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GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

VOORBEREIDENDE EKSAMEN

2016

MEMORANDUM

PHYSICAL SCIENCES: PHYSICS P1 (10841)

FISIESE WETENSKAPPE V1 (10841)

GAUTENG DEPARTMENT OF EDUCATION
GAUTENG DEPARTEMENT VAN ONDERWYS
PREPARATORY EXAMINATION
VOORBEREIDENDE EKSAMEN

PROOFREAD ☐	DATE _____
SIGNATURE _____	
PROOFREAD ☐	DATE _____
SIGNATURE _____	

PHYSICAL SCIENCES: PHYSICS
(First Paper)
FISIESE WETENSKAPPE: FISIKA
(Eerste vraestel)

MEMORANDUM

QUESTION / VRAAG 1

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

QUESTION / VRAAG 2

- 2.1 When a resultant/net force acts on an object, the object accelerates in the direction of the (net) force at an acceleration directly proportional to the force ✓ and inversely proportional to the mass of the object. ✓

Wanneer 'n resultante /netto krag op 'n voorwerp uitgeoefen word, versnel die voorwerp in die rigting van die (netto) krag met 'n versnelling direk eweredig aan die grootte van die krag ✓ en omgekeerd eweredig aan die massa van die voorwerp. ✓ (2)

2.2

T/Force of Y on X ✓

T/Krag Y op X ✓

180 N/F/F_{applied}/applied force ✓180 N/F/F_{toegepas}/toegepaste krag ✓Weight/mg/w/F_g/39,2 N ✓
Gewig/mg/w/F_g/39,2 N ✓**Notes/Aantekeninge:**

- Correct arrow and label for each force for one mark. / Korrekte pyle en benoeming vir elke krag vir een punt.
- Comparative lengths of arrows are not required. / Vergelykende lengte van pyle nie vereiste nie.

(3)

2.3

2.3.1

For block **X** / Vir blok **X**:

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

$$180 - w - T = ma$$

$$180 - (4)(9,8) - T = 4a \checkmark$$

$$140,8 - T = 4a \dots\dots\dots(i)$$

For block **Y** / Vir blok **Y**:

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

$$T - w = ma$$

$$T - (8)(9,8) = 8a \checkmark$$

$$-78,4 + T = 8a \dots\dots\dots(ii)$$

$$281,6 - 2T = 8a$$

$$-78,4 + T = 8a$$

$$360 - 3T = 0$$

$$T = 120 \text{ N}$$

$$T = 120 \text{ N upwards / opwaarts} \checkmark$$

Note/Aantekeninge:

- If the system approach is used to first calculate acceleration and then acceleration is substituted to obtain T:

$$\text{Max. } \frac{2}{4}$$

- Indien die stelsel benader word om eerstens versnelling te bereken en dan die versnelling gebruik om T te bereken:

$$\text{Maks } \frac{2}{4}$$

(4)

2.3.2

POSITIVE MARKING FROM QUESTION 2.3.1 / POSITIEWE NASIEN VAN VRAAG 2.3.1**OPTION / OPSIE 1**

$$-78,4 + T = 8a$$

$$-78,4 + 120 = 8a \checkmark$$

$$a = 5,2 \text{ m} \cdot \text{s}^{-2} \checkmark$$

OPTION / OPSIE 2

$$140,8 - T = 4a$$

$$140,8 - 120 = 4a \checkmark$$

$$a = 5,2 \text{ m} \cdot \text{s}^{-2} \checkmark$$

OPTION / OPSIE 3

$$281,6 - 2T = 8a$$

$$281,6 + 220 = 8a \checkmark$$

$$a = 5,2 \text{ m} \cdot \text{s}^{-2} \checkmark$$

(2)

[11]**QUESTION / VRAAG 3**

3.1

The object had an upward velocity when it was released. ✓ / Die voorwerp het 'n opwaartse snelheid toe dit losgelaat is.**OR/ OF**

The object continues with its state of motion in a straight line. / Die voorwerp beweeg voort in dieselfde rigting van beweging in 'n reguit lyn.

