3.2 laagste hitteverstelling te verkry? (1)

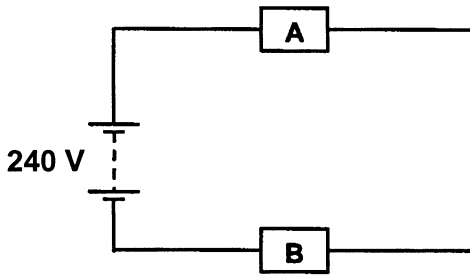
[19]

b.o.

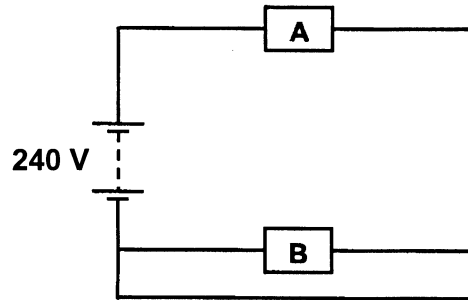
QUESTION 3
OHM'S LAW

An electric heater has two identical heating elements, **A** and **B**, each with a resistance of 50Ω . By a suitable arrangement of switches and wires, the two elements may be connected in three different ways to the electrical main supply in order to allow three settings of the heater: low, medium and high. The three different connections of the heating elements are shown in the diagram as circuits **X**, **Y** and **Z**.

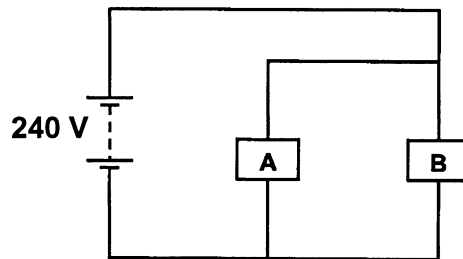
Circuit X



Circuit Y



Circuit Z

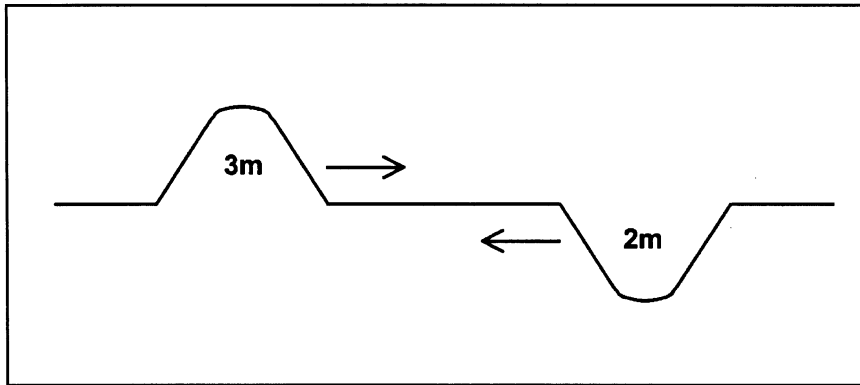


- 3.1 Which circuit has the two heating elements connected
- 3.1.1 in series? (1)
- 3.1.2 parallel? (1)
- 3.2 Calculate the current in each of the following circuits:
- 3.2.1 X (5)
- 3.2.2 Y (4)
- 3.2.3 Z (6)
- 3.3 Which circuit is used to obtain
- 3.3.1 the highest heat setting? (1)
- 3.3.2 the lowest heat setting? (1)

[19]

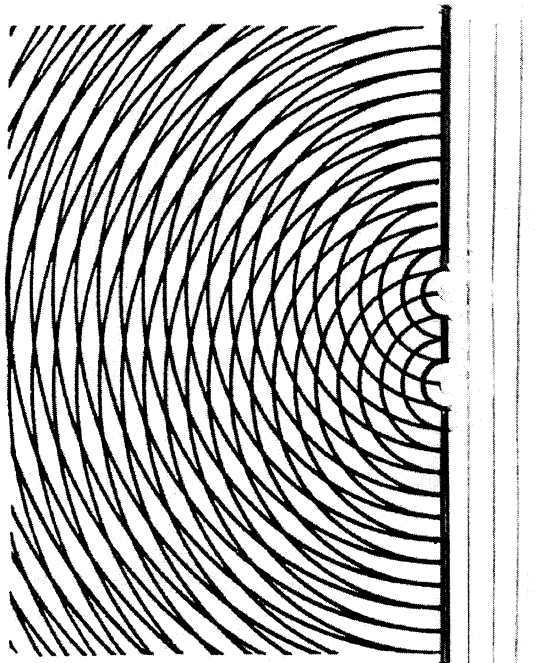
VRAAG 4
GOLWE

- 4.1 Twee golfpuls nader mekaar vanuit teenoorgestelde rigtings soos in die skets hieronder aangetoon.



