



GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

**GAUTENG DEPARTMENT OF EDUCATION/
GAUTENGSE DEPARTEMENT VAN
ONDERWYS**

**PREPARATORY EXAMINATION/
VOORBEREIDENDE EKSAMEN**

2021

**MARKING GUIDELINES/
NASIENRIGLYNE**

10841

**PHYSICAL SCIENCES: PHYSICS/
FISIESE WETENSAPPE: FISIKA**

**PAPER 1/
VRAESTEL 1**

QUESTION/VRAAG 1

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

QUESTION/VRAAG 2

- 2.1 When a resultant/net force acts on an object, the object will accelerate in the direction of the 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 inwerk, sal die voorwerp versnel in die rigting van die krag teen 'n versnelling wat direk eweredig is aan die krag ✓ en omgekeerd eweredig is aan die massa van die voorwerp. ✓

OR/OF

The net/resultant force is directly proportional to the rate of change in momentum and the change in momentum is in the direction of the force. ✓✓

Die netto/resultante krag is direk eweredig aan die tempo van verandering in momentum en die verandering in momentum is in die rigting van die krag. ✓✓

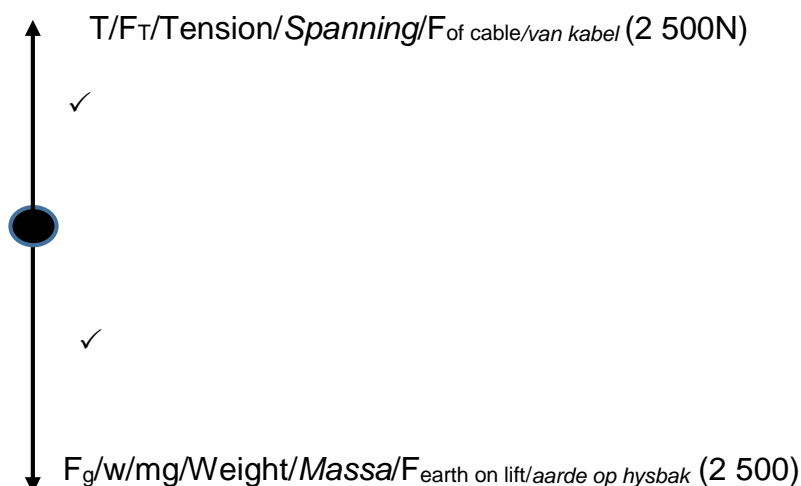
(2)

Marking criteria/Nasienriglyne:

If any of the underlined key words/phrases in the correct context are omitted: -1 mark per word/phrase.

Indien enige van die onderstreepte sleutelwoorde/frases in die korrekte konteks weggelaat word: -1 punt per woord/frase.

- 2.2



(2)

Marking criteria/Nasienriglyne:

- Mark is awarded for label and arrow./Punt word gegee vir byskrif en pyl.
- Do not penalise for length of arrows./Moenie penaliseer vir pylengtes nie.
- Deduct 1 mark for any additional force./Trek 1 punt af vir enige ekstra kragte.
- If all forces are correctly drawn and labelled but no arrows, -1 mark./Indien alle kragte korrek geteken en benoem is maar geen pyle nie, -1 punt.
- If forces are not making contact with the dot, -1 mark./Indien kragte nie kontak maak met die kol nie, -1 punt.

2.3 $0 \text{ m}\cdot\text{s}^{-2} \checkmark$ (1)

2.4 $F_g = mg \checkmark$
 $2500 \checkmark = m(9,8)$
 $m = 255,10 \text{ kg} \checkmark$ (3)

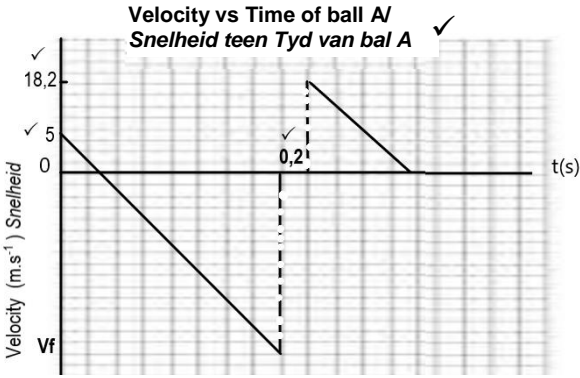
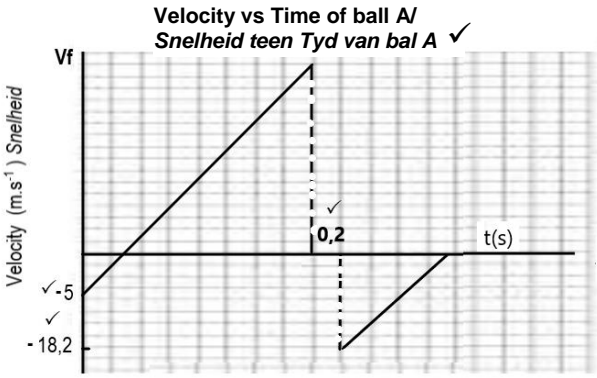
ANSWER/ANTWOORD	Marking Guidelines/Nasienriglyne
2.5 $F_{\text{net}} = ma \checkmark$ $T + F_g = ma$ $T - F_g = ma$ $3\ 000 - 2\ 500 \checkmark = 255,10a \checkmark$ $500 = 255,10a$ $a = 1,96 \text{ m}\cdot\text{s}^{-2} \checkmark$	\checkmark Formula ($F_{\text{net}} = mxa$)/Formule \checkmark substitution/vervanging (3 000-2 500) \checkmark substitution/vervanging (255,10) \checkmark answer with unit/antwoord met eenheid (4)
2.6 The force of <u>the empty lift on earth.</u> $\checkmark\checkmark$ / <u>Die krag van die leë hysbak op die aarde.</u> $\checkmark\checkmark$	(2)
	[14]

