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**PROVINCIAL COMMON QUESTION PAPER
PROVINSIALE GEMEENSKAPLIKE VRAESTEL**

**GRADE 12
GRAAD 12**

PHYSICAL SCIENCES: PHYSICS (P1)

FISIESE WETENSKAPPE: FISIKA (V1)

SEPTEMBER 2017

MEMORANDUM

MARKS/ PUNTE: 150

This memorandum consists of **22** pages
*Hierdie memorandum bestaan uit **22** bladsye*

GENERAL GUIDELINES / ALGEMENE RIGLYNE**1. CALCULATIONS/ BEREKENINGE**

- 1.1 **Marks will be awarded for:** correct formula, correct substitution, correct answer with unit.

Punte sal toegeken word vir: korrekte formule, korrekte substitusie, korrekte antwoord met eenheid.

- 1.2 **No marks** will be awarded if an **incorrect or inappropriate formula is used**, even though there may be relevant symbols and applicable substitutions.

Geen punte sal toegeken word waar 'n **verkeerde of ontoepaslike formule gebruik** word nie, selfs al is daar relevante simbole en relevante substitusies.

- 1.3 When an error is made during **substitution into a correct formula**, a mark will be awarded for the correct formula and for the correct substitutions, but **no further marks** will be given.

*Wanneer 'n fout gedurende **substitusie in 'n korrekte formule** begaan word, sal 'n punt vir die korrekte formule en vir korrekte substitusies toegeken word, maar **geen verdere punte** sal toegeken word nie*

- 1.4 If **no formula** is given, but **all substitutions are correct**, a candidate will **forfeit one mark**.

*Indien **geen formule** gegee is nie, maar **al die substitusies is korrek**, verloor die kandidaat **een punt**.*

- 1.5 **No penalisation if zero substitutions are omitted** in calculations where **correct formula / principle is given correctly**.

Geen penalisering indien **nulwaardes nie getoon** word nie in berekeninge waar die **formule/beginsel korrek gegee is nie**.

- 1.6 Mathematical manipulations and change of subject of appropriate formulae carry no marks, but if a candidate starts off with the correct formula and then changes the subject of the formula incorrectly, marks will be awarded for the formula and the correct substitutions. The mark for the incorrect numerical answer is forfeited.

Wiskundige manipulasies en verandering van die onderwerp van toepaslike formules tel geen punte nie, maar indien 'n kandidaat met die korrekte formule begin en dan die onderwerp van die formule verkeerd verander, sal punte vir die formule en korrekte substitusies toegeken word. Die punt vir die verkeerde numeriese antwoord word verbeur.

- 1.7 Marks are only awarded for a formula if a **calculation has been attempted**. i.e. substitutions have been made or a numerical answer given.

Punte word slegs vir 'n formule toegeken indien 'n poging tot 'n berekening aangewend is, d.w.s. substitusies is gedoen of 'n numeriese antwoord is gegee.

- 1.8 Marks can only be allocated for substitutions when values are substituted into formulae and not when listed before a calculation starts.

Punte kan slegs toegeken word vir substitusies wanneer waardes in formule ingestel is en nie vir waardes wat voor 'n berekening gelys is nie.

- 1.9 All calculations, when not specified in the question, must be done to two decimal places.

Alle berekenings, wanneer nie in die vraag gespesifiseer word nie, moet tot 'n minimum van twee desimale plekke gedoen word.

2. UNITS/ EENHEDE

- 2.1 Candidates will only be penalised once for the repeated use of an incorrect unit **within a question or sub-question**.

Kandidate sal slegs een keer gepeenaliseer word vir die herhaaldelike gebruik van 'n verkeerde eenheid in 'n vraag.

- 2.2 Units are only required in the final answer to a calculation.

Eenhede word slegs in die finale antwoord op 'n vraag verlang.

