



**GAUTENG PROVINCE**  
EDUCATION  
REPUBLIC OF SOUTH AFRICA

**PREPARATORY EXAMINATION**  
***VOORBEREIDENDE EKSAMEN***  
**2020**

**MARKING GUIDELINES /**  
***NASIENRIGLYNE***

**PHYSICAL SCIENCES: PHYSICS (PAPER 1) (10841)**  
***FISIESE WETENSKAPPE: FISIKA (VRAESTEL 1) (10841)***

15 pages / bladsye

## QUESTION / VRAAG 1

- 1.1 D ✓✓  
 1.2 A ✓✓  
 1.3 D ✓✓  
 1.4 B ✓✓  
 1.5 B ✓✓  
 1.6 D ✓✓  
 1.7 B ✓✓  
 1.8 C ✓✓  
 1.9 B ✓✓  
 1.10 D ✓✓

[20]

## QUESTION / VRAAG 2

- 2.1 When a net force acts on an object, the object will accelerate in the direction of the force and the acceleration is directly proportional to the force ✓ and inversely proportional to the mass of the object. ✓

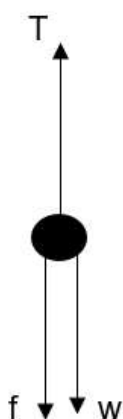
*Wanneer 'n netto krag op 'n voorwerp inwerk sal die voorwerp in die rigting van die krag versnel en die versnelling sal direk eweredig wees aan die krag en omgekeerd eweredig aan die massa van die voorwerp.*

The net (or resultant) force acting on an object is equal to the rate of change of momentum of the object in the direction of the net force. ✓✓

*Die netto (of resultante) krag wat inwerk op 'n voorwerp is gelyk aan die tempo van die verandering van momentum van die voorwerp in die rigting van die netto krag.*

(2)

2.2



Accepted labels/Aanvaarde benoemings	
w	$F_g/F_w$ /weight/mg/gravitational force $F_g/F_w$ /gewig/mg/gravitasiekrag
f	$F_{\text{friction}}/F_f$ /friction/ $f_k$ $F_{\text{wrywing}}/F_w$ /wrywing/ $f_k$
T	$F_T/F_{\text{normal}}$ /normal force $F_N/F_{\text{normaal}}$ /Normaalkrag
	Deduct 1 mark for any additional force. / Trek een punt af vir enige ekstra krag.
	Mark is given for both arrow and label / Punt word toegeken vir beide 'n pyl en byskrif

(3)

2.3 For drone / Vir hommeltuig

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

$$F_{\text{lift}} - T - f - F_g = ma$$

$$180 - T - f - (5,8)(9,8) \checkmark = (5,8)(0,9) \checkmark$$

$$T = -f + 117,94 \dots (1)$$

For m / Vir m

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

$$T - f - F_g = ma$$

$$T - f - (3,2)(9,8) \checkmark = (3,2)(0,9) \checkmark$$

$$T = f + 34,24 \dots (2)$$

$$1 = 2$$

$$-f + 117,94 = f + 34,24 \checkmark$$

$$-2f = -83,67$$

$$\text{Magnitude / Grootte } 2f = 83,7 \text{ N} \checkmark$$

(7)

Marking guidelines / Nasienglyne	
✓	Formula for $F_{\text{net}} = ma$ <i>Formule vir <math>F_{\text{net}} = ma</math></i>
✓	Substitution left side for drone <i>Inervanging linkerkant vir hommeltuig</i>
✓	Substitution right side for drone with $ma = (5,8)(0,9)$ <i>Inervanging regterkant vir hommeltuig met <math>ma = (5,8)(0,9)</math></i>
✓	Substitution left side for m <i>Inervanging linkerkant vir m</i>
✓	Substitution right side for m with $ma = (3,2)(0,9)$ <i>Inervanging regterkant vir m met <math>ma = (3,2)(0,9)</math></i>
✓	Equate 1 and 2 <i>Stel 1 en 2 gelyk aan mekaar</i>
✓	Final answer and unit <i>Finale antwoord en eenheid</i>

2.4 Positive marking from 2.3 / Positiewe nasien vanaf 2.3

$$T = -(41,85 \checkmark) + 117,94$$

$$= 76,09 \text{ N} \checkmark$$

or / of

$$T = f + 34,24$$

$$= 41,85 \checkmark + 34,24$$

$$= 76,09 \text{ N} \checkmark$$

(2)

2.5

$$P = Fv \checkmark$$

$$= (180)(19,7) \checkmark$$

$$= 3546 \text{ W} \checkmark$$

(3)

**[17]**

## QUESTION / VRAAG 3

3.1 A moving object upon which the only force acting is the force of gravity. ✓✓

*'n Bewegende voorwerp waarop slegs gravitasiekrag inwerk.* (2)

3.2.1 A ✓ (1)

3.2.2 The initial velocity is not zero. ✓

*Die beginsnelheid (aanvanklike snelheid) is nie nul nie.* (1)

3.3.1 **OPTION 1 / OPSIE 1**

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

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

$$\Delta t = 1,28 \text{ s } \checkmark$$

Because the graph is given the learners should take down as positive only. The graph determines the direction of the ball and down is positive in the graph.

