



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

NOVEMBER 2012

PHYSICAL SCIENCES P1

MARKS: 150

TIME: 3 hours

This question paper consists of 22 pages, including 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 FULL NAME and SURNAME 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. Data and 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 gravitational force that the earth exerts on an object (1)
- 1.2 The part in a motor vehicle, especially the extreme front and rear, designed to absorb the force of impact in order to protect passengers during an accident (1)
- 1.3 The point through which light rays are focused by a lens (1)
- 1.4 The type of current in which charges flow only in one direction in the circuit (1)
- 1.5 An example of a longitudinal wave consisting of alternating regions of compressions and rarefactions (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 A net force of one newton is the force which, when acting on an object of mass 1 kg, will ...
- A move it a distance of 1 m.
- B lift it a distance of 1 m.
- C move it at a velocity of $1 \text{ m}\cdot\text{s}^{-1}$
- D increase its velocity by $1 \text{ m}\cdot\text{s}^{-1}$ in 1 s. (2)

- 2.2 A trolley in the diagram strikes the wall at a velocity of 2 m.s^{-1} and bounces back at a velocity of 1 m.s^{-1} . Take the direction towards the wall as positive.

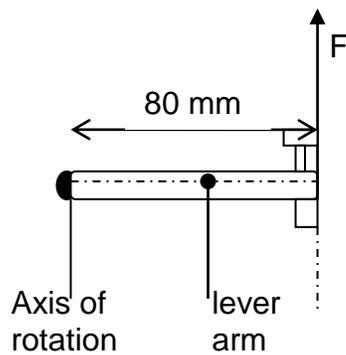


The change in the velocity of the trolley due to the collision is ...

- A 1 m.s^{-1} .
- B -1 m.s^{-1} .
- C 3 m.s^{-1} .
- D -3 m.s^{-1} .

(2)

- 2.3 A force of 55 N is applied to the door. The sketch below shows the force diagram for the door.



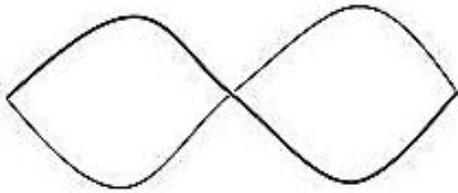
The magnitude of the torque is ...

- A $4\,400 \text{ N.m}$.
- B $1,455 \text{ N.m}$.
- C $4,4 \text{ N.m}$.
- D $68,75 \text{ N.m}$.

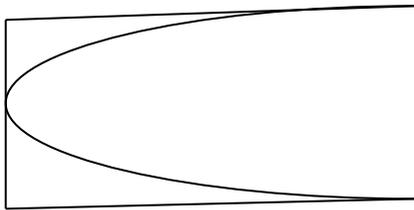
(2)

2.4 Which of the following standing wave patterns shows the fundamental frequency?

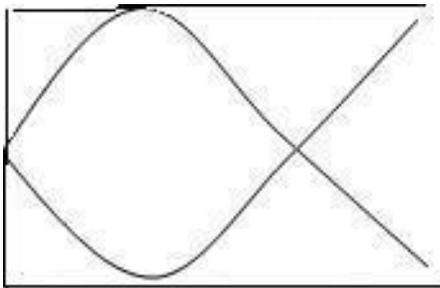
A



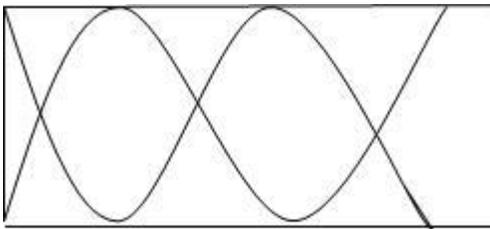
B



C



D



(2)

2.5 AM radio waves travel at a speed of $3 \times 10^8 \text{ m} \cdot \text{s}^{-1}$ and the station broadcasts AM radio waves at a frequency of $91,9 \times 10^6 \text{ Hz}$. The wavelength of AM radio waves is ...

A $2,757 \times 10^{16} \text{ m}$.

B 3,26 m.

C 0,067 m.

D 26 m.

(2)

2.6 If the frequency of sound is increased, the note will be ...

A lower and louder.

B the same pitch but louder.

C higher but the same loudness.

