



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE  
NASIONALE  
SENIOR SERTIFIKAAT**

**GRADE/GRAAD 12**

**PHYSICAL SCIENCES: PHYSICS (P1)  
FISIESE WETENSKAPPE: FISIKA (V1)**

**FEBRUARY/MARCH 2015  
FEBRUARIE/MAART 2015**

**MEMORANDUM**

**MARKS/PUNTE: 150**

**This memorandum consists of 17 pages.  
Hierdie memorandum bestaan uit 17 bladsye.**

**QUESTION 1/VRAAG 1**

- |      |      |             |
|------|------|-------------|
| 1.1  | A ✓✓ | (2)         |
| 1.2  | C ✓✓ | (2)         |
| 1.3  | D ✓✓ | (2)         |
| 1.4  | B ✓✓ | (2)         |
| 1.5  | D ✓✓ | (2)         |
| 1.6  | A ✓✓ | (2)         |
| 1.7  | A ✓✓ | (2)         |
| 1.8  | C ✓✓ | (2)         |
| 1.9  | A ✓✓ | (2)         |
| 1.10 | B ✓✓ | (2)         |
|      |      | <b>[20]</b> |

**QUESTION 2/VRAAG 2**

2.1 When one body exerts a force on a second body, the second body exerts a force of equal magnitude in the opposite direction on the first body.  
*Wanneer een liggaam 'n krag op 'n tweede liggaam uitoefen, oefen die tweede liggaam 'n krag van gelyke grootte in die teenoorgestelde rigting op die eerste liggaam.*

**OR/OF:**

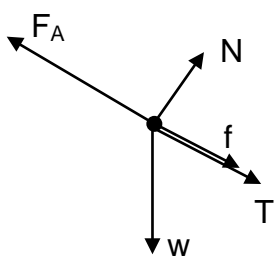
When body A exerts a force on body B, body B will exert a force of equal magnitude but opposite in direction on body A.  
*Indien liggaam A 'n krag uitoefen op liggaam B, sal B 'n krag van gelyke grootte maar teenoorgesteld in rigting op liggaam A uitoefen.*

**ACCEPT/AANVAAR (for 1 mark only/vir slegs 1 punt)**

Action and reaction are equal and opposite.  
*Aksie en reaksie is gelyk en teenoorgesteld*

(2)

2.2



<p><b>Accept/Aanvaar</b> Force diagram <i>Kragtediagram</i></p>	<p><b>Notes/Aantekeninge</b> Do not penalise for length of arrows <i>Moenie vir die lengte van die pyltjies penaliseer nie</i> If <math>w</math> is not shown but <math>F_{\parallel}</math> and <math>F_{\perp}</math> are shown give 1 mark for both. <i>Indien <math>w</math> nie aangetoon is nie maar <math>F_{\parallel}</math> en <math>F_{\perp}</math> is getoon, ken 1 punt toe vir beide.</i></p>
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Accept the following symbols/Aanvaar die volgende simbole.	
N	$F_N$ ; Normal;/Normaal ✓
$F_A$	40 N ✓
f	$F_f, f_k$ ✓
w	$F_G$ Weight/Gewig; Gravitational force/Gravitasiekrag ✓
T	Tension/Spansing; $F_T$ ; ✓

(5)

2.3.1 **OPTION 1/OPSIE 1**

For the 1 kg block/Vir die 1 kg blok;

$$f_k = \mu_k N$$

$$= \mu_k mg \cos \theta \checkmark$$

$$= 0,29 (1 \times 9,8 \cos 30^\circ) \checkmark$$

$$= 2,46 \text{ N} \checkmark$$

**OPTION 2/OPSIE 2**

BY PROPORTION:/DEUR EWEREDIGHEID

The smaller mass =  $\frac{1}{4}$  of the larger mass  $\checkmark$

Die kleiner massa =  $\frac{1}{4}$  die groter massa

$$\therefore \text{frictional force/wrywingskrag} = \frac{1}{4} (10) \checkmark$$

$$= 2,5 \text{ N} \checkmark$$

(3)

