

1.1 Electromagnetic induction ✓ **OR/OF** Faraday's law

1.2 Current

1.3 Coulomb's law

1.4 electromagnetic

1.5 (Line) emission (spectrum)

[1 x 5 = 5]

2.1 B

2.2 D

2.3 B

2.4 A

2.5 A

2.6 C

2.7 D

2.8 B

2.9 C

2.10 B

[2 x 10 = 20]

QUESTION 3/VRAAG 3

3.1 50 N ✓ downwards/afwaarts✓

(2)

3.2

3.2.1

<p>OPTION 1/OPSIE 1 Downward positive: Afwaarts positief: $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $\therefore v_f^2 = 0^2 + 2(9,8)(0,8)$ ✓ $\therefore v_f = 3,96 \text{ m}\cdot\text{s}^{-1}$ ✓ downward /afwaarts✓</p> <p>Downward negative: Afwaarts negatief: $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $\therefore v_f^2 = 0^2 + 2(-9,8)(-0,8)$ ✓ $\therefore v_f = -3,96 \text{ m}\cdot\text{s}^{-1}$ $\therefore v_f = 3,96 \text{ m}\cdot\text{s}^{-1}$ ✓ downward /afwaarts✓</p>	<p>Notes/Aantekeninge Accept/Aanvaar: g or/of a Accept/Aanvaar: $v_f^2 = v_i^2 + 2a\Delta x$ $v^2 = u^2 + 2as$</p>
<p>OPTION 2/OPSIE 2 $(E_p + E_k)_{\text{top/bo}} = (E_p + E_k)_{\text{bottom/onder}}$ ✓ $mgh + 0 = 0 + \frac{1}{2}mv^2$ $(9,8)(0,8) \checkmark = \frac{1}{2}v^2$ $v = 3,96 \text{ m}\cdot\text{s}^{-1}$ ✓ downward/afwaarts✓</p>	<p>Notes/Aantekeninge Accept/Aanvaar: $(U + K)_{\text{top/bo}} = (U + K)_{\text{bottom/onder}}$</p>

(4)

3.2.2

<p>POSITIVE MARKING FROM QUESTION 3.2.1 POSITIEWE NASIEN VAN VRAAG 3.2.1 OPTION 1/OPSIE 1 Downward positive/Afwaarts positief: $F_{\text{net}}\Delta t = \Delta p$ OR $F_{\text{net}}\Delta t = m(v_f - v_i)$ ✓ $(F_{\text{app}} + mg)\Delta t = \Delta p$ $(-50 + (0,2)(9,8))\Delta t \checkmark = 0,2(-3,43 - 3,96)$ ✓ $\therefore \Delta t = 0,03 \text{ s}$ ✓ ($3 \times 10^{-2} \text{ s}$)</p> <p>Downward negative/Afwaarts negatief: $F_{\text{net}}\Delta t = \Delta p$ OR $F_{\text{net}}\Delta t = m(v_f - v_i)$ ✓ $(F_{\text{app}} + mg)\Delta t = \Delta p$ $(50 - (0,2)(9,8))\Delta t \checkmark = 0,2[3,43 - (-3,96)]$ ✓ $\therefore \Delta t = 0,03 \text{ s}$ ✓ ($3 \times 10^{-2} \text{ s}$)</p>	<p>Notes/Aantekeninge: Substitution: F_{app} and v_f must have the same sign. Substitusie: F_{app} en v_f moet dieselfde tekens hê.</p>
<p>OPTION 2/OPSIE 2 Downward positive/Afwaarts positief: $F_{\text{net}} = ma$ $F_{\text{app}} + mg = ma$ $(-50 + (0,2)(9,8)) = 0,2a$ ✓ $\therefore a = -240,2 \text{ m}\cdot\text{s}^{-2}$ ✓</p> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin-left: 200px;"> <p>✓ both formulae beide formules</p> </div> <p>$v_f = v_i + a \Delta t$ $-3,43 = 3,96 + (-240,2)\Delta t$ ✓ $\therefore \Delta t = 0,03 \text{ s}$ ✓ ($3 \times 10^{-2} \text{ s}$)</p> <p>Downward negative/Afwaarts negatief: $F_{\text{net}} = ma$ $F_{\text{app}} + mg = ma$ $(50 - (0,2)(9,8)) = 0,2a$ ✓ $\therefore a = 240,2 \text{ m}\cdot\text{s}^{-2}$ ✓</p> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin-left: 200px;"> <p>✓ both formulae beide formules</p> </div> <p>$v_f = v_i + a \Delta t$ $3,43 = -3,96 + (240,2)\Delta t$ ✓ $\therefore \Delta t = 0,03 \text{ s}$ ✓ ($3 \times 10^{-2} \text{ s}$)</p>	<p>Notes/Aantekeninge Accept/Aanvaar: $v = u + at$ $v_f = v_i + a \Delta t$</p>