- 2.3 Marks are only awarded for an answer and not for a unit *per se*. Candidates will therefore forfeit the mark allocated for the answer in each of the following situations:

- Correct answer + wrong unit
- Wrong answer + correct unit
- Correct answer + no unit

Punte word slegs vir 'n antwoord en nie vir 'n eenheid per se toegeken nie. Kandidate sal derhalwe die punt vir die antwoord in die volgende gevalle verbeur:

- Korrekte antwoord + verkeerde eenheid
- Verkeerde antwoord + korrekte eenheid
- Korrekte antwoord + geen eenheid

- 2.4 SI units must be used except in certain cases, e.g. $V \cdot m^{-1}$ instead of $N \cdot C^{-1}$, and $cm \cdot s^{-1}$ or $km \cdot h^{-1}$ instead of $m \cdot s^{-1}$ where the question warrants this.

SI-eenhede moet gebruik word, behalwe in sekere gevalle, bv. $V \cdot m^{-1}$ in plaas van $N \cdot C^{-1}$, en $cm \cdot s^{-1}$ of $km \cdot h^{-1}$ in plaas van $m \cdot s^{-1}$ waar die vraag dit regverdig.

3. GENERAL/ ALGEMEEN

- 3.1 If one answer or calculation is required, but two given by the candidate, only the first one will be marked, irrespective of which one is correct. If two answers are required, only the first two will be marked, etc.

Indien een antwoord of berekening verlang word, maar twee word deur die kandidaat gegee, sal slegs die eerste een nagesien word, ongeag watter een

korrek is. Indien twee antwoorde verlang word, sal slegs die eerste twee nagesien word, ens.

- 3.2 For marking purposes, alternative symbols (s,u,t, etc.) will also be accepted.
Vir nasiendoeleindes sal alternatiewe simbole (s, u, t, ens.) ook aanvaar word.
- 3.3 Separate compound units with a multiplication dot, not a full stop, for example, $m \cdot s^{-1}$.
 For marking purposes $m \cdot s^{-1}$ and m/s will also be accepted.
Skei saamgestelde eenhede met 'n vermenigvuldigpunt en nie met 'n punt nie, byvoorbeeld, $m \cdot s^{-1}$. Vir nasiendoeleindes sal $m \cdot s^{-1}$ en m/s ook aanvaar word.

4. POSITIVE MARKING/POSITIEWE NASIEN

Positive marking regarding calculations will be followed in the following cases:

Positiewe nasien met betrekking tot berekenings sal in die volgende gevalle geld:

- 4.1 **Sub-question to sub-question:** When a certain variable is calculated in one sub-question (e.g. 3.1) and needs to be substituted in another (3.2 or 3.3), e.g. if the answer for 3.1 is incorrect and is substituted correctly in 3.2 or 3.3, **full marks** are to be awarded for the subsequent sub-questions.
Subvraag na subvraag: *Wanneer 'n sekere veranderlike in een subvraag (bv. 3.1) bereken word en dan in 'n ander vervang moet word (3.2 of 3.3), bv. indien die antwoord vir 3.1 verkeerd is en word korrek in 3.2 of 3.3 vervang, word volpunte vir die daaropvolgende subvraag toegeken.*
- 4.2

A multi-step question in a sub-question: If the candidate has to calculate, for example, current in the first step and gets it wrong due to a substitution error, the mark for the substitution and the final answer will be forfeited.

'n Vraag met veelvuldige stappe in 'n subvraag: *Indien 'n kandidaat byvoorbeeld, die stroom verkeerd bereken in 'n eerste stap as gevolg van 'n substitusiefout, verloor die kandidaat die punt vir die substitusie sowel as die finale antwoord.*

- 4.5 Normally an incorrect answer cannot be correctly motivated if based on a conceptual mistake. If the candidate is therefore required to motivate in question 3.2 the answer given to question 3.1, and 3.1 is incorrect, no marks can be awarded for question 3.2. However, if the answer for e.g. 3.1. is based on a calculation, the motivation for the incorrect answer in 3.2 could be considered.
'n Verkeerde antwoord, indien dit op 'n konsepsuele fout gebaseer is, kan normaalweg nie korrek gemotiveer word nie. Indien 'n kandidaat gevra word om in VRAAG 3.2 die antwoord op VRAAG 3.1 te motiveer en 3.1 is verkeerd, kan geen punte vir VRAAG 3.2 toegeken word nie. Indien die antwoord op bv. 3.1 egter op 'n berekening gebaseer is, kan die motivering vir die verkeerde antwoord in 3.2 oorweeg word.

