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

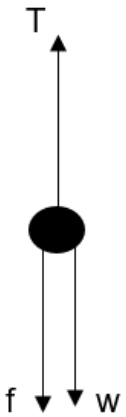
2.1 When a net force acts on an object, the object will accelerate in the direction of the force and the acceleration is directly proportional to the force ✓and inversely proportional to the mass of the object. ✓

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	$F_{friction}$/F_f/friction/f_k *$F_{wrywing}$/F_w/wrywing/f_k*
T	F_T/F_{normal}/normal force F_N/$F_{normaal}$/*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*	For **m** / *Vir **m***
F_{net} = ma ✓	F_{net} = ma
F_{lift} - T - f - F_g = ma	T - f – F_g = ma
180 - T - f - (5,8)(9,8) ✓ = (5,8)(0,9) ✓	T - f - (3,2)(9,8) ✓ = (3,2)(0,9) ✓
T = - f + 117,94...(1)	T = f + 34,24…(2)

1 = 2

- f + 117,94 = f + 34,24 ✓

- 2 f = - 83,67

Magnitude / *Grootte* 2 f = 83,7 N ✓ (7)

Marking guidelines / *Nasienriglyne*	
✓	Formula for Fnet = ma *Formule vir Fnet = ma*
✓	Substitution left side for drone *Invervanging linkerkant vir hommeltuig*
✓	Substitution right side for drone with ma = (5,8)(0,9) *Invervanging regterkant vir hommeltuig met ma = (5,8)(0,9)*
✓	Substitution left side for m *Invervanging linkerkant vir m*
✓	Substitution right side for m with ma = (3,2)(0,9) *Invervanging regterkant vir m met ma = (3,2)(0,9)*
✓	Equate 1 and 2 *Stel 1 en 2 gelyk aan mekaar*
✓	Final answer and unit *Finale antwoord en eenheid*

2.4 **Positive marking from 2.3 / *Positiewe nasien vanaf 2.3***

T = - (41,85✓) + 117,94
= 76,09 N✓

or / *of*

T = f + 34,24
= 41,85✓ + 34,24
= 76,09 N✓ (2)

2.5 P = Fv ✓
= (180)(19,7) ✓
= 3 546 W✓ (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***

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

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

$\Delta t = 1,28$ s ✓

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*

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

$= \underline{0 + 2(9,8)(8)}$ ✓

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

$v_f = v_i + a\Delta t$ ✓

$12,52 = 0 + 9,8\Delta t$ ✓

$t = 1,278$ s ✓

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*

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

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

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

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

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

$v_f^2 = (0)^2 + 2(9,8)(8)$ ✓

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

$v_f = v_i + a\Delta t$ ✓

$12,52 = v_i + (9,8)(1,28 - 0,6)$ ✓

$v_i = 8,34\ m\cdot s^{-1}$ downwards / *afwaarts* ✓ (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*

Area under the graph indicates the total displacement. It was the same height (2)

for both the objects.

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

3.5 $9{,}8\ m{\cdot}s^{-2}$ ✓ 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 $F_{net}\Delta t = \Delta p$
$F_{net}\Delta t = m\Delta v$
✓ any one of the equations

F_{net} (1,5) ✓ = 50(700 - 0) ✓

F_{net} = 23 333,33 N ✓ (4)

4.3 $\sum p$ before = $\sum p$ after ✓

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

Any one / *Enige een*

(5 000 + 50)(275) ✓ = 5 000 v_{1f} + (50)(700) ✓

$v_{1f} = 270{,}75\ m{\cdot}s^{-1}$ ✓

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:

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

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

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

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

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

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

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

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

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 2 / *OPSIE 2*

Diagram 1

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

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

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

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

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

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

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

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

OPTION 3 / *OPSIE 3*

Diagram 1

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

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

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

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

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

(6)

5.2.2 **OPTION 1 / *OPSIE 1***

Diagram 2

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

$= 114,58\ N$

$W_{net} = \Delta E_k$ ✓

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

$(mg\sin\theta)\Delta x\cos\theta + f_{k2}\Delta x\cos\theta = ½mv_f^2 - ½mv_i^2$

$(50)(9,8)(\sin 30^o)(5,5)\cos 0^o$ ✓$+(114,58)(5,5)(\cos 180)$ ✓$= ½\ (50)(v_f^2) - (0)$ ✓

$v_f = 5,35\ m\cdot s^{-1}$ ✓

OPTION 2 / *OPSIE 2*

For diagram 2:

$Wnc = \Delta K + \Delta U$ ✓

$F_{k2}\Delta x\cos\theta = ½mv^2_f - 0 + 0 - mgh_i$

$[0,26(50)(9,8)](5,5)\cos 180^o$ ✓ $= 1/2\ (50)v^2_f$ ✓$- 50(9,8)(5,5)\sin 30^o$ ✓