OR/ OF

The object has inertia / die voorwerp het inersie

(1)

3.2 3.2.1 Upwards / *opwaarts* ✓ (1)

3.2.2 Downwards / *afwaarts* ✓ (1)

3.3	3.3.1	Upward positive / <i>opwaarts positief</i> $v_f = v_i + a \Delta t$ ✓ $0 = 110 - 9,8 \Delta t$ ✓ $\Delta t = 11,22 \text{ s}$ ✓	Downward positive / <i>afwaarts positief</i> $v_f = v_i + a \Delta t$ ✓ $0 = -110 + 9,8 \Delta t$ ✓ $\Delta t = 11,22 \text{ s}$ ✓	(3)
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3.3.2 **OPTION 1**

Upward positive / <i>opwaarts positief</i> $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓ $-550 \checkmark = 110 \Delta t + \frac{1}{2} (-9,8) \Delta t^2$ ✓ $4,9 \Delta t^2 - 110 \Delta t - 550 = 0$ $\Delta t = \frac{-(-110) \pm \sqrt{(-110)^2 - 4(4,9)(-550)}}{2(4,9)}$ $\Delta t = 26,66 \text{ s or } -4,21 \text{ s}$ $\Delta t = 26,66 \text{ s}$ ✓	Upward negative / <i>opwaarts negatief</i> $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓ $550 \checkmark = -110 \Delta t + \frac{1}{2} (9,8) \Delta t^2$ ✓ $4,9 \Delta t^2 - 110 \Delta t - 550 = 0$ $\Delta t = 26,66 \text{ s or } -4,21 \text{ s}$ $\Delta t = 26,66 \text{ s}$ ✓
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OPTION 2

POSITIVE MARKING FROM QUESTION 3.3.1 / POSITIEWE NASIEN VAN VRAAG 3.3.1.

Time(point Q to R): 11,22 s Time(point R to Q): 11,22 s Time(point Q to ground): Upward positive / <i>opwaarts positief</i> $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓ $-550 \checkmark = (-110) \Delta t + \frac{1}{2} (-9,8) \Delta t^2$ ✓ $4,9 \Delta t^2 + 110 \Delta t - 550 = 0$ $\Delta t = \frac{-110 \pm \sqrt{(110)^2 - 4(4,9)(-550)}}{2(4,9)}$ $\Delta t = 4,21 \text{ s}$ Total time = 11,22 + 11,22 + 4,21 = 26,65 s ✓	Time(point Q to R): 11,22 s Time(point R to Q): 11,22 s Time(point Q to ground): Upward negative / <i>opwaarts negatief</i> $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓ $550 \checkmark = (110) \Delta t + \frac{1}{2} (9,8) \Delta t^2$ ✓ $4,9 \Delta t^2 + 110 \Delta t - 550 = 0$ $\Delta t = \frac{-110 \pm \sqrt{(110)^2 - 4(4,9)(-550)}}{2(4,9)}$ $\Delta t = 4,21 \text{ s}$ Total time = 11,22 + 11,22 + 4,21 = 26,65 s ✓
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(4)

OPTION 3**POSITIVE MARKING FROM QUESTION 3.3.1 / POSITIEWE NASIEN VAN VRAAG 3.3.1.****Upward positive / opwaarts positief**

Height reached above point Q:

$$v_f^2 = v_i^2 + 2a\Delta y_2$$

$$(0)^2 = (110)^2 + 2(-9,8)\Delta y_2$$

$$\therefore \Delta y_2 = 617,35 \text{ m}$$

Displacement from point R to ground:

$$\Delta y = 550 + 617,35 = 1\,167,35 \text{ m}$$

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

$$-1\,167,35 \checkmark = (0)\Delta t + \frac{1}{2}(-9,8)\Delta t^2 \quad \checkmark$$