ANSWER/ANTWOORD	Marking Guidelines/Nasienriglyne	
QUESTION/VRAAG 3:		
3.1 9,8 m.s ⁻² downwards/afwaarts ✓✓		(2)
<p>3.2 Up is positive/Opwaarts is positief OPTION/OPSIE 1: $y = v_i t + \frac{1}{2} g t^2$ ✓ -20 ✓ $= +5 t + \frac{1}{2} (-9,8) t^2$ ✓ $= -4,9 t^2 + 5t + 20$ $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $t = -1,57$ s not applicable/nie van toepassing nie $t = 2,59$ s ✓</p> <p>OR/OF</p>	<p>OPTION/OPSIE 1: ✓ Formula/formule ✓ Substitution v_i and g with opposite signs./Vervanging van v_i en g met teenoorgestelde tekens. ✓ Substitution: y and g same signs/ Vervanging: y en g dieselfde tekens ✓ Answer/Antwoord 2,59 s</p>	
<p>OPTION/OPSIE 2: Time up/Tyd opwaarts: $v_f = v_i + at$ $0 = +5 + (-9,8) \times t$ $t = 0,51$ s height above bridge/hoogte bo brug: $y = v_i t + \frac{1}{2} g t^2$ $= (+5 \times 0,51) + \frac{1}{2} \times (-9,8) \times (0,51)^2$ $= 1,2755$ m ∴ total height/totale hoogte = 21,276 m</p> <p>Time down/Tyd afwaarts: $y = v_i t + \frac{1}{2} g t^2$ $-21,276 = 0 + (-9,8) t^2$ $t = 2,0837$ s</p> <p>TOTAL TIME/TOTALE TYD = $2,0837 + 0,51 = 2,59$ s</p> <p>OR/OF</p>	<p>OPTION/OPSIE 2: ✓ Both Formulae/Beide Formules ($v_f = v_i + at$ and/en $y = v_i t + \frac{1}{2} g t^2$) ✓ Substitution v_i and g with opposite signs./Vervanging v_i en g met teenoorgestelde tekens. ✓ Substitution: y and g same signs/ Vervanging: y en g dieselfde tekens ✓ Answer/Antwoord 2,59 s</p>	

ANSWER/ANTWOORD	Marking Guidelines/Nasienriglyne
<p>OPTION/OPSIE 3:</p> <p>Time up/Tyd opwaarts:</p> $v_f = v_i + at$ $0 = +5 + (-9,8) \times t$ $t = 0,51 \text{ s}$ <p>FINAL VELOCITY/FINALE SNELHEID:</p> $v_f^2 = v_i^2 + 2ay$ $+ 5^2 + 2 \times (-9,8)(-20)$ $v_f = 20,42 \text{ m.s}^{-1}$ <p>Time down/Tyd afwaarts:</p> $v_f = v_i + at$ $20,42 = 0 + (-9,8) \times t$ $t = 2,08 \text{ s}$ <p>TOTAL TIME/TOTALE TYD =</p> $2,08 + 0,51 = 2,59 \text{ s}$ <p>OR/OF</p> <p>OPTION/OPSIE 4:</p> <p>FINAL VELOCITY/FINALE SNELHEID:</p> $v_f^2 = v_i^2 + 2ay$ $= + 5^2 + 2 \times (-9,8)(-20)$ $v_f = 20,42 \text{ m.s}^{-1}$	<p>OPTION/OPSIE 3 and/en 4:</p> <ul style="list-style-type: none"> ✓ Both Formulae/Beide Formules ($v_f = v_i + at$ and/en $v_f^2 = v_i^2 + 2ay$) ✓ Substitution v_i and g with opposite signs/Vervanging v_i en g met teenoorgestelde tekens ✓ Substitution: y and g same signs/Vervanging: y en g dieselfde tekens ✓ Answer/Antwoord 2,59 s <p>DOWN IS POSITIVE/AF IS POSITIEF</p> <p>OPTION/OPSIE 1:</p> <p>Down is positive/Af is positief</p> $y = vit + \frac{1}{2} at^2$ $20 = -5t + \frac{1}{2} (9,8)t^2$ $0 = 4,9t^2 - 5t - 20$ $t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= 2,593 \text{ s or } 1,573 \text{ s}$ <p>OPTION/OPSIE 2:</p> <p>Time up/Tyd opwaarts</p> $v_f = v_i + at$ $0 = -5 + (9,8) \times t$ $t = 0,51 \text{ s}$ <p>height above bridge/hoogte bo brug</p> $y = vit + \frac{1}{2} at^2$ $= -5 \times 0,51 + \frac{1}{2} \times 9,8 \times (0,51)^2$ $= -1,2755 \text{ m}$ <p>Therefore total height/Daarom totale hoogte = 21,276 m</p> <p>Time down/Tyd afwaarts</p> $y = vit + \frac{1}{2} at^2$ $21,276 = 0 + 9,8 \times t^2$ $t = 2,0837 \text{ s}$ <p>Total time/Totale tyd</p> $= 2,0837 + 0,51 = 2,59 \text{ s}$

