

**Question 1**

1.1 Gravitational force

1.2 Resultant/net

1.3 Elastic

1.4 Doppler effect

1.5 ohm

**Question 2**

2.1 D

2.2 A

2.3 B

2.4 C

2.5 C

2.6 C

2.7 B

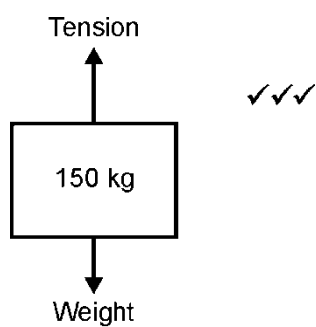
2.8 B

2.9 D

2.10 D

**Question 3**

3.1



3.2 Apply Newton's second law of motion to the 150 kg block:

$$F = ma \checkmark$$

$$T + F_{\text{attraction to Earth}} = ma \checkmark$$

$$T - (150 \times 9,8) = 150 \times 2 \checkmark \checkmark$$

$$\therefore T = 1\,770 \text{ N upwards } \checkmark$$

3.3 The inertia of the block resists any change to its state of motion – Newton's first law of motion.  $\checkmark \checkmark$

#### Question 4

$$F_x = F \cdot \cos \theta \checkmark$$

$$= 450 \cdot \cos 30 \checkmark$$

$$= 389.71 \text{ N}$$

$$F_{\text{net}} = F_x - F_f \checkmark$$

$$m \cdot a \checkmark = 389.71 - 140$$

$$300 \cdot (a) = 389.71 - 140$$

$$a = 0,83 \text{ m} \cdot \text{s}^{-2} \quad \checkmark$$

#### Question 5

$$5.1 \quad v_f^2 = v_i^2 + 2a \Delta x \checkmark$$

$$= 50^2 + 2(-5) \checkmark$$

$$= 250 \text{ m} \checkmark$$

Thus  $250 \text{ m} < 275 \text{ m}$

Thus the aeroplane stops in time

6.1 From 10 s to 25 s ✓

6.2 Displacement =  $\frac{1}{2}b \cdot h + l \cdot b + \frac{1}{2}b \cdot h - \frac{1}{2}b \cdot h$  ✓

$$= 0,5(10)(10) + 15(10) + 0,5(10)(10) \checkmark - 0,5(5)(5) \checkmark$$

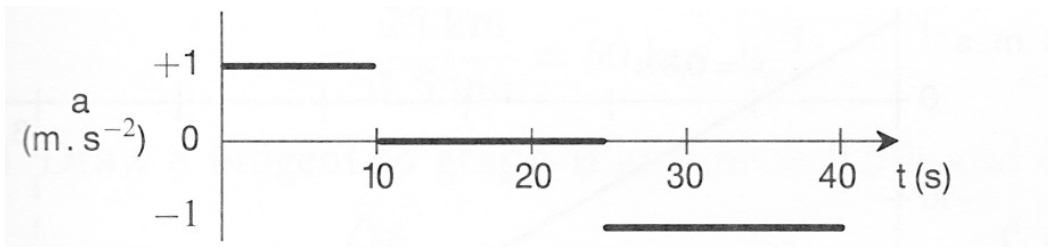
$$= 237,5 \text{ m} \checkmark$$

6.3

$$a = \Delta v / \Delta x$$

$$\text{gradient} = \frac{(-5 - 10) \text{ m} \cdot \text{s}^{-1}}{15 \text{ s}} = -1 \text{ m} \cdot \text{s}^{-2}$$

6.4



Question 7

7.1 Arrestor beds cause the stopping time to increase ✓, thus the force on the truck decreases ✓

$$(f \propto 1/\Delta t) \checkmark$$

Question 8

8.1 The total (linear) momentum remains constant is conserved / does not change. ✓

in an isolated / a closed system / the absence of external forces. ✓

(2)

8.2 **Option 1:**

To the right as positive:

$$\Sigma p_{\text{before}} = \Sigma p_{\text{after}} \checkmark$$

$$(1\ 000)(40) \checkmark + (5\ 000)(-20) \checkmark = (1\ 000 + 5\ 000)v_f \checkmark$$

$$\therefore v_{f2} = -10 \text{ m} \cdot \text{s}^{-1} \checkmark$$

$$\therefore v_{f2} = 10 \text{ m} \cdot \text{s}^{-1} \text{ left} \checkmark \text{ OR west}$$

(6)