$$\Delta t = 15,435 \text{ s}$$

$$\text{Total time} = 11,22 + 15,435$$

$$= 26,66 \text{ s} \quad \checkmark$$

Upward negative / Opwaarts negatief

Height reached above point Q:

$$v_f^2 = v_i^2 + 2a\Delta y_2$$

$$(0)^2 = (-110)^2 + 2(9,8)\Delta y_2$$

$$\therefore \Delta y_2 = 617,35 \text{ m}$$

Displacement from point R to ground:

$$\Delta y = 550 + 617,35 = 1\,167,35 \text{ m}$$

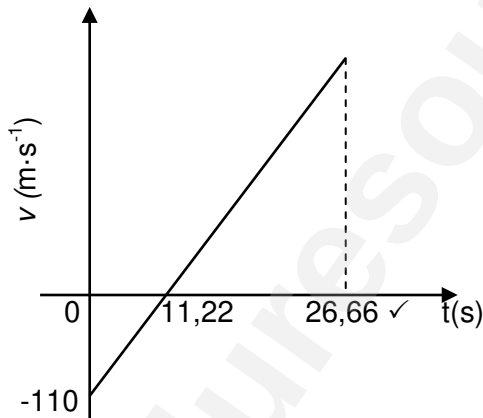
$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \quad \checkmark$$

$$1\,167,35 \checkmark = (0)\Delta t + \frac{1}{2}(9,8)\Delta t^2 \quad \checkmark$$

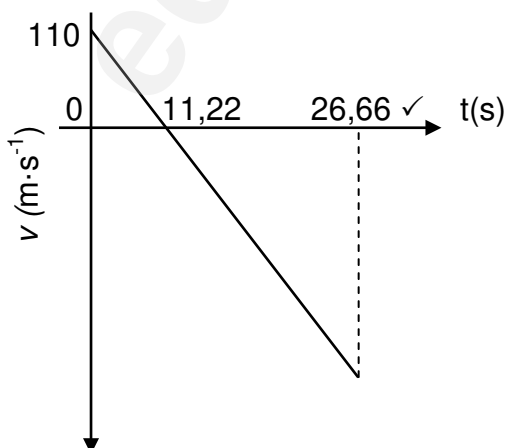
$$\Delta t = 15,435 \text{ s}$$

$$\text{Total time} = 11,22 + 15,435$$

$$= 26,66 \text{ s} \quad \checkmark$$

3.4 POSITIVE MARKING FROM QUESTION 3.3 / POSITIEWE NASIEN VAN VRAAG 3.3.**Downward as positive / afwaarts as positief:**

Marking criteria/nasienriglyne	
Positive slope / positiewe helling	✓
Graph starts at $v = -110 \text{ m}\cdot\text{s}^{-1}$ Grafiek begin by $v = -110 \text{ m}\cdot\text{s}^{-1}$	✓
Graph intercepts x axis at 11,22 s Grafiek sny x axis by 11,22 s	✓
Graph ends at 26,66 s Grafiek eindig by 26,66 s	✓

Upward as positive / opwaarts as positief:

Marking criteria	
Negative slope / negatiewe helling	✓
Graph starts at $v = 110 \text{ m}\cdot\text{s}^{-1}$ Grafiek begin by $v = 110 \text{ m}\cdot\text{s}^{-1}$	✓
Graph intercepts x axis at 11,22 s Grafiek sny x axis by 11,22 s	✓
Graph ends at 26,66 s Grafiek eindig by 26,66 s	✓

QUESTION / VRAAG 4

- 4.1 The total (linear) momentum of a closed system remains constant/is conserved. ✓✓
(2 marks or zero)

Die totale (liniêre) momentum van 'n geslote sisteem bly konstant/bly behoue. ✓✓
(2 punte or niks)

(2)

- 4.2 $\Sigma p_i = \Sigma p_f$ ✓
 $m_1 v_1 + m_2 v_2 = (m_1 + m_2) v_c$
 $(68 \times 20) \checkmark + (12 \times 0) = (68 + 12) v_c \checkmark$
 $\therefore v_c = 17 \text{ m} \cdot \text{s}^{-1} \checkmark$