**OPTION 2 / OPSIE 2**

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

$$= 0 + 2(9,8)(8) \checkmark$$

$$v_f = 12,52 \text{ m} \cdot \text{s}^{-1}$$

$$v_f = v_i + a\Delta t \checkmark$$

$$12,52 = 0 + 9,8\Delta t \checkmark$$

$$t = 1,278 \text{ s } \checkmark$$

*Omdat die grafiek gegee is behoort die leerders slegs afwaarts as positief te neem. Die grafiek bepaal die rigting van die bal en afwaarts is dan positief in die grafiek.*

(4)

3.3.2 Positive marking from 3.3.1 / *Positiewe nasien vanaf 3.3.1:*

**OPTION 1 / OPSIE 1** (Downwards as positive) / *Afwaarts as positief*

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

$$8 \checkmark = v_i (1,28 - 0,6) + \frac{1}{2} (9,8) (1,28 - 0,6)^2 \checkmark$$

$$v_i = 8,43 \text{ m} \cdot \text{s}^{-1} \text{ downwards / afwaarts } \checkmark$$

**OPTION 2 / OPSIE 2** (Downwards as positive) / *Afwaarts as positief*

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

$$v_f^2 = (0)^2 + 2(9,8)(8) \checkmark$$

$$v_f = 12,52 \text{ m} \cdot \text{s}^{-1}$$

$$v_f = v_i + a\Delta t \checkmark$$

$$12,52 = v_i + (9,8)(1,28 - 0,6) \checkmark$$

$$v_i = 8,34 \text{ m} \cdot \text{s}^{-1} \text{ downwards / afwaarts } \checkmark$$

(4)

3.4 Same as ✓. They fall from the same height / change in position is the same for A and B. ✓

*Dieselfde as. ✓ Beide balle val van dieselfde hoogte / verandering in posisie is dieselfde vir beide A en B. ✓*

**OR / OF**

(2)

Area under the graph indicates the total displacement. It was the same height for both the objects.

*Die oppervlakte onder die grafiek dui die totale verplasing aan. Dit was dieselfde hoogte vir beide die voorwerpe.*

3.5  $9,8 \text{ m}\cdot\text{s}^{-2}$  ✓ downwards / afwaarts ✓ (2)  
[16]

#### QUESTION / VRAAG 4

4.1 It is the product of the net force acting on an object and the time that the net force acts on the object. ✓✓

*Dit is die produk van die netto krag wat inwerk op die voorwerp en die tyd waarin die netto krag op die voorwerp inwerk.* (2)

4.2 
$$\left. \begin{array}{l} F_{\text{net}}\Delta t = \Delta p \\ F_{\text{net}}\Delta t = m\Delta v \end{array} \right\} \text{✓ any one of the equations}$$

$$F_{\text{net}} (1,5) \text{ ✓} = 50(700 - 0) \text{ ✓}$$

$$F_{\text{net}} = 23\,333,33 \text{ N } \text{ ✓} \quad (4)$$

4.3  $\sum p \text{ before} = \sum p \text{ after}$  ✓

$$(m_1 + m_2)v_i = m_1v_{1f} + m_2v_{2f}$$

$$(5\,000 + 50)(275) \text{ ✓} = 5\,000 v_{1f} + (50)(700) \text{ ✓}$$

$$v_{1f} = 270,75 \text{ m}\cdot\text{s}^{-1} \text{ ✓}$$

in original direction of motion of missile / ✓

*in oorspronklike rigting van beweging van missiel* (5)

4.4 Momentum is only conserved ✓ in a closed/isolated system. ✓

*Momentum bly slegs behoue ✓ in 'n geslote sisteem. ✓* (2)  
[13]

**QUESTION / VRAAG 5**

- 5.1 The work done on an object by a net force is equal to the change in the object's kinetic energy. ✓✓ **OR**  
The net work done on an object is equal to the change in kinetic energy of the object.