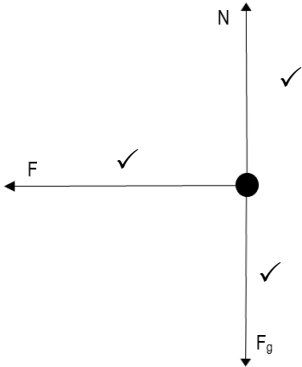
ANSWER/ANTWOORD	Marking Guidelines/Nasienriglyne
<p>TOTAL TIME/TOTALE TYD:</p> $v_f = v_i + at$ $-20,42 = +5 + (-9,8) \times t$ $t = 2,59 \text{ s}$	<p>OPTION/OPSIE 3:</p> <p>Time up/Tyd opwaarts</p> $v_f = v_i + at$ $0 = -5 + (9,8) \times t$ $t = 0,51 \text{ s}$ <p>FINAL VELOCITY/FINALE SNELHEID</p> $v_f^2 = v_i^2 + 2ay$ $= (-5)^2 + 2 \times 9,8 \times 20$ $= 20,42 \text{ m}\cdot\text{s}^{-1}$
	<p>Time down/Tyd afwaarts:</p> $v_f = v_i + at$ $20,42 = 0 + 9,8 \times t$ $t = 2,08 \text{ s}$ <p>Total time/Totale tyd =</p> $2,08 + 0,51 = 2,59 \text{ s}$ <p>OR/OF</p> <p>OPTION/OPSIE 4:</p> $v_f^2 = v_i^2 + 2ay$ $= (-5)^2 + 2 \times 9,8 \times 20$ $= 20,42 \text{ m}\cdot\text{s}^{-1}$ <p>TOTAL TIME/TOTALE TYD</p> $v_f = v_i + at$ $20,42 = -5 + 9,8 \times t$ $T = 2,59 \text{ s}$ <p style="text-align: right;">(4)</p>

ANSWER/ANTWOORD	Marking Guidelines/Nasienriglyne
<p>3.3 UP IS POSITIVE/Op is positief</p> <p>DISPLACEMENT OF BALL A/ VERPLASING VAN BAL A:</p> $y = v_i t + \frac{1}{2} g t^2 \quad \checkmark$ $= (+5 \times 1,2) + \left(\frac{1}{2} \times (-9,8) \times (1,2)^2 \right) \checkmark$ $= -1,056 \text{ m}$ <p>\therefore it is 1,056 m below the bridge/ \therefore dit is 1,056 m onder die brug</p> <p>DISPLACEMENT OF BALL B/ VERPLASING VAN BAL B:</p> $y = v_i t + \frac{1}{2} g t^2$ $= (+14 \times 1,2) + \left(\frac{1}{2} \times (-9,8) \times (1,2)^2 \right) \checkmark$ $= 9,74 \text{ m} \quad \checkmark \text{ upwards from ground/}$ <p><i>opwaarts vanaf die grond</i></p> <p>distance apart/afstand apart $= 20 - 1,056 - 9,74 \quad \checkmark$ $= 9,20 \text{ m apart.} \quad \checkmark$</p>	<p>\checkmark Formula (only once)/formule (slegs een keer)</p> <p>\checkmark Substitution v_i and g with opposite signs/Vervanging v_i en g met teenoorgestelde tekens</p> <p>\checkmark Substitution: v_i and g same signs (Second equation)/Vervanging: v_i en g dieselfde tekens (tweede vergelyking)</p> <p>\checkmark Displacement of B/Verplasing van B = 9,74 m</p> <p>\checkmark Subtraction of displacement of A and B/Aftrekking van verplasing van A en B</p> <p>\checkmark Answer/Antwoord = 9,20 m</p> <p>DOWN is POSITIVE/AF is POSITIEF</p> <p>DISPLACEMENT OF BALL A/ VERPLASING VAN BAL A:</p> $y = v_i t + \frac{1}{2} g t^2 \quad \checkmark$ $= (-5 \times 1,2) + \left(\frac{1}{2} \times 9,8 \right) \times (1,2)^2 \checkmark$ $= 1,056 \text{ m}$ <p>\therefore it is 1,056 m below the bridge/ \therefore dit is 1,056 m onder die brug</p> <p>DISPLACEMENT OF BALL B/ VERPLASING VAN BAL B:</p> $y = v_i t + \frac{1}{2} g t^2 = (-14 \times 1,2) + \left(\frac{1}{2} \times (9,8) \times (1,2)^2 \right) \checkmark$ $= -9,74 \text{ m} \quad \checkmark \text{ upwards from ground/}$ <p><i>opwaarts vanaf die grond</i></p> <p>distance apart/afstand van mekaar af $= 20 - 1,056 - 9,74 \quad \checkmark$ $= 9,20 \text{ m apart.} \quad \checkmark$</p> <p style="text-align: right;">(6)</p>

ANSWER/ANTWOORD	Marking Guidelines/Nasienriglyne
<p>3.4 For up positive/<i>Vir opwaarts positief</i></p>  <p>Velocity vs Time of ball A/ <i>Snelheid teen Tyd van bal A</i> ✓</p> <p>For down positive/<i>Vir afwaarts positief</i></p>  <p>Velocity vs Time of ball A/ <i>Snelheid teen Tyd van bal A</i> ✓</p>	<ul style="list-style-type: none"> ✓ Heading on axis/<i>Asse benoem</i> ✓ The initial velocity of the ball/<i>Die aanvanklik snelheid van die bal</i> ✓ The time when the ball hits the ground and is in contact with the ground/<i>Die tyd wanneer die bal die grond tref en in kontak is met die grond</i> ✓ 18,2 the velocity of the ball when it rebounds from the ground/<i>18,2 die snelheid van die bal wanneer dit weer terugbous van die grond af</i> <p style="text-align: right;">(4)</p>
[16]	
<p>QUESTION/VRAAG 4</p> <p>4.1 The <u>total linear momentum</u> of a <u>closed/isolated system remains constant</u> (is conserved). ✓✓</p> <p><i>Die <u>totale lineêre momentum</u> in 'n <u>geslote/geïsoleerde sisteem</u> bly <u>konstant</u> (is behou). ✓✓</i></p>	<p>If any of the underlined key words/phrases in the correct context are omitted: -1 mark per word/phrase./ <i>Indien enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word: -1 punt per woord/frase.</i></p> <p style="text-align: right;">(2)</p>
<p>4.2.1 $p = m \times v_f$ ✓</p> <p>$-144 = 900 \times v_f$ ✓</p> <p>$v_f = 0,160 \text{ m.s}^{-1}$ ✓ West/left/Wes /links ✓</p>	<ul style="list-style-type: none"> ✓ Formula/<i>Formule</i> ✓ Substitution/<i>Vervanging</i> ✓ Answer with units/<i>Antwoord met eenhede</i> ✓ Direction – West/left/<i>Rigting – Wes/links</i> <p style="text-align: right;">(4)</p>