- 4.1.1 Wat sal die grootte van die amplitude wees wanneer die twee pulse kruis? (2)
 4.1.2 Wat word hierdie verskynsel genoem? (2)
 4.1.3 Wat gebeur met die pulse nadat hulle gekruis het? (2)

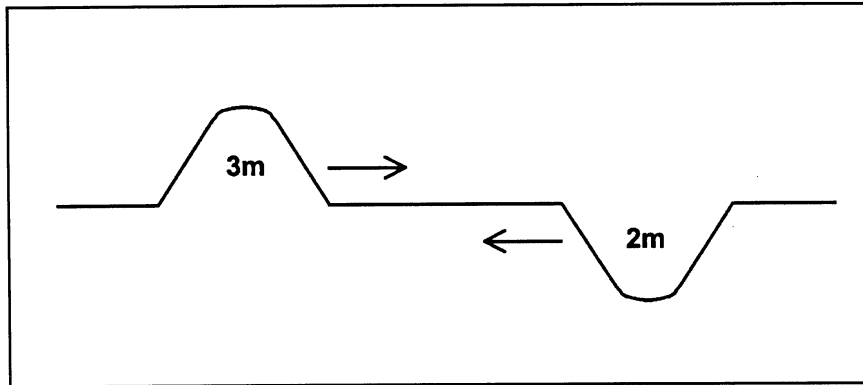
- 4.2 Die golfpatroon wat die gevolg is van vlakgolwe wat deur twee openinge in 'n versperring in 'n golftenk ontstaan het, word bestudeer.



- 4.2.1 Wat word die verskynsel wat waargeneem word, genoem? (2)
 4.2.2 Wat word die waaivormige strepe in die patroon genoem? (2)
 4.2.3 Hoe word hierdie strepe gevorm? (2)
 4.2.4 Noem TWEE maniere waarop die aantal strepe in die waaier vermeerder kan word. (4)

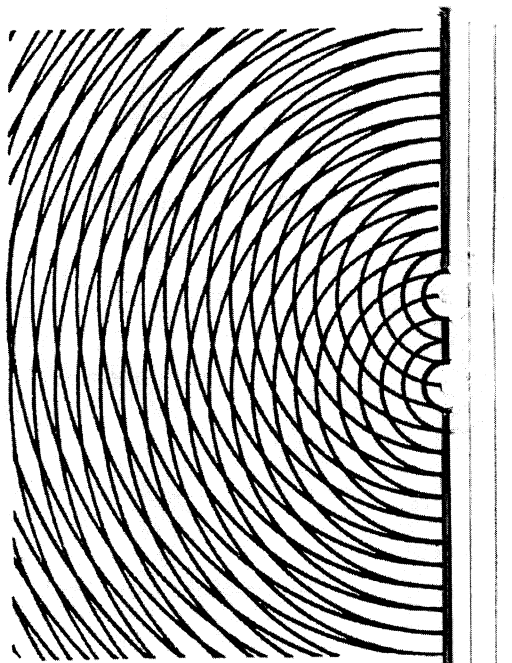
QUESTION 4
WAVES

- 4.1 Two wave pulses approach each other from opposite directions as shown in the sketch below.



- 4.1.1 What will the magnitude size of the amplitude be when the two pulses cross? (2)
 4.1.2 What is this phenomenon called? (2)
 4.1.3 What happens to the pulses after they have crossed? (2)

- 4.2 The wave pattern resulting from plane waves through two openings in an obstruction in a ripple tank is studied.



- 4.2.1 Name the phenomenon being observed. (2)
 4.2.2 What are the fan-shaped lines in the pattern called? (2)
 4.2.3 How are these lines formed? (2)
 4.2.4 Name TWO ways in which the number of lines in the fan can be increased. (4)

4.3 Zandah genereer 'n puls elke 0,2 s in 'n golftenk. Die lengte van die golwe is 80 mm. Die maksimum verplasing van 'n drywende deeltjie op die wateroppervlak is 20 mm.