*Die arbeid verrig op 'n voorwerp deur 'n netto krag is gelyk aan die verandering in die voorwerp se kinetiese energie. **OF***

*Die netto arbeid verrig op die voorwerp is gelyk aan die verandering in kinetiese energie van die voorwerp.*

(2)

5.2.1 **OPTION 1 / OPSIE 1**

For diagram 1:

$$W_{nc} = \Delta K + \Delta U \quad \checkmark$$

$$f_{k1}\Delta x \cos\theta = (0 - 0) \quad \checkmark + 0 - mgh_i$$

$$f_{k1}(5,5)\cos 180^\circ \checkmark = -50(9,8)(5,5\sin 15^\circ) \quad \checkmark$$

$$f_{k1} = 126,821 \text{ N}$$

$$f_{k1} = \mu_k N$$

$$126,821 = \mu_k (50)(9,8)\cos 15^\circ \quad \checkmark$$

$$\mu_k = 0,26 \quad \checkmark$$

Marking guideline:

- ✓ energy formula used
- ✓ change in Ek = 0
- ✓ substitution for work done by w or mgh
- ✓ substitution for work done by f
- ✓ substitution for N force equating to vertical component of w
- ✓ answer with NO unit

**OPTION 2 / OPSIE 2**

Diagram 1

$$W_{net} = \Delta E_k \quad \checkmark$$

$$W_{Fg(\text{parallel})} + W_f = 0 \quad \checkmark \quad (\Delta E_k = 0)$$

$$0 = (mg\sin\theta)\Delta x \cos\theta + f_{k1}\Delta x \cos\theta$$

$$0 = (50)(9,8)(\sin 15^\circ)(5,5)(\cos 0^\circ) \quad \checkmark + (f_{k1})(5,5)\cos 180^\circ \quad \checkmark$$

$$f_{k1} = 126,88 \text{ N}$$

$$f_{k1} = \mu_k N$$

$$126,88 = \mu_k (50)(9,8)(\cos 15^\circ) \quad \checkmark$$

$$\mu_k = 0,27 \quad \checkmark$$

Nasienriglyne:

- ✓ energie formule gebruik
- ✓ verandering in Ek = 0
- ✓ invervanging vir arbeid verrig deur w of mgh
- ✓ invervanging vir arbeid verrig deur f
- ✓ invervanging vir N krag gelyk gestel aan vertikale komponent van w
- ✓ antwoord met GEEN eenheid

**OPTION 3 / OPSIE 3**

Diagram 1

$$W_{net} = \Delta E_k \quad \checkmark$$

$$W_{Fg(\text{parallel})} + W_f = 0 \quad \checkmark \quad (\Delta E_k = 0)$$

$$0 = (mg\sin\theta)\Delta x \cos\theta + f_{k1}\Delta x \cos\theta$$

$$0 = (50)(9,8)(\sin 15^\circ)(5,5)(\cos 0^\circ) \quad \checkmark + (\mu_k)(50 \times 9,8 \cos 15^\circ) \quad \checkmark (5,5)\cos 180^\circ \quad \checkmark$$

$$\mu_k = 0,27 \quad \checkmark$$

(6)

5.2.2 **OPTION 1 / OPSIE 1**

Diagram 2

$$f_{k2} \text{ (at } \theta=30^\circ) = 0,27(50)(9,8\cos 30^\circ)$$

$$= 114,58 \text{ N}$$

$$W_{\text{net}} = \Delta E_k \quad \checkmark$$

$$W_{Fg} + W_{fk2} = \Delta E_k$$

$$(mg\sin\theta)\Delta x\cos\theta + f_{k2}\Delta x\cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$(50)(9,8)(\sin 30^\circ)(5,5)\cos 0^\circ \checkmark + (114,58)(5,5)(\cos 180^\circ) \checkmark = \frac{1}{2}(50)(v_f^2) - (0) \checkmark$$

$$v_f = 5,35 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

**OPTION 2 / OPSIE 2**

For diagram 2:

$$W_{nc} = \Delta K + \Delta U \quad \checkmark$$

$$F_{k2}\Delta x\cos\theta = \frac{1}{2}mv_f^2 - 0 + 0 - mgh_i$$

$$[0,26(50)(9,8)](5,5)\cos 180^\circ \checkmark = \frac{1}{2}(50)v_f^2 \checkmark - 50(9,8)(5,5)\sin 30^\circ \quad \checkmark$$