D higher and louder.

(2)

2.7 Which of the following music instruments is a percussion instrument?

 <p>A. Saxophone</p>	 <p>B. Guitar</p>
 <p>C. Xylophone</p>	 <p>D. Trumpet</p>

(2)

2.8 The single SI unit for joule per coulomb:

- A volt
- B newton
- C ampere
- D ohm

(2)

2.9 When a dielectric material is inserted between the plates of a capacitor, the capacitance ...

- A decreases.
- B remains the same.
- C becomes zero.
- D increases.

(2)

2.10 The process of generating electricity from motion:

- A Magnetism
- B Electromagnetism
- C Electromagnetic induction
- D Magnetic flux

(2)

[20]

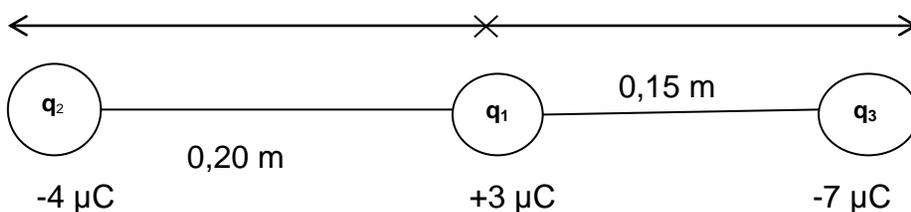
TOTAL SECTION A: 25

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.
5. Answer this section in the ANSWER BOOK.

QUESTION 3 (Start on a new page.)

Three charges are arranged as shown in the diagram.



- 3.1 Calculate the magnitude and direction of the **NET electrostatic force** on q_1 . (6)

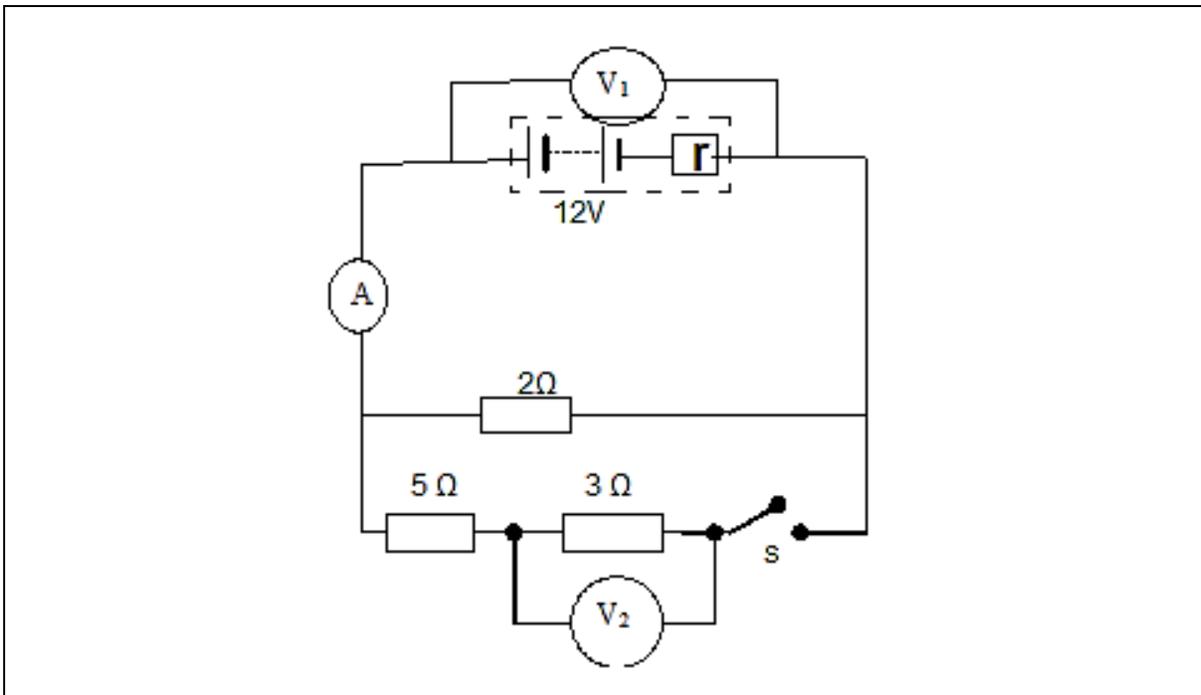
q_2 is removed and q_1 and q_3 are left

- 3.2 3.2.1 The two charges were made to touch each other and then separated. Briefly explain what happened during contact. (2)
- 3.2.2 What type of force exists between the two charges after they were in contact? (1)

[9]

QUESTION 4 (Start on a new page.)

