



Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2011

PHYSICAL SCIENCES P1

MARKS: 150

TIME: 3 hours



This question paper consists of 16 pages, a data sheet, a formula sheet, graph paper and an answer sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Write your name and/or examination number (and centre number if applicable) in the appropriate spaces on the ANSWER SHEET, GRAPH PAPER and ANSWER BOOK.
2. Answer ALL the questions.
3. The question paper consists of TWO sections.
SECTION A: [25 MARKS]
SECTION B: [125 MARKS]
4. Answer SECTION A on the ANSWER SHEET and SECTION B in the ANSWER BOOK.
5. Non-programmable calculators may be used.
6. Appropriate mathematical instruments may be used.
7. Number the answers correctly according to the numbering system used in this question paper.
8. Information sheets are attached for your use.
9. Give brief motivations, discussions, et cetera where required.

SECTION A

Answer this section on the ANSWER SHEET.

QUESTION 1: ONE-WORD ITEMS

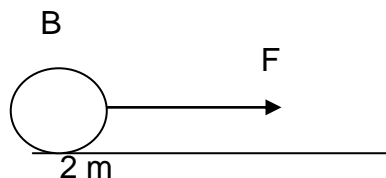
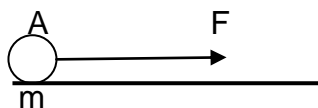
Give ONE word/term for EACH of the following descriptions. Write only the word/term next to the question number (1.1 – 1.5) on the ANSWER SHEET.

- 1.1 The resistance of an object to changing its position. (1)
- 1.2 The quotient of the net force acting on a body and the acceleration produced in that direction. (1)
- 1.3 Any note with a higher frequency than the fundamental frequency. (1)
- 1.4 An insulating material used to fill the distance between two plates of a capacitor. (1)
- 1.5 The type of transformer that has more turns in the secondary coil than in the primary coil. (1)

[5]**QUESTION 2: MULTIPLE-CHOICE QUESTIONS**

Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the best answer and mark the correct letter (A – D) next to the question number (2.1 – 2.10) with a cross (X) on the ATTACHED ANSWER SHEET.

- 2.1 Two constant forces each of magnitude F newton act at the same time, on two different bodies A and B. The mass of B is twice the mass A.



The magnitude of the acceleration of B is ... the acceleration of A (effect of friction is negligible).

- A twice
B half
C equal to
D one fourth

(2)

- 2.2 The conductivity of semi-conductors may be improved by adding small amounts of impurities. This process is known as ...
- A doping.
 - B mixing.
 - C baking.
 - D pushing.
- (2)
- 2.3 A learner is standing between two tall buildings. When he claps his hands he hears the echo from one building 2 s and the echo from the other building after 3 s. If the speed of light is $343 \text{ m} \cdot \text{s}^{-1}$, the distance between the buildings is ...
- A 137,5 m.
 - B 857,5 m.
 - C 0,0073 m.
 - D 343 m.
- (2)
- 2.4 A microscope is used to view objects that are ...
- A very close.
 - B far.
 - C close and far.
 - D very far.
- (2)
- 2.5 Ultrasound is sound with a frequency greater than the upper limit of human hearing (audible range). It is able to penetrate a medium and measure the reflection signature which reveals details about inner structure of the medium. The main application of this is in ...
- A agriculture.
 - B business.
 - C medicine.
 - D accountancy.
- (2)
- 2.6 A 50 kg man has a distance, d of 5 cm from his ankle to the position of the opposing downward force. The turning effect of the ankle is ...
- A 250 N.m
 - B 500 N.m
 - C 2,5 N.m
 - D 24,5 N.m
- (2)

- 2.7 A ball with a mass of 0,1 kg strikes the ground at a velocity of 10 m.s^{-1} . It then bounces back at a velocity of 5 m.s^{-1} . The change in momentum of the ball during the collision is ...
- A 0,5 kg.m.s^{-1} upwards.
B 0,5 kg.m.s^{-1} downwards.
C 1,5 kg.m.s^{-1} upwards.
D 1,5 kg.m.s^{-1} downwards. (2)
- 2.8 N identical cells of emf ε and internal resistance r, are connected in parallel. This combination is then connected to an external resistance R. The current in R is ...
- A $\varepsilon / (R + N/r)$.
B $\varepsilon / (R + r/N)$.
C $\varepsilon / (R + Nr)$.
D $\varepsilon / (R + r)$. (2)
- 2.9 The force between two positively charged balls is F when they are r meters apart. The charges are now moved until the force between them is 16 F. The distance between the charges is ...
- A $1/4r$.
B $3/4r$.
C $4r$.
D $(16)^2r$. (2)
- 2.10 The induced emf in a coil is directly proportional to ...
- A the rate of change of magnetic flux inside the coil.
B change in magnetic flux inside the coil.
C the rate of change of magnetic flux outside the coil.
D change in magnetic flux outside the coil. (2)

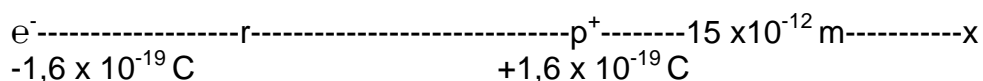
[20]**TOTAL SECTION A: 25**

SECTION B**INSTRUCTIONS AND INFORMATION**

1. Start each QUESTION on a NEW page.
2. Leave one line between two sub-questions, for example between QUESTIONS 3.1 and 3.2.
3. The formulae and substitutions must be shown in ALL calculations.
4. Round off your answers to TWO decimal places.