2.3.2 **POSITIVE MARKING FROM QUESTION 2.2**  
**POSITIEWE NASIEN VANAF VRAAG 2.2**

**OPTION 1/OPSIE 1**

$$F_{\text{net}} = ma \checkmark$$

For 1 kg block/Vir 1 kg blok

$$F_A - \{(T + f_k) + mg \sin \theta\} = ma$$

$$40 - \{T + 2,46 + 1(9,8)(\sin 30^\circ)\} \checkmark = (1 \times) a \checkmark$$

$$40 - T - 7,36 = a$$

$$32,64 - T = a \dots \dots (1)$$

For 4 kg block/Vir 4 kg blok

$$T - (mg \sin \theta + f_k) = 4a$$

$$T - (4 \times 9,8 \sin 30^\circ + 10) = 4a \checkmark$$

$$T - 29,6 = 4a \dots \dots (2)$$

From (1) and (2)/Vanaf (1) en (2)

$$a = 0,61 \text{ m} \cdot \text{s}^{-2}$$

$$T = 29,6 + (4(0,61)) \checkmark$$

$$T = 32,04 \text{ N} \checkmark$$

**OPTION 2/OPSIE 2**

Consider the blocks as a single system.

Beskou die blokke as 'n enkele sisteem.

$$F_A - [(f_{\text{tot}}) - \{(4+1) g \sin 30^\circ\}] = (4+1)a$$

$$40 - (10 - 2,46) - (5(9,8) \sin 30^\circ) \checkmark = 5a \checkmark$$

$$\therefore a = 0,61 \text{ m} \cdot \text{s}^{-2}$$

For 1 kg block/Vir 1 kg blok

$$F_{\text{net}} = ma \checkmark$$

$$F_A - \{(T + f_k) + mg \sin \theta\} = ma$$

$$40 - \{T + 2,46 + 1(9,8)(\sin 30^\circ)\} = (1 \times) a \checkmark$$

$$40 - T - 7,36 = a$$

$$32,64 - T = 0,61 \checkmark$$

$$T = 32,04 \text{ N} \checkmark$$

**Notes/Aantekeninge**

Learners need not show how (1) and (2) were combined  
*Leerdere hoef nie aan te toon hoe (1) en (2) gekombineer is nie.*

The first correct substitution for equation (1) should carry 2 marks.

The second substitution must carry 1 mark.

*Die eerste korrekte vervanging vir vergelyking (1) moet 2 punte tel.*

*Die tweede vervanging tel 1 punt.*

**OR/OF**

For 4 kg block/Vir 4 kg blok

F<sub>net</sub> - ma

$$T - (mg \sin\theta + f_k) = 4a$$

$$T - (4 \times 9,8 \sin 30^\circ + 10) = 4a \checkmark$$

$$T - 29,6 = 4a$$

$$T = 29,6 + (4)(0,61) \checkmark$$

$$= 32,04 \text{ N} \checkmark$$

(6)  
**[16]**

**QUESTION 3/VRAAG 3**

3.1 Free fall/Vrye val

**ACCEPT/AANVAAR**

Vertically accelerated motion/projectile motion.

Vertikale versnelde beweging /projektielbeweging

(1)

3.2.1 **Downward motion as positive**  
**Afwaartse beweging as positief**

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$30 \checkmark = v_i (1,5) + \frac{1}{2} (9,8)(1,5)^2 \checkmark$$

$$v_i = 12,65 \text{ m} \cdot \text{s}^{-1} \checkmark$$

**Upward motion as positive**  
**Opwaartse beweging as positief**

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$-30 \checkmark = v_i (1,5) + \frac{1}{2} (-9,8)(1,5)^2 \checkmark$$

$$v_i = 12,65 \text{ m} \cdot \text{s}^{-1} \checkmark$$

**Notes / Aantekeninge**

Accept/Aanvaar

g or/of a

$$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$s = ut + \frac{1}{2} at^2$$

(4)

3.2.2 **OPTION 1/OPSIE 1**  
**Positive marking from QUESTION 3.2.1**  
**Positiewe nasien vanaf VRAAG 3.2.1**

**Downward motion as positive**  
**Afwaartse beweging as positief**

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$12,65^2 \checkmark = 0 + 2(9,8) \Delta y \checkmark$$

$$\Delta y = 8,16 \text{ m} \checkmark$$

Height/Hoogte **XC = XB + BC**

$$(30 + 8,16) = 38,16 \text{ m}$$

Height is/Hoogte is 38,16 m  $\checkmark$

**Notes / Aantekeninge**

For/Vir **XB**

Accept/Aanvaar

g or/of a

$$v^2 = u^2 + 2as$$

The height must be written down in order to score the final mark.