ANSWER/ANTWOORD	Marking Guidelines/Nasienriglyne
<p>4.2.2 OPTION/OPSIE 1:</p> $\Delta p = p_f - p_i \checkmark$ $= -144 - (18\,000) \checkmark$ $= -18\,144 \text{ kg.m.s}^{-1}$ $= 18\,144 \text{ N.s} \checkmark \text{West/towards the car/Wes/in die rigting van die motor} \checkmark$ <p>OR/OF</p> <p>OPTION/OPSIE 2:</p> $\Delta p = p_f - p_i$ $= 18144 - 0$ $= 18\,144 \text{ kg.m.s}^{-1}$ $= 18\,144 \text{ N.s} \text{ West/towards the car/Wes/in die rigting van die motor}$ <p>OR/OF</p> <p>OPTION/OPSIE 3:</p> $\Delta p = mv_f - mv_i \checkmark$ $= (900 \times (-0,16)) - (900 \times 20) \checkmark$ $= -18\,144 \text{ kg.m.s}^{-1}$ $= 18\,144 \text{ N.s} \checkmark \text{West/towards the car/Wes/in die rigting van die motor} \checkmark$ <p>OR/OF</p> <p>OPTION/OPSIE 4:</p> $\Delta p = mv_f - mv_i \checkmark$ $= (3\,200 \times (5,67)) - 0 \checkmark$ $= -18\,144 \text{ kg.m.s}^{-1}$ $= 18\,144 \text{ N.s} \checkmark \text{West/towards the car/Wes/in die rigting van die motor} \checkmark$	<ul style="list-style-type: none"> ✓ Formula/Formule ✓ Substitution/Vervanging ✓ Answer must be positive/ <i>Antwoord moet positief wees</i> ✓ The direction of the impulse (West/towards the car)/ <i>Die rigting van die impuls (Wes/in die rigting van die motor)</i> <p style="text-align: right;">(4)</p>

ANSWER/ANTWOORD	Marking Guidelines/Nasienriglyne
<p>4.3 $\sum E_{ki} = E_{ki} \text{ car} + E_{ki} \text{ barrier/versperring}$ } $= \frac{1}{2} m v_i^2 + \frac{1}{2} m v_i^2$ ✓ any one/ <i>enige een</i></p> <p>$= \frac{1}{2} \times 900 \times 20^2 + 0$ ✓ $= 180\,000 \text{ J}$</p> <p>$\sum E_{kf} = E_{kf} \text{ car/motor} + E_{kf} \text{ barrier/versperring}$</p> <p>$= \frac{1}{2} m v_f^2 + \frac{1}{2} m v_f^2$ $= \frac{1}{2} \times 900 \times 0,16^2$ ✓ + $\frac{1}{2} \times 3200 \times 5,67^2$ ✓ $= 11,52 + 51438,24$ $= 51449,76 \text{ J}$</p> <p>$\therefore \sum E_{ki} \neq \sum E_{kf}$ inelastic collision/<i>onelastiese botsing</i>. ✓</p>	<p>✓ Formula/Formule ✓ Substitution - initial/ <i>Vervanging - aanvanklik</i> ✓✓ Substitution/<i>Vervanging</i></p> <p>✓ $\sum E_{ki} \neq \sum E_{kf}$</p> <p>NOTE: Final mark can only be given if rest of the question was answered correctly./ <i>Finale punt kan net toegeken word as die res van die vraag korrek beantwoord is.</i></p>
	(5) [15]

ANSWER/ANTWOORD	Marking Guidelines/Nasienriglyne
<p>QUESTION/VRAAG 5:</p> <p>5.1 It is a force for which the work done in moving an object between two points depends on the path taken. ✓✓ <i>’n Krag waarvoor die arbeid verrig om ’n voorwerp tussen twee punte te beweeg, afhanglik is van die roete of padlengte wat gevolg word. ✓✓</i></p>	<p>If the words work done is not in the definition, then zero marks./Indien die woorde arbeid verrig nie in die definisie is nie, dan geen punte nie.</p> <p>(2)</p>
<p>5.2</p> 	<p>✓ N/ F_N ✓ F/ $F_{\text{applied/toegepas}}$ ✓ F_g/w</p> <p>NOTES</p> <ul style="list-style-type: none"> • Mark is awarded for a label and arrow./Punt toegeken vir byskrif en pyltjies. • Do not penalise for length of arrows./Moenie penaliseer vir lengte van pyle nie. • Any additional force -1/Enige addisionele krag -1 • Lines that do not make contact with the body -1/Lyne wat nie kontak maak met kol nie -1 • Do not accept force diagram./Moenie kragtediagram aanvaar nie. <p>(3)</p>

- 5.3 The net/total work done on an object is equal to the change in the object's kinetic energy. ✓✓

Die netto/totale arbeid verrig op 'n voorwerp is gelyk aan die verandering in die voorwerp se kinetiese energie. ✓✓

OR/OF

The work done on an object by a resultant/net force is equal to the change in the object's kinetic energy. ✓✓

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

(2)

Marking criteria/Nasienriglyne

If any of the underlined key words/phrases in the correct context are omitted: -1 mark per word/phrase.

