



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

NOVEMBER 2013

PHYSICAL SCIENCES P1

MARKS: 150

TIME: 3 hours

This question paper consists of 15 pages, including an answer sheet
and data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your full name and surname (and/or examination number if applicable) in the appropriate spaces on the ANSWER SHEET and ANSWER BOOK.
2. Answer all the questions.
3. This paper consists of two sections.

SECTION A: 25 marks

SECTION B: 125 marks

4. Answer SECTION A on the attached 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 your answers correctly according to the numbering system used in this question paper.
8. Data sheets are attached for your use.
9. Wherever motivations, discussions, etc. are required, be brief.

SECTION A**QUESTION 1: ONE-WORD ITEMS**

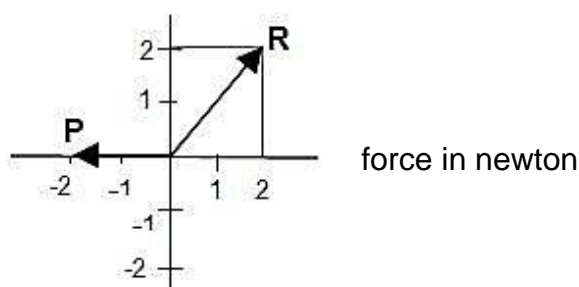
Give one word/term for each of the following descriptions. Write only the word/term next to the question number (1.1–1.5) on the ATTACHED ANSWER SHEET.

- 1.1 The force exerted by a surface on an object in contact with it (1)
- 1.2 The ratio of the speed of light in a vacuum to the speed of light in the material (1)
- 1.3 The incident angle that forms an angle of refraction of 90° (1)
- 1.4 Force per unit charge (1)
- 1.5 Product of power and time (1)

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

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

2.1



The resultant of vectors R and P is ...

- A 0 N.
- B 4 N to the right and 2 N down.
- C 2 N up.
- D 2 N down.

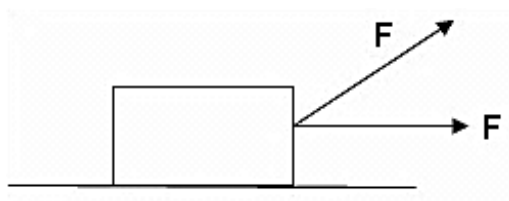
(2)

2.2 Frictional force ...

- A is opposite the direction of motion of an object and acts perpendicular to the surface the object is in contact with.
- B is in the same direction as the motion of an object and acts parallel to the surface the object is in contact with.
- C is in the same direction as gravitational force.
- D opposes the motion of an object and acts parallel to the surface the object is in contact with.

(2)

- 2.3 A crate is pulled along a smooth frictionless surface by two forces, each with a magnitude F , as shown in the diagram.

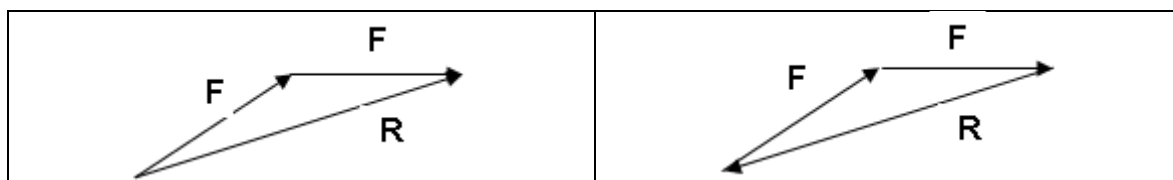


Which vector diagram correctly shows how the resultant force R on the crate can be determined?