(4)

- 4.3 **POSITIVE MARKING FROM QUESTION 4.2 / POSITIEWE NASIEN VAN VRAAG 4.2.**

OPTION / OPSIE 1

$$(E_p + E_k)_i = (E_p + E_k)_f \checkmark$$

$$(mgh + \frac{1}{2}mv_c^2)_i = (mgh + \frac{1}{2}mv_c^2)_f$$

$$0 + \frac{1}{2}(80)(17)^2 \checkmark = (80)(9,8)h + 0 \checkmark$$

$$\therefore h = 14,75 \text{ m}$$

Distance up the incline, d/ *Afstand opwaarts teen skuinsvlak*

$$\sin \theta = \frac{h}{\Delta x}$$

$$\sin 25^\circ = \frac{14,75}{\Delta x} \checkmark$$

$$\therefore \Delta x = 34,89 \text{ m} \checkmark$$

OPTION / OPSIE 2

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

$$W_w = E_{kf} - E_{ki}$$

$$mgsin25^\circ \cos 180^\circ = \frac{1}{2}m(v_f^2 - v_i^2)$$

$$(80)(9,8)\sin 25^\circ \checkmark \Delta x \cos 180^\circ \checkmark = \frac{1}{2}(80)(0^2 - 17^2) \checkmark$$

$$\Delta x = 34,89 \text{ m} \checkmark$$

(5)

- 4.4 Decreases / *verminder* ✓

Friction is a non-conservative force/ opposes motion/removes kinetic energy from the system. ✓

Wrywing is 'n nie-konserwatiewe krag /opponeer beweging / verwyder kinetiese energie van die sisteem. ✓

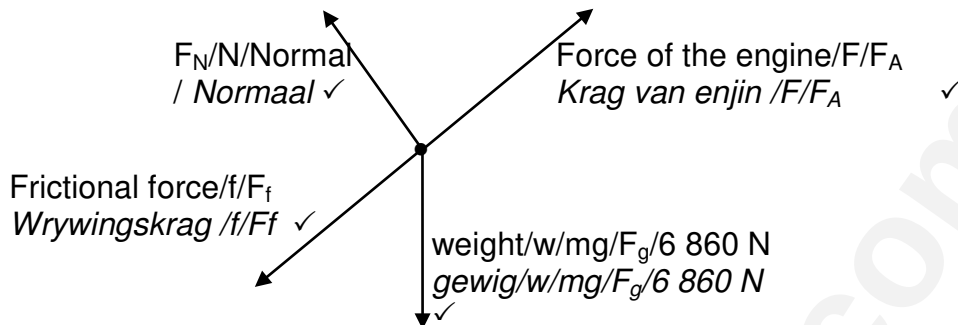
(2)

[13]

QUESTION / VRAAG 5

5.1 Zero/0 (J) ✓ (1)

5.2



(4)

5.3 5.3.1 The net/total work done on an object is equal to the change in the object's kinetic energy. ✓✓ (2 marks or zero.)

Die netto/totale werk verrig op 'n voorwerp is gelyk aan die verandering in die voorwerp se kinetiese energie. ✓✓ (2 punte or niks.)

(2)

5.3.2 **Marking guidelines / nasienriglyne**

- Formula/ Formule: $W_{\text{net}} = \Delta E_k$ or $W_{\text{nc}} = \Delta E_p + \Delta E_k$ ✓
- Formula / Formule: $W = F \Delta x \cos \theta$ ✓
- Substitution to calculate / Vervanging in formule $f = \mu_k mg \cos 30^\circ$ ✓
- Substitute to calculate / Vervanging om te bereken: W_f ✓
- Substitute to calculate / Vervanging om te bereken: W_w OR ΔE_p ✓
- Substitute to calculate / Vervanging om te bereken: W_F ✓
- Substitute to calculate / Vervanging om te bereken: ΔE_k ✓
- Final answer / Finale antwoord: $11,59 \text{ m} \cdot \text{s}^{-1}$ ✓