## Option 2

To the left as positive:

$$\Sigma p_{\text{before}} = \Sigma p_{\text{after}} \checkmark$$

$$(1\,000)(-40) \checkmark + (5\,000)(20) \checkmark = (1\,000 + 5\,000)v_{f2} \checkmark$$

$$\therefore v_{f2} = 10 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ left} \checkmark \text{ OR west}$$

8.3

### Option 1:

Force on car:

To the right as positive  $F_{\text{net}}\Delta t = \Delta p \checkmark = mv_f - mv_i$

$$F_{\text{net}}(0,5) \checkmark = \underline{1\,000(-10 - 40)} \checkmark$$

$$\therefore F_{\text{net}} = -1 \times 10^5 \text{ N} \checkmark \text{ OR/OF}$$

$$\therefore F_{\text{net}} = 1 \times 10^5 \text{ N} \text{ (100 000 N)}$$

$$\therefore F_{\text{net}} > 85\,000 \text{ N}$$

Yes collision is fatal  $\checkmark$

Force on car:

To the left as positive

$$F_{\text{net}}\Delta t = \Delta p \checkmark = mv_f - mv_i$$

$$F_{\text{net}}(0,5) \checkmark = \underline{1\,000(10 - (-40))} \checkmark$$

$$\therefore F_{\text{net}} = 1 \times 10^5 \text{ N} \checkmark \text{ (100 000 N)}$$

$$\therefore F_{\text{net}} > 85\,000 \text{ N}$$

Yes collision is fatal  $\checkmark$

### **Question 9**

9.1 (Take to the right as positive)

$$\begin{aligned} \Delta p &= m(v - u) \\ &= 0,75 \text{ kg} \cdot [25 - (-10)] \\ &= 26,25 \text{ kg}\cdot\text{m}\cdot\text{s}^{-1} \text{ to the right} \end{aligned}$$

9.2 Impulse =  $\Delta p = 26.25 \text{ N}\cdot\text{s}$  to the right

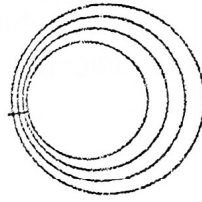
$$\begin{aligned} 9.3 \quad F &= \frac{\Delta p}{\Delta t} \\ &= \frac{26,25}{0,075} \\ &= 350 \text{ N to the right} \end{aligned}$$

9.4 Equal

9.5 The net force applied to an object, is equal to the rate of change in momentum.

### Question 10

10.1 towards ✓ (1)



10.2 When the source is moving towards the listener there will be more waves per second ✓ with shorter wavelengths ✓ between the source and the listener than when the source is stationary ✓ resulting in an increased frequency being perceived. ✓ (4)

10.3 
$$f_L = \left( \frac{v \pm v_L}{v \pm v_s} \right) f_s \checkmark$$

$$372,44 \checkmark = \left( \frac{340 \pm 0}{340 - v_s} \right) 349,62 \checkmark$$

$$v_s = 19,83 \text{ m}\cdot\text{s}^{-1} \checkmark$$

$$\text{speed limit} = 60\,000 \div 3600 = 16,67 \text{ m}\cdot\text{s}^{-1} \checkmark$$

The taxi exceeds the speed limit. ✓ (6)  
(11)

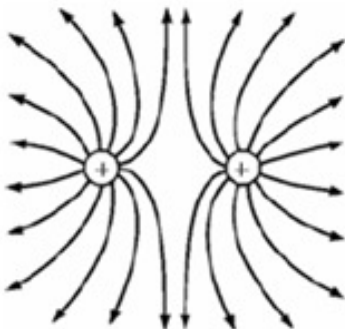
### Question 11

11.1 The (electrostatic) force experienced at a point ✓ per unit charge at that point. ✓  
Die elektrostatiese krag ondervind by 'n punt ✓ per eenheidslading by daardie punt. ✓

**OR/OF**

The (electrostatic) force experienced ✓ by a charge placed at that point divided by the charge itself. ✓  
Die (elektrostatiese) krag ondervind ✓ deur 'n lading geplaas by daardie punt gedeel deur die lading self. ✓ (2)

11.2



Criteria for sketch/Kriteria vir skets	Marks/Punte
Correct shape as shown. Korrekte vorm soos getoon	✓
Direction from positive to negative. Rigting van positief na negatief.	✓
Field lines start on spheres and do not cross. Veldlyne begin op elke sfeer en kruis nie.	✓

(3)