Die hoogte moet neergeskryf word om die finale punt te kry.

**Upward motion as positive**  
**Opwaartse beweging as positief**

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$(-12,65)^2 \checkmark = 0 + 2(-9,8) \Delta y \checkmark$$

$$\Delta y = -8,16 \text{ m} \checkmark$$

Height/Hoogte **XC = XB + BC**

$$(-30) + (-8,16) = -38,16 \text{ m}$$

Height is /Hoogte is 38,16 m)  $\checkmark$

(5)

**OPTION / OPSIE 2**

**Positive marking from QUESTION 3.2.1**

**Positiewe nasien vanaf VRAAG 3.2.1**

**Downward motion as positive**

**Afwaartse beweging as positief**

$$v_B = v_X + a\Delta t \checkmark$$

$$12,65 = 0 + 9,8\Delta t \checkmark$$

$$\Delta t = 1,29 \text{ s}$$

$$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2 \checkmark$$

$$= 0 + \frac{1}{2} (9,8)(1,29)^2 \checkmark$$

$$\Delta y = 8,15 \text{ m}$$

Height/Hoogte **XC = XB + BC**

$$(30 + 8,15) = 38,15 \text{ m} \checkmark$$

**Upward motion as positive**

**Opwaartse beweging as positief**

$$v_B = v_X + a\Delta t \checkmark$$

$$-12,65 = 0 + (-)9,8\Delta t \checkmark$$

$$\Delta t = 1,29 \text{ s}$$

$$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2 \checkmark$$

$$= 0 + \frac{1}{2} (-9,8)(1,29)^2 \checkmark$$

$$\Delta y = -8,15 \text{ m}$$

Height/Hoogte **XC = XB + BC**

$$(-30) + (-8,15) = 38,15 \text{ m} \checkmark$$

**Notes / Aantekeninge**

**Start with time for XB**

**Begin met tyd vir XB**

Accept/Aanvaar

g or/of a

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2} at^2$$

(5)

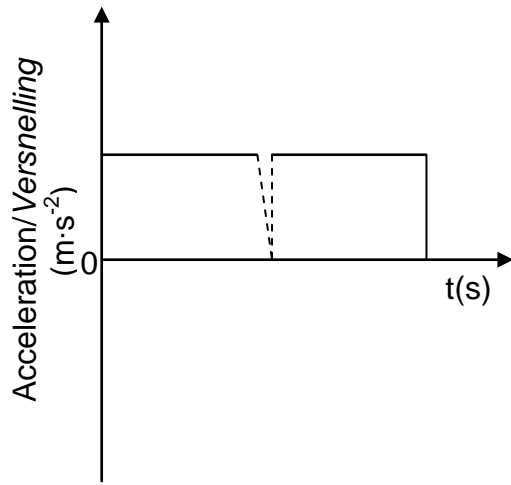
<p><b>OPTION 3/OPSIE 3</b>  <b>Positive marking from QUESTION 3.2.1</b>  <b>Positiewe nasien vanaf VRAAG 3.2.1</b></p> <p><b>Downward motion as positive</b>  <b>Afwaartse beweging as positief</b></p> $v_C = v_B + a\Delta t \checkmark$ $= \underline{12,65 + 9,8 (1,5)} \checkmark$ $= 27,35 \text{ m}\cdot\text{s}^{-1}$ $v_C^2 = v_x^2 + 2a\Delta y \checkmark$ $\underline{(27,35)^2 = 0 + 2(9,8) \Delta y} \checkmark$ $\therefore \Delta y = 38,16 \text{ m}$ <p>Height is /Hoogte is 38,16 m ✓</p> <p><b>Upward motion as positive</b>  <b>Opwaartse beweging as positief</b></p> $v_C = v_B + a\Delta t \checkmark$ $= \underline{-12,65 + (-9,8) (1,5)} \checkmark$ $= -27,35 \text{ m}\cdot\text{s}^{-1}$ $v_C^2 = v_x^2 + 2a\Delta y \checkmark$ $\underline{(-27,35)^2 = 0 + 2(-9,8) \Delta y} \checkmark$ $\therefore \Delta y = -38,16 \text{ m}$ <p>Height/Hoogte = 38,16m ✓</p>	<p><b>Notes / Aantekeninge</b>                  start with velocity at C                  Accept/Aanvaar                  g or/of a  <math>v = u+at</math>  <math>v^2 = u^2 + 2as</math></p> <p>The height must be written down in order to score the final mark.  <i>Die hoogte moet neergeskryf word om die finale punt te kry.</i></p>
<p><b>OPTION 4/OPSIE 4</b>  <b>Positive marking from QUESTION 3.2.1</b>  <b>Positiewe nasien vanaf VRAAG 3.2.1</b></p> $\Delta U + \Delta K = 0 \checkmark$ $(mgh + 0) \checkmark = 0 + (\frac{1}{2} m(12,65)^2) \checkmark$ $h = 8,16 \text{ m} \checkmark$ $XC = h + 30$ $= (30 + 8,16)$ $= 38,16 \text{ m} \checkmark$	<p><b>Notes / Aantekeninge</b>                  Accept/Aanvaar  <math>mgh_i + \frac{1}{2} mv_i^2 = mgh_f + \frac{1}{2} mv_f^2</math></p> <p>Take point B as the zero position and <math>XH = h</math>  <i>Neem punt B is nul posisie en <math>XH = h</math></i></p>