QUESTION 3 (Start on a new page.)

In the Bohr model of the hydrogen atom an electron (e^-) and a proton (p^+) experience an electrostatics force of $8,22 \times 10^{-8} \text{ N}$ and the distance between them is r as shown below.

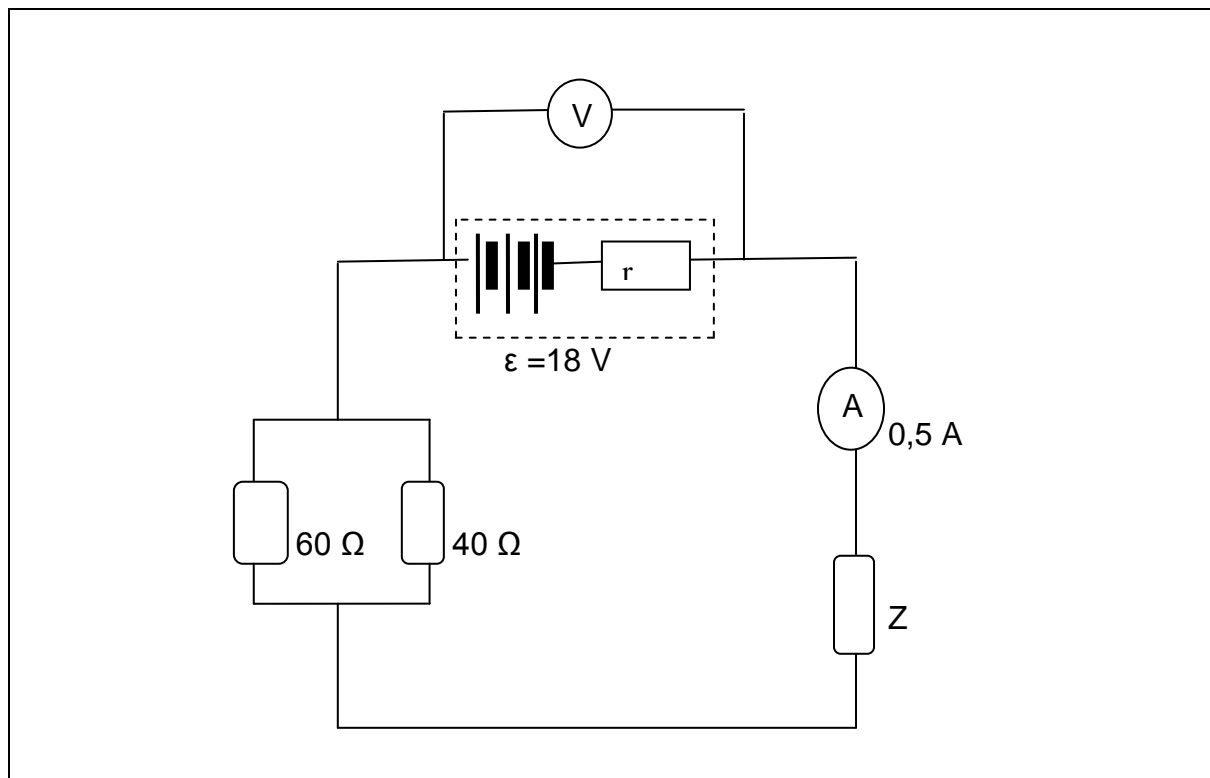


- 3.1 State Coulomb's law of electrostatics. (2)
- 3.2 Draw the electric field pattern caused by e^- and p^+ . (2)
- 3.3 Calculate the distance r between an electron and the proton. (4)
- 3.4 Calculate the net electric field at point x as shown in the diagram above. (6)
- 3.5 Lightning is a natural effect which occurs most often during summer season. What causes lightning? (1)

[15]

QUESTION 4 (Start on a new page.)

In the diagram below the battery has an emf of 18 V. The resistor Z has an unknown resistance. The reading on the ammeter is 0,5 A.