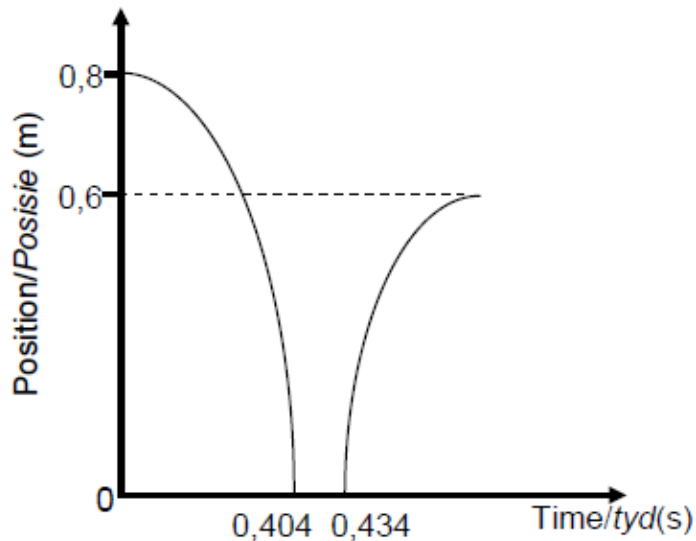
(4)

POSITIVE MARKING FROM QUESTION 3.2.
POSITIEWE NASIEN VAN VRAAG 3.2.

OPTION/OPSIE 1

Ground as zero reference and downward negative:
Grond as nulverwysing en afwaarts negatief:

Criteria for graph/Kriteria vir grafiek:	Marks/Punte
Correct shape (both curves) <i>Korrekte vorm (beide krommes)</i>	✓
Graph starts at $y = 0,8$ m at $t = 0$ s <i>Grafiek begin by $y = 0,8$ m at $t = 0$ s</i>	✓
Second maximum height at $y = 0,6$ m <i>Tweede maksimum by $y = 0,6$ m s</i>	✓
Contact time shown as space on x axis between two curves. <i>Kontaktyd aangetoon as spasie op x-as tussen twee krommes.</i>	✓
Time at which ball leaves the floor shown as $t = 0,434$ s. <i>Tyd wanneer die bal die vloer verlaat getoon as $t = 0,434$ s.</i>	✓

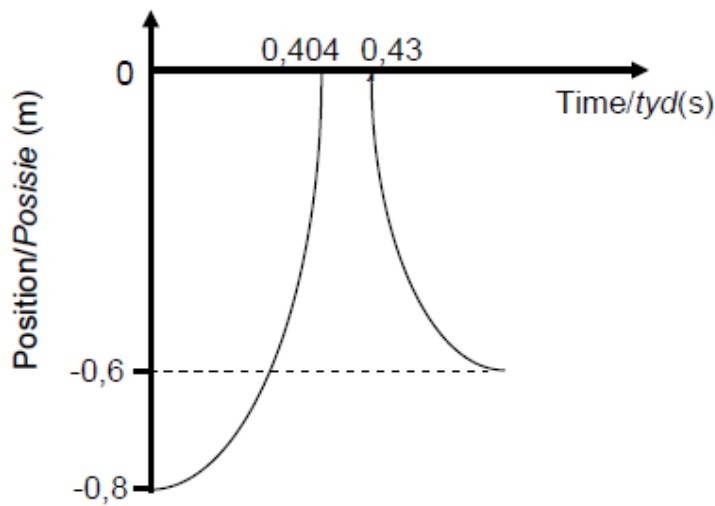


OPTION/OPSIE 2

Ground as zero reference and downward positive:

Grond as nulverwysing en afwaarts positief:

Criteria for graph/ <i>Kriteria vir grafiek:</i>	Marks/ <i>Punte</i>
Correct shape (both curves) <i>Korrekte vorm (beide krommes)</i>	✓
Graph starts at $y = -0,8$ m at $t = 0$ s <i>Grafiek begin by $y = -0,8$ m at $t = 0$ s</i>	✓
Second maximum height at $y = -0,6$ m <i>Tweede maksimum by $y = -0,6$ m</i>	✓
Contact time shown as space on x axis between two curves. <i>Kontaktyd aangetoon as spasie op x-as tussen twee krommes.</i>	✓
Time at which ball leaves the floor shown as $t = 0,434$ s. <i>Tyd wanneer die bal die vloer verlaat getoon as $t = 0,434$ s.</i>	✓



(5)
[15]

Question 4

4.1 Law of conservation of linear momentum ✓

Law of conservation of mechanical energy ✓

4.2 They system must be isolated/there must be no friction. ✓

4.3 Emech (bottom) = Emech(top)

$$mgh + \frac{1}{2}mv^2 = mgh + \frac{1}{2}mv^2 \quad \checkmark$$

$$\underline{0} + \frac{1}{2}(5.5)v^2 \quad \checkmark = \underline{(5.5)(9.8)(0.8)} + 0 \quad \checkmark$$

$$v = 3,96\text{m}\cdot\text{s}^{-1}$$

$$P_{\text{initial}} = P_{\text{final}} \quad \checkmark$$

$$m_1v_{1i} + m_2v_{2i} = m_{1+2}v_f$$

$$\underline{1,5(v_i)} + 4(0) \quad \checkmark = \underline{5,5 (3.96)} \quad \checkmark$$

$$v_i = 14,52\text{m}\cdot\text{s}^{-1} \quad \checkmark$$

Question 5

$$P_{\text{initial}} = P_{\text{final}}$$

$$(m_1 + m_2)V_i = m_1v_{f1} + m_2v_{f2} \quad \checkmark$$

$$0 \quad \checkmark = 2V_{fR} \quad \checkmark + 6 V_{fS} \quad \checkmark$$

$$V_R = -3V_S \quad \checkmark$$

$$E_{kR} + E_{kS} = 48 \text{ J}$$

$$\frac{1}{2}mV_R^2 + \frac{1}{2}mV_S^2 = 48 \quad \checkmark$$

$$\checkmark \quad \checkmark$$

$$\underline{\frac{1}{2}(2)(-3V_S)^2} + \underline{\frac{1}{2}(6)V_S^2} = 48$$

$$V_S = 2 \text{ m}\cdot\text{s}^{-1}$$

$$V_R = -3V_S$$

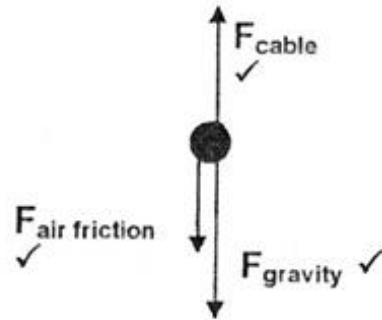
$$= -3 (2)$$

$$= -6\text{m}\cdot\text{s}^{-1}$$

$$V_R = \underline{6\text{m}\cdot\text{s}^{-1}} \text{ in opposite direction to S} \quad \checkmark$$

Question 6

6.1.1



(3)