QUESTION 1 / VRAAG 1

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

[20]**QUESTION 2 / VRAAG 2**

2.1 (gravitational) acceleration ✓

(Gravitasie) versnelling

(1)

2.2

Option 1/Opsie1 Up as positive / Op as positief 2.5 s – 5 s $v_f = v_i + g\Delta t$ ✓ $0 = v_i + (-9.8)(2.5)$ ✓ $v_f = 24,5 \text{ m} \cdot \text{s}^{-1}$ ✓	Option 2/Opsie2 Down as positive / Af as positief 2.5 s – 5 s $v_f = v_i + g\Delta t$ ✓ $0 = v_i + (9.8)(2.5)$ ✓ $v_f = -24.5 \text{ m} \cdot \text{s}^{-1}$ $v_f = 24,5 \text{ m} \cdot \text{s}^{-1}$ ✓
Option 3/Opsie3 Up as positive / Op as positief 0 - 2.5s $v_f = v_i + g\Delta t$ ✓ $v_f = 49 + (-9.8)(2.5)$ ✓ $v_f = 24,5 \text{ m} \cdot \text{s}^{-1}$ ✓	Option 4/Opsie4 Down as positive / Af as positief 0 – 2.5 s $v_f = v_i + g\Delta t$ ✓ $v_f = -49 + (9.8)(2.5)$ ✓ $v_f = -24.5 \text{ m} \cdot \text{s}^{-1}$ $v_f = 24,5 \text{ m} \cdot \text{s}^{-1}$ ✓

NB: Do not penalise if learners used **a** instead of **g**. / **LW: Moenie penaliseer as leerders (a) in plaas van (g) gebruik het nie.**

2.3.1 Displacement = area underneath the graph

Verplasing = area onder grafiek

OR/OF

$$\Delta x = \frac{1}{2}bh$$

$$= \frac{1}{2}(5)(49) \checkmark$$

$$= 122.5 \text{ m} \checkmark$$

(2)

2.3.2 POSITIVE MARKING FROM 2.2 / POSITIEWE NASIEN VANAF 2.2

Displacement = area underneath the graph between graph and t-axis.

Verplasing = area onder grafiek

OR/OF

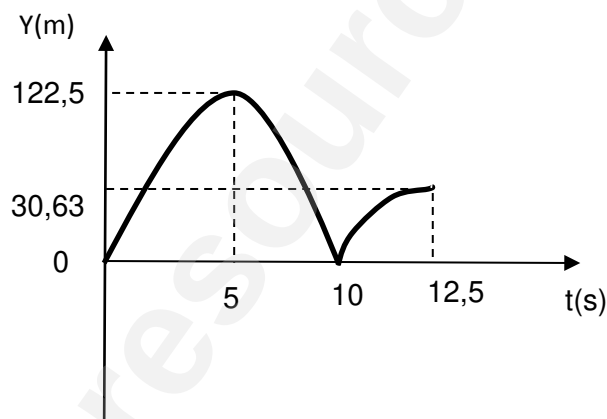
$$\Delta x = \frac{1}{2}bh$$

$$= \frac{1}{2}(2.5)(24.5) \checkmark$$

$$= 30.63 \text{ m} \checkmark$$

(2)

2.4



Criteria/	Marks/Punte
Correct shape from 0 s to 10 s.	✓
Correct shape from 10 s to 12,5 s.	✓
The position of the projectile at 5 s.	✓
The time the projectile reaches the projection point.	✓
Position of the projectile at 12,5 s.	✓

(5)

[13]

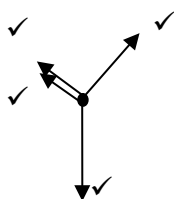
QUESTION 3

- 3.1 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 resulterende/netto krag op 'n voorwerp inwerk, sal die voorwerp in die rigting van die krag versnel teen 'n versnelling direk eweredig aan die krag ✓ en omgekeerd eweredig aan die massa ✓ van die voorwerp.

(2)

3.2



NB: Do not penalise if arrows omitted (vectors notation).