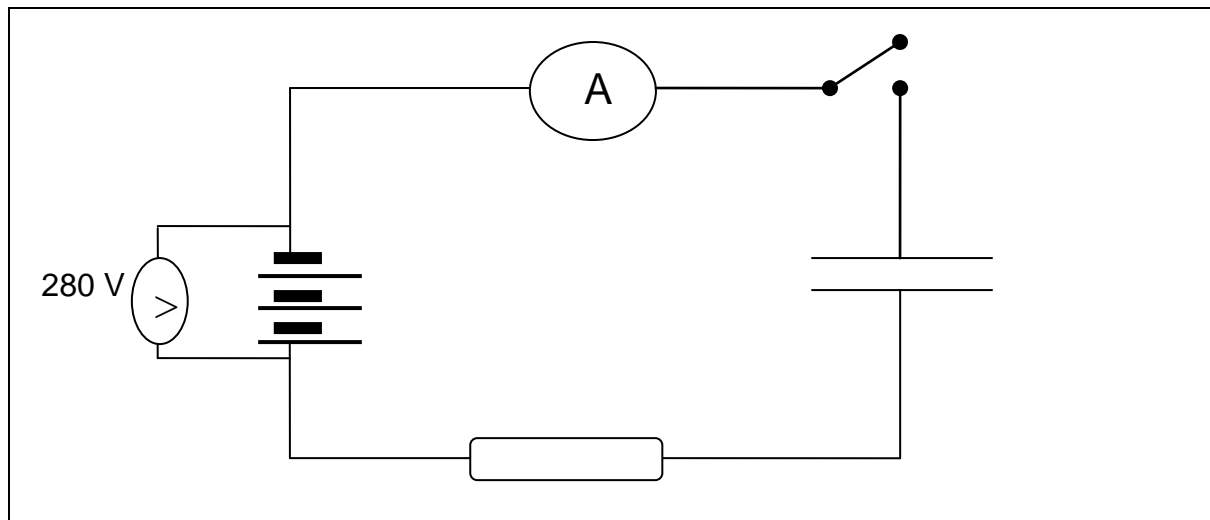
Calculate:

- 4.1 The equivalent resistance of parallel resistors. (3)
- 4.2 The potential difference across parallel resistors. (3)
- 4.3 The resistance of Z, if the potential difference across Z is 3 V. (2)
- 4.4 The internal resistance of the battery. (3)
- 4.5 How will the reading on the voltmeter change if the 40 Ω resistor burns out, (answer increase, decrease or stays the same)? Explain your answer. (3)

[14]

QUESTION 5 (Start on a new page.)

Hazel Nut Senior Secondary school learners were investigating the change in electric current over time in a capacitor that is being charged. At the beginning of the investigation no charge was registered on the capacitor.

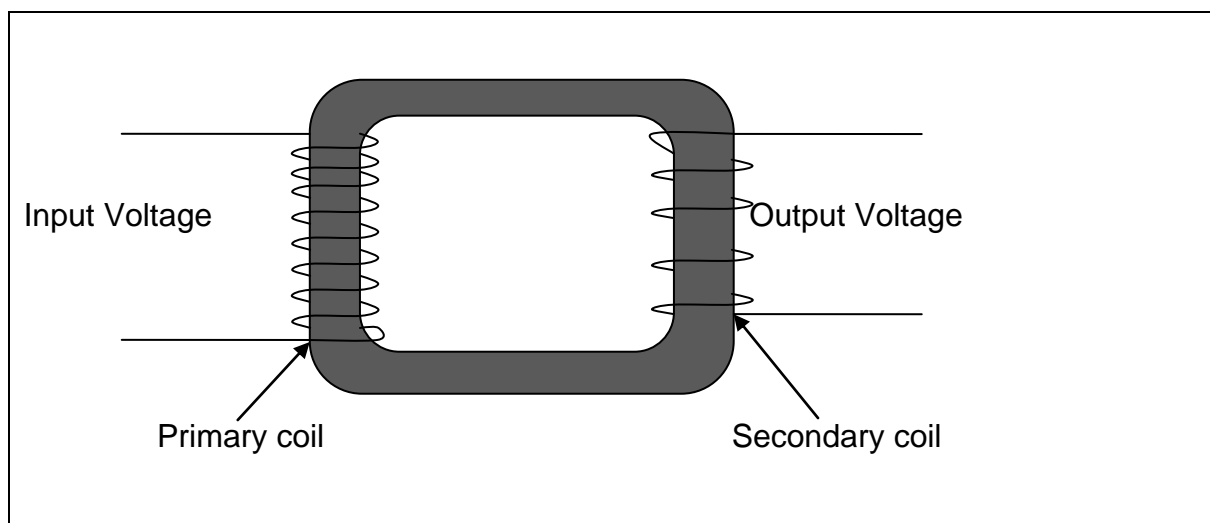


Learners took readings every 12 seconds with the switch closed. The results for the investigation are tabulated below:

$I (\mu A)$	100	76	50	34	24	18	13	10
$t (s)$	0	12	24	36	48	60	72	84

- 5.1 What is a capacitor? (2)
- 5.2 Write an investigative question for this investigation. (1)
- 5.3 Give a suitable hypothesis for this investigation. (1)
- 5.4 Draw a graph of electric current (on the y-axis) against time (on the x-axis) on the graph paper provided. Supply a suitable heading for your graph. (3)
- 5.5 The area of each plate in the capacitor above is $0,04 \text{ m}^2$. The plates are separated by 20 mm air gap. The reading on the voltmeter is 280 V. Calculate:
 - 5.5.1 The capacitance of the capacitor. (3)
 - 5.5.2 The charge that accumulates on each plate (3)
 - 5.5.3 Use your knowledge of capacitors to explain why is it dangerous to open an amplifier while it is in operation. (2)

[15]

QUESTION 6 (Start on a new page.)