$$v_f = 5,44 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

**OPTION 3 / OPSIE 3**

Diagram 1

$$W_{nc} = \Delta K + \Delta U$$

$$f_{k1}\Delta x\cos\theta = 0 - 0 + 0 - mgh_{i1}$$

$$\mu_k N_1 \Delta x\cos\theta = -mgh_{i1}$$

$$\mu_k = \frac{-mgh_{i1}}{N_1 \Delta x\cos\theta} \quad \text{_____ (1)}$$

Diagram 2

$$W_{nc} = \Delta K + \Delta U$$

$$f_{k2}\Delta x\cos\theta = \frac{1}{2}mv_{f2}^2 - 0 + 0 - mgh_{i2}$$

$$\mu_k N_2 \Delta x\cos\theta = \frac{1}{2}mv_{f2}^2 - mgh_{i2}$$

$$\mu_k = \frac{\frac{1}{2}mv_{f2}^2 - mgh_{i2}}{N_2 \Delta x\cos\theta} \quad \text{_____ (2)}$$

$$(1) = (2)$$

$$\frac{-mgh_{i1}}{N_1 \Delta x\cos\theta} = \frac{\frac{1}{2}mv_{f2}^2 - mgh_{i2}}{N_2 \Delta x\cos\theta}$$

$$\frac{-gh_{i1}}{N_1} = \frac{\frac{1}{2}v_{f2}^2 - gh_{i2}}{N_2}$$

$$\frac{-(9,8)(5,5 \sin 15^\circ)}{(50)(9,8)(\cos 15^\circ)} = \frac{\frac{1}{2}v_{f2}^2 - (9,8)(5,5 \sin 30^\circ)}{(50)(9,8)\cos 30^\circ}$$

$$v_f = 5,30 \text{ m}\cdot\text{s}^{-1}$$

**Marking guideline:**

- ✓ energy formula
- ✓ substitution of  $\mu_k N$  for new  $fk$
- ✓ substitution for final  $E_k$  in diagram 2
- ✓ substitution  $W_{Fg}$  and  $W_{fk2}$  in diagram 2
- ✓ answer with correct unit

**Nasienriglyne:**

- ✓ energie formule
- ✓ invervanging van  $\mu_k N$  vir nuwe  $fk$
- ✓ invervanging vir finale  $E_k$  in diagram 2
- ✓ invervanging  $W_{Fg}$  en  $W_{fk2}$  in diagram 2
- ✓ antwoord met korrekte eenheid

(5)  
[13]

## QUESTION / VRAAG 6

- 6.1 It is the (apparent) change in frequency (or pitch) of the sound (detected by a listener) ✓ because the sound source and the listener have different velocities relative to the medium of sound propagation. ✓

*Dit is die waarneembare verandering in frekwensie (of toonhoogte) van die klank deur die luisteraar waargeneem as gevolg van die beweging van die klankbron en die luisteraar relatief tot mekaar en die voortplanting van die klank.*

(2)

- 6.2.1 1 200 Hz ✓

(1)

- 6.2.2 1 120 Hz ✓

(1)

- 6.3 **OPTION 1 / OPSIE 1**  
Towards the source / na die bron

$$f_L = \frac{v \pm v_L}{v \pm v_s} f_s \quad \checkmark$$

$$1200 \checkmark = \frac{340 + v_L \checkmark}{340 - 0} \quad 1160 \checkmark$$

$$v = 11,72 \text{ m} \cdot \text{s}^{-1} \quad \checkmark$$

- OPTION 2 / OPSIE 2**  
Away from the source / weg van die bron

$$f_L = \frac{v \pm v_L}{v \pm v_s} f_s \quad \checkmark$$

$$1120 \checkmark = \frac{340 - v_L \checkmark}{340 + 0} \quad 1160 \checkmark$$

$$v = 11,72 \text{ m} \cdot \text{s}^{-1} \quad \checkmark$$

(5)

- 6.4.1 velocity / speed of blood ✓ or rate of flow of blood in arteries

*snellheid / spoed van die bloed / of tempo van vloei van bloed in are.*

(1)

- 6.4.2 Waves from the Doppler meter bounce off moving blood cells and are detected with a different frequency. ✓ The meter uses the changed frequency to calculate the velocity ✓ of the blood.

**OR**

Veins and arteries let blood flow in opposite directions. The Doppler flow meter detects the change in frequency of the flowing blood and shows the data on the monitors for doctors to interpret.