6.1.2

$$W_{\text{gravitational force}} + W_{\text{air friction}} + W_{\text{cable}} = 0 \checkmark$$

$$(m \times 9,8 \times \cos 180^\circ \times 70) \checkmark + (8 \times \cos 180^\circ \times 70) \checkmark + (377\,300) \checkmark = 0$$

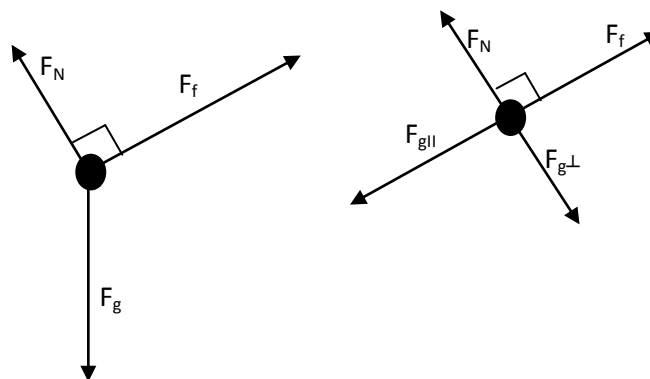
$$m = 549,18 \text{ kg } \checkmark \quad (5)$$

[8]

Question 7

7.1

- F_g – force of gravity \checkmark
- F_N – normal force \checkmark
- F_f – force of friction \checkmark



(3)

7.2 $W_{\text{net}} = \Delta K \checkmark$

$$= K_f - K_i$$

$$= \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

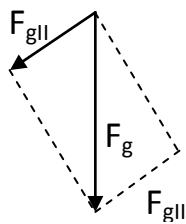
$$= \frac{1}{2}(80)(7)^2 \checkmark - \frac{1}{2}(80)(0)^2 \checkmark$$

$$= 1960 \text{ J } \checkmark \quad (4)$$

$$\begin{aligned}
 7.3 \quad W &= F\Delta x \cos\Theta \\
 &= (200)(6)\cos 180^\circ \\
 &= \mathbf{-1200 \text{ J}} \qquad (3)
 \end{aligned}$$

$$\begin{aligned}
 7.4 \quad W_{\text{net}} &= W_{F_{\text{gll}}} + W_{F_f} \quad \checkmark \\
 1960 &= W_{F_{\text{gll}}} + (-1200) \quad \checkmark \\
 W_{F_{\text{gll}}} &= 3160 \text{ J}
 \end{aligned}$$

$$\begin{aligned}
 W_{F_{\text{gll}}} &= F_{\text{gll}}\Delta x \cos\Theta \quad \checkmark \\
 3160 &= F_{F_{\text{gll}}}(6)\cos 0^\circ \quad \checkmark \\
 F_{F_{\text{gll}}} &= 526,67 \text{ N down ramp}
 \end{aligned}$$



$$\begin{aligned}
 \sin\Theta &= F_{\text{gll}} / F_g \\
 \sin\Theta &= 526,67 / (80)(9,8) \quad \checkmark \\
 \sin\Theta &= \mathbf{42,20^\circ} \quad \checkmark \qquad (6)
 \end{aligned}$$

[16]

Question 8

$$\begin{aligned}
 8.1 \quad \frac{1}{R_p} &= \frac{1}{R_1} + \frac{1}{R_2} \quad \checkmark \\
 \frac{1}{R_p} &= \frac{1}{2+2} + \frac{1}{10+6} \quad \checkmark
 \end{aligned}$$

$$\begin{aligned}
 1/R_p &= 5/16 \\
 R_p &= \mathbf{3,2 \Omega} \quad \checkmark \qquad (3)
 \end{aligned}$$

$$\begin{aligned}
 8.2.1 \quad V_1 &= IR \quad \checkmark \\
 &= (6)(3,2) \quad \checkmark \\
 &= \mathbf{19,2 \text{ V}} \quad \checkmark
 \end{aligned}
 \tag{3}$$

$$\begin{aligned}
 8.2.2 \quad I_{10\Omega + 6\Omega} &= V/R \quad \checkmark & V_2 &= IR \\
 &= 19,2 / 16 \quad \checkmark & &= (1,2)(6) \quad \checkmark \\
 &= 1,2 \text{ A} & &= \mathbf{7,2 \text{ V}} \quad \checkmark
 \end{aligned}
 \tag{4}$$

$$\begin{aligned}
 8.2.3 \quad \varepsilon &= I(R+r) \quad \checkmark \\
 24 &= 6(3,2 + r) \quad \checkmark \\
 r &= \mathbf{0,8 \Omega} \quad \checkmark
 \end{aligned}
 \tag{3}$$