A step-down transformer inside a stereo receiver has 330 turns in the primary coil and 25 turns in the secondary coil. The plug connects the primary coil to a 120 V wall socket, and there is a current of 0,83 A in the primary coil while the receiver is turned on. Connected to the secondary coil are transistor circuits of the receiver.

6.1 On which law/principle do transformers work? (2)

6.2 Calculate:

6.2.1 The voltage across the secondary coil. (3)

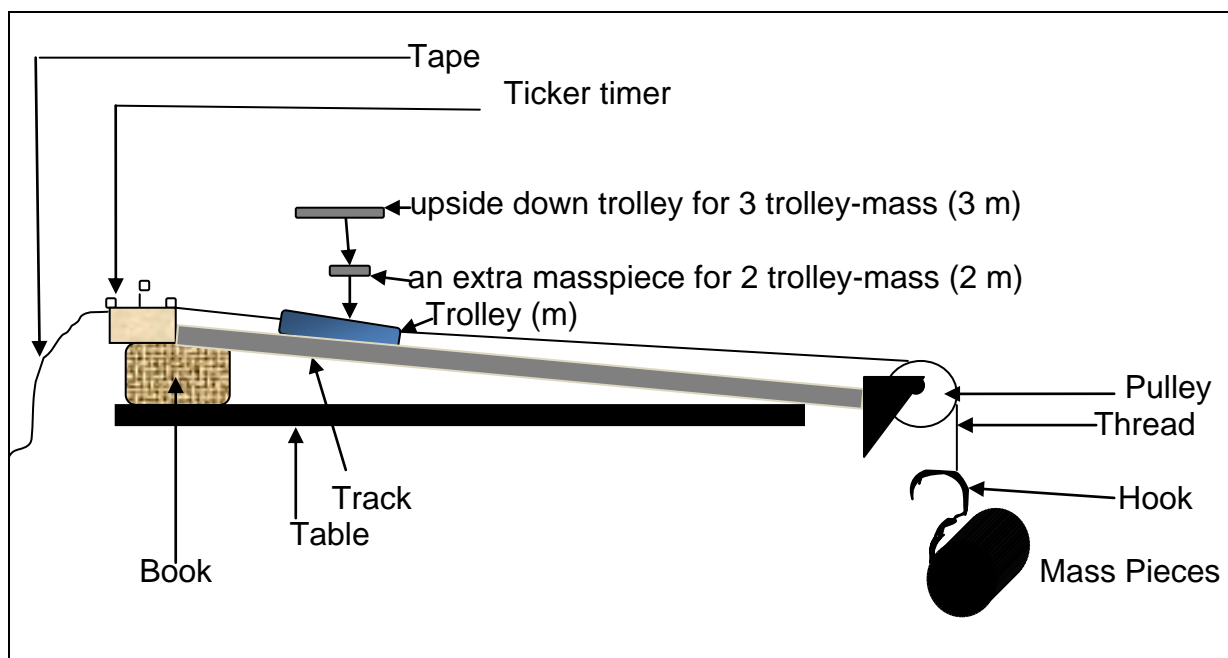
6.2.2 The current in the secondary coil. (3)

6.2.3 How can the same transformer be used as a step-up transformer? (2)

[10]

QUESTION 7 (Start on a new page.)

Learners from Gqogqa Senior Secondary School set up a runway as shown in the diagram to investigate the relationship between mass and acceleration.



The following are the results that were obtained during the investigation:

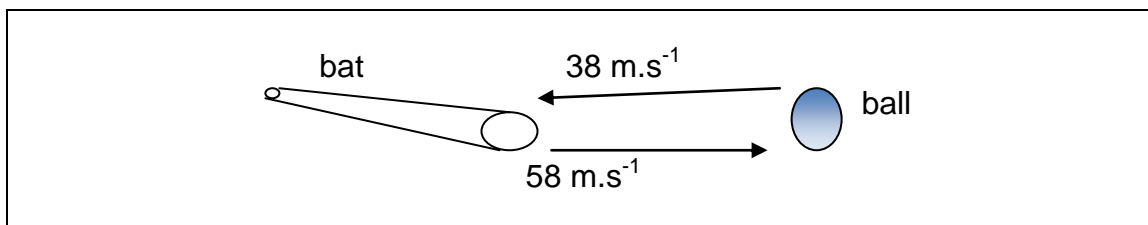
m (trolley masspiece) in g	a (m.s⁻²)	ma (N)
200	10	
400	5	
600	3,3	
800	2,5	
1000	2	