(5)

(5)

3.3

**OPTION 1/OPSIE 1**

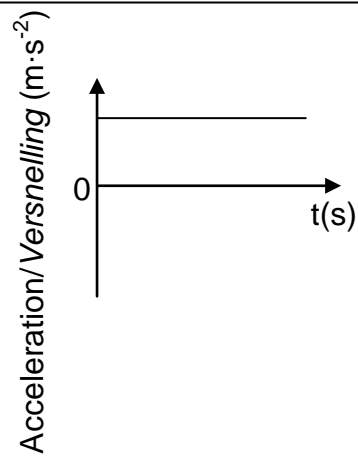


**Notes / Aantekeninge**

Criteria/Kriteria	Mark/Punt
For <b>each</b> line correctly drawn as shown Vir <b>elke</b> lyn korrek geteken soos getoon	✓✓
Both axes correctly labelled Beide asse korrek benoem	✓

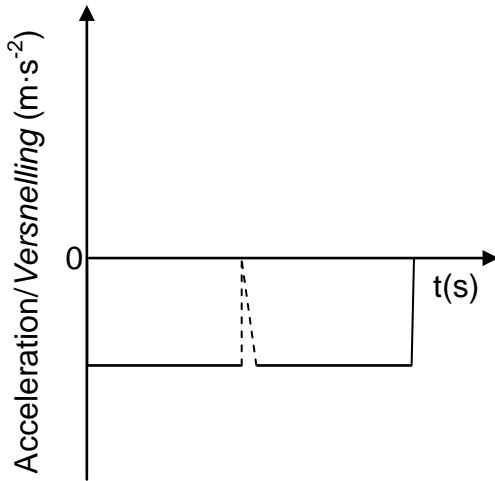
**Accept/Aanvaar**

Only 2 marks for this answer/Slegs 2 punte vir hierdie antwoord





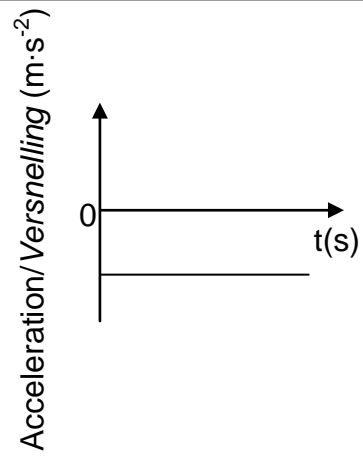
**OPTION 2/OPSIE 2**



**Notes / Aantekeninge**

Criteria/Kriteria	Mark/Punt
For <b>each</b> line correctly drawn as shown <i>Vir elke lyn korrek geteken soos getoon</i>	✓✓
Both axes correctly labelled <i>Beide asse korrek benoem</i>	✓

Only 2 marks for this answer/Slegs 2 punte vir hierdie antwoord



(3)  
[13]