Indien enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word: -1 punt per woord/frase.

- 5.4.1

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

$$F_{\text{net}} \Delta x \cos \theta = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

$$(8)(3) \cos 0 \quad \checkmark = \frac{1}{2} (2) v_f^2 - 0 \quad \checkmark$$

$$24 = v_f^2$$

$$v_f = 4,90 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

- ✓ Formula/Formule (W_{net})
- ✓ Substitution/Vervanging (W_{net})
- ✓ Substitution/Vervanging (ΔE_K)
- ✓ Answer (in $\text{m}\cdot\text{s}^{-1}$)/Antwoord (in $\text{m}\cdot\text{s}^{-1}$)

(4)

**Marking
Guidelines/
Nasienriglyne**

5.4.2 $W_{nc} = \Delta E_P + \Delta E_K$ ✓

$$W_{\text{friction/wrywing}} = \Delta E_P + \Delta E_K$$

$$f \Delta x \cos \theta = (mgh_f - mgh_i) + \left(\frac{1}{2} mv_f^2 - \frac{1}{2} mv_i^2 \right)$$

$$(1,5)(7) \cos 180^\circ = [(2)(9,8)h - 0] + [0 - \frac{1}{2} (2)(4,9)^2]$$
 ✓

$$-10,5 = 19,6h - 24$$

$$13,5 = 19,6h$$

$$h = 0,69 \text{ m.}$$
 ✓

OR/OF

$$W_f = f_x \cos \theta$$

$$= 1,5(7) \cos 180^\circ$$

$$= -10,5 \text{ J}$$

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

$$= 0 - \frac{1}{2} (2) 4,90^2$$

$$= -24,01 \text{ J}$$

$$\Delta E_p = mgh_f - mgh_i$$

$$= 2 (9,8)h - 0$$

$$= 19,6 h$$

$$W_f = \Delta E_k + \Delta E_p$$
 ✓

$$-10,5 = -24,01 + 19,6 h$$
 ✓

$$h = 0,69 \text{ m}$$
 ✓

✓	Formula/ Formule (W_f)
✓	Substitution/ Vervanging (W_f)
✓	Substitution/ Vervanging (ΔE_k and/en ΔE_p)
✓	Answer with unit/ Antwoord met eenheid (0,6892m)

(4)

[15]

QUESTION/VRAAG 6

6.1 Doppler effect ✓/Doppler effek (1)

6.2.1 LESS THAN ✓/MINDER AS (1)

6.2.2 STAYS THE SAME ✓/BLY DIESELFDE (1)

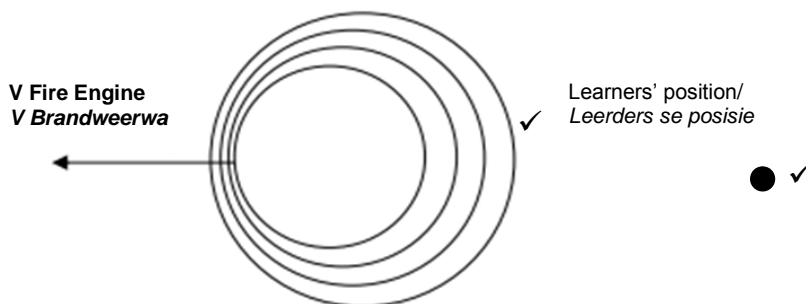
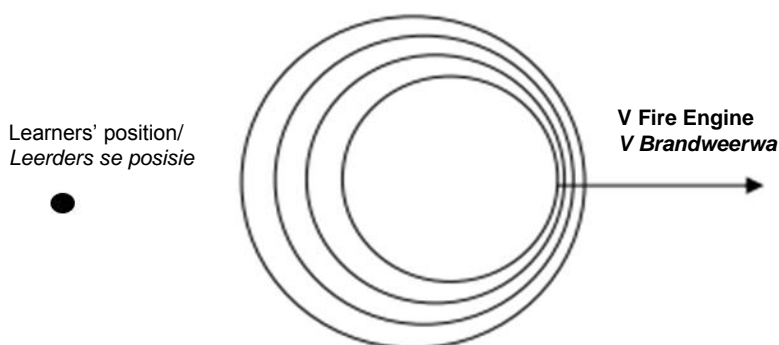
Marking Guidelines/Nasienriglyne

6.3
$$f_L = \frac{(v \pm v_L)}{(v \pm v_s)} f_s \checkmark$$

$$= \frac{340-0}{340+20} \checkmark 250 \checkmark$$

$$F_L = 236,11 \text{ Hz} \checkmark$$

6.4

**OR/OF**

(2)

Marking guidelines/Nasienriglyne:

Shape correct: Compressed to fire engine movement, rarefaction on the side of the learners' position. Direction of fire engine's velocity ✓
Learners' position on the opposite side of the fire engine's velocity. ✓

Korrekte vorm: Saamgedruk na die die brandweerwa se beweging, verdunning aan die kant van die leeders se posisie. Rigting van die brandweerwa se snelheid. ✓

Leeders se posisie aan die teenoorgestelde kant van die brandweerwa se snelheid. ✓