- 7.1 Calculate the values of ma in the table. (2)
- 7.2 Give the scientific reason why learners have placed a book under the track. (1)
- 7.3 Which variable is kept constant during this investigation? (1)
- 7.4 Draw a sketch graph of acceleration (on the y-axis) versus mass (x-axis). (3)
- 7.5 Write down the mathematical relationship between acceleration and mass from the learners conclusion based on the graph obtained. (2)
- 7.6 Explain the relationship that you have written in QUESTION 7.5 above. (1)
- 7.7 Name the law that was investigated by the learners. (1)

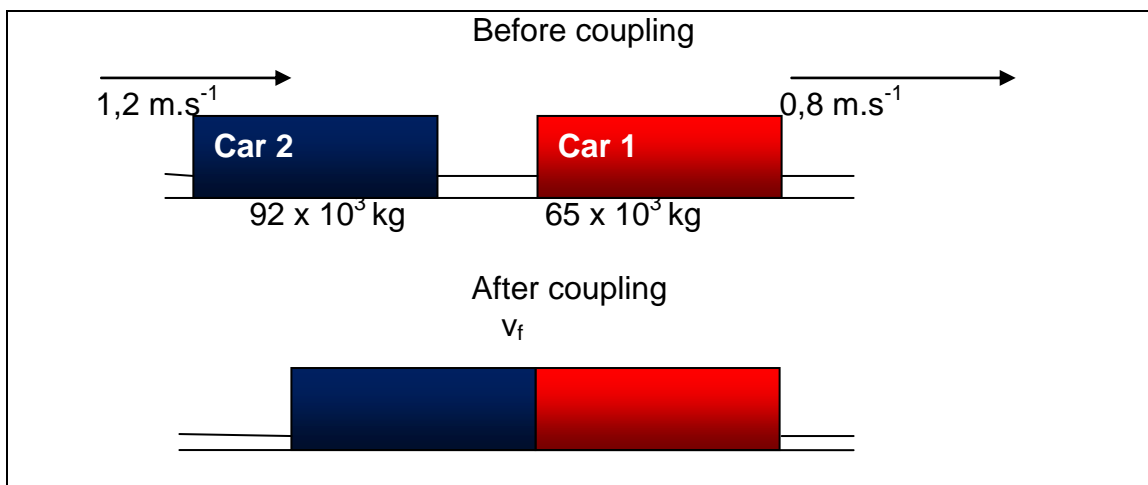
[11]

QUESTION 8 (Start on a new page.)

- 8.1 A baseball ($m = 0,14 \text{ kg}$) has a velocity of 38 m.s^{-1} as it approaches the bat. The batsman applies a force which is greater than the weight of the ball and the ball leaves the bat with a velocity of 58 m.s^{-1} . The contact time between the bat and the ball is $4 \times 10^{-3} \text{ s}$.



- 8.1.1 Define 'impulse'. (2)
- 8.1.2 Determine the average force exerted on the ball by the bat. (3)
- 8.1.3 The ball is then caught by the baseball player where the impulse to stop the ball is provided by the player's hands. How would you advise the player to make the catch of the ball to be less painful on his hands? (2)
- 8.2 A freight train is being assembled in a switching yard, car 1 has a mass of $65 \times 10^3 \text{ kg}$ and moves at a velocity of $0,8 \text{ m.s}^{-1}$ to the east. Car 2 with a mass of $92 \times 10^3 \text{ kg}$ moving at a velocity of $1,2 \text{ m.s}^{-1}$ catches up with car 1 and couples to it.



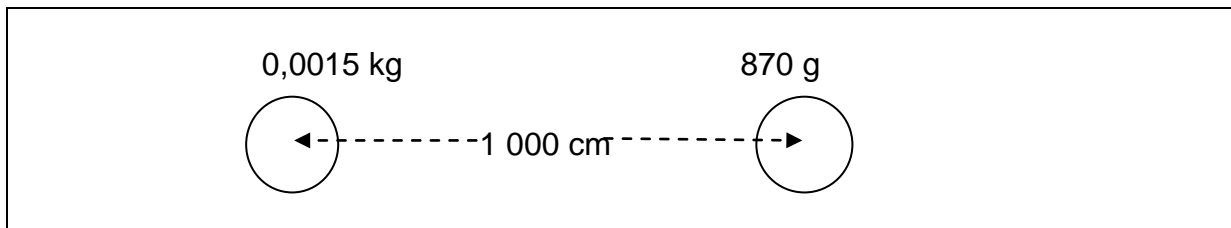
- 8.2.1 State the principle of conservation of momentum. (2)
- 8.2.2 Neglecting friction, calculate the velocity of the two carriages after they become coupled. (5)

- 8.3 Modern cars are fitted with airbags to protect the driver/passenger during a collision. What effect will the airbags have on the acceleration of the driver/passenger during impact? Explain how this change in acceleration affects the impact of the driver/passenger.