LW: Moenie penaliseer indien pyle uitgelaat is nie (vektornotasie)

(4)

3.3 Option 1/Opsie 1

$$\vec{F}_{net} = m\vec{a} \checkmark \text{ OR/OF } \Sigma \vec{F} = m\vec{a}$$

Block A/Blok A (In x direction/ In x rigting)

$$\vec{F}_{gx(A)} + \vec{f}_{f(A)} + \vec{F}_{BA} = m\vec{a}$$

$$F_{gx(A)} - f_{f(A)} - F_{BA} = ma$$

$$mg \sin \alpha - \mu_A N_A - F_{BA} = ma$$

✓ Anyone/ enigeen

Block A OR B /Blok A OF B (In y direction/ In y rigting)

$$\vec{F}_{net} = \vec{0} \checkmark \text{ OR/OF } \Sigma \vec{F} = \vec{0}$$

$$\vec{F}_{gy} + \vec{N} = \vec{0}$$

$$-F_{gy} + N = 0$$

$$N = F_{gy} = mg \cos \alpha$$

✓ Anyone/ enigeen

$$mg \sin \alpha - \mu_A mg \cos \alpha - F_{BA} = ma$$

Block B(In x direction/ In x rigting)

$$\left. \begin{aligned} \vec{F}_{gx(B)} + \vec{f}_{f(B)} + \vec{F}_{AB} &= m\vec{a} \\ F_{gx(B)} - f_{f(B)} + F_{AB} &= ma \\ mg \sin \alpha - \mu_B N_B + F_{AB} &= ma \\ mg \sin \alpha - \mu_B mg \cos \alpha + F_{AB} &= ma \end{aligned} \right\} \checkmark \text{Anyone/ enigeen}$$

Solving/ oplossing

$$mg \sin \alpha - \mu_A mg \cos \alpha - F_{BA} + mg \sin \alpha - \mu_B mg \cos \alpha + F_{AB} = ma + ma$$

$$a = g \sin 45^\circ - \frac{1}{2}(\mu_A + \mu_B)g \cos 45^\circ$$

$$a = (9,8) \sin 45^\circ \checkmark - \frac{1}{2}(0,01 + 1,0)(9,8) \cos 45^\circ \checkmark$$

$$a = + \checkmark 3,43 m \cdot s^{-2} \checkmark$$

OR/OF

$$a = 3,43 m \cdot s^{-2} \checkmark \text{in the direction of motion/in die rigting van beweging} \checkmark$$

Option 2

$$\vec{F}_{net} = m\vec{a} \checkmark \text{ OR/OF } \Sigma \vec{F} = m\vec{a}$$

Block A/Blok A (In x direction/ In x rigting)

$$\left. \begin{aligned} \vec{F}_{gx(A)} + \vec{f}_{f(A)} + \vec{F}_{BA} &= m\vec{a} \\ F_{gx(A)} - f_{f(A)} - F_{BA} &= ma \\ mg \sin \alpha - \mu_A N_A - F_{BA} &= ma \end{aligned} \right\} \checkmark \text{Anyone/ enigeen}$$

Block A OR B /Blok A OF B (In y direction/ In y rigting)

$$\left. \begin{aligned} \vec{F}_{net} &= \vec{0} \checkmark \text{ OR/OF } \Sigma \vec{F} = \vec{0} \\ \vec{F}_{gy} + \vec{N} &= \vec{0} \\ -F_{gy} + N &= 0 \\ N = F_{gy} &= mg \cos \alpha \end{aligned} \right\} \checkmark \text{Anyone/ enigeen}$$

$$mg \sin \alpha - \mu_A mg \cos \alpha - F_{BA} = ma$$

$$(0,2)(9,8) \sin 45^\circ - (0,01)(0,2)(9,8) \cos 45^\circ - F_{BA} = (0,2)a$$

$$1,386 - 0,01386 - F_{BA} = (0,2)a \quad \text{OR/OF} \quad 1,372 - F_{BA} = (0,2)a$$