A

B

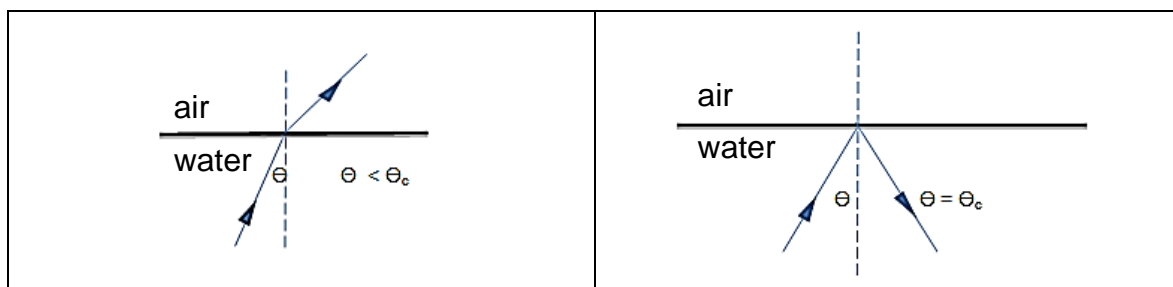


C

D

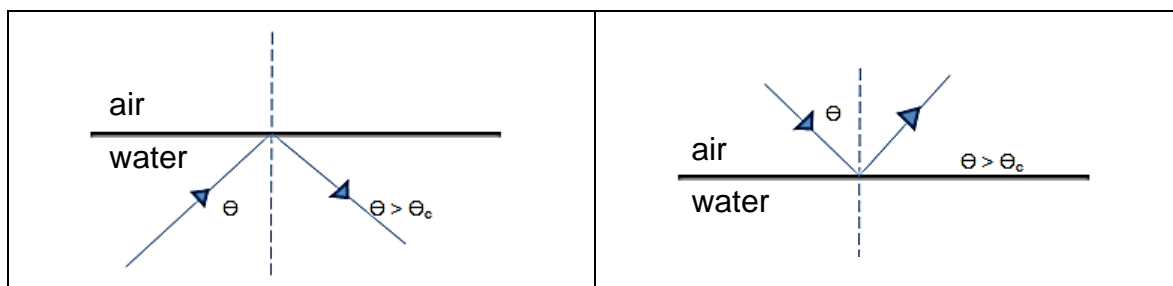
(2)

- 2.4 Which of the following diagrams represents TOTAL INTERNAL REFLECTION? (θ_c is the critical angle)



A

B



C

D

(2)

2.5 Diffraction of light is proof of the ...

- A particle nature of light.
- B wave nature of light.
- C dual nature of light.
- D rainbow nature of light.

(2)

2.6 The degree of diffraction decreases when ...

- A the wavelength decreases and the slit width increases.
- B both the wavelength and the slit width decreases.
- C the wavelength increase and slit width decreases.
- D both the wavelength and the slit width increases.

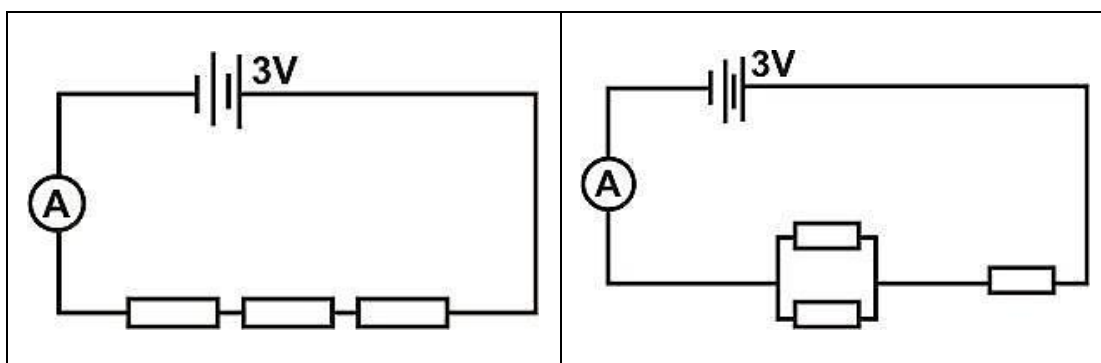
(2)

2.7 The electric field experienced by a point charge is 800 N.C^{-1} at a distance of 30 cm from the centre of the sphere. The charge carried by the sphere is ...

- A 26,7 nC.
- B 375 nC.
- C 8 nC.
- D 4 nC.