**QUESTION 4/VRAAG 4**

<p>4.1</p> $W_{\text{net}} = \Delta K$ $W_{\text{net}} = \frac{1}{2} (M + m)(v_f^2 - v_i^2)$ $W_{\text{fr}} = f\Delta x \cos\theta \checkmark = \frac{1}{2} (M + m)(v_f^2 - v_i^2)$ $\frac{10 \times 2 \cos 180^\circ \checkmark = \frac{1}{2} (7,02)(0 - v_i^2) \checkmark}{v_{\text{bb}} = 2,39 \text{ m}\cdot\text{s}^{-1} \checkmark \quad (2,387) \text{ m}\cdot\text{s}^{-1}}$	<p><b>Notes / Aantekeninge</b> 1 mark for either of the formulae indicated 1 punt vir enige van die formule aangedui</p> <p><b>Accept/Aanvaar</b> <math>W_{\text{nc}} = \Delta K + \Delta U</math> with <math>\Delta U = 0</math></p>
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(5)

<p>4.2</p> <p><u>The total linear momentum of an (isolated) closed system remains constant.</u> <u>Die totale lineêre momentum in 'n geslote (geïsoleerde) sisteem bly konstant</u></p> <p><b>ACCEPT/AANVAAR</b> <u>In an isolated system the total momentum before collision equals the total momentum after collision.</u> <u>In 'n (geïsoleerde) geslote sisteem is die totale momentum voor botsing gelyk aan die totale momentum na botsing.</u></p>	<p><b>Notes/Aantekeninge</b> 2 or/of 0</p>
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(2)

<p>4.3.</p> <p><b>Positive marking from QUESTION 4.1</b> <b>Positiewe nasien vanaf VRAAG 4.1</b></p> $\Sigma p_i = \Sigma p_f \checkmark$ $m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$ $0,02 v_i + (7)(0) = (7,02)(2,39)$ $0,02 v_i \checkmark = 7,02 (2,39) \checkmark$ $v_i = 838,89 \text{ m}\cdot\text{s}^{-1} \checkmark$	<p><b>Notes / Aantekeninge</b> Accept/Aanvaar</p> $(m_1 + m_2) v_i = m_1 v_{1f} + m_2 v_{2f}$ <p>837,84 <math>\text{m}\cdot\text{s}^{-1}</math> (for learners working with 2,387 <math>\text{m}\cdot\text{s}^{-1}</math>/vir leerders wat met 2,387 <math>\text{m}\cdot\text{s}^{-1}</math> werk)</p>
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(4)

[11]

**QUESTION 5/VRAAG 5**

5.1  $\Delta U + \Delta K = 0 \checkmark$   
 $(5)(9,8)(5) + 0 \checkmark + (0 + \frac{1}{2}(5v_f^2)) \checkmark = 0$   
 $v_f = \sqrt{2 \times 9,8 \times 5}$   
 $= 9,90 \text{ m}\cdot\text{s}^{-1} \checkmark (9,899 \text{ m}\cdot\text{s}^{-1})$

**Notes / Aantekeninge**  
 Accept/Aanvaar  
 $Mgh_i + \frac{1}{2} Mv_i^2 = Mgh_f + \frac{1}{2} Mv_f^2$

(4)

5.2 No friction/zero resultant force  $\checkmark$  so there is no loss in energy.  $\checkmark$  / Only conservative forces present./Mechanical energy is conserved  
Geen wrywing/nul resulterende krag dus is daar geen verlies in energie nie/  
Slegs konserwatiewe kragte is teenwoordig./Meganiese energie bly behoue

(2)

5.3 A force for which the work done is path dependent.  $\checkmark \checkmark$   
*'n Krag waarvoor arbeid verrig afhanklik van die pad gevolg is*

**Notes / Aantekeninge**  
 Accept/Aanvaar  
 A force which does not conserve mechanical energy./'n Krag wat nie meganiese energie behoue laat bly nie.

(2)

5.4

**OPTION 1/OPSIE 1**

$W_{nc} = \Delta U + \Delta K \checkmark$   
 $F \Delta x \cos \theta = \Delta U + \Delta K$   
 $(18 \Delta x \cos 180 \checkmark) = (5) (9,8) (3 - 0) \checkmark + \frac{1}{2} (5) (0 - 9,90^2) \checkmark$   
 $\Delta x = 5,4458 \text{ m} \checkmark$   
 $\theta = \sin^{-1} \frac{3}{5,4458} \checkmark$   
 $\theta = 33,43^\circ \checkmark$