4.3.1 Druk die amplitude van die golwe in meter uit. (2)

4.3.2 Bereken die frekwensie van die golwe. (3)

4.3.3 Bereken die spoed van die golwe. (4)

[25]

VRAAG 5
LIG, KLEUR EN SPEKTRA

Beskou die lig wat deur 'n kwikargondamplamp vrygestel word.

5.1 Hoe sal jy aantoon dat hierdie lig nie monochromaties is nie? (3)

5.2 Is die spektrum van hierdie lig kontinu? Hoe sal jy dit bevestig? (4)

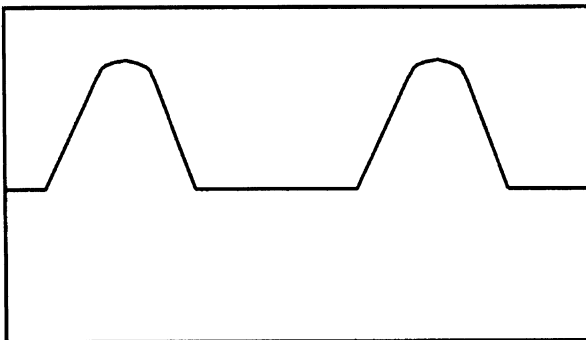
5.3 Hoe sal jy aantoon dat hierdie lig ongepolariseer is? (3)

[10]

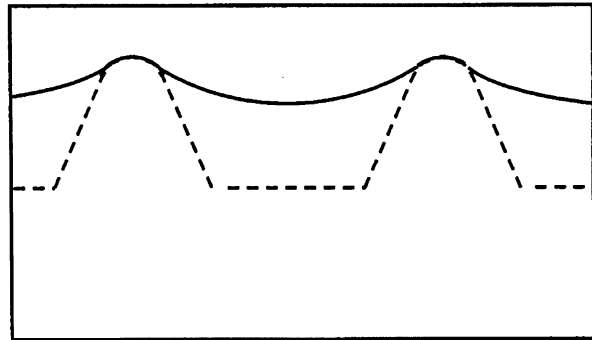
VRAAG 6
ELEKTRONE IN DIE ATOOM

6.1 Verduidelik die verskil tussen wisselstroom en gelykstroom. (4)

6.2 Suelle verbind 'n sekere elektriese komponent in 'n elektriese stroombaan. Die komponent veroorsaak dat die beeld wat op die ossilloskoop waargeneem word, soos volg verander:



Beeld voordat die komponent ingeskakel is



Beeld nadat die komponent ingeskakel is

6.2.1 Watter komponent is in die stroombaan verbind? (2)

6.2.2 Wat is die funksie van hierdie komponent? (2)

6.2.3 Benoem die golfpatroon wat hierdie komponent tot gevolg het. (2)

4.3 Zandah generates a pulse every 0,2 s in a ripple tank. The length of the waves is 80 mm. The maximum displacement of a floating particle on the surface of the water is 20 mm.

4.3.1 Express the amplitude of the waves in metres. (2)

4.3.2 Calculate the frequency of the waves. (3)

4.3.3 Calculate the speed of the waves. (4)

[25]

QUESTION 5
LIGHT, COLOUR AND SPECTRA

Consider the light emitted by a mercury-argon vapour lamp.

5.1 How would you show that this light is not monochromatic? (3)

5.2 Is the spectrum of this light continuous? How would you verify this? (4)

5.3 How would you show that this light is unpolarised? (3)

[10]

QUESTION 6
ELECTRONS IN THE ATOM

6.1 Explain the difference between alternating current and direct current. (4)

6.2 Suelle connects a certain electrical component in an electric circuit. The component causes the picture which is observed on the oscilloscope to change as follows:

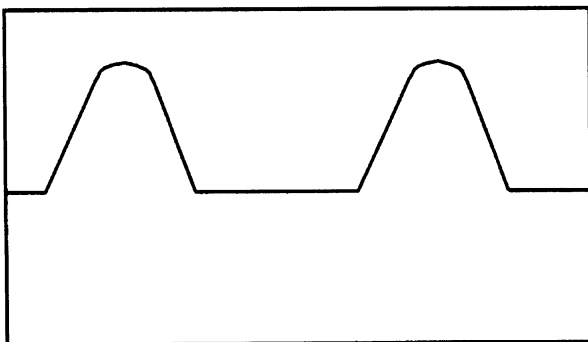


Image before the component is connected

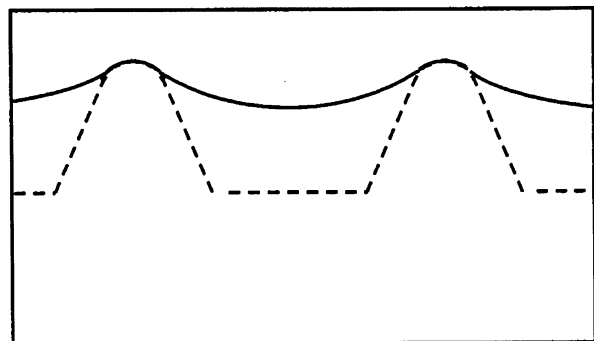


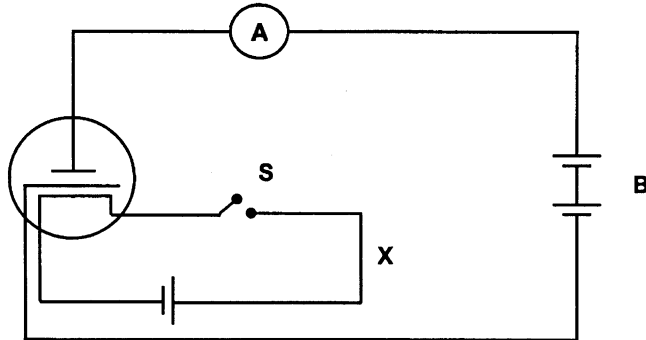
Image after the component is connected

6.2.1 Which component is connected in the circuit? (2)

6.2.2 What is the function of this component? (2)

6.2.3 Name the wave pattern that this component is causing. (2)

- 6.3 Die diagram hieronder stel 'n termioniese diode voor wat in 'n stroombaan geskakel is.

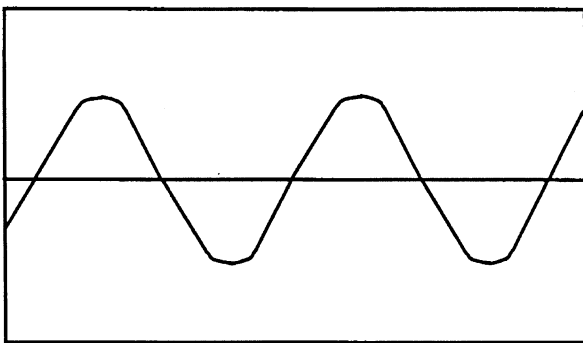


- 6.3.1 Verduidelik wat **termioniese emissie** is. (3)
 6.3.2 Wat is die funksie van stroombaan **X**? (2)
 6.3.3 Sodra die skakelaar **S** gesluit word, is daar 'n lesing van 200 mA op die ammeter. Wat sal met die lesing op die ammeter gebeur indien die pole van die battery **B** omgeruil word? (2)
 6.3.4 Verklaar jou antwoord in Vraag 6.3.3. (3)

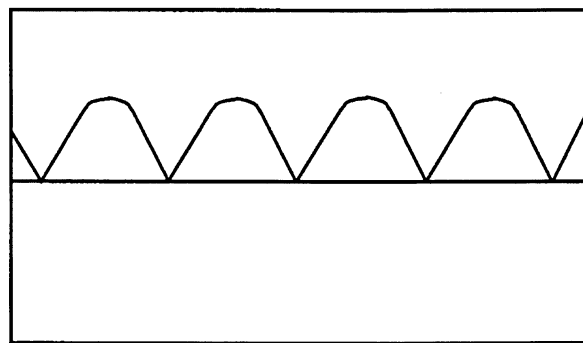
[20]

VRAAG 7 ELEKTRONIKA

- 7.1 Benoem die komponent wat 'n termioniese diode in 'n gelykriktigstroombaan kan vervang. (2)
 7.2 Teken die simbool van die komponent in 7.1. (2)
 7.3 Noem TWEE voordele van hierdie komponent in 'n kring. (4)