8.3

8.3.1 Increase \checkmark (1)

8.3.2 Decrease \checkmark (1)

8.3.3 Decrease \checkmark (1)

[16]

Question 9

- 9.1 Stores (electric) charge/energy. ✓
Stoor (elektriese) lading/energie.

OR/OF

Releases (stored) charge instantly/very fast. ✓

Stel (gestoorde) lading onmiddellik vry/baie vinnig vry. (1)

- 9.2 The brightness of the bulb decreases (gradually) ✓
until it stops glowing/dies.
Die helderheid van die gloeilamp verminder (geleidelik).

OR/OF

The bulb glows dimmer ✓

until it stops glowing/dies.

Die gloeilamp gloei flouer totdat dit ophou gloei/uitbrand. (1)

- 9.3.1 0 (V) ✓ (1)

- 9.3.2 12 V ✓ (1)

POSITIVE MARKING FROM QUESTION 9.3.2

POSITIEWE NASIEN VAN VRAAG 9.3.2

9.4.1 $E = \frac{V}{d}$ ✓

$$= \frac{12}{5,4 \times 10^{-3}} \checkmark$$

$$= 2,22 \times 10^3 \text{ V}\cdot\text{m}^{-1} \checkmark \quad (2 \ 222,22 \text{ V}\cdot\text{m}^{-1})$$
 (3)

- 9.4.2 **POSITIVE MARKING FROM QUESTION 8.4.1.**

POSITIEWE NASIEN VAN VRAAG 8.4.1.

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

$$\therefore 2,22 \times 10^3 = \frac{F}{1,6 \times 10^{-19}} \checkmark$$

$$\therefore F = 3,55 \times 10^{-16} \text{ N} \checkmark$$
 (3)

Question 10

- 10.1 D C ✓ - has a split ring commutator OR has a battery. (2)
- 10.2 electrical to mechanical ✓ (1)
- 10.3 Split ring commutator ✓ (1)
- 10.4 North ✓ (1)
- 10.5.1 coil rotates faster ✓ (1)
- 10.5.2 coil rotates in the opposite direction ✓ (1)
- 10.6 $I_{rms} = \frac{I_{max}}{\sqrt{2}} \checkmark$
 $= \frac{2,5}{\sqrt{2}} \checkmark$
 $= 1,77 A$
 $P = I^2 R \checkmark$
 $= 1,77^2 \times 4,8 \checkmark$
 $= 15,04 W \checkmark$ (5)
- Or 15 W (12)

Question 11

- 11.1 Medical imaging/ CT scan/ security checks ✓ (1)
- 11.2 burn tissues leading to cancer ✓ (1)
- 11.3 Gamma rays ✓ (1)

Question 12

12.1

Criteria for investigative question/ <i>Kriteria vir ondersoekende vraag:</i>	Mark/Punt
The <u>dependent</u> and <u>independent</u> variables are stated. <i>Die afhanklike en onafhanklike veranderlikes is genoem.</i>	✓
Asks a question about the relationship between dependent and independent variables. <i>Vra 'n vraag oor die verwantskap tussen die afhanklike en onafhanklike veranderlikes.</i>	✓

Dependent variable:

Afhanklike veranderlike:

Broadness of central (bright) band/degree of diffraction
Breedte van sentrale (helder) band/mate van diffraksie

Independent variable:

Onafhanklike veranderlike:

Wavelength (of light)/Golflengte (van lig)

Example/*Voorbeeld:*

How will the width of the central band change/differ when the wavelength (of the light) changes/is increased/is decreased?

