



Province of the  
**EASTERN CAPE**  
EDUCATION

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 11**

**NOVEMBER 2011**

**PHYSICAL SCIENCES P1  
MEMORANDUM**

**MARKS: 150**

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This memorandum consists of 12 pages.

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

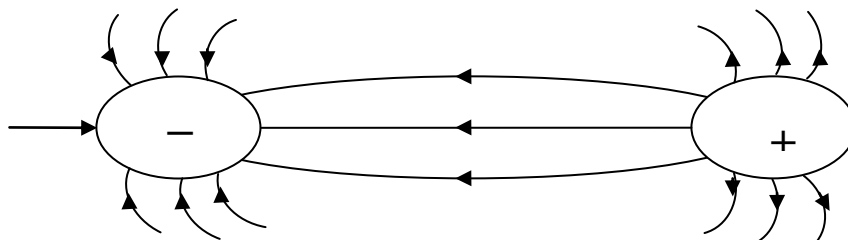
1.1	Inertia ✓	11.2.1	(1)
1.2	Mass ✓	11.2.1	(1)
1.3	Overtone ✓	11.2.1	(1)
1.4	Dielectric ✓	11.2.1	(1)
1.5	step up transformer ✓	11.2.1	(1)
<b>[5]</b>			

**QUESTION 2: MULTIPLE-CHOICE QUESTIONS**

2.1	B ✓✓	11.2.2	(2)
2.2	A ✓✓	11.2.1	(2)
2.3	B ✓✓	11.2.3	(2)
2.4	A ✓✓	11.2.1	(2)
2.5	C ✓✓	11.3.1	(2)
2.6	D ✓✓	11.2.3	(2)
2.7	C ✓✓	11.2.3	(2)
2.8	B ✓✓	11.2.3	(2)
2.9	A ✓✓	11.1.2	(2)
2.10	A ✓✓	11.2.1	(2)
<b>[20]</b>			

**TOTAL SECTION A: 25****SECTION B****QUESTION 3**

- 3.1 Coulomb's law of electrostatics states that: the electrostatic force between two charges is directly proportional to the product of the charges and is inversely proportional to the square of the distance between them. ✓✓ LO2 AS123 (2)
- 3.2 Electric field pattern between charges  
 One mark electric field lines  
 One mark for the direction of electric field lines



LO2 AS123 (2)

3.3  $F = k q_1 q_2 / r^2$  ✓

$$8,22 \times 10^{-8} \text{ ✓} = \frac{9 \times 10^9 (1,6 \times 10^{-19}) (1,6 \times 10^{-19})}{r^2} \text{ ✓}$$

$$r = 5,29 \times 10^{-11} \text{ m ✓}$$

LO2 AS23 (4)

3.4 Take right direction as positive, the electric field of  $e^-$  at x

$$E_1 = \frac{kq}{r^2} \text{ ✓}$$

$$= \frac{9 \times 10^9 (-1,6 \times 10^{-19})}{(15 \times 10^{-12} + 5,29 \times 10^{-11})^2} \text{ ✓}$$

$$= 3,12 \times 10^{11} \text{ N.C}^{-1} \text{ to the left ✓}$$

The electric field of  $p^+$  at x

$$E_2 = \frac{kq}{r^2}$$

$$= \frac{9 \times 10^9 \cdot (-1,6 \times 10^{-19})}{(15 \times 10^{-12})^2} \text{ ✓}$$

$$= 6,4 \times 10^{12} \text{ N.C}^{-1} \text{ to the right ✓}$$

$$E_{\text{net}} = E_1 + E_2$$

$$= (6,4 \times 10^{12}) + (-3,12 \times 10^{11})$$

$$= 6,088 \times 10^{12} \text{ N.C}^{-1} \text{ to the right ✓}$$

LO123 AS23 (6)

3.5 Lightning is caused by the build up of charges between the clouds. ✓

LO3 AS12 (1)  
[15]

#### QUESTION 4

4.1  $1/R = 1/r_1 + 1/r_2$  ✓

$$= 1/60 + 1/40 \text{ ✓}$$

$$R = 24 \Omega \text{ ✓}$$

LO2 AS23 (3)

4.2  $V = IR$  ✓

$$= 0,5 \times 24 \text{ ✓}$$

$$= 12 \text{ V ✓}$$

LO2 AS23 (3)