✓ Anyone/ enigeen

Block B (In x direction/ In x rigting)

$$\vec{F}_{gx(B)} + \vec{f}_{f(B)} + \vec{F}_{AB} = m\vec{a}$$

$$F_{gx(B)} - f_{f(B)} + F_{AB} = ma$$

$$mg \sin \alpha - \mu_B N_B + F_{AB} = ma$$

$$mg \sin \alpha - \mu_B mg \cos \alpha + F_{AB} = ma$$

✓ Anyone/ enigeen

$$(0,2)(9,8) \sin 45^\circ - (1,0)(0,2)(9,8) \cos 45^\circ + F_{AB} = (0,2)a$$

$$1,39 - 1,39 + F_{BA} = (0,2)a \quad \text{OR/OF} \quad 0 + F_{BA} = (0,2)a$$

Solving/ oplossing

$$1,372 - F_{BA} + 0 + F_{BA} = (0,2)a + (0,2)a$$

$$1,372 = (0,4)a$$

✓ Anyone/ enigeen

$$a = + \quad \checkmark \quad 3,43 \text{ m} \cdot \text{s}^{-2} \quad \checkmark$$

OR/OF

$$a = 3,43 \text{ m} \cdot \text{s}^{-2} \quad \checkmark \text{ in the direction of motion/ in die rigting van beweging} \quad \checkmark$$

Option 3/Opsie 3

$$\vec{F}_{net} = m\vec{a} \quad \checkmark \quad \text{OR/OF} \quad \sum \vec{F} = m\vec{a}$$

$$\vec{F}_{gx} + \vec{f}_{f1} + \vec{f}_{f2} = (m_A + m_B)\vec{a}$$

$$F_{gx} - f_{f1} - f_{f2} = (m_A + m_B)a$$

$$(m_A + m_B)g \sin \alpha - (\mu_A + \mu_B)N = (m_A + m_B)a$$

✓ Anyone/ enigeen

In y direction/ *In y rigting*

$$\vec{F}_{net} = \vec{0} \checkmark \text{ OR/OF } \Sigma \vec{F} = \vec{0}$$

$$\vec{F}_{gy} + \vec{N} = \vec{0}$$

$$-F_{gy} + N = 0$$

$$N = F_{gy} = mg \cos \alpha$$

$$m_A = m_B$$

$$m_A + m_B = 2m$$

$$2mg \sin \alpha - \mu_A mg \cos \alpha - \mu_B mg \cos \alpha = 2ma$$

$$g \sin \alpha - \frac{1}{2} \mu_A mg \cos \alpha - \frac{1}{2} \mu_B mg \cos \alpha = a$$

$$a = g \sin 45^\circ - \frac{1}{2} (\mu_A + \mu_B) g \cos 45^\circ$$

$$a = (9,8) \sin 45^\circ \checkmark - \frac{1}{2} (0,01 + 1,0)(9,8) \cos 45^\circ \checkmark$$

$$a = + \checkmark 3,43 m \cdot s^{-2} \checkmark$$

OR/OF

$$a = 3,43 m \cdot s^{-2} \checkmark \text{ in the direction of motion/in die rigting van beweging} \checkmark$$

3.4 **POSITIVE MARKING FROM 3.3/POSITIEWE NASIEN VANAF 3.3**

Option 1/Opsie 1

$$mg \sin \alpha - \mu_A mg \cos \alpha - F_{BA} = ma \checkmark$$

$$(0,2)(9,8) \sin 45^\circ - (0,01)(9,8) \cos 45^\circ - F_{BA} = (0,2)(3,43) \checkmark$$

$$F_{BA} = 0,69 \text{ N} \checkmark$$

Option 2/Opsie 2

$$mg \sin \alpha - \mu_B mg \cos \alpha + F_{AB} = ma \checkmark$$

$$(0,2)(9,8) \sin 45^\circ - (1,0)(0,2)(9,8) \cos 45^\circ + F_{AB} = (0,2)(3,43) \checkmark$$

$$F_{AB} = F_{BA} = 0,69 \text{ N} \checkmark$$

Option 3/Opsie 3

$$F_{BA} = \frac{1}{2} mg (\mu_B - \mu_A) \cos \alpha \checkmark$$

$$F_{BA} = \frac{1}{2} (0,2)(9,8)(1,0 - 0,01) \cos 45^\circ \checkmark$$

$$F_{BA} = 0,69 \text{ N} \checkmark$$

(3)