- 6.5 Speed of sound in air is less than speed of light. ✓ The velocity of the fire engine produces a noticeable Doppler shift in the frequency of the sound but is of no consequence when compared with the speed of light. ✓✓

Spoed van klank in lug is minder as die spoed van lig. ✓ Die snelheid van die brandweerwa produseer 'n waarneembare Doppler verskuiwing in die frekwensie van die klank, maar het geen effek wanneer dit vergelyk word met die spoed van lig nie. ✓✓

OR/OF

Speed of sound in air is comparable with the speed of the fire engine ✓ hence the noticeable difference in frequency ✓ whilst the speed of light is too high compared to the speed of the fire engine. ✓

Spoed van klank in lug is vergelykbaar met die spoed van die brandweerwa ✓ daarom die merkbare verandering in verskillende frekwensies ✓ terwyl die spoed van lig te hoog is in vergelyking met die spoed van die brandweerwa. ✓

(3)

Marking criteria/Nasienriglyne:

- ✓ Comparison between the speed of the ambulance and the speed of sound that are closely related to each other./*Vergelyking tussen die spoed van die ambulans en die spoed van klank wat naby aan mekaar verwant is.*
- ✓ The speed of light is too high in relation to speed of the ambulance./*Die spoed van lig is te hoog in verhouding tot die spoed van die ambulans.*
- ✓ Hence the change in frequency of sound will be noticeable./*Daarom sal die verandering in frekwensie van klank waarneembaar wees.*

[12]

QUESTION/VRAAG 7

- 7.1 The magnitude of the electrostatic force exerted by one point charge (Q_1) on another point charge (Q_2) is directly proportional to the product of the magnitudes of the charges ✓ and inversely proportional to the square of the distance (r) between them. ✓

Die grootte van die elektrostatische krag uitgeoefen deur een puntlading (Q_1) op 'n ander puntlading (Q_2) is direk eweredig aan die produk van die grootte van die ladings ✓ en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle. ✓

(2)

Marking guidelines/Nasienriglyne:

When giving the definition with mass instead of charge, zero out of 2.
Any missing key phrases, one out of 2.
*Indien die definisie gegee word met massa in plaas van lading, nul uit 2.
Enige kernwoorde of frases uitgelaat, slegs een uit 2.*

Marking Guidelines/ *Nasienriglyne*

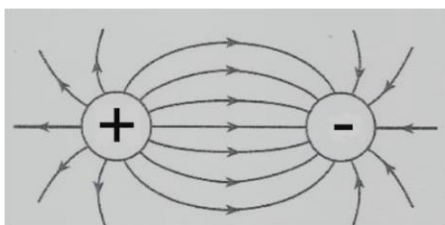
7.2 $F = \frac{kQ_1Q_2}{r^2} \checkmark$

$$F = \frac{9 \times 10^9 (5 \times 10^{-9})(8 \times 10^{-9}) \checkmark}{(2 \times 10^{-2})^2 \checkmark}$$

$$F = 9 \times 10^{-4} \text{ N } \checkmark$$

\checkmark	Formula/Formule	
$\checkmark\checkmark$	Substitution (top and bottom)/ <i>Vervanging (bo en onder)</i>	
\checkmark	Answer/Antwoord	(4)

7.3



Lines do not cross/ <i>Lyne kruis nie</i>	\checkmark	
Correct shape/ <i>Korrekte vorm</i>	\checkmark	
Arrow direction indicated correctly/ <i>Pyl rigtings korrek aangedui</i>	\checkmark	(3)

7.4 $Q_{\text{new/nuut}} = \frac{Q_X + Q_Y}{2} \checkmark$

$$= \frac{(+5 \times 10^{-9}) + (-8 \times 10^{-9}) \checkmark}{2}$$

$$= -1,5 \times 10^{-9} \text{ C on each/op elk } \checkmark$$

(3)
[12]

QUESTION/VRAAG 8

8.1 8 J of energy could be delivered per coulomb of charge travelling in the circuit. ✓✓

8 J energie word gelewer per coulomb lading wat deur die stroombaan beweeg. ✓✓

OR/OF

The battery supplies 8 J of energy per coulomb of charge. ✓✓

Die battery verskaf 8 J energie per coulomb lading. ✓✓

OR/OF

The maximum work done by the battery per unit charge is 8 J. ✓✓

Die maksimum arbeid verrig deur die battery per eenheid lading is 8 J. ✓✓

OR/OF

The total amount of electrical energy supplied by the battery per coulomb/unit of charge is 8 J. ✓✓

Die totale hoeveelheid elektriese energie verskaf deur die battery per coulomb/eenheid lading is 8 J. ✓✓

(2)

Marking criteria/Nasienriglyne:

If any of the underlined key words/phrases in the correct context is omitted, deduct one mark.

Indien enige van die onderstreepte kernwoorde/frases in die korrekte konteks uitgelaat is, word een punt afgetrek.