**OPTION 2/OPSIE 2**

$W_{net} = W_f + W_G \checkmark$   
 $W_{net} = f \Delta x \cos \theta + mg \sin \theta \Delta x \cos \theta$   
 $= [(18) \Delta x \cos 180^\circ] + 5 (9,8) \frac{3}{\Delta x} (\Delta x) \cos 180^\circ \checkmark$   
 $= -18 \Delta x - 147$   
 $W_{net} = \Delta K \checkmark$   
 $\Delta K = \frac{1}{2} (5) (0 - 9,90^2) \checkmark$   
 $= -245,025$   
 $-18 \Delta x - 147 = -245,025$   
 $\Delta x = 5,4458 \text{ m} \checkmark$   
 $\theta = \sin^{-1} \frac{3}{5,4458} \checkmark$   
 $\theta = 39,43^\circ \checkmark$

(7)  
**[15]**

**QUESTION 6/VRAAG 6**

6.1.1  $v = f\lambda$  ✓  
 $\lambda = \frac{340}{520}$   
 $= 0,65 \text{ m}$  ✓ (2)

6.1.2  $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$  ✓  
 $f_L = \frac{340}{(340-15)} (520)$  ✓  
 $f_L = 544 \text{ Hz}$   
 $v = f\lambda$   
 $\lambda = \frac{340}{544}$  ✓  
 $= 0,63 \text{ m}$  ✓

<p><b>Notes / Aantekeninge</b> Accept/Aanvaar <math>f_L = \frac{v}{v - v_s} f_s</math></p>
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(6)

6.2 The wavelength in QUESTION 6.1.2 is shorter because the waves are compressed as they approach the observer. ✓ ✓  
*Die golflengte in VRAAG 6.1.2 is korter omdat die golwe saamgedruk word soos hulle die waarnemer nader.* (2)

6.3 The red shift occurs when the spectrum of a distant star moving away from the earth is shifted toward the red end of the spectrum. ✓ ✓  
*Rooi verskuiwings vind plaas wanneer die spektrum van 'n vêr afgeleë ster wat vanaf die aarde wegbeweeg na die rooi end van die spektrum skuif.* (2)  
**[12]**

### QUESTION 7/VRAAG 7

- 7.1 The net electrostatic force on a charged particle due to the presence of another charged particle is directly proportional to the product of the charges ✓ and inversely proportional to the square of the distance between them (their centres) ✓

*Die netto elektrostatiiese krag op 'n gelaaide deeltjies as gevolg van die teenwoordigheid van 'n ander gelaaide deeltjie is direk eweredig aan die produk van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle (hul middelpunte)*

#### OR/OF

The force of attraction or repulsion between two point charges is directly proportional to the product of the charges ✓ and inversely proportional to the square of the distance between them. ✓

*Die aantrekkings- of afstotingskrag tussen twee puntladings is direk eweredig aan die produk van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle.*

#### OR/OF

Any two charged particles will exert an electrostatic force on each other where the force is directly proportional to the product of the charges and inversely proportional to the square of the distance between the charged particles. (their centres)

*Enige twee gelaaide deeltjies sal 'n elektrostatiiese krag op mekaar uitoefen waar die krag direk eweredig is aan die produk van die ladings en omgekeerd eweredig is aan die kwadraat van die afstand tussen hulle (tussen hul middelpunte)*

(2)

7.2  
7.2.1  $F = \frac{KQ_1Q_2}{r^2}$  ,

$$1,44 \times 10^{-1} = \frac{(9 \times 10^9)Q^2}{(0,5)^2} \quad \checkmark$$

$$Q = 2 \times 10^{-6} \text{ C} \quad \checkmark$$

(4)

#### 7.2.2 Positive marking from QUESTION 7.2.1

##### **Positiewe nasien vanaf VRAAG 7.2.1**

$$Q = ne \quad \checkmark$$

$$2 \times 10^{-6} = n(1,6 \times 10^{-19}) \quad \checkmark$$

$$n = 1,25 \times 10^{13} \text{ electrons/elektrone} \quad \checkmark$$

(3)

7.3

7.3.1 Left /Links (west/wes) ✓ (1)

7.3.2 Take right as positive/Neem regs as positief

$$E_{\text{net}} = E_A + E_B \checkmark$$

$$(3 \times 10^4) = - \frac{(9 \times 10^9)(2 \times 10^{-6})}{(1,5)^2} + \frac{(9 \times 10^9)Q_{\text{final}}}{(1)^2} \checkmark$$

$$Q_{\text{final}} = 4,22 \times 10^{-6} \text{ C} \checkmark$$

$$Q = ne$$

$$4,22 \times 10^{-6} = n(1,6 \times 10^{-19}) \checkmark$$

$$n_f = 2,64 \times 10^{13} \text{ electrons/elektrone} \checkmark$$

electrons removed/elektrone verwyder

$$= (2,64 \times 10^{13} + 1,25 \times 10^{13}) \checkmark$$

$$= 3,89 \times 10^{13} \text{ electrons/elektrone} \checkmark$$

**Notes / Aantekeninge**

No. electrons should be removed =  $n_f - n_i$   
allocate the 1 mark for the subtraction