(2)
[16]

QUESTION 9 (Start on a new page.)

The diagram below shows two balls, the mass of one small ball is 0,0015 kg and the mass of another is 870 g. The centre-to-centre distance between the balls is 1 000 cm.

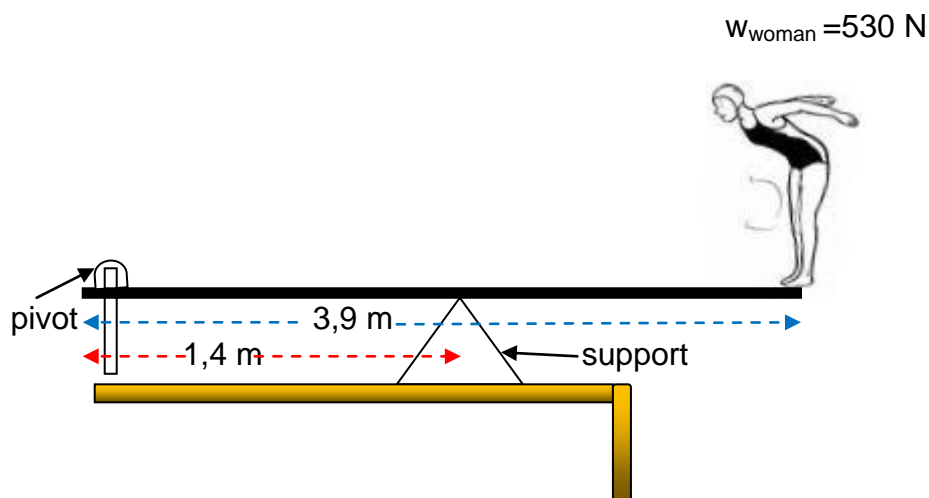


- 9.1 State Newton's law of universal gravitation. (2)
- 9.2 Calculate the magnitude of the force between the balls. (4)
- 9.3 A friend of yours who is doing Grade 11 but not taking Physical Sciences as one of his/her subjects, comes to you and tells you that his/her weight is 60 kg. As a Physical Sciences learner explain to him/her the difference between weight and mass. (2)

[8]

QUESTION 10

A woman whose weight is 530 N is poised at the right end of a diving board, whose length is 3,9 m. The board has negligible weight and is bolted down at the left end (which acts as a fulcrum/pivot), while being supported 1,40 m away by the support as shown in the diagram. (**Useful information: torque, $\tau = F \perp r$**)



10.1 State the principle of moments.

(2)

10.2 Draw a force diagram of the diving board.

(3)

10.3 Calculate the forces that the bolt and the fulcrum, respectively exert on the board.

(7)

[12]

QUESTION 11 (Start on a new page.)

An audiologist is a health professional who is trained to identify, evaluate and manage hearing problems and hearing loss. Through a variety of tests, audiologists determine which frequencies an individual cannot hear, or hears well. They give advice on hearing aids and where necessary, refer patients to a medical doctor who specialises in hearing problems.

The table shows the hearing range of different animals as tested by the audiologist:

Animal	Low frequency (Hz)	High frequency (Hz)
Humans	20	20 000
Dogs	40	46 000
Elephants	16	12 000
Dolphins	70	150 000
Bats	1000	150 000

Refer to the above information to answer the following questions:

- 11.1 Is sound, a transverse or longitudinal wave? (1)
- 11.2 Which animal can detect infrasound? (1)
- 11.3 Linda attended a rock concert and was seated in the front row because she did not want to miss even a single note on her favourite instrument, the guitar. The morning after concert she visited an audiologist complaining about the severe pain in the ear and experienced hearing problems. The audiologist confirms that her deafness is caused by the damage in the cochlea.
- 11.3.1 What type of music instrument is a guitar? Write (wind, stringed or percussion instrument) (1)
- 11.3.2 What is the cause of discomfort in Linda's ear? (1)
- 11.3.3 Assume that the guitar string vibrates with a period of 0,005 s. Calculate the wavelength of the note that is produced if the speed of sound in air is 343 m.s^{-1} . (5)

[9]

QUESTION 12 (Start on a new page.)

A camper is trying to start a fire by using a lens to focus sun's rays onto a piece of paper.

- 12.1 Define a lens. (2)
- 12.2 What type of a lens can be used to kindle the fire, a diverging lens or converging lens? (1)
- 12.3 Where should a lens be placed relative to the paper, in order to ignite it as quickly as possible? (2)
- 12.4 Draw a ray diagram for the type of a lens you chose in QUESTION 12.2 to support your answer in QUESTION 12.3 above. (2)
- [7]**

QUESTION 13 (Start on a new page.)