OPTION / OPSIE 1:

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

$$W_N + W_f + W_w + W_F = \Delta E_k$$

$$0 + f \Delta x \cos 180^\circ + w \Delta x \cos 180^\circ + F \Delta x \cos 0^\circ \quad \checkmark = E_{kf} - E_{ki}$$

$$\mu_k mg \cos 30^\circ \Delta x \cos 180^\circ + mg \Delta x \sin 30^\circ \cos 180^\circ + F \Delta x \cos 0^\circ = \frac{1}{2} m(v_f^2 - v_i^2)$$

$$0,32(700)(9,8) \cos 30^\circ \checkmark (70) \cos 180^\circ \checkmark + (700)(9,8) \sin 30^\circ (70) \cos 180^\circ \checkmark + (6000)(70) \cos 0^\circ \checkmark = \frac{1}{2} (700)(v_f^2 - 0) \quad \checkmark$$

$$-1,33 \times 10^5 - 2,4 \times 10^5 + 4,2 \times 10^5 = 350v_f^2$$

$$v_f = 11,59 \text{ m} \cdot \text{s}^{-1} \quad \checkmark$$

OPTION / OPSIE 2:

$$W_{\text{nc}} = \Delta E_p + \Delta E_k \quad \checkmark$$

$$W_f + W_F = mg \Delta h + \frac{1}{2} m(v_f^2 - v_i^2)$$

$$f \Delta x \cos 180^\circ + F \Delta x \cos 0^\circ \quad \checkmark = mg \Delta h + \frac{1}{2} m(v_f^2 - v_i^2)$$

$$0,32(700)(9,8) \cos 30^\circ \checkmark (70) \cos 180^\circ \checkmark + (6000)(70) \cos 0^\circ \checkmark =$$

$$(700)(9,8)(70 \sin 30^\circ - 0) \checkmark + \frac{1}{2} (700)(v_f^2 - 0) \quad \checkmark$$

$$v_f = 11,59 \text{ m} \cdot \text{s}^{-1} \quad \checkmark$$

(8)

[15]

QUESTION / VRAAG 6

- 6.1 6.1.1 It is the apparent change in frequency of a source when there is relative motion between the source and the observer. ✓✓

Dit is die skynbare verandering in frekwensie van 'n bron wanneer daar 'n relatiewe verandering in beweging tussen die bron en die waarnemer is. ✓✓ (2)

- 6.1.2 Away / Weg ✓ (1)

6.1.3
$$f_L = \frac{v \pm v_L}{v \pm v_s} f_s \quad \checkmark$$

$$73 = \frac{340}{340 + v_s} 75 \quad \checkmark$$

$$v_s = 9,32 \text{ m} \cdot \text{s}^{-1} \quad \checkmark \quad (4)$$

- 6.2
- The absorption spectrum observed for elements on a distant star compared to spectrum of elements on the earth or sun. ✓
 - Absorption lines in spectrum from star shifted to red end of the spectrum/ red shifted. ✓
 - Wavelengths in the absorption spectrum lines have increased. ✓
 - According to the Doppler effect the star is thus moving away from the earth. ✓

- *The absorbsiespektrum waargeneem vir elemente van 'n verafgeleë ster in vergelyking met die spektrum van elemente nader aan die aarde of die son. ✓*
- *Absorbsielyne in die spektrum van ster verskuif na die rooi kant van die spektrum/ rooiverskuiwing. ✓*
- *Golflengte in the absorbsiespektrumlyne vermeerder. ✓*
- *Volgens die Doppler effek beweeg die ster dus verder van die aarde. ✓ (4)*

- 6.3 Ultrasound scans / *ultraklankskandering* ✓
 Measuring rate of flow of blood (Blood-flow meter) / *Meting van die tempo waarteen bloed vloei (bloedvloeiometer)* ✓