A battery of emf 12 V and an internal resistance r is connected in a circuit.



4.1 State Ohm's law. (2)

Switch S is now closed. The reading on the ammeter is 3 A.

Calculate:

4.2 The effective resistance of external resistors in the circuit. (3)

4.3 The reading on the voltmeter V_1 . (3)

4.4 The reading on voltmeter V_2 . (4)

4.5 The internal resistance of the battery. (4)

4.6 Explain what happens when a battery is flat. (2)

Switch S is now open.

4.7 Explain what will happen to the readings on the ammeter and voltmeters V_1 and V_2 . (4)

[22]

QUESTION 5 (Start on a new page.)

Capacitors can be used to delay the reaction of a sensor that switches on an output device after detecting a change. Kelvin investigates how potential difference changes with time when a capacitor discharges.

- 5.1 Draw the electric field pattern between two oppositely charged plates of a capacitor. (3)
- 5.2 Draw a sketch graph of potential difference versus time to show the discharge of a capacitor. (3)
- 5.3 What conclusion can you draw from the shape of the graph about the rate of discharge? (2)
- 5.4 This capacitor has capacitance of 1,2 pF and a potential difference of 12 V. Calculate the charge on each plate. (3)

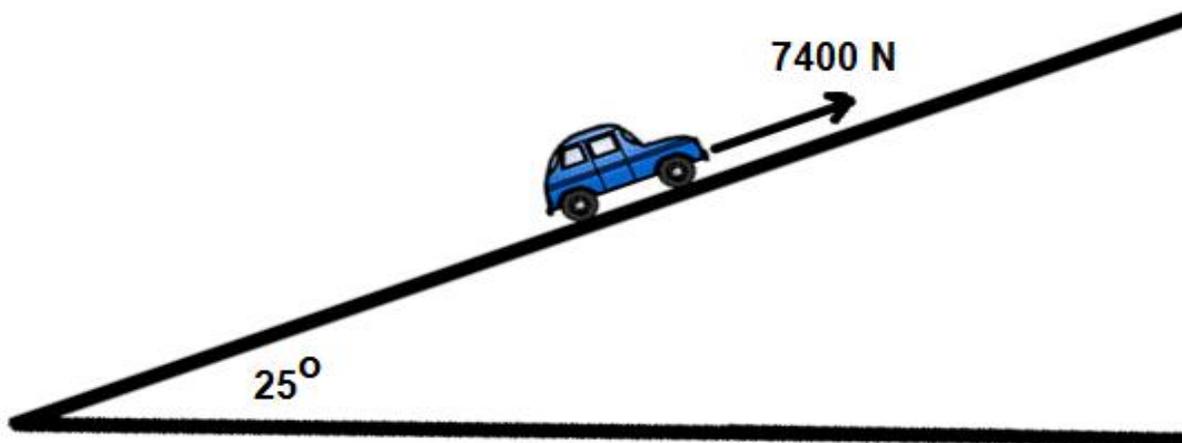
[11]

QUESTION 6 (Start on a new page.)

Insect 'zappers', with their blue light are a familiar sight on a summer's night in some parts of the country. These devices use high voltage to electrocute insects. One of such device uses an a.c. voltage of 4 150 V, which is obtained from a standard 120 V outlet by means of a transformer.

- 6.1 Explain why direct current is not suitable for use in the transformer. (2)
- 6.2 Is a step up, or a step down transformer used in this device? (1)
- 6.3 If the primary coil has 17 turns, calculate how many turns are in the secondary coil. (4)
- 6.4 The current in the secondary coil is 0,1 A. Assume that the transformer is 100% efficient. Calculate the current in the primary coil. (4)

[11]

QUESTION 7 (Start on a new page.)

A car with a mass of 1 400 kg is accelerated up a hill while experiencing a net force of 7 400 N. The hill makes an angle of 25° with the horizontal and the coefficient of dynamic friction is equal to 0,23.