4.3  $R_z = V/I$

$$= 3/0,5 \text{ ✓}$$

$$= 6 \Omega \text{ ✓}$$

(2)

$$4.4 \quad \text{Emf} = I(R + r) \checkmark$$

$$18 = 0,5 \left( \boxed{24 + 6} + r \right) \checkmark$$

$$r = 6 \, \Omega \checkmark$$

OR

$$R_{\text{tot}} = V/I$$

$$= 18/0,5 \checkmark$$

$$= 36 \, \Omega$$

$$r = 36 - 24 - 6 \checkmark$$

$$= 6 \, \Omega \checkmark$$

$$\text{OR } \text{emf} = V_{\text{ext}} + V_{\text{int}}$$

$$18 = (12 + 3) + V_{\text{int}} \checkmark$$

$$V_{\text{int}} = 3 \, \text{V}$$

$$V_{\text{int}} = Ir \checkmark$$

$$3 \, \text{V} = 0,5 r$$

$$r = 6 \, \Omega \checkmark$$

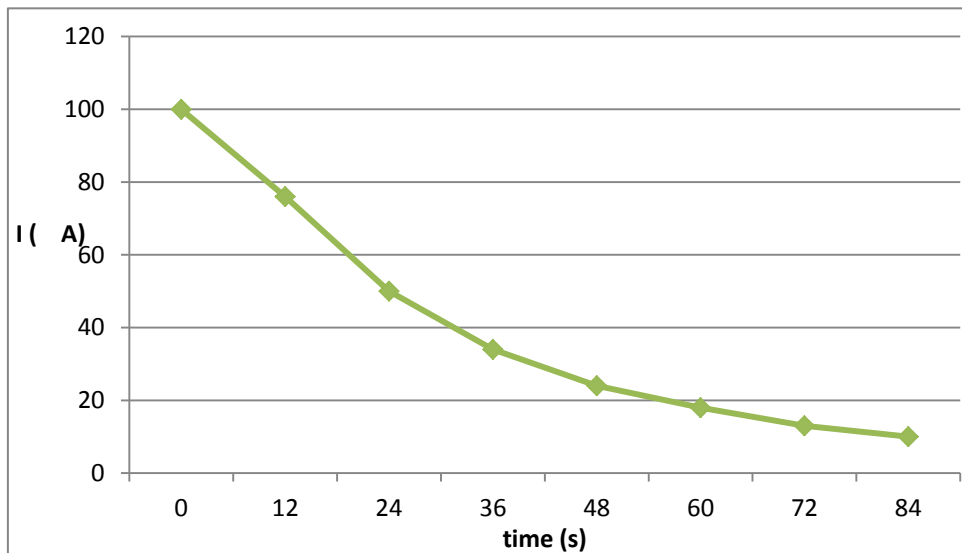
LO1 AS123 LU2 AS23 (3)

- 4.5 Increase;  $\checkmark$  total resistance increase, current decreases  $\checkmark$  therefore internal voltage decrease and the reading on the voltmeter increases.  $\checkmark$  LO2 AS23 (3)
- [14]**

**QUESTION 5**

- 5.1 A capacitor is a component that can be used in an electric circuit to store charge.  $\checkmark\checkmark$  LO2 AS123 (2)
- 5.2 What is the relationship between electric current and time when the capacitor is charging?  $\checkmark$  LO2 AS123 (1)
- 5.3 As time increases, the current decreases.  $\checkmark$  LO2 AS123 (1)

## 5.4 The graph of current versus time



One mark for the heading. ✓

One mark for both axes labelled. ✓

One mark for the shape of the graph. ✓

LO1 AS123 LO2 AS23 (3)

5.5 5.5.1

$$C = \frac{\epsilon_0 A}{d} \quad \checkmark$$

$$= \frac{8,85 \times 10^{-12} \times 0,04}{0,02} \quad \checkmark$$

$$= 1,77 \times 10^{-11} \text{ F} \quad \checkmark$$

LO2 AS23 LO1 AS123 (3)

5.5.2

$$C = Q/V \quad \checkmark$$

$$1,77 \times 10^{-11} = Q / 280 \quad \checkmark$$

$$Q = 4,956 \times 10^{-9} \text{ C} \quad \checkmark$$

LO2 AS23 LO1 AS123 (3)

5.5.3

A capacitor stores charge, the large amount of charge can discharge quickly ✓ and cause an electric shock to the body. ✓

LO3 AS12 LO1 AS123 (2)

**[15]**

**QUESTION 6**

6.1 Mutual induction ✓✓ LO2 AS123 (2)

6.2 6.2.1  $\frac{V_s}{V_p} = \frac{N_s}{N_p}$  ✓  
 $\frac{V_s}{120} = \frac{25}{330}$  ✓  
 $V_s = 9,09 \text{ V}$  ✓ LO2 AS123 (3)