$v_f = 5,44\ m\cdot s^{-1}$ ✓

OPTION 3 / *OPSIE 3*

Diagram 1

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

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

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

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

Marking guideline:
- ✓ energy formula
- ✓ substitution of μkN for new fk
- ✓ substitution for final Ek in diagram 2
- ✓ substitution W_{Fg} and W_{fk2} in diagram 2
- ✓ answer with correct unit

Diagram 2

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

$f_{k2}\Delta x\cos\theta = ½mv^2_{f2} - 0 + 0 - mgh_{i2}$

$\mu_k N_2\Delta x\cos\theta = ½mv^2_{f2} - mgh_{i2}$

$$\mu_k = \frac{½mv^2_{f2} - mgh_{i2}}{N_2\Delta x\cos\theta} \quad \text{_____(2)}$$

Nasienriglyne:
- ✓ *energie formule*
- ✓ *invervanging van μkN vir nuwe fk*
- ✓ *invervanging vir finale Ek in diagram 2*
- ✓ *invervanging W_{Fg} en W_{fk2} in diagram 2*
- ✓ *antwoord met korrekte eenheid*

$(1) = (2)$

$$\frac{-mgh_{i1}}{N_1\Delta x\cos\theta} = \frac{½mv^2_{f2} - mgh_{i2}}{N_2\Delta x\cos\theta}$$

$$\frac{-gh_{i1}}{N_1} = \frac{½v^2_{f2} - gh_{i2}}{N_2}$$

$$\frac{-(9,8)(5,5\sin 15^o)}{(50)(9,8)(\cos 15^o)} = \frac{½v^2_{f2} - (9,8)(5,5\sin 30^o)}{(50)(9,8)\cos 30^o}$$

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

(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***	**OPTION 2 / *OPSIE 2*** **Away from the source / weg van die bron**
$f_L = \frac{v \pm v_L}{v \pm v_S} f_S$ ✓	$f_L = \frac{v \pm v_L}{v \pm v_S} f_S$ ✓
$1200 ✓ = \frac{340 + v_L}{340 - 0} ✓ \ 1160 ✓$	$1120 ✓ = \frac{340 - v_L}{340 + 0} ✓ \ 1160 ✓$
$v = 11{,}72 \text{ m} \cdot \text{s}^{-1}$ ✓	$v = 11{,}72 \text{ m} \cdot \text{s}^{-1}$ ✓

(5)

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

snelheid / 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 vloeimeter 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. ✓

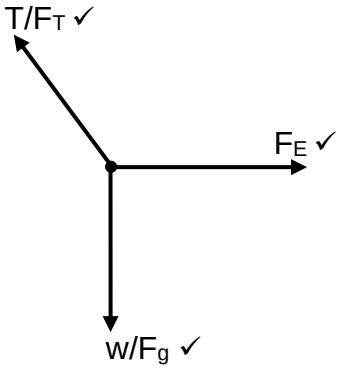
Nee. ✓
Die ster het 'n rooi kleur as gevolg van die rooiverskuiwing. Die ster is besig om weg te beweeg van die aarde af.✓ (2)
[15]

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. (2)

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***

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

$$= \frac{(9x10^9)(0,6x10^{-6})(1x10^{-6})}{(0,18)^2} \quad \checkmark$$

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

$$\frac{F_E}{\sin 7^0} = \frac{T}{\sin 90}$$

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

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

OPTION 2 / *OPSIE 2*

$$F_E = \frac{(kQ_1Q_2)}{r^2} \checkmark = \frac{(T\cos 83^0)}{(T\sin 7^0)} \quad \checkmark$$

$$T = \frac{(9x10^9)(0,6x10^{-6})(1x10^{-6})}{(0,18^2)(\cos 83^0)} \checkmark$$

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

OPTION 3 / *OPSIE 3*

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

$$= \frac{(9x10^9(0,6x10^{-6})(1x10^{-6})}{0,18^2} \quad \checkmark$$

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

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

$$T_Y = 1,358$$

$$T = \sqrt{Tx^2+Ty^2}$$

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

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

OPTION 4 / *OPSIE 4*

Horizontal components

$F_{net} = 0$

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

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

$$\frac{(9x10^9)(0,6x10^{-6})(1x10^{-6})}{(18x10^{-2})^2} \checkmark = T\cos 83^o \quad \checkmark$$

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

(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 staanders voorkom dat die negatiewe ladings na die aarde vloei en die balle ontlaai. (2)

[14]