Figuur A



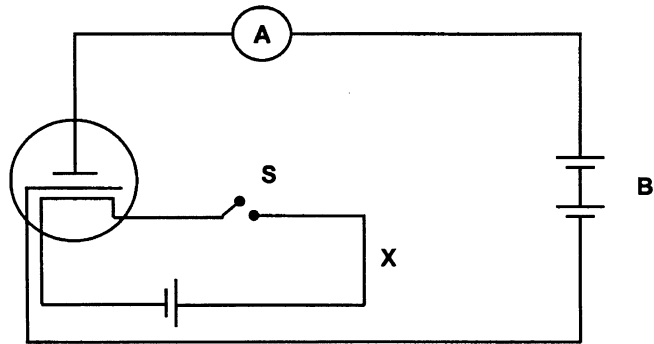
Figuur B

- 7.4 Figuur A toon wisselstroom terwyl Figuur B gelykstrom toon nadat 'n komponent op 'n sekere manier ingeskakel is.
 Wat sal die voordeel van hierdie skakeling wees?

(2)
[10]

TOTAAL: 150

6.3 The diagram below presents a thermionic diode which is connected in a circuit.



- 6.3.1 Explain what **thermionic emission** means. (3)
- 6.3.2 What is the function of circuit **X**? (2)
- 6.3.3 When the switch **S** is closed, there is a reading of 200 mA on the ammeter. What will happen with the reading on the ammeter if the poles of battery **B** are switched around? (2)
- 6.3.4 Explain your answer to Question 6.3.3. (3)

[20]

**QUESTION 7
ELECTRONICS**

- 7.1 Name a component that can replace the thermionic diode in a rectification circuit. (2)
- 7.2 Sketch the component symbol in 7.1. (2)
- 7.3 Name TWO advantages of this component in a circuit. (4)

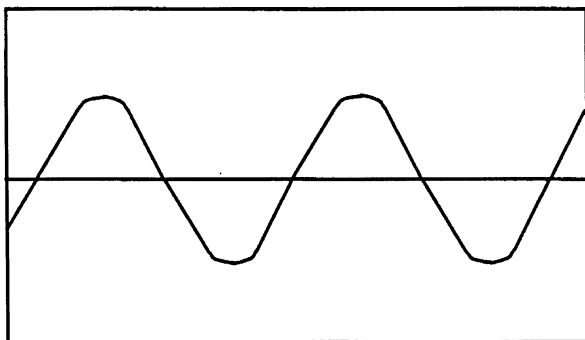


Figure A

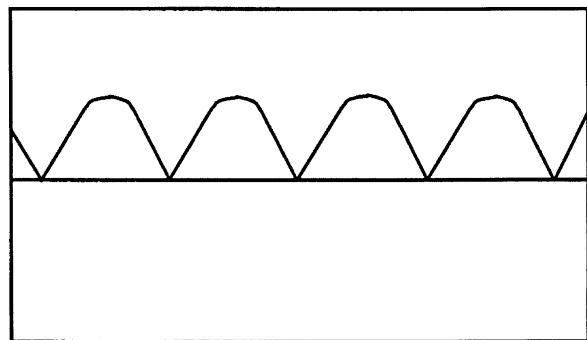


Figure B

- 7.4 Figure A shows alternating current while Figure B shows direct current produced when the component is connected in a certain way. What is the advantage of such a circuit? (2)

[10]

TOTAL: 150

PHYSICS INFORMATION SHEET/
 FISIKA-INLIGTINGSBLAD

EQUATIONS / VERGELYKINGS

WAVES / GOLWE	ELECTRICITY / ELEKTRISITEIT
$v = f\lambda$	$R = r_1 + r_2 + r_3$
$f = \frac{1}{T}$	$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3}$
	$V_p I_p = V_s I_s$
	$\frac{V_s}{V_p} = \frac{N_s}{N_p}$

PHYSICS CONSTANTS /
 FISIKA KONSTANTES

Miscellaneous constants (Approximate values)
 Diverse konstantes (Benaderde waardes)

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Speed of light <i>Spoed van lig</i>	c	$3,0 \times 10^8 \text{ x m.s}^{-1}$
Charge on electron <i>Lading op elektron</i>	e^-	$-1,6 \times 10^{-19} \text{ C}$

END / EINDE