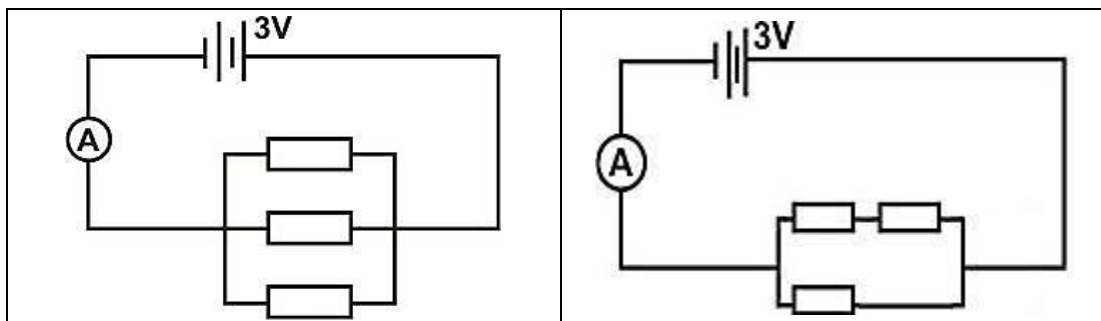
(2)

2.8 A learner is provided with three identical resistors to insert in any manner in a circuit. Which ONE of the following circuit diagrams will allow the largest current through the ammeter?



A

B



C

D

(2)

- 2.9 The magnitude of the electrostatic force between two identically charged spheres is given as F_0 .

If the charge on each sphere is doubled, while the distance between them is halved, the new electrostatic force between the spheres will be ...

- A $16 F_0$.
- B $4 F_0$.
- C F_0 .
- D $\frac{1}{2} F_0$.

(2)

- 2.10 Work done per unit charge:

- A Energy
- B Potential difference
- C Power
- D Current

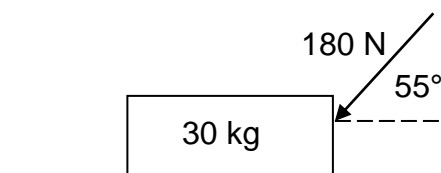
(2)

[20]**TOTAL SECTION A: 25****SECTION B****INSTRUCTIONS AND INFORMATION**

1. Start each QUESTION on a new page.
2. Leave one line open between two sub questions, for example between QUESTION 3.1 and 3.2.
3. The formulae and substitutions must be shown in ALL calculations.
4. Round off your final numerical answers to a minimum of TWO decimal places.
5. Answer this section in the ANSWER BOOK.

QUESTION 3: (Start on a new page.)

- 3.1 A force of 180 N is acting on a block at 55° to the horizontal as shown in the diagram. The block remains stationary.



- 3.1.1 CONSTRUCT a vector diagram to determine the x- and y-components of the force. (Use a scale of 3 N : 1 mm)

(7)

- 3.1.2 Use your answer in QUESTION 3.1.1 and calculate the normal force.

(3)

3.2 Define a resultant vector. (2)

3.3 Two forces act on a point as indicated in the diagram below.



3.3.1 CALCULATE the magnitude of the resultant force. A vector diagram MUST accompany your calculations. (3)

3.3.2 CALCULATE the direction of the resultant force clockwise from the positive y-axis. (2)

3.4 What is meant by a CLOSED vector diagram and what conclusion can be made from such a diagram? (2)
[19]

QUESTION 4 (Start on a new page.)

A sled travelling at 6 m.s^{-1} enters a stretch of snow as indicated in the diagram. The coefficient of kinetic friction is 6×10^{-2} .



4.1 Draw a free body diagram to show all forces that act on the sled. (NAME ALL FORCES.) (3)

4.2 Calculate:

4.2.1 The magnitude of the acceleration of the sled (4)

4.2.2 The distance travelled by the sled before stopping (3)
[10]

QUESTION 5 (Start on a new page.)

Douglie and Bulie are pushing a car with a mass of 2 000 kg on a rough surface which has a frictional force of 500 N. Douglie applies a force of 400 N to the right and Bulie applies a force of 250 N in the same direction.