*Golwe van die Doppler meter weerkaats terug vanaf die bewegende bloedselle en word waargeneem as 'n sekere frekwensie. Die meter gebruik die verandering in frekwensie om die spoed van die bloed te bereken.*

**OF**

*Are en slagare laat bloed in teenoorgestelde rigtings vloei. Die Doppler vloeiometer neem die verandering in die frekwensie van die vloeiende bloed waar en toon dit op die monitors aan vir die dokters om te interpreteer.*

(2)



6.5.1 Red shift / Doppler shift for light  
*Rooiverskuiwings / Doppler verskuiwing vir lig* ✓ (1)

6.5.2 No. ✓  
 The star has a red colour due to the red shift. The star is moving away from the Earth. ✓

*Nee.* ✓

*Die ster het 'n rooi kleur as gevolg van die rooiverskuiwing. Die ster is besig om weg te beweeg van die aarde af.* ✓

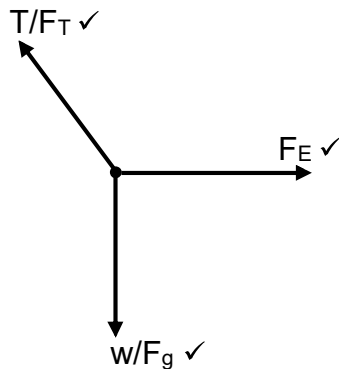
(2)  
**[15]**

### QUESTION / VRAAG 7

7.1 The magnitude of the electrostatic force exerted by a point charge on another point charge is directly proportional to the product of the two charges ✓ and inversely proportional to the square of the distance between the charges. ✓

*Die grootte van die elektrostatiese krag uitgeoefen deur een puntlading op 'n ander puntlading is direk eweredig aan die produk van die twee ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen die twee ladings.*

7.2



Accepted labels Aanvaarbare benoemings	
W	$F_g / F_w / mg$ / weight / gravitational force $F_g / F_w / mg$ / gewig / gravitasiekrag
T	$F_T$ / tension $F_T$ / spanning / spankrag
$F_E$	$F_C / F_Q$ / Coulombic force / Electrostatic force $F_C / F_Q$ / Coulomb krag / elektrostatiese krag

(3)

7.3

**OPTION 1 / OPSIE 1**

$$F_E = \frac{(kQ_1Q_2)}{r^2} \quad \checkmark$$

$$= \frac{(9 \times 10^9)(0,6 \times 10^{-6})(1 \times 10^{-6})}{(0,18)^2} \quad \checkmark$$

$$= 0,1667 \text{ N}$$

$$\frac{F_E}{\sin 7^\circ} = \frac{T}{\sin 90^\circ}$$

$$T = \frac{(0,1667 \sin 90^\circ)}{\sin 7^\circ} \quad \checkmark$$

$$= 1,367 \text{ N} \quad \checkmark$$

**OPTION 2 / OPSIE 2**

$$F_E = \frac{(kQ_1Q_2)}{r^2} \quad \checkmark = \frac{(T \cos 83^\circ)}{(T \sin 7^\circ)} \quad \checkmark$$

$$T = \frac{(9 \times 10^9)(0,6 \times 10^{-6})(1 \times 10^{-6})}{(0,18^2)(\cos 83^\circ)} \quad \checkmark$$

$$= 1,367 \text{ N} \quad \checkmark$$

**OPTION 3 / OPSIE 3**

$$F_E = \frac{(kQ_1Q_2)}{r^2} \quad \checkmark$$

$$= \frac{(9 \times 10^9)(0,6 \times 10^{-6})(1 \times 10^{-6})}{0,18^2} \quad \checkmark$$

$$= 0,1667 \text{ N}$$

$$\tan 7^\circ = \frac{T_x}{T_y} = \frac{0,1667}{T_y} \quad \checkmark$$

$$T_y = 1,358$$

$$T = \sqrt{T_x^2 + T_y^2}$$

$$= \sqrt{0,1667^2 + 1,358^2}$$

$$= 1,368 \text{ N} \quad \checkmark$$

**OPTION 4 / OPSIE 4****Horizontal components**

$$F_{\text{net}} = 0$$

$$F_{\text{el}} \text{ on } x = T_x \quad \checkmark$$

$$\frac{kQ_1Q_2}{r^2} = T \cos 83^\circ$$

$$\frac{(9 \times 10^9)(0,6 \times 10^{-6})(1 \times 10^{-6})}{(18 \times 10^{-2})^2} \quad \checkmark = T \cos 83^\circ \quad \checkmark$$

$$T = 1,37 \text{ N} \quad \checkmark$$

(4)

- 7.4.1 Increase ✓  
Vermeerder (1)
- 7.4.2 The net field at X increases, ✓resulting in an increase on the force attracting X to Y and Z hence the angle increases. ✓  
*Die netto veld by X verhoog, dit veroorsaak 'n toename in die aantrekkingskrag van X na Y en Z en daarom vergroot die hoek.* (2)
- 7.4.3 The insulated stands prevent the negative charges ✓ from flowing to the earth and discharging the balls. ✓  
*Die geïsoleerde standers voorkom dat die negatiewe ladings na die aarde vloei en die balle ontlai.* (2)
- [14]**