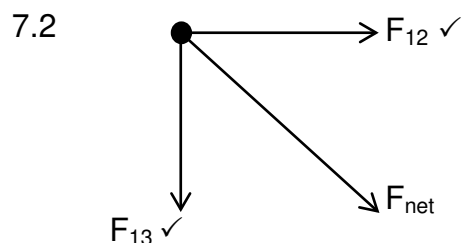
(2)
[13]

QUESTION / VRAAG 7

- 7.1 The force of attraction that two charges at rest exert on each other is directly proportional to the product of the two charges ✓ and inversely proportional to the square of the distance between their centres. ✓

Die aantrekkingskrag wat twee ladings in rus op mekaar uitoefen is direk eweredig aan die produk van die twee ladings ✓ en omgekeerd eweredig aan die vierkant van die afstand tussen die middelpunte. ✓

(2)



(2)

7.3

$$F_{12} = \frac{kQ_1Q_2}{r_{12}^2} \checkmark$$

$$= \frac{(9 \times 10^9)(2 \times 10^{-5})(2 \times 10^{-4})}{(0,5)^2} \checkmark$$

$$= 144 \text{ N, to the right / na regs}$$

$$F_{13} = \frac{kQ_1Q_3}{r_{13}^2}$$

$$= \frac{(9 \times 10^9)(2 \times 10^{-5})(2 \times 10^{-4})}{(0,4)^2} \checkmark$$

$$= 225 \text{ N, downwards / afwaarts}$$

$$F_{\text{net}} = \sqrt{(225)^2 + (144)^2}$$

$$= 267,13 \text{ N}$$

$$\tan \theta = \frac{225}{144} \therefore \theta = 57,38^\circ$$

$$F_{\text{net}} = 267,13 \text{ N, } \checkmark 147,38^\circ / \text{E}57,38^\circ\text{S} / 57,38^\circ \text{ south of east / suid van oos } \checkmark$$

(7)

[11]

QUESTION / VRAAG 8

8.1 12 V ✓ (1)

8.2	8.2.1	OPTION / OPSIE 1 $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} \checkmark$ $= \frac{1}{6} + \frac{1}{10} \checkmark$ $R_p = 3,75 \, \Omega$ $R_{\text{external}} = 3,75 + 2 \checkmark = 5,75 \, \Omega \checkmark$	OPTION 2 / OPSIE 2 $R_p = \frac{R_1 R_2}{R_1 + R_2} \checkmark$ $= \frac{(6)(10)}{6 + 10} \checkmark$ $R_p = 3,75 \, \Omega$ $R_{\text{external}} = 3,75 + 2 \checkmark = 5,75 \, \Omega \checkmark$	(4)
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8.2.2 **POSITIVE MARKING FROM QUESTION 8.2.1 / POSITIEWE NASIEN VAN VRAAG 8.2.1.**

OPTION / OPSIE 1 $V_1 = IR_{\text{ext}} \checkmark$ $\therefore I = \frac{10}{5,75} \checkmark$ $= 1,74 \, \text{A}$ $\mathcal{E} = IR_{\text{ext}} + Ir \checkmark$ $12 = (1,74)(5,75) + 1,74r \checkmark$ $\therefore r = 1,15 \, \Omega \checkmark$	OPTION / OPSIE 2 $V_1 = IR_{\text{ext}} \checkmark$ $\therefore I = \frac{10}{5,75} \checkmark$ $= 1,74 \, \text{A}$ $V_{\text{lost}} = Ir \checkmark$ $12 - 10 = 1,74r \checkmark$ $r = 1,15 \, \Omega \checkmark$	(5)
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8.3 Increases / Verhoog ✓
 Closing S_2 effectively cuts off the $2 \, \Omega$ resistor / is a short circuit. / Sluit van S_2 sny die $2 \, \Omega$ weerstand effektief af ✓
 Total resistance decreases / Totale weerstand verminder. ✓ (3)

[13]

QUESTION / VRAAG 9

9.1 9.1.1 AC / Alternating current / Wisselstroom ✓ (1)