(3. Decreases ✓

5

Acceleration of the blocks is directly proportional to gravitational acceleration (g) ✓

Acceleration due to gravity on the Moon is less than on the Earth ✓

Verminder

Versnelling van die blokke is direk eweredig aan gravitasieversnelling (g)

gravitasieversnelling op die Maan is kleiner as op die Earth

(3)

[20]

QUESTION 4 / VRAAG 4

- 4.1 Newtons First law✓ / Newton se Eerste wet✓
OR/OF
Law of inertia / *Wet van Traagheid* (1)
- 4.2 The total linear momentum in an isolated/closed system✓ remains constant
(is conserved).✓
Die totale lineêre momentum in 'n geïsoleerde/geslote sisteem ✓ bly constant. ✓ (2)
- 4.3 $\vec{p}_{T(before)/voor} = \vec{p}_{T(after)/na}$ } ✓ Anyone/ enigeen
 $(m_{syste})(\vec{v}_{syst}) = m_J \vec{v}_J + m_{P/T} \vec{v}_{P/T}$
 $(160)(2)✓ = [(60)(2.5) + 100\vec{v}]✓$
 $\vec{v} = 1.7 \text{ m} \cdot \text{s}^{-1}✓ \text{ to the right / na regs✓}$ (5)
[8]

NB: Do not penalise if vector notation is not used.

LET WEL: Moenie penaliseer as vectornotasie nie gebruik is nie.

Notes/Aantekeninge:

The mark for 'closed/isolated system' is only awarded if used in conjunction momentum.

Die punt vir 'geslote/geïsoleerde sisteem' word slegs toegeken indien saam met momentum gebruik

QUESTION 5 / VRAAG 5

- 5.1 The total mechanical energy remains constant/is conserved ✓ in
an isolated/closed system. ✓
*Die totale meganiese energie bly konstant/bly behoue✓ in 'n
geïsoleerde/ geslote sisteem✓*

OR/OF

The sum of the potential and kinetic energy remains constant ✓ in
an isolated/closed system. ✓

*Die som van die potensiële en kinetiese energie bly konstant✓ in
'n geïsoleerde/ geslote sisteem ✓*

OR/OF

When the work done by the non-conservative forces is zero✓
the total mechanical energy of the system of bodies is conserved✓.

Wanneer die werk wat gedoen is deur die nie-konserwatiewe kragte nul is✓, is die totale meganiese energie van die stelsel van liggame behoue✓.

(2)

Notes/Aantekeninge:

The mark for 'closed/isolated system' is only awarded if used in conjunction with energy

Die punt vir 'geslote/geïsoleerde sisteem' word slegs toegeken indien saam met energie gebruik

5.2

$$\begin{aligned}
 K_i + U_i &= K_f + U_f \\
 \frac{1}{2}mv^2 + mgh &= \frac{1}{2}mv^2 + mgh \\
 0 + (40)(9.8)(1.5) &= \frac{1}{2}(40)v^2 + 0 \\
 v &= 5.42 \text{ m} \cdot \text{s}^{-1}
 \end{aligned}$$

Notes/ Aantekeninge
Accept/ Aanvaar

E_p and E_k

(4)

5.3

Option 1/Opsie 1

$$\begin{aligned}
 w_{net} &= \Delta K \\
 mg\Delta x \cos\theta + f\Delta x \cos\theta &= \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 \\
 (22)(9.8)(3) \cos 60^\circ + (1.9)(3) \cos 180^\circ &= \frac{1}{2}(22)(v_f^2 - 0^2) \\
 v_f &= 5.37 \text{ m} \cdot \text{s}^{-1}
 \end{aligned}$$