Frictional force = 500 N

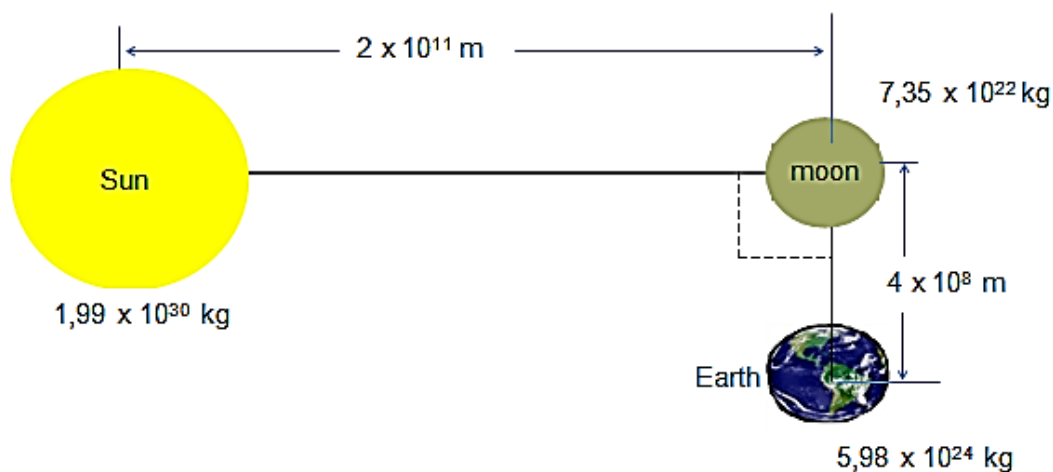
- 5.1 Draw a free body diagram to show the **horizontal** forces acting on the car. (3)
- 5.2 Calculate the magnitude and direction of the acceleration of the car. (4)
- 5.3 If the road has a slight incline of 5° , calculate the component of the car's weight parallel to the incline. (2)
- 5.4 What will the motion of the car be on the incline, if Douglie and Bulie are applying the same force as before? Only write STATIONARY, ACCELERATE UP the incline, ACCELERATE DOWN the incline, MOVE AT A CONSTANT VELOCITY UP the incline OR MOVE WITH A CONSTANT VELOCITY DOWN the incline. (1)
- 5.5 The "Arrive alive campaign" always warns passengers and drivers to wear seatbelts when getting into vehicles to ensure their safety during accidents.
What is inertia? (1)
- 5.6 Explain, using relevant laws of physics, how a seatbelt works when a vehicle suddenly slows down in an accident. (2)
- 5.7 A book is resting on a table as shown below.



- Write down Newton's third law of motion (2)
- 5.8 Identify all the Newton-third pairs that act ON THE DESK. (3)

QUESTION 6 (Start on a new page.)

Consider the diagram below, which is not drawn to scale.



Calculate:

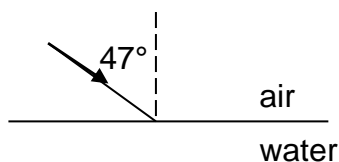
- 6.1 The magnitude of the gravitational force between the **earth and sun** at the position indicated in the diagram (5)
 - 6.2 The acceleration due to gravity on the **moon** if the radius of the moon is $1,6 \times 10^6 \text{ m}$ (4)
 - 6.3 The weight of a 50 g object on **earth** (3)
- [12]**

QUESTION 7 (Start on a new page.)

A light ray strikes an air-water surface at an angle of 47° with respect to the normal.
[Refractive index for air = 1,00 and refractive index for water = 1,33]

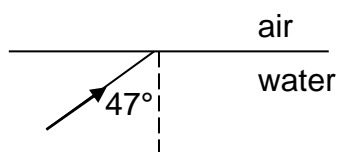
- 7.1 Calculate the angle of refraction when the direction of a light ray is as follows:

- 7.1.1 From air to water



(4)

- 7.1.2 From water to air



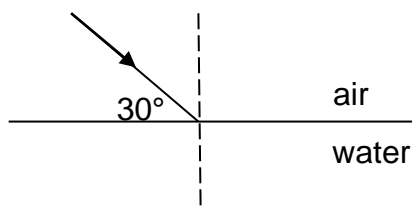
(3)

- 7.2 Calculate the speed of light in water. (3)

7.3 Prove that the critical angle of water is $48,75^\circ$. (2)

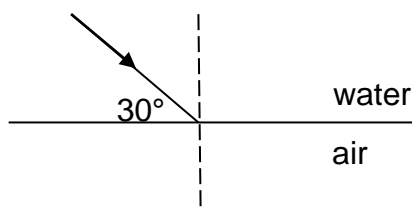
7.4 Complete the following diagrams (not to scale):