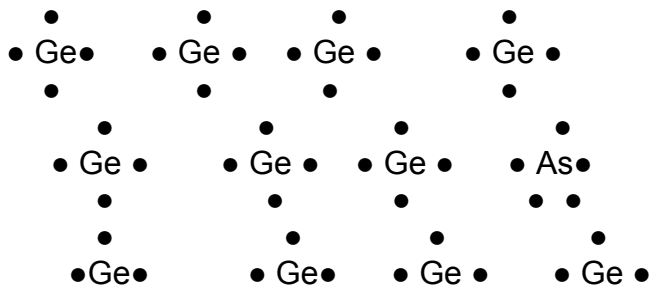
- 13.1 Classify the following diagrams as conductors, insulators, semiconductors and diodes and give a brief explanation for your choice.

DIAGRAM A

○	○	-	-
○	○	-	-
○	○	-	-
○	○	-	-
○	○	-	-

(2)

DIAGRAM B



(2)

- 13.2 From the list of electronic devices that are used in our everyday lives choose the device that matches the statement given. Write only the device next to the question number.

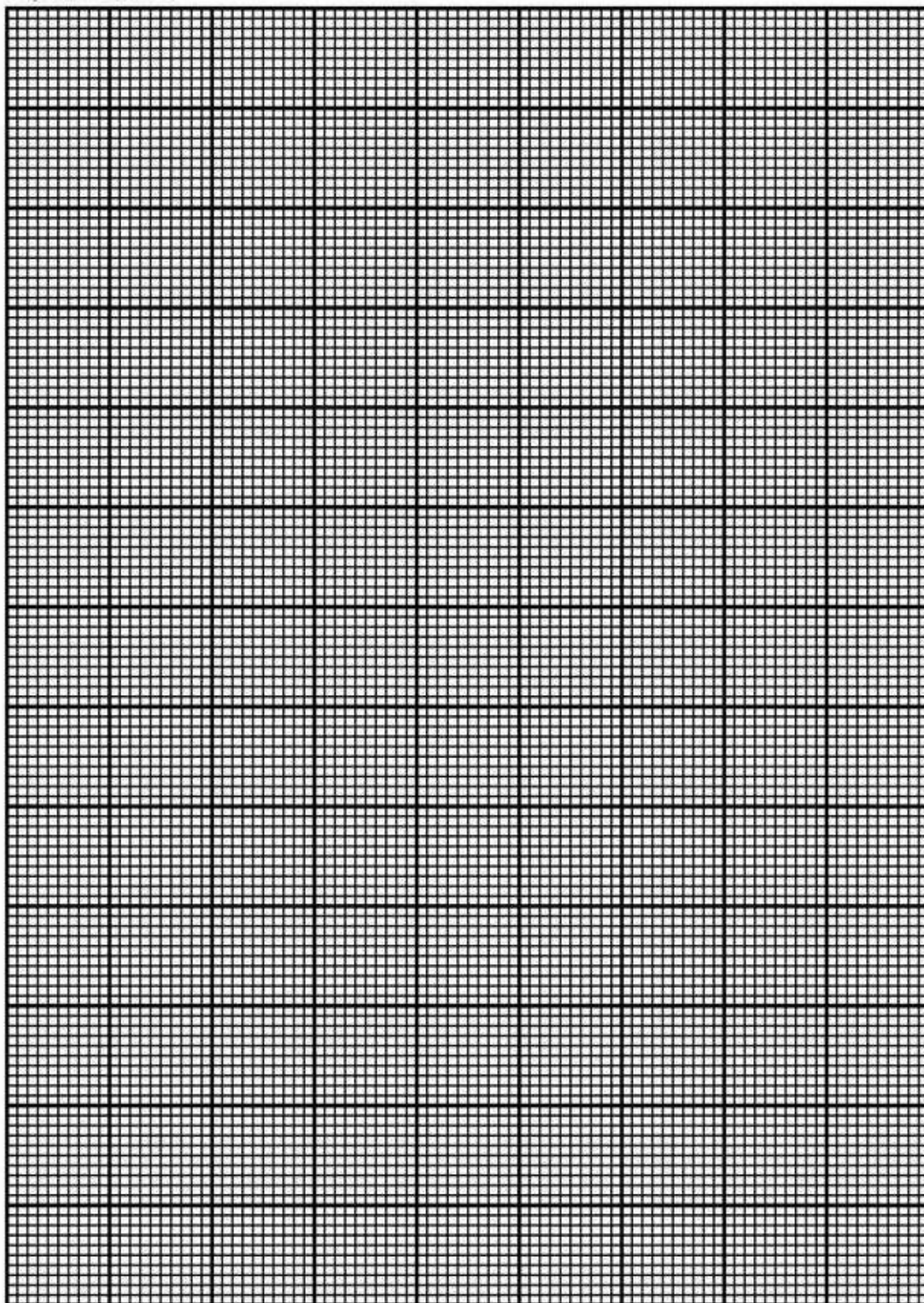
Diode, light-emitting diode, amplifier, capacitor, light-dependent resistor, forward biased diode, reverse biased diode