Hoe sal die breedte van die sentrale helder band verander wanneer die golflengte (van die lig) toeneem/afneem?

(2)

12.2 Slit width/*Spleetwydte* ✓

Distance between slit and screen/*Afstand tussen spleet en skerm.* ✓

(2)

12.3 $\tan \theta = \frac{0,033}{0,45}$ ✓ $\therefore \theta = 4,19(4)^\circ$

$\sin \theta = \frac{m\lambda}{a}$ ✓

$\sin 4,19^\circ$ ✓ = $\frac{(1)\lambda}{5,6 \times 10^{-7}}$ ✓

$\therefore \lambda = 4,1 \times 10^{-8} \text{ m}$ ✓

(5)

12.4 Greater than/*Groter as* ✓

Red light has a longer wavelength (and is diffracted more.) ✓

Rooilig het 'n langer golflengte (en word meer diffrakteer.)

OR/OF

Diffraction/*Diffraksie* $\propto \lambda$ ✓

(2)

[11]

Or (sin) θ is directly proportional to wavelength

Question 13

13.1 Quantum/packet of energy/*Kwantum/pakkie energie* ✓
found in light/*In lig gevind* ✓ (2)

13.2.1	<p><u>OPTION 1/OPSIE 1</u></p> $E = \frac{hc}{\lambda} \checkmark$ $6,9 \times 10^{-19} \checkmark = \frac{(6,63 \times 10^{-34})(3 \times 10^8)}{\lambda} \checkmark$ $\therefore \lambda = 2,88 \times 10^{-7} \text{ m} \checkmark$				
	<p><u>OPTION 2 / OPSIE 2</u></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 35%; padding: 5px;"> $E = hf$ $6,9 \times 10^{-19} \checkmark = 6,63 \times 10^{-34} f \checkmark$ $\therefore f = 1,04 \times 10^{15} \text{ Hz}$ </td> <td style="width: 15%; padding: 5px; text-align: center;"> <p>✓ Both formulae <i>Beide formules</i></p> </td> <td style="width: 50%;"></td> </tr> </table> <p style="margin-left: 20px;">↙</p> $c = f\lambda$ $3 \times 10^8 = 1,04 \times 10^{15} \lambda \checkmark$ $\therefore \lambda = 2,88 \times 10^{-7} \text{ m} \checkmark$	$E = hf$ $6,9 \times 10^{-19} \checkmark = 6,63 \times 10^{-34} f \checkmark$ $\therefore f = 1,04 \times 10^{15} \text{ Hz}$	<p>✓ Both formulae <i>Beide formules</i></p>		<p><u>Notes/Aantekeninge</u> Accept/<i>Aanvaar</i>: $v = f\lambda$</p>
$E = hf$ $6,9 \times 10^{-19} \checkmark = 6,63 \times 10^{-34} f \checkmark$ $\therefore f = 1,04 \times 10^{15} \text{ Hz}$	<p>✓ Both formulae <i>Beide formules</i></p>				

(5)

13.2.2 $E = W_o + E_k \checkmark$
 $6,9 \times 10^{-19} = 6,4 \times 10^{-19} + E_k \checkmark$
 $\therefore E_k = 5 \times 10^{-20} \text{ J} \checkmark$ (3)

13.3.1 *Increases/Vermeerder* ✓

- More photons (packets of energy) strike the surface of the metal per unit time./*Meer fotone (pakkies energie) tref die oppervlakte van die metaal per eenheid tyd.* ✓
- More (photo)electrons ejected per unit time./*Meer (foto)elektrone vrygestel per eenheid tyd.* ✓

(3)

13.3.2 *Increases/Vermeerder* ✓

- (Photo)electrons are emitted with higher kinetic energy/move faster./*(Foto)elektrone word vrygestel met hoër kinetiese energie/beweeg vinniger.* ✓
- Increase in rate of flow of charge./*Same number of charges pass a point in a shorter time./Toename in tempo van vloei van lading/dieselfde aantal lading beweeg verby 'n punt in 'n korter tyd.* ✓

(3)

[16]