6.2.2  $\frac{I_s}{I_p} = \frac{N_p}{N_s}$  ✓ OR  $V_s I_s = V_p I_p$  ✓  
 $\frac{I_s}{0,83} = \frac{330}{25}$  ✓  $9,09 I_s = 120 (0,83)$  ✓  
 $I_s = 10,96 \text{ A}$  ✓  $I_s = 10,96 \text{ A}$  ✓ LO2 AS123 (3)

6.2.3 Change the coils around: use the primary coil as the secondary coil  
 and the secondary coil as the primary coil. ✓✓ LO2 AS123 (2)  
**[10]**

**QUESTION 7**

- 7.1 One mark for the first three correct values. ✓  
 One mark for the last two correct values. ✓

m(kg)	a(m.s <sup>-2</sup> )	ma(N)
0,2	10	2
0,4	5	2
0,6	3,3	1,98
0,8	2,5	2
1	2	2

(2)

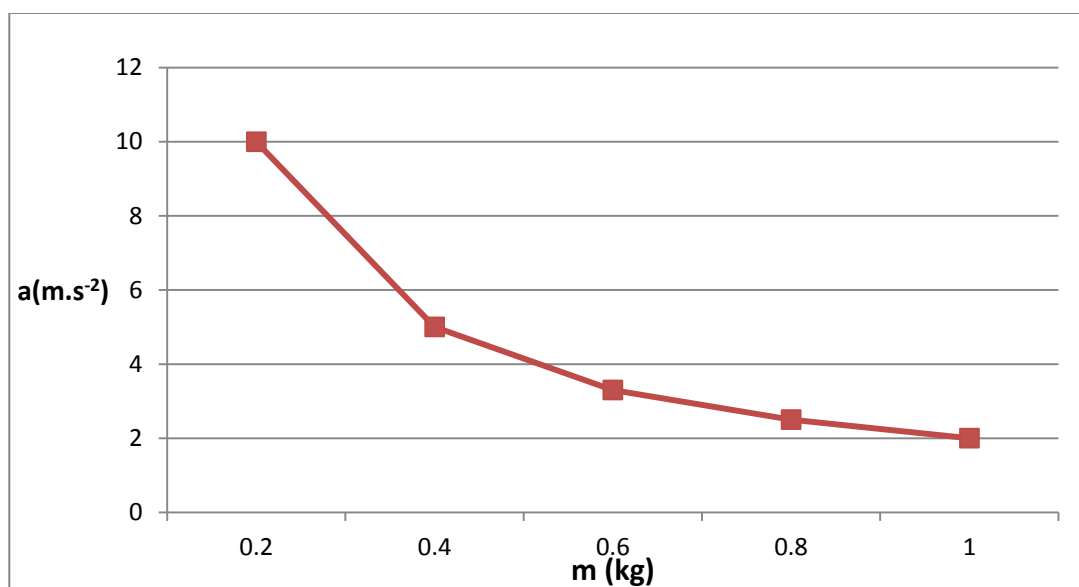
- 7.2 To compensate for friction. ✓

LO2 AS23 LO3 AS12 (1)

- 7.3 Net Force ✓

LO2AS23 (1)

- 7.4 The graph of acceleration versus mass



One mark for the heading

One mark for both axes

One mark for the shape of the graph

LO1AS123 LO2 AS23 (3)

- 7.5  $a \propto 1/m$  ✓✓

LO2 AS23 (2)

- 7.6 As the mass increases acceleration decreases ✓

LO2 AS13 (1)

- 7.7 Newton's second law of motion. ✓

LO2 AS13 (1)

**[11]**

**QUESTION 8**

8.1 8.1.1 Impulse is the product of net force and change in time. ✓✓ LO2 AS123 (2)

8.1.2  $F \Delta t = \Delta p$  ✓  
 $F \times 4 \times 10^{-3} = 0,14 (-58 - 38)$  OR  $F \times 4 \times 10^{-3} = 0,14 (58 - (-38))$  ✓  
 $F = 3\,360 \text{ N away from the bat}$  ✓ LU2 AS13 (3)

8.1.3 The baseball player should increase the time taken ✓ to stop the ball by moving his hands backwards as he catches the ball. ✓  
 LO2 AS123 LO3 AS123 (2)

8.2 8.2.1 In an isolated system the total linear momentum remains constant in both magnitude and direction. ✓✓ LO2 AS123 (2)