Marking Guidelines/Nasienriglyne

8.2 $emf = I(R + r)$ ✓ or/of
 $emk = IR + Ir$

$$= \frac{8 - 6,86}{2} \checkmark$$

$$= 0,57 \Omega \checkmark$$

✓ Formula/Formule

✓ Substitution/Vervanging

✓ Answer/Antwoord

$$= 0,57 \Omega$$

(3)

8.3 **OPTION/OPSIE 1:**

$$V = I \times R$$

$$R_T = \frac{6,86}{2} \checkmark$$

$$= 3,34 \Omega \checkmark$$

$$R_T = R_s + R_p$$

$$\therefore R_p = R_T - R_s$$

$$= 3,34 - 2$$

$$= 1,43 \Omega \checkmark$$

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

$$\frac{1}{1,43} = \frac{1}{R_1} + \frac{1}{2} \checkmark$$

$$R_1 = \frac{286}{57}$$

$$= 5,02 \Omega \checkmark$$

OPTION/OPSIE 2:

$$\varepsilon = I (R_T + r)$$

$$8 = 2 (R_T + 0,57) \checkmark$$

$$R_T = \frac{8 - 1,14}{2} \checkmark$$

$$= 3,34 \Omega \checkmark$$

$$R_T = R_s + R_p$$

$$\therefore R_p = R_T - R_s$$

$$= 3,34 - 2$$

$$= 1,43 \Omega \checkmark$$

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

$$\frac{1}{1,43} = \frac{1}{R_1} + \frac{1}{2} \checkmark$$

$$R_1 = \frac{286}{57}$$

$$= 5,02 \Omega \checkmark$$

- ✓ Substitution/Vervanging (A and/en V)
- ✓ Answer/Antwoord (= 3,34 Ω)
- ✓ Finding/Bevinding R_p
- ✓ Formula/Formule R_p
- ✓ Substitution/Vervanging
- ✓ Answer/Antwoord $R_1 = 5,02 \Omega$
- Accept/Aanvaar 5,00 Ω

OPTION/OPSIE 3:

At/By 2 Ω series resistor, $V_{2\Omega} = IR_{2\Omega} = 2 \times 2 = 4V$

Across parallel network/Oor *parallele* netwerk, $V_{//} = 6,86 - 4 = 2,86 V$

Current through 2 Ω resistor at // network/Lading deur 2 Ω resistor by // netwerk

$$I_{2\Omega} = \frac{V}{R} = \frac{2,86}{2} = 1,43A$$

$$\begin{aligned} I_{R1} &= I_{\text{series}} - I_{2\Omega} \\ &= 2 - 1,43 \\ &= 0,57 A \end{aligned}$$

$$R_1 = \frac{V}{I} = \frac{2,86}{0,57} = 5,02 \Omega$$

(5)

8.4 The rate at which work is done/the rate at which the energy is transferred. ✓✓

Die tempo waarteen arbeid verrig word/die tempo waarteen energie oorgedra word. ✓✓

OR/OF

The amount of work done in a certain time. ✓✓

Die hoeveelheid arbeid verrig binne 'n sekere tyd. ✓✓

OR/OF

The energy used in a specific time. ✓✓

Die energie gebruik binne 'n spesifieke tyd. ✓✓

OR/OF

The amount of energy used in one second. ✓✓

Die hoeveelheid energie gebruik binne een sekonde. ✓✓ (2)

8.5.1 INCREASE ✓/VERMEERDER (1)

8.5.2 The resistance will increase, ✓ Potential difference across R_1 will increase ✓ and V^2 is directly proportional to P ✓ thus the power will increase as

$$P = \frac{V^2}{R}$$

Die weerstand sal verhoog. ✓ Potensiaalverskil oor R_1 sal verhoog ✓ en V^2 is direk eweredig aan P ✓ daarom sal die drywing verhoog as $P = \frac{V^2}{R}$.

OR/OF

The resistance will increase, ✓ current will decrease ✓ thus the square of the current multiplied by the increase in resistance is directly proportional to the power thus power will increase. $P = I^2 R$ ✓

Die weerstand sal vermeerder, ✓ stroom sal verminder ✓ en dus sal die kwadraat van die stroom vermenigvuldig met die toename in weerstand direk eweredig wees aan die drywing dus sal drywing verhoog. $P = I^2 R$ ✓ (3)

Marking guidelines/Nasienriglyne:

- ✓ resistance increases/weerstand verhoog
- ✓ potential difference increases/potensiaalverskil verhoog
- ✓ relationship between the potential difference and power/verwantskap tussen die potensiaalverskil en die drywing

[16]

QUESTION/VRAAG 9

9.1 DC/GS (generator/generator) ✓

(1)

Marking criteria/Nasienriglyne:

Generator is optional. (specified in the question)
Generator is opsioneel. (reeds genoem in vraag)

9.2 split ring or commutator ✓✓

splitring of kommutator

(2)

Marking criteria/Nasienriglyne:

Accept "Part B" for ONLY 1 mark
Aanvaar "Deel B" vir SLEGS 1 punt.

9.3 Coil/armature/spoel/anker ✓

(1)

9.4 Mechanical energy to Electrical energy ✓✓

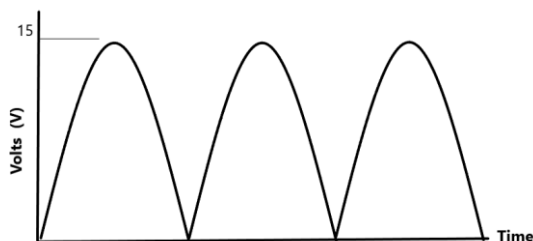
Meganiese energie na Elektriese energie ✓✓

(2)

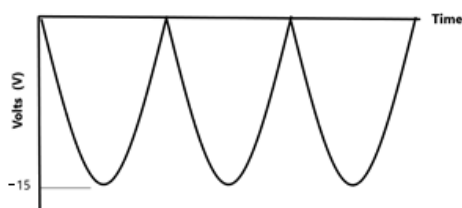
Marking guidelines/Nasienriglyne:

2 or 0. Not one mark if only one energy given.
2 of 0. Geen punte indien slegs een energie gegee is nie.