11.3

$$E_p = \frac{kQ}{r^2} \checkmark$$

$$= \frac{(9 \times 10^9)(5 \times 10^{-9})}{(30 \times 10^{-3})^2} \checkmark$$

$$= 5 \times 10^4 \text{ N}\cdot\text{C}^{-1} \text{ to the right/na regs}$$

$$E_Q = \frac{kQ}{r^2}$$

$$= \frac{(9 \times 10^9)(5 \times 10^{-9})}{(10 \times 10^{-3})^2} \checkmark$$

$$= 4,5 \times 10^5 \text{ N}\cdot\text{C}^{-1} \text{ to the right/na regs}$$

$$E_{\text{net}} = 5 \times 10^4 + 4,5 \times 10^5$$

$$= 5 \times 10^5 \text{ N}\cdot\text{C}^{-1} \text{ to the right/na regs} \checkmark$$

(6)

11.4 POSITIVE MARKING FROM QUESTION 8.3 TO QUESTION 8.4/  
POSITIEWE NASIEN VAN VRAAG 8.3 NA VRAAG 8.4

$$E = \frac{F}{q} \checkmark$$

$$5 \times 10^5 = \frac{F}{1,6 \times 10^{-19}} \checkmark$$

$$F = 8 \times 10^{-14} \text{ N} \checkmark$$

(3)  
[14]

Question 12

12.1 Discharges very fast  $\checkmark$  when touched and can cause electric shock (that can be fatal)  $\checkmark$

*Ontlaai baie vinnig wanneer aangeraak word en kan 'n (dodelike) elektriese skok tot gevolg hê*

[12.3.2] (2)

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

$$= \frac{(8,85 \times 10^{-12})(2 \times 10^{-4})}{(0,03 \times 10^{-3})} \checkmark$$

$$\therefore C = 5,9 \times 10^{-11} \text{ F} \checkmark$$

[12.2.3] (4)

12.2.2  $C = \frac{Q}{V} \checkmark$

$$\therefore Q = 5,9 \times 10^{-11} \times 6 \checkmark$$

$$\therefore Q = 3,54 \times 10^{-10} \text{ C} \checkmark$$

[12.2.3] (3)

12.3.1 Increases/*Toeneem*  $\checkmark$

[12.2.2] (1)

12.3.2 Decreases/*Afneem*  $\checkmark$

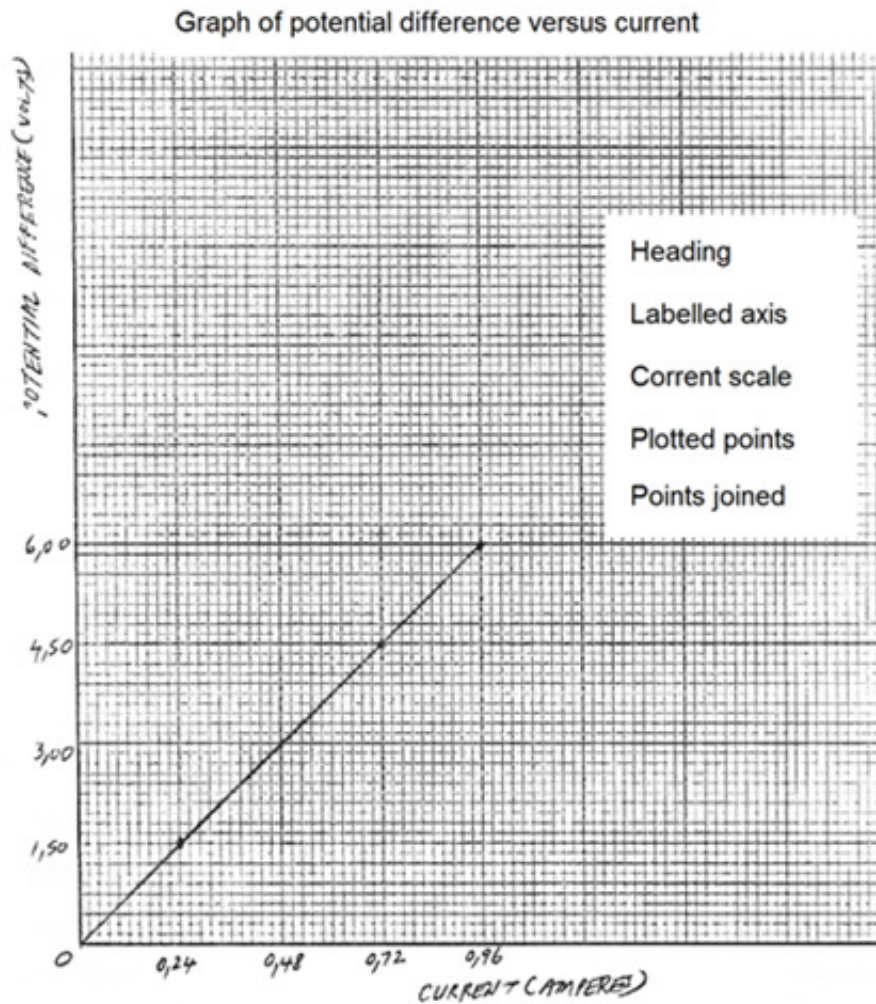
[12.2.2] (1)