**QUESTION / VRAAG 8**

- 8.1 A resistor which obeys Ohm's law at constant temperature. ✓✓  
**OR**  
A resistor for which the ratio  $V/I$  is a constant at constant temperature.  
*'n Weerstand wat die wet van Ohm gehoorsaam by konstante temperatuur.* ✓✓  
**OF**  
*'n Weerstand waarvan die verhouding  $V/I$  'n konstante is by konstante temperatuur.* (2)
- 8.2.1 **OPTION 1 /**  
For  $R_1$ :  
 $V = IR$  ✓  
 $= (1,15)(10)$  ✓  
 $= 11,5 \text{ V}$   
But as in a parallel circuit the potential difference stays the same the voltmeter reading over both  $R_2$  and  $R_3$  is also 11,5 V  
So for the two in series ( $R_2$  and  $R_3$ ):  
 $V = IR$   
 $11,5 = I(12+14)$  ✓  
 $I = 0,44 \text{ A}$  ✓
- OPTION 2 / OPSIE 2**  
RATIO of  $R_1 : R_2 + R_3$  ✓  
 $10 : 26$  ✓  
RATIO of  $I_1 : I_{2+3}$   
 $26 : 10$  ✓  
 $1,15 : 0,44$   
 $I_{2+3} = 0,44 \text{ A}$  ✓
- OPSIE 1**  
Vir  $R_1$ :  
 $V = IR$  ✓  
 $= (1,15)(10)$  ✓  
 $= 11,5 \text{ V}$   
*Soos in 'n parallel stroombaan sal die potensiaalverskil dieselfde bly vir die voltmeterlesing oor beide  $R_2$  en  $R_3$  en is dus ook 11,5 V.*  
*Dus vir die twee in serie ( $R_2$  en  $R_3$ ):*  
 $V = IR$   
 $11,5 = I(12 + 14)$  ✓  
 $I = 0,44 \text{ A}$  ✓
- (4)

8.2.2 Positive marking from 8.2.1

**OPTION 1 / OPSIE 1**

$$I_{\text{circuit/stroombaan}} = 1,15 + 0,442 \quad \checkmark$$

$$= 1,592 \text{ A}$$

$$R_4 = \frac{V_{R4}}{I_{\text{circuit}}} \quad \checkmark$$

$$= \frac{21,5 - 11,5}{1,59} \quad \checkmark$$

$$= 6,281 \Omega \quad \checkmark$$

**OPTION 2 / OPSIE 2**

$$I_{\text{Total}} = 1,15 + 0,44 = 1,592 \text{ A} \quad \checkmark$$

Whole Circuit:

$$V_{\text{ext}} = I_T R_T \quad \checkmark$$

$$21,5 = 1,59 \times R_T$$

$$R_T = 13,51 \Omega$$

$$R_T = R_p + R$$

$$\frac{1}{R_p} = \frac{1}{R_2 + R_3} + \frac{1}{R_1}$$

$$= \frac{1}{12 + 14} + \frac{1}{10}$$

$$R_p = 7,22 \Omega$$

$$R_T = R_p + R_s$$

$$13,51 = 7,22 + R \quad \checkmark$$

$$R = 6,285 \Omega \quad \checkmark$$

(4)

8.2.3 Positive marking from 8.2.2

**OPTION 1 / OPSIE 1**

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

$$24 = 1,592(13,51 + r) \quad \checkmark$$

$$r = 1,57 \Omega \quad \checkmark$$

**OPTION 2 / OPSIE 2**

$$r = \frac{V_{\text{lost volts}}}{I_{\text{circuit}}} \quad \checkmark$$

$$= \frac{24 - 21,5}{1,59} \quad \checkmark$$

$$= 1,570 \Omega \quad \checkmark$$

(3)

8.3 When current flows through the battery, electrical energy is converted to heat energy  $\checkmark$  due to the battery's internal resistance.  $\checkmark$  This explains the lower potential difference.

*Wanneer stroom vloei deur die battery word elektriese energie omgeskakel na hitte energie as gevolg van die battery se interne weerstand.*

(2)  
[15]**QUESTION / VRAAG 9**9.1.1 B to A  $\checkmark$ 

(1)