QUESTION *I 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 *I***
For R_1:
V = IR✓
= (1,15)(10) ✓
= 11,5 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 A ✓

OPTION 2 *I 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 A ✓ (4)

***OPSIE* 1**
Vir R_1:
V = IR ✓
= (1,15)(10) ✓
= 11,5 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 A ✓

8.2.2 Positive marking from 8.2.1

OPTION 1 / *OPSIE 1*

$I_{circuit\ /stroombaan} = 1,15 + 0,442$ ✓
$= 1,592$ A

$R_4 = \frac{V_{R4}}{I_{circuit}}$ ✓
$= \frac{21,5 - 11,5}{1,59}$ ✓
$= 6,281\ \Omega$ ✓

OPTION 2 / *OPSIE 2*

$I_{Total} = 1,15 + 0,44 = 1,592$ A ✓
Whole Circuit:
$V_{ext} = I_T R_T$ ✓
$21,5 = 1,59 \times R_T$
$R_T = 13,51\ \Omega$
$R_T = R_P + R$
$\frac{1}{R_P} = \frac{1}{R_2 + R_3} + \frac{1}{R_1}$
$= \frac{1}{12 + 14} + \frac{1}{10}$
$R_P = 7,22\ \Omega$
$R_T = R_P + R_s$
$13,51 = 7,22 + R$ ✓
$R = 6,285\ \Omega$ ✓

(4)

8.2.3 Positive marking from 8.2.2

OPTION 1 / *OPSIE 1*

$Emf = I(R + r)$ ✓
$24 = 1,592(13,51 + r)$ ✓
$r = 1,57\ \Omega$ ✓

OPTION 2 / *OPSIE 2*

$r = \frac{V_{lost\ volts}}{I_{circuit}}$ ✓
$= \frac{24 - 21,5}{1,59}$ ✓
$= 1,570\ \Omega$ ✓

(3)

8.3 When current flows through the battery, electrical energy is converted to heat energy ✓ due to the battery's internal resistance. ✓ 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 ✓ (1)

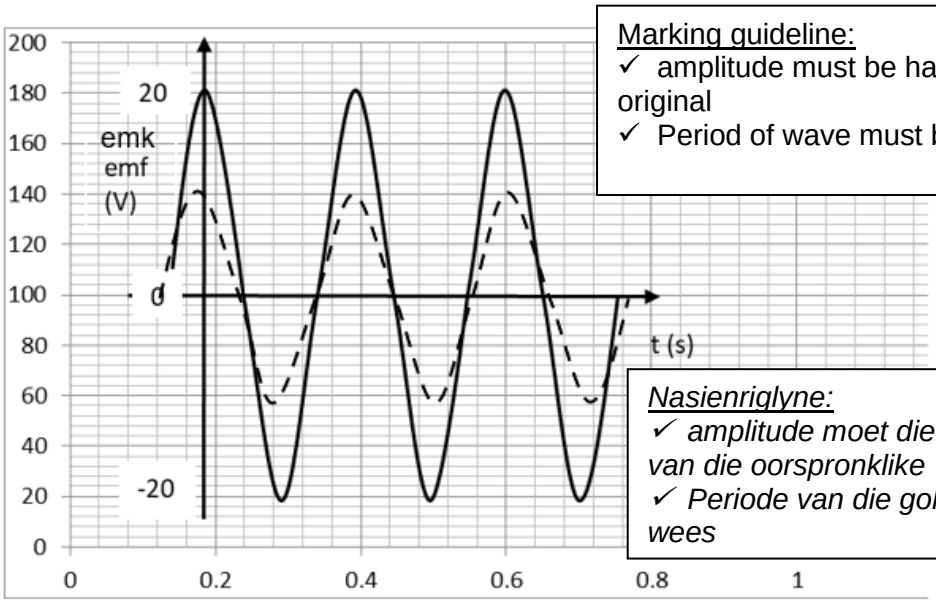
9.1.2 Faraday's law (of electromagnetic induction) ✓

Faraday se wet (van elektromagnetiese induksie) (1)

9.1.3 Remove the slipring ✓ and replace it with a splitring. ✓

Verwyder die sleepring 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 emk is direk eweredig aan die tempo van verandering van die magnetiese vloedkoppeling, die halvering van die spoed sal die tempo halveer dus sal V_{maks} halveer word. (2)