- 13.2.1 A device that takes electric signal and makes it larger. (1)
- 13.2.2 A device in which holes in the p-side are connected to the battery's negative terminal, and electrons in the n-side are connected to the positive terminal. (1)
- 13.2.3 A device that allows current to flow in one direction only. (1)
- 13.2.4 A device which gives out light when a current flows through it. (1)
- [8]**

TOTAL SECTION B: 125

GRAND TOTAL: 150

QUESTION 5.4



DATA/GEGEWENS

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIESE KONSTANTES

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Acceleration due to gravity <i>Swaartekragversnelling</i>	g	$9,8 \text{ m}\cdot\text{s}^{-2}$
Speed of light in a vacuum <i>Spoeed van lig in 'n vakuum</i>	c	$3,0 \times 10^8 \text{ m}\cdot\text{s}^{-1}$
Gravitational constant <i>Swaartekragkonstante</i>	G	$6,67 \times 10^{-11} \text{ N}\cdot\text{m}^2\cdot\text{kg}^{-2}$
Coulomb's constant <i>Coulomb se konstante</i>	k	$9,0 \times 10^9 \text{ N}\cdot\text{m}^2\cdot\text{C}^{-2}$
Charge on electron <i>Lading op elektron</i>	e^-	$-1,6 \times 10^{-19} \text{ C}$
Electron mass <i>Elektronmassa</i>	m_e	$9,11 \times 10^{-31} \text{ kg}$
Permittivity of free space <i>Permittiwiteit in 'n vakuum</i>	ϵ_0	$8,85 \times 10^{-12} \text{ F}\cdot\text{m}^{-1}$

TABLE 2: FORMULAE/TABEL 2: FORMULES**MOTION/BEWEGING**

$v_f = v_i + a \Delta t$	$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$ or/of $v_f^2 = v_i^2 + 2a\Delta y$	$\Delta x = \left(\frac{v_f + v_i}{2} \right) \Delta t$

FORCE/KRAG

$F_{\text{net}} = ma$	$p = mv$
$F = \frac{Gm_1m_2}{r^2}$	$F\Delta t = \Delta p = mv - mu$
$\mu_s = \frac{f_{s(\text{max})}}{N}$	$\mu_k = \frac{f_k}{N}$
$\tau = F \perp r$	

WEIGHT AND MECHANICAL ENERGY/GEWIG EN MEGANIESE ENERGIE

$F_g = mg$	$U = E_p = mgh$
$K = E_k = \frac{1}{2} mv^2$	

WAVES, SOUND AND LIGHT/GOLWE, KLANK EN LIG

$v = f \lambda$ or/of $v = v \lambda$	$T = \frac{1}{f}$ or/of $T = \frac{1}{v}$
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ELECTROSTATICS/ELEKTROSTATIKA

$F = \frac{kQ_1Q_2}{r^2} \quad (k = 9,0 \times 10^9 \text{ N} \cdot \text{m}^2 \cdot \text{C}^{-2})$	$E = \frac{F}{q}$
$E = \frac{kQ}{r^2} \quad (k = 9,0 \times 10^9 \text{ N} \cdot \text{m}^2 \cdot \text{C}^{-2})$	$E = \frac{V}{d}$
$V = \frac{W}{Q}$	$W = QEs$
$U = \frac{kQ_1Q_2}{r} \quad (k = 9,0 \times 10^9 \text{ N} \cdot \text{m}^2 \cdot \text{C}^{-2})$	$C = \frac{Q}{V}$
$C = \frac{\epsilon_0 A}{d}$	

TABLE 3: FORMULAE/TABEL 3: FORMULES**ELECTROMAGNETISM/ELEKTROMAGNETISME**

$\varepsilon = -N \frac{\Delta\Phi}{\Delta t}$	$\Phi = BA$
$\frac{V_s}{V_p} = \frac{N_s}{N_p}$	$F = qvB$

CURRENT ELECTRICITY/STROOMELEKTRISITEIT

$I = \frac{Q}{\Delta t}$	$R = \frac{V}{I}$
$emf / emk = I(R + r)$	$R = r_1 + r_2 + r_3 + \dots$
$\frac{1}{R_p} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + \dots$	

PHYSICAL SCIENCES P1 : ANSWER SHEET**GRADE 11****NAME:****SECTION A****QUESTION 1**

- 1.1 _____ (1)
- 1.2 _____ (1)
- 1.3 _____ (1)
- 1.4 _____ (1)
- 1.5 _____ (1)
- [5]**

QUESTION 2

2.1	A	B	C	D
2.2	A	B	C	D
2.3	A	B	C	D
2.4	A	B	C	D
2.5	A	B	C	D
2.6	A	B	C	D
2.7	A	B	C	D
2.8	A	B	C	D
2.9	A	B	C	D
2.10	A	B	C	D

(10 x 2) **[20]****TOTAL SECTION A: 25**