[11]

Question 13

13.1 What is the relationship between current through the conducting wire and the potential difference across its ends. (2)

13.2



(5)

13.3 directly proportional ✓  
graph is a straight line ✓ (2)

13.4 resistance ✓ (1)

(10)

### Question 14

$$14.1 \quad \frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} \checkmark = \frac{1}{4} + \frac{1}{16} \checkmark$$

$$\therefore R = 3,2 \Omega$$

$$R_{\text{effective/effektief}} = 3,2 \Omega + 2 \Omega + 0,8 \Omega \checkmark \\ = 6 \Omega \checkmark$$

(4)

14.2

<p><b>Option 1/Opsie 1:</b>  <math>V = IR \checkmark</math>  <math>12 = I(6) \checkmark</math>  <math>I = 2 \text{ A} \checkmark</math></p>	<p><b>Option 2/Opsie 2:</b>  <math>\text{emf} = I(R + r) \checkmark</math>  <math>12 = I(5,2 + 0,8) \checkmark</math>  <math>I = 2 \text{ A} \checkmark</math></p>
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(3)

14.3

<p><b>Option 1/Opsie 1:</b>  <math>V_{\text{parallel}} = IR \checkmark</math>  <math>= (2)(3,2) \checkmark</math>  <math>= 6,4 \text{ V}</math>  <math>V_{8\Omega} = \frac{6,4}{2} \checkmark = 3,2 \text{ V} \checkmark</math></p>	<p><b>Option 2/Opsie 2:</b>  <math>V_p = \frac{R_p}{R} \times V \checkmark</math>  <math>= \frac{3,2}{6} \checkmark \times 12 \checkmark = 6,4 \text{ V}</math>  <math>\therefore V_{8\Omega} = 3,2 \text{ V} \checkmark</math></p>
<p><b>Option 3/Opsie 3:</b>  <math>I_{8\Omega} = \frac{4}{20} (2) \checkmark</math>  <math>= 0,4 \text{ A}</math>  <math>V_{8\Omega} = IR \checkmark</math>  <math>= (0,4)(8) \checkmark</math>  <math>= 3,2 \text{ V} \checkmark</math></p>	<p><b>Option 4/Opsie 4:</b>  <math>\text{emf} = I(R + r) \checkmark</math>  <math>12 = IR_{2\Omega} + V_p + Ir</math>  <math>12 = (2)(2) + V_p + (2)(0,8) \checkmark</math>  <math>V_p = 6,4 \text{ V}</math>  <math>V_{8\Omega} = \frac{6,4}{2} \checkmark = 3,2 \text{ V} \checkmark</math></p>

(4)

### Question 15

- 15.1 Amount of charge that passes a cross-section of a conductor per unit time.  $\checkmark \checkmark$   
*Aantal lading wat deur die deursnit van 'n geleier per eenheid tyd beweeg*

Only/Slegs  $\frac{2}{2}$  or/of  $\frac{0}{2}$

**OR/OF**

Rate of flow of charge/*Tempo van vloei van lading*

[12.2.1] (2)

- 15.2  $q = I \Delta t \checkmark$   
 $20 = I(1,1 \times 10^{-4}) \checkmark$   
 $\therefore I = 1,82 \times 10^5 \text{ A} \checkmark$

[12.2.3] (3)

- 15.3  $W = VQ \checkmark$   
 $= (1,2 \times 10^8)(20) \checkmark$   
 $= 2,4 \times 10^9 \text{ J} \checkmark$

[12.2.3] (3)

- 15.4.1 Lightning tends to strike the highest points  $\checkmark$   
*Weerlig is ge neig om die hoogste punte te tref*

[12.3.1] (2)