Aantal elektrone wat verwyder moet word =  $n_f - n_i$   
Ken 1 punt toe vir aftrekking

(8)  
[18]

**QUESTION 8/VRAAG 8**

8.1.1 Ensure that the wires have:/Maak seker dat die drade

The same length/dieselfde lengte het. ✓

The same thickness/cross-sectional area/dieselfde dikte/deursnit-area/oppervlakte het ✓ (2)

8.1.2 Wire A (Resistor A)/Draad A ✓

$$R = \frac{\Delta V}{\Delta I} \checkmark$$

$$R_A = \frac{4,4}{0,4} \checkmark = 11 \Omega \checkmark$$

$$R_B = \frac{2,2}{0,4} \checkmark = 5,5 \Omega \checkmark$$

$$E = I^2 R \Delta t \checkmark$$

Accept any correct coordinates chosen from the graph  
Aanvaar enige korrekte koördinate van die grafiek gekies.

For the same time and current, the heating in A will be higher because its resistance is higher than that of B. ✓

Vir dieselfde tyd en stroom, sal die verwarming in A hoër wees omdat sy weerstand groter is as die van B.

**ACCEPT/AANVAAR:**  $P = I^2 R$

For the same current, the heat produced per unit time in A will be higher because its resistance is higher than that of B. ✓

Vir dieselfde stroom, sal die hitte vrygestel per eenheidstyd in A hoër wees omdat sy weerstand groter is as die van B. (8)

8.2.1	<p><b>OPTION 1/OPSIE 1</b></p> $I_{5,5\Omega} : I_{11\Omega}$ $2 : 1$ $I_{5,5\Omega} = (0,2)(2) \checkmark \checkmark$ $= 0,4 \text{ A} \checkmark$	<p><b>OPTION 2/OPSIE 2</b></p> $V = IR$ $V_{11\Omega} = 0,2 \times 11$ $= 2,2 \text{ V} \checkmark$ $V_{5,5} = V_{11} = 2,2 \text{ V} \checkmark$ $I_{5,5} = \frac{2,2}{5,5}$ $= 0,4 \text{ A} \checkmark$	(3)
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8.2.2	<p><b>OPTION 1/OPSIE 1</b></p> $V = IR$ $I_{\text{tot}} = (0,4 + 0,2) \checkmark$ $= 0,6 \text{ A}$ $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots \checkmark$ $\frac{1}{R_p} = \frac{1}{11} + \frac{1}{5,5} \checkmark$ $R_p = 3,67 \Omega$ $R_T = R_p + R_A$ $= 3,67 + 11 \checkmark$ $= 14,67 \Omega$ $\mathcal{E} = I(R + r) \checkmark$ $9 = 0,6(14,67 + r) \checkmark$ $r = 0,33 \Omega \checkmark$	<p><b>Notes / Aantekeninge</b></p> <p>Accept/Aanvaar</p> $R_p = \frac{R_1 R_2}{R_1 + R_2} \checkmark$ $= \frac{11 \times 5,5}{11 + 5,5} \checkmark$ $= 3,67 \Omega$	(7)
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<p><b>OPTION 2/OPSIE 2</b></p> $I_{\text{tot}} = (0,4 + 0,2) \checkmark$ $= 0,6 \text{ A}$ $V_{\text{ext}} = V_{11\Omega} + V_{//} \checkmark$ $= [I_{\text{tot}}(R_{11}) + 2,2]$ $= 0,6(11) \checkmark + 2,2$ $= 8,8 \text{ V} \checkmark$ $\mathcal{E} = V_{\text{ext}} + I_{\text{tot}}(r) \checkmark$ $9 = 8,8 + 0,6r \checkmark$ $r = 0,33 \Omega \checkmark$	(7)
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8.2.3 Decrease/Afneem  $\checkmark$   
 The total resistance increases  $\checkmark$  / Die totale weerstand neem toe (2)  
**[22]**