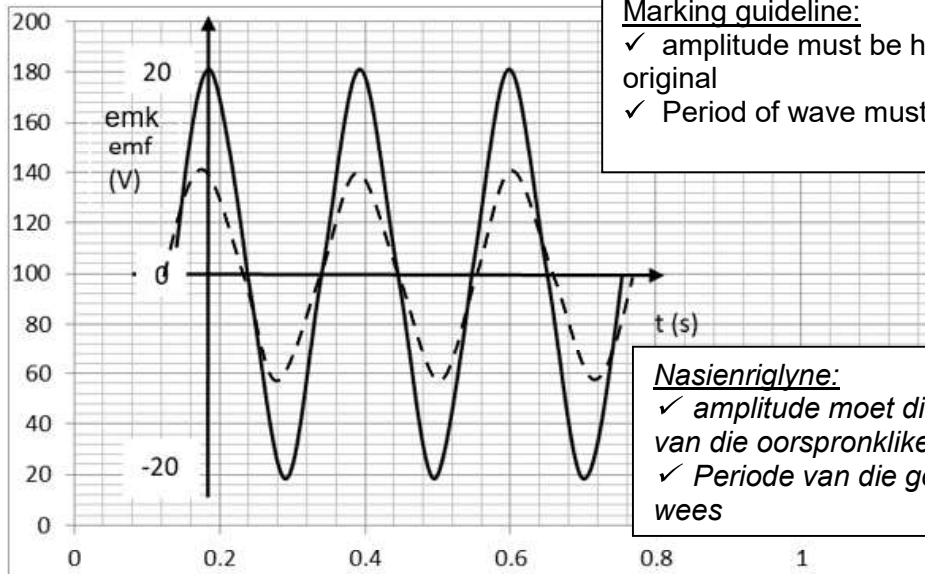
9.1.2 Faraday's law (of electromagnetic induction)  $\checkmark$ *Faraday se wet (van elektromagnetiese induksie)*

(1)

9.1.3 Remove the slipring  $\checkmark$  and replace it with a splitring.  $\checkmark$ *Verwyder die sleepkring en vervang dit met 'n spleetring.*

(2)

9.2.1

**Marking guideline:**

- ✓ amplitude must be half that of the original
- ✓ Period of wave must be the same

**Nasienriglyne:**

- ✓ amplitude moet die helfte wees van die oorspronklike
- ✓ Periode van die golf sal dieselfde wees

(2)

9.2.2 From Faraday's Law, induced emf is directly proportional to the rate of change of magnetic flux, ✓✓ hence halving speed halves the rate, hence  $V_{\max}$  is halved

*Vanuit Faraday se wet, die geïnduseerde emf is direk eweredig aan die tempo van verandering van die magnetiese vloedkoppeling, die halvering van die spoed sal die tempo halveer dus sal  $V_{\max}$  halveer word.*

(2)

9.3

**OPTION 1 / OPSIE 1**

$$\begin{aligned}
 V_{\text{rms}} &= \frac{V_{\text{max}}}{\sqrt{2}} \\
 &= \frac{20}{\sqrt{2}} \quad \checkmark \\
 &= 14,142 \text{ V} \\
 I_{\text{rms}} &= \frac{V_{\text{rms}}}{R} \\
 &= \frac{14,142}{50} \quad \checkmark \\
 &= 0,283 \text{ A} \\
 P_{\text{ave}} &= I_{\text{rms}} V_{\text{rms}} \quad \checkmark \\
 &= 0,283 \times 14,142 \quad \checkmark \\
 &= 4,002 \text{ W} \quad \checkmark
 \end{aligned}$$

**OPTION 2 / OPSIE 2**

$$\begin{aligned}
 V_{\text{rms}} &= \frac{V_{\text{max}}}{\sqrt{2}} \\
 &= \frac{20}{\sqrt{2}} \quad \checkmark \\
 &= 14,142 \text{ V} \\
 P_{\text{ave}} &= \frac{V_{\text{rms}}^2}{R} \quad \checkmark \\
 &= \frac{14,142^2}{50} \quad \checkmark \\
 &= 4,002 \text{ W} \quad \checkmark
 \end{aligned}$$

(5)  
[13]

## QUESTION / VRAAG 10

- 10.1 It is a phenomenon in which electrons are emitted from a metal surface when light of a suitable frequency is shone on the metal surface. ✓✓

*Dit is die verskynsel waar die elektrone vrygestel word vanuit die metaal se oppervlakte wanneer lig van 'n geskikte frekwensie op die metaal oppervlakte geskyn word.*

(2)

- 10.2 Example:  
What is the relationship between the frequency of light incident on the photocell and the maximum kinetic energy of the corresponding ejected photoelectrons?