9.5



OR/OF



- ✓ 15 Volt as max/Volt as maks.
- ✓ 3 loops/hoops/
lusse/hoepels
- ✓ All the same height/
Almal dieselfde hoogte

(3)

- 9.6.1 The DC potential difference/current which dissipates the same amount of energy as AC. ✓✓

Die GS potensiaalverskil/stroom wat dieselfde hoeveelheid energie versprei as die WS. ✓✓ (2)

- 9.6.2 240 V ✓✓ (2)

Marking Guidelines/Nasienriglyne

9.6.3 OPTION/OPSIE 1:

$$P_{\text{ave}} = V_{\text{rms}} I_{\text{rms}}$$

$$2100 = 240 \times I_{\text{rms}} \quad \checkmark$$

$$I_{\text{rms}} = 8,75\text{A}$$

$$I_{\text{max}} = I_{\text{rms}} \times \sqrt{2} \quad \checkmark$$

$$= 8,75 \times \sqrt{2} \quad \checkmark$$

$$= 12,37\text{A} \quad \checkmark$$

- ✓ I_{max} formula (No subscripts no marks)/ I_{maks} formule (Geen onderskrifte geen punte)
 $I_{\text{max/maks}} = I_{\text{rms/wgk}} \times \sqrt{2}$
- ✓ Substitution that leads to finding/
Vervanging wat lei tot berekening van I_{wgk}
- ✓ Substitution into I_{max} formula using the value calculated in the first calculations/
Vervanging in I_{maks} formule en gebruik waarde uit eerste bewerkings.
- ✓ Final answer/*Finale antwoord*

OR/OF

OPTION/OPSIE 2:

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

$$2100 = 240^2 / R$$

$$R = 27,43 \Omega$$

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

$$= \frac{240}{27,43}$$

$$I_{\text{rms}} = 8,75\text{A}$$

$$I_{\text{max}} = I_{\text{rms}} \times \sqrt{2} \quad \checkmark$$

$$= 8,75 \times \sqrt{2}$$

$$= 12,37\text{A} \quad \checkmark$$

OR/OF

OPTION/OPSIE 3:

$$P_{\text{ave}} = \frac{V_{\text{rms}}^2}{R} \checkmark$$

$$2\,100 = 240 / R$$

$$R = 27,43 \, \Omega$$

$$P_{\text{ave}} = I_{\text{rms}}^2 R$$

$$2\,100 = I_{\text{rms}}^2 \times 27,43$$

$$I_{\text{rms}} = 8,75 \text{ A}$$

$$I_{\text{max}} = I_{\text{rms}} \times \sqrt{2} \checkmark$$

$$= 8,75 \times \sqrt{2}$$

$$= 12,37 \text{ A} \checkmark$$

(4)
[17]**QUESTION/VRAAG 10**

- 10.1 The process whereby electrons are ejected from a metal surface when light of suitable frequency is incident on that surface. ✓✓

Die proses waarby elektrone vrygestel word vanuit 'n metaal se oppervlakte wanneer lig van 'n geskikte frekwensie inval op die oppervlakte. ✓✓

OR/OF

When electrons escape the surface of the metal by gaining energy when light of suitable frequency is incident on that surface. ✓✓

Wanneer elektrone ontsnap uit die oppervlakte van die metaal deur energie by te kry wanneer lig van 'n geskikte frekwensie inval op die oppervlakte. ✓✓ (2)

Marking criteria/Nasienriglyne:

If any of the underlined key words/phrases in the correct context is omitted deduct one mark.

Indien enige van die onderstreepte kernwoorde/frases in die korrekte konteks weggelaat word, trek een punt af.

- 10.2.1 Independent: The frequency/wavelength/colour of the incident light. ✓
 Dependent: Kinetic energy of the electrons ✓
 Controlled variable: Type of metal ✓

Onafhanklik: Die frekwensie/golflengte/kleur van die invallende lig ✓

Afhanklik: Kinetiese energie van die elektrone ✓

Gekontroleerde veranderlike: Tipe metaal ✓

(3)

$$10.2.2 \quad E = h\frac{c}{\lambda} = W_0 + E_k \checkmark$$

$$6,63 \times 10^{-34} \times \frac{3 \times 10^8}{280 \times 10^{-9}} \checkmark = W_0 + 5,74 \times 10^{-20} \checkmark$$

Marking Guidelines/Nasienriglyne

$$W_0 = 6,53 \times 10^{-19} \text{ J } \checkmark$$

\therefore metal **X** is aluminium. ✓ / is metaal **X** aluminium.

OR/OF

$$v = f \times \lambda \quad \text{OR/OF} \quad (c = f \times \lambda \quad)$$

$$3 \times 10^8 = f \times 280 \times 10^{-9}$$

$$f = 1,07 \times 10^{15} \text{ Hz}$$

$$E = hf = W_0 + E_k \checkmark$$

$$6,63 \times 10^{-34} \times 1,07 \times 10^{15} \checkmark = W_0 + 5,74 \times 10^{-20} \checkmark$$

$$W_0 = 6,52 \times 10^{-19} \text{ J } \checkmark$$

\therefore metal **X** is aluminium. / is metaal **X** aluminium. ✓

(5)

- 10.2.3 Photon energy increases as the frequency of the light increases. ✓
Intensity only increases the number of electrons not their average kinetic energy. ✓
Thus the ultraviolet light will release electrons with a much higher kinetic energy. ✓

*Die foton se energie verhoog soos die frekwensie van die lig verhoog. ✓
Intensiteit verhoog slegs die aantal elektrone en nie die gemiddelde kinetiese energie nie. ✓*

Dus sal die ultraviolet lig die elektrone vrylaat met 'n baie hoër kinetiese energie. ✓

(3)
[13]

TOTAL/TOTAAL: 150