7.1 Draw a labelled free body diagram for ALL the forces acting on the car. (4)

Calculate:

7.2 The acceleration of the car (3)

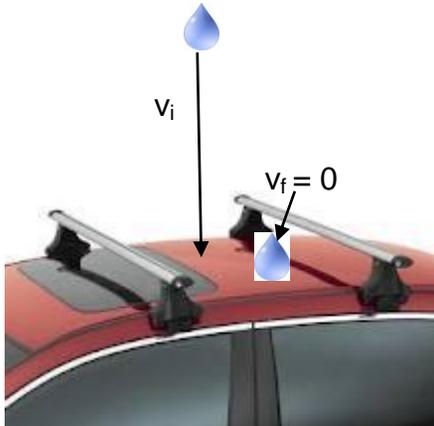
7.3 The magnitude of the friction force (3)

7.4 The applied force (3)

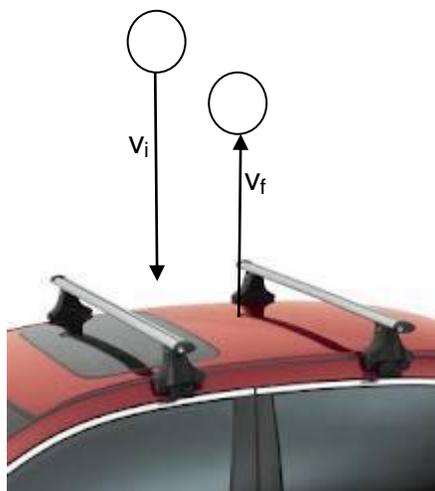
[13]

QUESTION 8 (Start on a new page.)

Clay, with a mass of 0,06 kg, is dropped straight down and hit the roof a car with a velocity of $15 \text{ m}\cdot\text{s}^{-1}$. The clay deforms in 1 s and sticks to the roof.



- 8.1 Define a net force in terms of momentum. (2)
- 8.2 Determine the magnitude of the net force exerted by the clay on the roof. (4)
- 8.3 Suppose a rubber ball is falling instead of clay. The mass of the ball is 0,06 kg and the velocity with which it strikes the roof is also $15 \text{ m}\cdot\text{s}^{-1}$. However, unlike clay the ball does not come to rest. Instead, after being in contact with the roof for 1 s, it bounces straight up in the air.



Would the force on the roof be **smaller than / equal to / greater than** the calculated value in QUESTION 8.2 above? Explain.

(4)

8.4 Starting from rest two skaters “push off” against each other on smooth level ice, where friction is negligible. The two skaters have a mass of 54 kg and 88 kg respectively. The 54 kg skater moves away with a velocity of $2,5 \text{ m}\cdot\text{s}^{-1}$



Calculate the velocity of the 88 kg skater. (5)

8.5 Road safety authorities have set some legal rules for South African motorists so that the campaigns for road users can be a success.

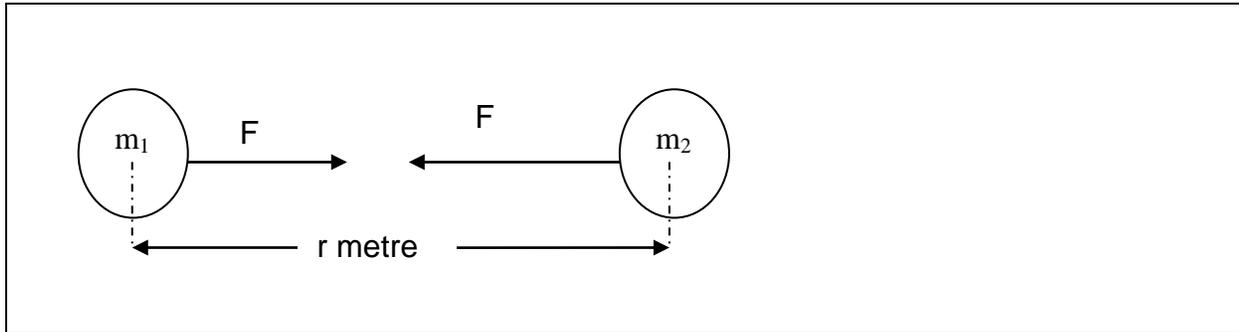
8.5.1 Give the name of the South African campaign which alerts motorists about road accidents and road safety. (1)

8.5.2 Give TWO illegal acts that are prohibited by the campaign you mentioned above. (2)

[18]

QUESTION 9 (Start on a new page.)