*Voorbeeld:*

*Wat is die verhouding tussen die frekwensie van die invallende lig op die fotosel en die maksimum kinetiese energie van die ooreenstemmende vrygestelde elektrone?*

<b>Marking criteria</b>	<b>Marks</b>
The independent and dependent variables are stated	✓
It must be a question about the relationship between the independent and dependent variables.	✓

<b>Nasiemriglyne</b>	<b>Punte</b>
<i>Die onafhanklike en afhanklike veranderlikes is gestel</i>	✓
<i>Dit moet 'n vraag wees oor die verhouding tussen die onafhanklike en afhanklike veranderlikes.</i>	✓

(2)

- 10.3.1 frequency of photons ✓ or frequency of incident light

*frekwensie van die fotone of frekwensie van invallende lig*

(1)

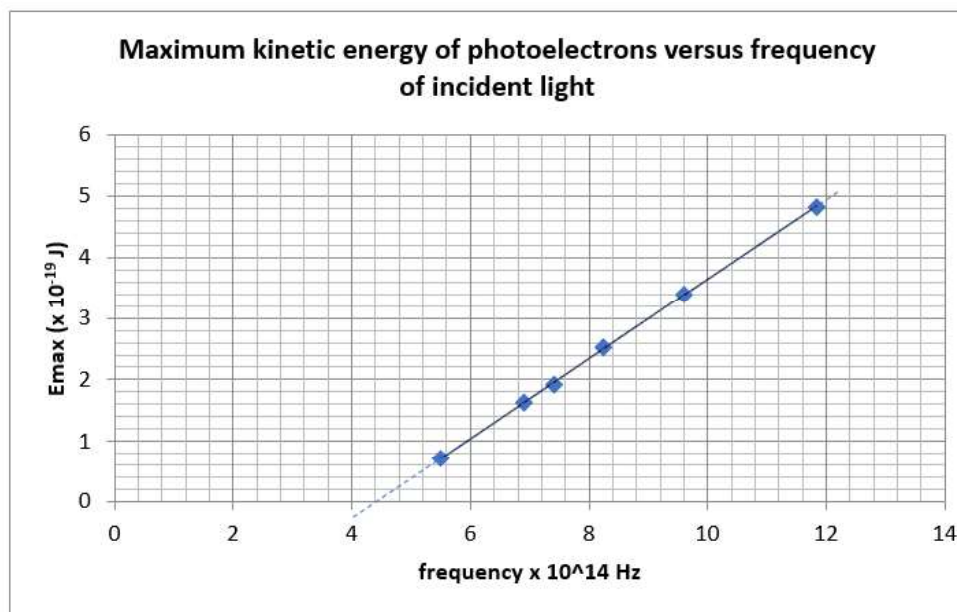
- 10.3.2 use the same metal ✓

*gebruik dieselfde metaal*

(1)

- 10.4 Mark positive from 10.3.1

(4)

Marking guideline:

- ✓ heading of graph
- ✓ labels on x and y axes and units
- ✓ all points plotted
- ✓ best fit line not through the origin

Nasienriglyne:

- ✓ opskrif vir grafiek
- ✓ byskrifte vir x en y asse en eenhede
- ✓ alle punte geplot
- ✓ beste paslyn maar nie deur die oorsprong nie

10.5.1  $4,2 \times 10^{14}$  Hz to  $4,4 \times 10^{14}$  Hz ✓  
Mark positive from 10.3 and 10.4

(1)

10.5.2

<p><b>OPTION 1</b> By extrapolation from graph <b>OPSIE 1</b> Deur ekstrapolering van grafiek <math>W_0 = hf_0</math> ✓ <math>= 6,63 \times 10^{-34} \times 4,4 \times 10^{14}</math> ✓ <math>= 2,917 \times 10^{-19}</math> J ✓</p>
<p><b>OPTION 2</b> Using any point on graph. <b>OPSIE 2</b> Gebruik enige punt op grafiek. <math>hf = W_0 + E_k</math> <math>6,63 \times 10^{-34} \times 5,4 \times 10^{14} = W_0 + 0,72 \times 10^{-19}</math> <math>W_0 = 2,919 \times 10^{-19}</math> J</p>
<p><b>OPTION 3</b> <b>OPSIE 3</b> <math>hf = W_0 + E_k</math> <math>6,63 \times 10^{-34} \times 6,91 \times 10^{14} = W_0 + 1,63 \times 10^{-19}</math> <math>W_0 = 2,951 \times 10^{-19}</math> J</p>
<p><b>OPTION 4</b> <b>OPSIE 4</b> <math>hf = W_0 + E_k</math> <math>6,63 \times 10^{-34} \times 7,41 \times 10^{14} = W_0 + 1,92 \times 10^{-19}</math> <math>W_0 = 2,993 \times 10^{-19}</math> J</p>

Marking guidelines:

- ✓ Formula
- ✓ Substitution
- ✓ Answer with unit

Nasienriglyne:

- ✓ Formule
- ✓ Invervanging
- ✓ Antwoord met eenheid

(3)  
[15]

150