**QUESTION 9/VRAAG 9**

9.1.1

	<p><b><u>OPTION 1/OPSIE 1</u></b></p> $P_{av} = \frac{V_{rms}^2}{R} \checkmark$ $100 \checkmark = \frac{\left(\frac{340}{\sqrt{2}}\right)^2}{R} \checkmark$ $R = 578 \Omega \checkmark$	<p><b><u>Notes / Aantekeninge</u></b></p> <p>Assume correct formula for <math>V_{rms}</math> and give a mark if the substitution is correct 1 mark <i>Aanvaar die korrekte formule vir <math>V_{wgk}</math> en ken 'n punt toe indien die vervanging korrek is.</i></p>
	<p><b><u>OPTION 2/OPSIE 2</u></b></p> $V_{rms} = \frac{V_{max}}{\sqrt{2}} = \frac{340}{\sqrt{2}} \checkmark = 240,04$ $P_{ave} = \frac{V_{rms}^2}{R} \checkmark$ $100 \checkmark = \frac{240,04^2}{R} \checkmark$ $R = 578 \Omega \checkmark$	

(5)

9.1.2

	<p><b><u>OPTION 1/OPSIE 1</u></b></p> $P_{av} = I_{rms} V_{rms} \checkmark$ $100 = I_{rms} \frac{340}{\sqrt{2}} \checkmark$ $I_{rms} = \frac{100}{\frac{340}{\sqrt{2}}}$ $= 0,417 A \checkmark$	<p><b><u>OPTION 2/OPSIE 2</u></b></p> $V_{rms} = I_{rms} R \checkmark$ $\frac{340}{\sqrt{2}} = I_{rms} (578) \checkmark$ $I_{rms} = 0,417 A \checkmark$
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(3)

9.2

Can be stepped up or down/ can be transmitted with less power loss.  
*Kan verhoog of verlaag word/ kan versend word met minder energie verlies.*

(1)  
**[9]**



**QUESTION 10/VRAAG 10**

10.1 The minimum energy needed to emit an electron ✓ from (the surface of) a metal. ✓  
*Die minimum energie benodig om 'n elektron uit die (oppervlak van) 'n metaal vry te stel.* (2)

10.2 
$$E = W_0 + \frac{1}{2}mv_{\max}^2$$
  

$$h\frac{c}{\lambda} = W_0 + \frac{1}{2}mv_{\max}^2$$
 } Any ONE OF/ENIGE EEN van ✓  

$$\frac{(6,63 \times 10^{-34})(3 \times 10^8)}{(\lambda)} = (3,36 \times 10^{-19}) + 2,32 \times 10^{-19}$$
 ✓  

$$\lambda = 3,50 \times 10^{-7} \text{ m}$$
 ✓ (4)

10.3 **POSITIVE MARKING FROM QUESTION 10.2**  
**POSITIEWE NASIEN VANAF VRAAG 10.2**

$$E = W_0 + \frac{1}{2}mv_{\max}^2$$
  
**OR/OF**  

$$h\frac{c}{\lambda} = W_0 + \frac{1}{2}mv_{\max}^2$$
 } ✓ ✓  

$$\frac{(6,63 \times 10^{-34})(3 \times 10^8)}{(3,50 \times 10^{-7})} = (3,65 \times 10^{-19}) + E_k$$
  

$$E = 2,03 \times 10^{-19} \text{ J}$$
 ✓ (4)

10.4.1 Increasing the intensity does not change the energy/ frequency/wavelength of the incident photons ✓ / The energy of a photon remains unchanged (for the same frequency).  
*Verhoging van die intensiteit, verander nie die energie/frekwensie/golflengte van die invallende fotone nie / Die energie van die foton bly onveranderd (vir dieselfde frekwensie).* (1)

10.4.2 Increases. / *Neem toe* ✓ (1)

10.4.3 More photons (packets of energy) strike the surface of the metal per unit time ✓ hence more (photo) electrons ejected per unit time ✓ (leading to increased current).  
*Meer fotone (energie pakkies) tref die oppervlakte van die metaal per eenheidstyd, gevolglik word meer (foto) elektrone per eenheidstyd vrygestel (wat lei tot 'n verhoogde stroom).* (2)  
**[14]**

**TOTAL/TOTAAL: 150**