Every particle in the universe attracts every other particle with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.



9.1 Name the law of physics that is stated above. (1)

Refer to the diagram to answer the questions that follow.

9.2 The gravitational force between the two bodies is F . If the following changes are made what will be the new force?

9.2.1 m_1 is doubled (2)

9.2.2 distance r between the bodies is doubled (2)

9.2.3 both masses are doubled (2)

9.2.4 the distance r and mass m_1 are halved (2)

[9]

QUESTION 10 (Start on a new page.)

A force can cause an object to turn.

10.1 Express torque as a word equation. (1)

10.2 A torque causes an object to rotate around a point. What is the name given to this point? (1)

In an experiment to investigate the moment of a force, a group of learners from Florence Secondary School tabulated the sample of the following results:

Mass (g)	Weight (N)	Distance (m) to the turning point	Moment of the force (N.m.)	Which side of the turning point	Clockwise / anticlockwise
10	0,098	0,2	10.3.1	Left	Anticlockwise
20	0,196	10.3.2	0,02	Right	Clockwise
30	10.3.3	0,068	0,02	Left	Anticlockwise
40	0,392	0,051	0,01999	Right	Clockwise

10.3 Complete the table by only writing the correct answer next to the numbers **10.3.1 to 10.3.3**. (3)

10.4 All four mass pieces are hanging from the beam simultaneously at the positions indicated in the table.

What will happen to the beam? Only write: **rotate clockwise / rotate anticlockwise / neither**. (1)

10.5 State the principle/law of physics that explains your answer in QUESTION 10.4 above. (2)

[8]

QUESTION 11 (Start on a new page.)

Semi-conductors are used on large scale in our modern technological world.

Silicon is an example of an element that can be used as a semi-conductor; to improve conductivity of silicon, arsenic is added to it.

11.1 Provide a single word for the underlined process above. (1)

11.2 Explain, using band theory, how the conductivity of a semi-conductor can be improved besides using the process mentioned in QUESTION 11.1. (3)

11.3 Give TWO examples of devices that use semi-conductors in real life situations. (2)

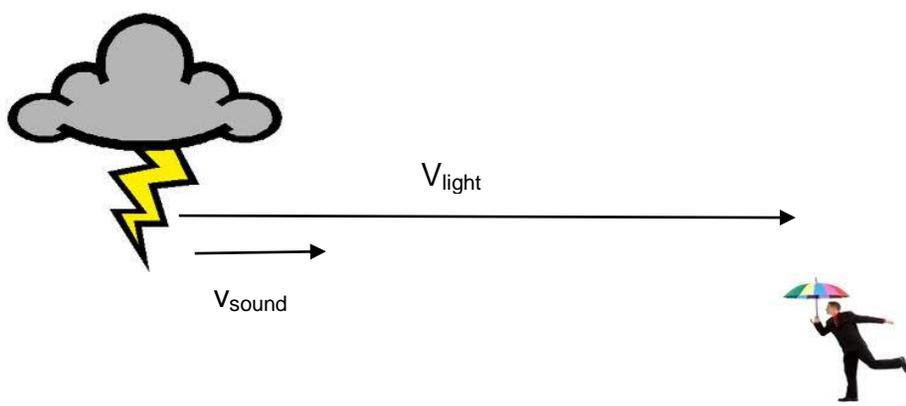
[6]

QUESTION 12 (Start on a new page.)

A wave has a frequency of 45 Hz and a speed of 22 m.s⁻¹.
Determine the:

- 12.1 Period of the wave (2)
- 12.2 wavelength of the wave (3)

There is a rule of thumb for estimating how far away a thunderstorm is. After you see a flash of lightening, count off seconds until thunder is heard. Divide the number of seconds by three. The result gives the approximate distance (in km) to the thunderstorm.



- 12.3 Explain why this rule works. (4)
- [9]**

QUESTION 13 (Start on a new page.)