Accept/
Aanvaar

$\Delta y / \Delta x$

Option 2/Opsie 2

Accept/
Aanvaar

$w_{net} = \Delta K \checkmark$ $mgsin\theta\Delta x\cos\theta + f\Delta x\cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ $(22)(9.8)\sin30^0(3)\cos0^0 \checkmark + (1.9)(3)\cos180^0 \checkmark = \frac{1}{2}(22)(v_i^2 - 0^0) \checkmark$ $v_f = 5,37m \cdot s^{-1} \checkmark$	$\Delta y / \Delta x$
Option 3/Opsie 3 $w_{net} = \Delta K \checkmark$ $mgh\cos\theta + f\Delta x\cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ $(22)(9.8)(1.5)\cos0^0 \checkmark + (1.9)(3)\cos180^0 \checkmark = \frac{1}{2}(22)(v_i^2 - 0^0) \checkmark$ $v_f = 5,37m \cdot s^{-1} \checkmark$	Accept/ Aanvaar h / Δy / Δx
$w_{net} = \Delta K \checkmark$ $-\Delta U + f\Delta x\cos\theta = \frac{1}{2}mv^2 - \frac{1}{2}mv^2$ $-(0 - (22)(9.8)(1.5)) \checkmark + (1.9)(3)\cos180^0 \checkmark = \frac{1}{2}(22)(v_i^2 - 0^0) \checkmark$ $v_f = 5,37m \cdot s^{-1} \checkmark$	Accept/ Aanvaar h / Δy / Δx

(5)

5.4 Equal to / Gelyk aan $\checkmark$ (1)
[12]**QUESTION 6 / VRAAG 6**6.1 Doppler Effect $\checkmark$ / Doppler Effek $\checkmark$

Doppler Effect is the change in frequency (or pitch) of the sound detected by a listener $\checkmark$ because the sound source and the listener have different velocities relative to the medium of sound propagation $\checkmark$.

Doppler Effek is die verandering in frekwensie (of toonhoogte) van die klank waargeneem deur 'n luisteraar $\checkmark$ omdat die klankbron en die luisteraar verskillende snelhede relatief tot die medium waarin die klank voortgeplant word, het. (3)

OR/OF

The change in the observe frequency when there is relative motion between the source and the observer.

Die verandering in die waargenome frekwensie as daar relatiewe beweging tussen die klankbron en die luisteraar.

6.2

$$f_l = \frac{v \pm v_L}{v \pm v_s} f_s \checkmark \quad \text{OR/OF} \quad f_l = \frac{v}{v \pm v_s} f_s$$

$$f_L = \frac{340 \checkmark}{(340 - 16) \checkmark} (420) \checkmark$$

$$f_L = 440.74 \text{ Hz} \checkmark \quad (5)$$

6.3.1 Smaller than $\checkmark$ / Kleiner as $\checkmark$ (1)

6.3.2 Increases $\checkmark$ / Toeneem $\checkmark$ (1)

6.4 Sun and stars emit light.

When a star moves away from the Earth, its spectrum shifts to longer wavelength $\checkmark$ (lower frequency) in other words, the **red shift** $\checkmark$

[NB - Red has a longer wavelength than blue).

The stars then appears red.

The Universe is expanding $\checkmark$

Sun en sterre straal lig uit.

As 'n **ster weg van die aarde** beweeg, verskuif sy spectrum na 'n **langer golflengte** $\checkmark$ (laer frekwensie) in ander woorde, **rooi verskuiwing** $\checkmark$ (NB Rooi het 'n langer golflengte as blou).

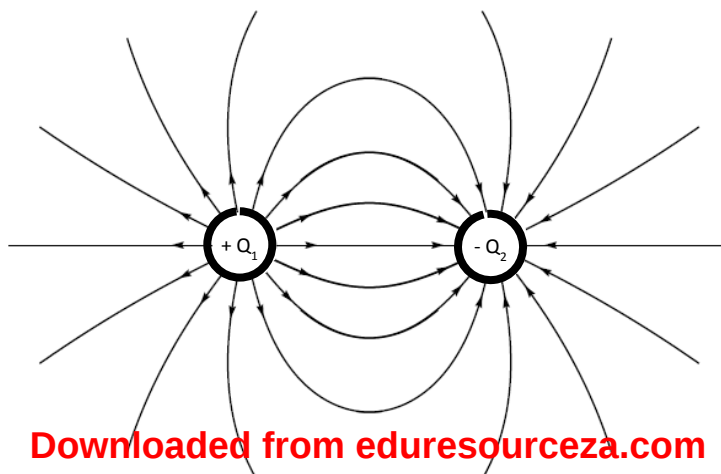
Die ster kom dan voor as rooi.