9.3

OPTION 1 / *OPSIE 1*

$$V_{rms} = \frac{V_{max}}{\sqrt{2}}$$

$$= \frac{20}{\sqrt{2}} \quad ✓$$

$$= 14{,}142 \text{ V}$$

$$I_{rms} = \frac{V_{rms}}{R}$$

$$= \frac{14{,}142}{50} \quad ✓$$

$$= 0{,}283 \text{ A}$$

$$P_{ave} = I_{rms}V_{rms} \quad ✓$$

$$= 0{,}283 \times 14{,}142 \quad ✓$$

$$= 4{,}002 \text{ W} \quad ✓$$

OPTION 2 / *OPSIE 2*

$$V_{rms} = \frac{V_{max}}{\sqrt{2}}$$

$$= \frac{20}{\sqrt{2}} \quad ✓$$

$$= 14{,}142 \text{ V}$$

$$P_{ave} = \frac{V_{rms}^2}{R} \quad ✓$$

$$= \frac{14{,}142^2}{50} \quad ✓$$

$$= 4{,}002 \text{ W} \quad ✓$$

(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?

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

Nasienriglyne	***Punte***
Die onafhanklike en afhanklike veranderlikes is gestel	✓
Dit moet 'n vraag wees oor die verhouding tussen die onafhanklike en afhanklike veranderlikes.	✓

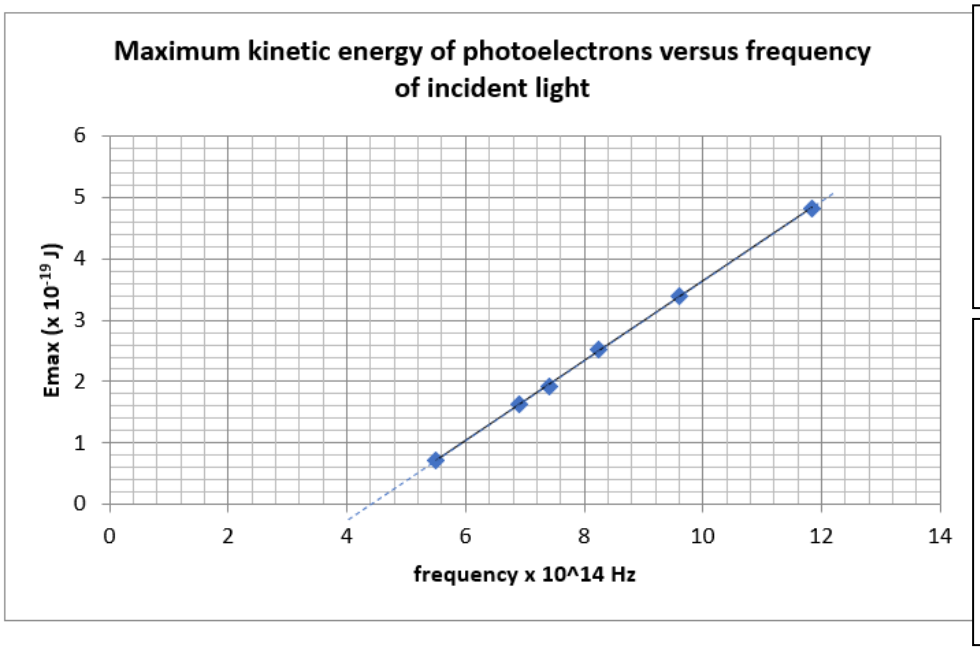
(2)

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 x 10^{14} Hz to 4,4 x 10^{14} Hz ✓ (1)
Mark positive from 10.3 and 10.4

10.5.2

OPTION 1 By extrapolation from graph
OPSIE 1 *Deur ekstrapolering van grafiek*
$W_o = hf_o$ ✓
$= 6{,}63 \times 10^{-34} \times 4{,}4 \times 10^{14}$ ✓
$= 2{,}917 \times 10^{-19}$ J ✓

OPTION 2 Using any point on graph.
OPSIE 2 *Gebruik enige punt op grafiek.*
$hf = W_o + E_k$
$6{,}63 \times 10^{-34} \times 5{,}4 \times 10^{14} = W_o + 0{,}72 \times 10^{-19}$
$W_o = 2{,}919 \times 10^{-19}$ J

OPTION 3
OPSIE 3
$hf = W_o + E_k$
$6{,}63 \times 10^{-34} \times 6{,}91 \times 10^{14} = W_o + 1{,}63 \times 10^{-19}$
$W_o = 2{,}951 \times 10^{-19}$ J

OPTION 4
OPSIE 4
$hf = W_o + E_k$
$6{,}63 \times 10^{-34} \times 7{,}41 \times 10^{14} = W_o + 1{,}92 \times 10^{-19}$
$W_o = 2{,}993 \times 10^{-19}$ J

Marking guidelines:
✓ Formula
✓ Substitution
✓ Answer with unit

Nasienriglyne:
✓*Formule*
✓*Invervanging*
✓*Antwoord met eenheid*

(3)
[15]

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