7.4.1



(2)

7.4.2



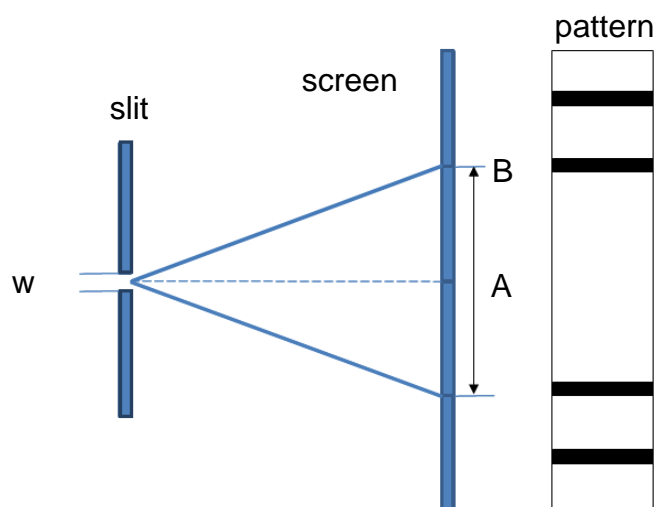
(2)

7.5 Give ONE use of optical fibres. (1)

[17]

QUESTION 8 (Start on a new page.)

Light with a wavelength of 760 nm passes through a slit 8×10^{-6} m wide and a diffraction pattern is observed on a screen as shown in the diagram.



8.1 Write down Huygens' principle. (2)

8.2 Describe the diffraction pattern which is observed on the screen by labelling A and B. (2)

8.3 Which part of the pattern (A or B) is the result of constructive interference? (1)

8.4 How will the broadness of A differ if the following changes are made to the setup? Write down only BROADER, NARROWER or REMAIN THE SAME.

8.4.1 Light with a wavelength of 900 nm is used (1)

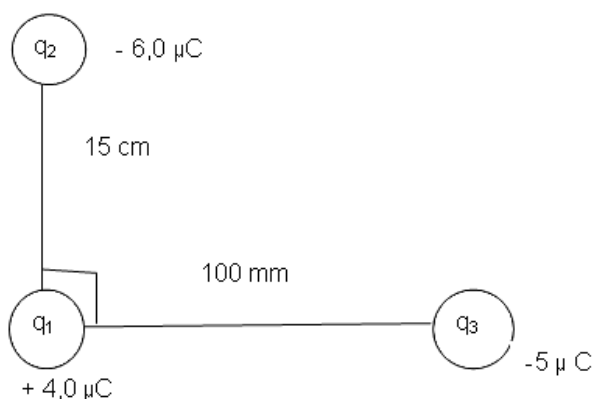
8.4.2 A narrower slit is used (1)

8.5 Give a reason for your answer in QUESTION 8.4.1. (2)

[9]

QUESTION 9 (Start on a new page.)

Consider the diagram below, not drawn to scale.

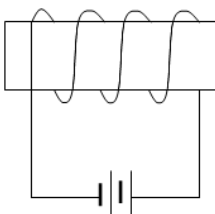


- 9.1 Draw a free-body diagram for all the electrostatic forces that act on q_1 . Also show the net electrostatic force (F_{net}). Label forces clearly. (3)
 - 9.2 Calculate the magnitude of the electrostatic force between q_1 and q_2 . (4)
 - 9.3 Calculate the net electrostatic force on q_1 . (7)
- [14]**

QUESTION 10 (Start on a new page.)

- 10.1 Copy the following diagrams in your answer book and show the form and direction of the magnetic field due to the current in each case.