8.2.2 Total linear momentum before p collision = total linear p after collision} ✓  
 $m_1 v_{i1} + m_2 v_{i2} = (m_1 + m_2) v_f$   
 $(65 \times 10^3 \times 0,8) \checkmark + (92 \times 10^3 \times 1, 2) \checkmark = (65\,000 + 92\,000) v_f \checkmark$   
 $v_f = 1,03 \text{ m.s}^{-1} \text{ east}$  ✓ LO2 AS13 (5)

8.3 When a car suddenly decelerates the airbags inflate and the forward motion of the drivers is halted. ✓ The airbags immediately deflate to prevent the drivers from bouncing back and experiencing whiplash. ✓

OR

$$F = m \frac{\Delta V}{\Delta t} \quad m \text{ and } \Delta V \text{ constant, but } a = \frac{\Delta V}{\Delta t}$$

thus as t increase (time the driver take to come to rest with airbag), a decrease (driver's deceleration) and thus also F ( $F \propto a$ ). LO3 AS123 (2)  
**[16]**

**QUESTION 9**

9.1 Newton's law of universal gravitation states that every particle in the universe exerts a gravitational force of attraction on every other particle which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them. ✓✓ LO1 AS123 LO2 AS123 (2)

9.2  $F = \frac{G m_1 m_2}{r^2}$  ✓  
 $= \frac{6,67 \times 10^{-11} \times 0,0015 \times 870 \times 10^{-3}}{(10)^2}$  ✓  
 $= 8,70 \times 10^{-16} \text{ N}$  ✓ LO2 AS123 LO1 AS123 (4)



- 9.3 Mass (in kg) is an intrinsic property of matter and does not change as an object is moved from one location to another ✓ while weight (in N) is a gravitational force acting on the object and can vary depending on how far the object is above the surface of earth or whether the object is located near another body such as moon. ✓

LO3 AS123

(2)

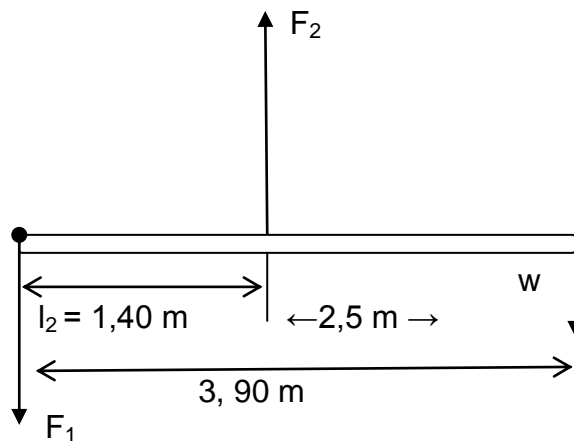
**[8]****QUESTION 10**

- 10.1 The principle of moments states that: for any object that is in equilibrium, the sum of clockwise moments about any point equals the sum of anticlockwise moments about that point. OR The net moments of all forces acting on an object in equilibrium is zero. ✓✓

LO1 AS123 LO2 AS123

(2)

- 10.2 Force diagram

One mark for  $F_1$  = force of boltOne mark for  $F_2$  = force of supportOne mark for  $W$  = weight of the woman

LO2 AS123 LO1 AS123

(3)

## 10.4 Fulcrum on the LHS (at the bolt)

$$\sum \tau_{\text{clockwise}} = \sum \tau_{\text{anticlockwise}} \checkmark$$

$$\begin{aligned} F_{\text{support}} \perp r &= W_{\text{woman}} \perp r \checkmark \\ F_{\text{support}} (1,4) &= 530(3,9) \checkmark \\ F_{\text{support}} &= 1\,476,43 \text{ N} \\ &= 1\,476,43 \text{ N up } \checkmark \end{aligned}$$

OR

$$\begin{aligned} \sum \tau &= 0 \checkmark \\ F_{\text{bolt}} \perp r + F_{\text{support}} \perp r + W_{\text{woman}} \perp r &= 0 \checkmark \\ F_{\text{bolt}} (0) + F_{\text{support}} (1,4) + 530(3,9) \checkmark &= 0 \checkmark \\ F_{\text{support}} &= -1\,476,43 \text{ N} \\ &= 1\,476,43 \text{ N up } \checkmark \end{aligned}$$

Substitute  $F_{\text{support}} = 1\,476,43 \text{ N}$  in  $\sum F = 0$ 

$$\begin{aligned} \sum F &= 0 \checkmark \\ F_{\text{bolt}} + F_{\text{support}} + W_{\text{woman}} &= 0 \\ F_{\text{bolt}} - 1\,476,43 + 530 &= 0 \checkmark \\ F_{\text{bolt}} &= 946,43 \text{ N } \checkmark \text{ down} \end{aligned}$$