9.1.2 DC ✓

Due to the presence of the split ring commutator, current always exits through the one brush and then through the other brush. ✓

Agv die teenwoordigheid van die splitringkommutator, is daar altyd stroom wat deur een borsel beweeg en dan deur die ander borsel. ✓

(2)

9.2 9.2.1 AC generator has slip rings ✓ whilst a DC generator has a split ring commutator. ✓

AC generator het slipringe, ✓ terwyl die DC generator splitringkommutator het. ✓

(2)

- 9.2.2 An AC voltage can be stepped up. / 'n AC stroom kan verhoging ondergaan. ✓
 Increase in voltage and decrease in current. / Verhoging in potensiaalverskil en verlaging in stroom. ✓
 Loss in power $P = I^2 R$ decreases. / Verlies aan drywing $P = I^2 R$ verminder ✓ (3)

9.3	9.3.1	OPTION / OPSIE 1 $f = \frac{1}{T}$ $= \frac{1}{0,02} \checkmark$ $= 50 \text{ Hz} \checkmark$	OPTION / OPSIE 2 $f = \frac{\text{cycles}}{\text{time}}$ $= \frac{3,5}{0,07} \checkmark$ $= 50 \text{ Hz} \checkmark$	(2)
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9.3.2	OPTION 1 $I_{\max} = \frac{V_{\max}}{R} \checkmark$ $= \frac{200}{20} \checkmark$ $= 10 \text{ A}$ $P_{\text{ave}} = \frac{1}{2}(V_{\max} I_{\max}) \checkmark$ $= \frac{1}{2}(200 \times 10) \checkmark$ $= 1000 \text{ W (1 kW)} \checkmark$	OPTION 2 $V_{\text{rms}} = \frac{V_{\max}}{\sqrt{2}} \checkmark$ $= \frac{200}{\sqrt{2}} \checkmark$ $= 141,42 \text{ V}$ $I_{\text{rms}} = \frac{V_{\text{rms}}}{R}$ $= \frac{141,42}{20}$ $= 7,07 \text{ A}$ $P_{\text{ave}} = I_{\text{rms}}^2 R$ $= (7,07)^2 20$ $= 999,70 \text{ W}$ OR $P_{\text{ave}} = V_{\text{rms}} I_{\text{rms}} \checkmark$ $= (141,42)(7,07) \checkmark$ $= 999,84 \text{ W} \checkmark$ Accept range / Aanvaar: 999,70 to 1000 W	(5)
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[15]

QUESTION / VRAAG 10

10.1 Minimum energy required to release (photo) electrons from a metal surface. ✓✓

Minimum energie nodig om (foto)elektrone uit 'n metaaloppervlak vry te stel. ✓✓ (2)

10.2

OPTION / OPSIE 1

$$\begin{aligned} W_o &= hf \checkmark \\ &= \frac{hc}{\lambda} \checkmark \\ &= \frac{(6,63 \times 10^{-34})(3 \times 10^8)}{500 \times 10^{-9}} \checkmark \\ &= 3,978 \times 10^{-19} \text{ J } \checkmark \end{aligned}$$

OPTION / OPSIE 2

$$\begin{aligned} f &= \frac{c}{\lambda} \checkmark \\ &= \frac{3 \times 10^8}{500 \times 10^{-9}} \checkmark \\ &= 6 \times 10^{14} \text{ Hz} \\ W_o &= hf \checkmark \\ &= (6,63 \times 10^{-34})(6 \times 10^{14}) \checkmark \\ &= 3,98 \times 10^{-19} \text{ J } \checkmark \end{aligned}$$

(5)

10.3 10.3.1 Remains the same / Bly dieselfde ✓

(1)

10.3.2 Remains the same / Bly dieselfde ✓

(1)