- 10.1.1  top view of current carrying conductor (2)

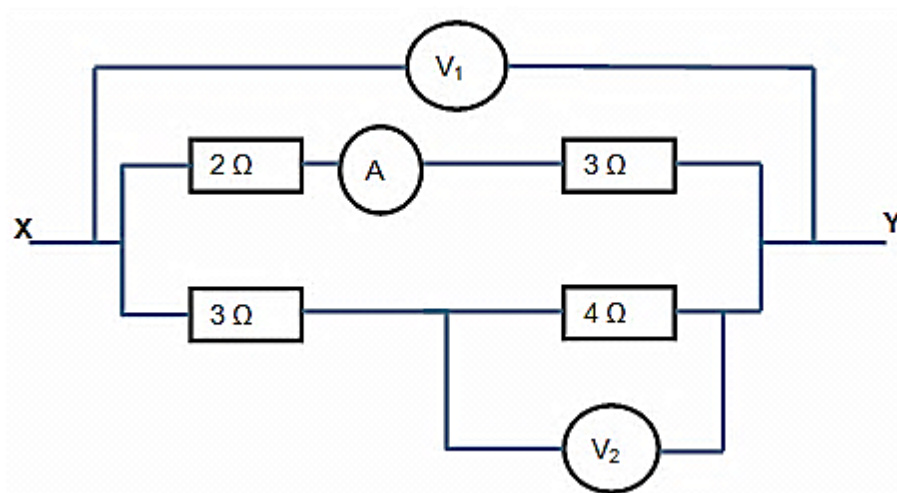
- 10.1.2  a solenoid (2)

- 10.2 A solenoid with 450 turns has a cross-sectional area of 176 cm^2 . It is positioned perpendicular to a uniform magnetic field of 0,72 T.

- 10.2.1 Calculate the flux through the solenoid. (3)
 - 10.2.2 Calculate the induced *emf* if the solenoid is pulled out of the magnetic field in 0,22 s. (3)
- [10]**

QUESTION 11 (Start on a new page.)

- 11.1 A number of meters and resistors are connected as shown in the diagram.
A 3,0 V battery is connected to the terminals X and Y.



- 11.1.1 Determine the reading on V_1 . (1)
- 11.1.2 Calculate the reading on A. (3)
- 11.1.3 Calculate the reading on V_2 . (5)
- 11.2 A tumble dryer is labelled: 220 V; 2600 W
- 11.2.1 Calculate the resistance of the tumble dryer's resistor. (4)
- 11.2.2 Calculate the cost of using the tumble dryer for $3\frac{1}{2}$ hours if electricity costs R1,04 per kWh. (3)

[16]

TOTAL SECTION B: 125
GRAND TOTAL: 150

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 m·s ⁻²
Gravitational constant <i>Swaartekragkonstante</i>	G	6,67 x 10 ⁻¹¹ N·m ² ·kg ⁻²
Coulomb's constant <i>Coulomb se konstante</i>	k	9,0 x 10 ⁹ N·m ² ·C ⁻²
Speed of light in a vacuum <i>Spoe van lig in 'n vakuum</i>	c	3,0 x 10 ⁸ m·s ⁻¹
Charge on electron <i>Lading op elektron</i>	e ⁻	-1,6 x 10 ⁻¹⁹ C
Electron mass <i>Elektronmassa</i>	m _e	9,11 x 10 ⁻³¹ kg
Radius of earth <i>Radius van aarde</i>	R _E	6,38 x 10 ⁶ m
Mass of earth <i>Massa van aarde</i>	M _E	5,98 x 10 ²⁴ kg

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

$F_{\text{net}} = ma$	$w = mg$
$F = \frac{Gm_1m_2}{r^2}$	$f_{s(\text{max})} = \mu_s N$
$f_k = \mu_k N$	

WAVES, SOUND AND LIGHT/GOLWE, KLANK EN LIG

$v = f\lambda$	$T = \frac{1}{f}$
$n_i \sin \theta_i = n_r \sin \theta_r$	$n = \frac{c}{v}$

ELECTROSTATICS/ELEKTROSTATIKA

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

ELECTROMAGNETISM/ELEKTROMAGNETISME

$\varepsilon = -N \frac{\Delta\Phi}{\Delta t}$	$\Phi = BA \cos \theta$
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CURRENT ELECTRICITY/STROOMELEKTRISITEIT

$I = \frac{Q}{\Delta t}$	$R = \frac{V}{I}$
$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + \dots$	$R = r_1 + r_2 + r_3 + \dots$
$W = Vq$ $W = VI \Delta t$ $W = I^2 R \Delta t$ $W = \frac{V^2 \Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2 R$ $P = \frac{V^2}{R}$

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

1.1 _____

1.2 _____

1.3 _____

1.4 _____

1.5 _____

(5 x 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**