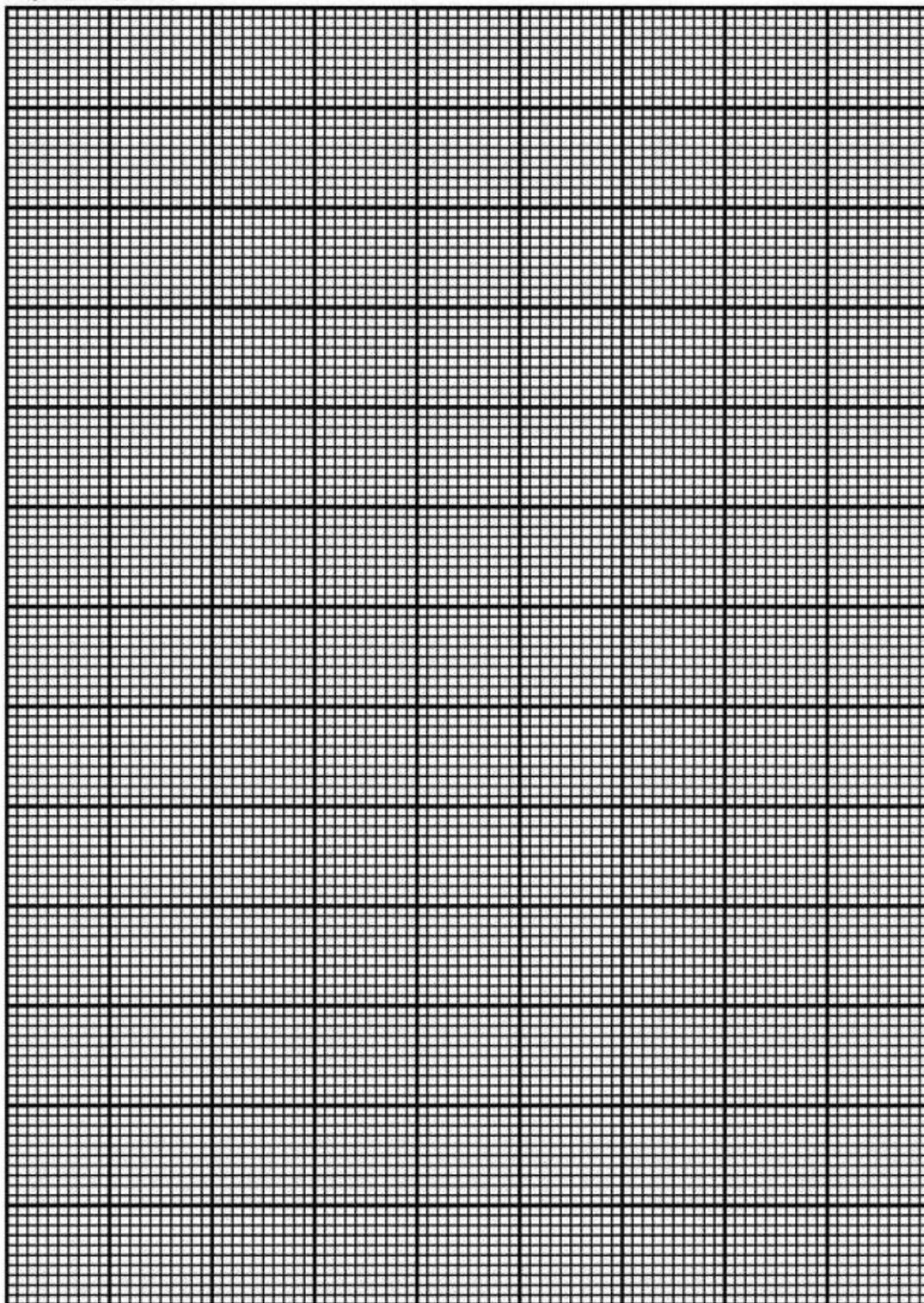
A 4 cm high object is placed 8 cm from a converging lens with a focal point of 6 cm.

- 13.1 Make use of a scale drawing to determine the position of the image. (Use the graph paper on page 18.) (4)
- 13.2 Calculate the magnification of the lens. (2)
- 13.3 Identify THREE properties of the image. (3)

[9]

TOTAL SECTION B: 125
GRAND TOTAL: 150

QUESTION 13.1



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>Spoed 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

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

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