OR

For fulcrum in the middle:

Take clockwise as negative

$$\begin{aligned} \sum \tau_{\text{clockwise}} &= \sum \tau_{\text{anticlockwise}} \\ F_{\text{bolt}} (1,4) &= 530 (2,5) \\ F_{\text{bolt}} &= 946,43 \text{ N down} \end{aligned}$$

OR

$$\begin{aligned} \sum \tau &= 0 \checkmark \\ F_{\text{bolt}} \perp r + F_{\text{support}} \perp r + W_{\text{woman}} \perp r &= 0 \checkmark \\ F_{\text{bolt}} (1,4) + F_{\text{support}}(0) + 530(2,5) &= 0 \checkmark \\ F_{\text{bolt}} (1,4) &= 1\,325 \text{ N.m anticlockwise} \\ F_{\text{bolt}} &= 946,43 \text{ N down } \checkmark \end{aligned}$$

Take down as positive

$$\begin{aligned} \sum F &= 0 \checkmark \\ 946,43 + F_{\text{support}} + 530 &= 0 \checkmark \\ F_{\text{support}} &= -1\,476,43 \text{ N} \\ &= 1\,476,43 \text{ N up } \checkmark \end{aligned}$$

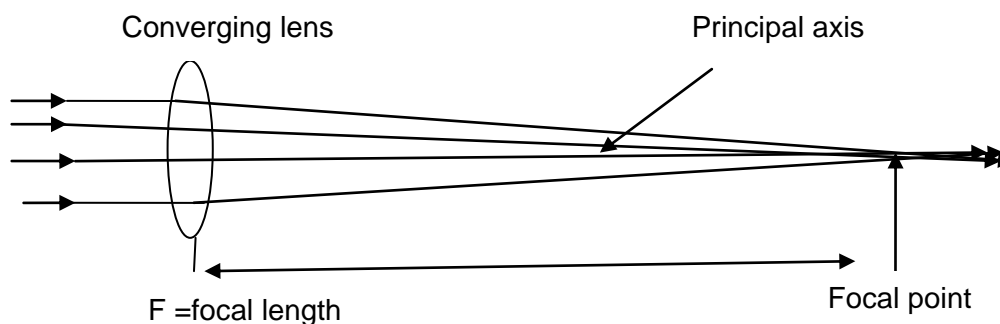
LO2 AS12 (7)  
[12]

**QUESTION 11**

- 11.1 Longitudinal wave ✓ LO2 AS3 (1)
- 11.2 Elephant ✓ LO1 AS123 (1)
- 11.3 11.3.1 stringed instrument ✓ LO1 AS123 (1)
- 11.3.2 Exposure to loud music (noise) can damage the eardrum/inner ear. ✓ LO1 AS123 LO2 AS123 (1)
- 11.3.3  $f = 1/T$  ✓  
 $f = 1/0,005$   
 $= 200 \text{ Hz}$  ✓  
 $V = f \times \lambda$  ✓  
 $343 = 200 \times \lambda$  ✓  
 $\lambda = 1,72 \text{ m (accept 1,715 m)}$  ✓ LO1 AS123 LO2 AS1 (5)
- [9]**

**QUESTION 12**

- 12.1 A lens is a transparent substance (usually made up of glass, plastic or Perspex) with at least one curved surface. ✓✓ LO2 AS23 (2)
- 12.2 Converging lens ✓ LO2 AS23 (1)
- 12.3 To start the fire in quickest possible time, position the converging lens so that the paper is at the focal point of the lens where the greatest concentration of the sun's rays occurs. ✓✓ LO2 AS123 LO1 AS123 (2)
- 12.4 Diagram for converging lens  
One mark for light rays with direction ✓  
One mark for light rays converging on the focal point ✓



(2)  
[7]

**QUESTION 13**

- 13.1 A p-type semiconductor ✓ is joined to an n-type semiconductor to form a pn-junction diode. ✓ LO1 AS123 LO2 AS23 (2)
- n-type semiconductor ✓ where germanium is doped with arsenic which provides an extra electron. ✓ LO1 AS123 LO2 AS23 (2)
- 13.2 13.2.1 Amplifier ✓ LO1 AS123 LO2 AS123 (1)
- 13.2.2 Reverse biased diode ✓ LO1 AS123 LO2 AS23 (1)
- 13.2.3 Diode ✓ LO1 AS123 (1)
- 13.2.4 Light emitting diode ✓ LO1 AS123 (1)

[8]

**TOTAL SECTION B: 125**

**GRAND TOTAL: 150**