10.4 **POSITIVE MARKING FROM QUESTION 10.2 / POSITIEWE NASIEN VAN VRAAG 10.2.**

OPTION / OPSIE 1

$$\begin{aligned} E &= W_o + E_{k(\max)} \checkmark \\ \frac{hc}{\lambda} &= W_o + E_{k(\max)} \\ \frac{(6,63 \times 10^{-34})(3 \times 10^8)}{400 \times 10^{-9}} &= 3,978 \times 10^{-19} + E_{k(\max)} \checkmark \end{aligned}$$

$$E_{k(\max)} = 9,95 \times 10^{-20} \text{ J } \checkmark$$

Range/ aanvaar:

$$9,93 \times 10^{-20} \text{ J to } 9,95 \times 10^{-20} \text{ J}$$

OPTION / OPSIE 2

$$\begin{aligned} f &= \frac{c}{\lambda} \\ &= \frac{3 \times 10^8}{400 \times 10^{-9}} \checkmark \\ &= 7,5 \times 10^{14} \text{ Hz} \\ E &= hf \\ &= (6,63 \times 10^{-34})(7,5 \times 10^{14}) \checkmark \\ &= 4,97 \times 10^{-19} \text{ J} \\ E &= W_o + E_{k(\max)} \checkmark \\ 4,97 \times 10^{-19} &= 3,98 \times 10^{-19} + E_{k(\max)} \checkmark \\ E_{k(\max)} &= 9,93 \times 10^{-20} \text{ J } \checkmark \end{aligned}$$

(5)

[14]

QUESTION / VRAAG 11

- 11.1 The energy transferred to / work done on ✓ each coulomb (of charge) / per C charge ✓ passing through the battery.

Die lading oorgedra / arbeid verrig op ✓ *elke coulomb* (lading) / per C lading ✓ *wat deur die battery beweeg.*

(2)

- 11.2 Gradient/helling = $\frac{3,8 - 0,5}{9 - 0} = 0,37 \text{ (V}^{-1}\text{)}$

✓

Note/Aantekening:

- Accept any correct values from graph to calculate the gradient.
- *Aanvaar enige korrekte waarde vanaf grafiek om helling te bereken.*

(3)

- 11.3 $\frac{1}{\text{emf}}$ ✓

(1)

- 11.4 11.4.1 **POSITIVE MARKING FROM QUESTION 11.2 / POSITIEWE NASIEN VAN VRAAG 11.2.**

OPTION / OPSIE 1

$$\frac{1}{\text{emf}} = 0,37 \text{ ✓}$$

$$\varepsilon (\text{emf}) = 2,70 \text{ V ✓}$$

Range/Aanvaar:
2,67 – 2,70 V

OPTION / OPSIE 2

$$\text{emf} = 2(0) + 2r$$

$$\text{emf} = 0,26(9) + 0,26r$$

$$0 = -2,34 + 1,74r$$

$$r = 1,34 \text{ } \Omega$$

$$\varepsilon = 2(0) + 2r$$

$$= 2(1,34)$$

$$= 2,67 \text{ V ✓}$$

(2)

- 11.4.2 **POSITIVE MARKING FROM QUESTION 11.2 AND 11.3.1 / POSITIEWE NASIEN VAN VRAAG 11.2 EN 11.3.1.**

OPTION / OPSIE 1

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

$$y = mx + c: \frac{1}{I} = \frac{1}{\text{emf}} R + \frac{r}{\text{emf}}$$

$$y \text{ intercept / afsnit} = \frac{r}{\text{emf}}$$

$$0,5 \text{ ✓} = \frac{r}{2,70} \text{ ✓}$$

$$R = 1,35 \text{ } \Omega \text{ ✓}$$

Range/ aanvaar:
1,34 – 1,35 Ω

OPTION / OPSIE 2

Any two equation using values from the graph/ *Enige twee vergelykings waar waardes van grafiek gebruik is:*

$$\text{emf} = 2(0) + 2r \text{ ✓}$$

$$\text{emf} = 0,26(9) + 0,26r \text{ ✓}$$

$$0 = -2,34 + 1,74r$$

$$r = 1,34 \text{ } \Omega \text{ ✓}$$

(3)

[11]**GRAND TOTAL: 150**