Die heelal brei uit $\checkmark$

(3)
[13]

QUESTION 7 / VRAAG 7

7.1



Criteria / Kriteria	Marks / Punte
Shape of field line between charges <i>Vorm van veldlyne tussen ladinge</i>	1
Shape of field lines outside charges <i>Vorm van veldlyne buite ladinge</i>	1
Direction of field lines <i>Rigting van die veldlyne</i>	1

(3)

7.2

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 elektrostatiese krag wat een puntlading (Q_1) op 'n ander puntlading (Q_2) uitoefen, is direk eweredig aan die produk van die groottes van die ladinge ✓ en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle ✓.

OR/OF

The electrostatic force between two point charges is directly proportional to product of the charges ✓ and inversely proportional to the square of the distance between them. ✓

Die elektrostatiese krag tussen twee punt ladinge is direk eweredig aan die produk van die ladinge ✓ en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle. ✓

(2)

7.3 Option 1/Opsie 1

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

$$F = \frac{(9 \times 10^9)(5 \times 10^{-6})(5 \times 10^{-6})}{(10 \times 10^{-2})^2} \checkmark$$

$$F = 22.5 \text{ N } \checkmark$$

Option 2/Opsie 2

$$F = \frac{kQ_1Q_2}{r^2} \checkmark \text{ OR/OF } F = \frac{k(Q)^2}{r^2}$$

$$F = \frac{(9 \times 10^9)(5 \times 10^{-6})^2}{(10 \times 10^{-2})^2} \checkmark$$

$$F = 22.5 \text{ N } \checkmark$$

(4)

7.4 Same magnitude ✓ but opposite in direction ✓
Dieselfde grootte maar teenoorgestelde rigting (2)

7.5 F will become 9 times smaller ✓
F sal 9 keer kleiner word. (1)

7.6

$$\vec{E}_{net} = \vec{E}_1 + \vec{E}_2 \checkmark$$

OR

$$E_{net} = E_1 + E_2$$

$$E_{net} = \frac{kQ}{r^2} + \frac{kQ}{r^2} \checkmark \quad (\text{Mark for/Punt vir } \frac{kQ}{r^2})$$

$$E_{net} = \frac{(9 \times 10^9)(5 \times 10^{-6})}{(2 \times 10^{-2})^2} \checkmark + \frac{(9 \times 10^9)(5 \times 10^{-6})}{(8 \times 10^{-2})^2} \checkmark$$

$$\vec{E}_{net} = 2,81 \times 10^8 \text{ N } \checkmark \text{ towards charge } Q_2 \checkmark \quad (6)$$

[18]

NB: Do not penalise if vector notation is not used.

LW: Moenie penaliseer as vektornotasie nie gebruik is nie.

QUESTION 8 / VRAAG 8

8.1.1

Criteria for hypothesis / <i>Kriteria vir hipotese:</i>	Mark/Punt
The dependent and independent variables are stated. <i>Die afhanklike en onafhanklike veranderlikes is genoem.</i>	✓
Makes a statement about the relationship between dependent and independent variables. <i>Maak 'n stelling oor die verwantskap tussen die afhanklike en onafhanklike veranderlikes.</i>	✓

Independent variable/ *Onafhanklike veranderlike:*

Amount of potato cells / *Aantal aartappelselle*

Dependent variable/ *Afhanklike veranderlike:*

Bulb glows or not / *Gloeilampie gloei of nie*

OR/OF

Current (strength) / *Stroom(sterkte)*

Notes/

Aantekeninge:

A statement that does not contain a relationship: Max ½

'n Stelling wat geen verwantskap bevat nie: Maks. ½

Example/

Voorbeeld:

Three potato cells are needed to make penlight bulb glow. ½

Drie aartappelselle is nodig om die gloei-lampie te laat gloei. ½

Examples/Voorbeelde:

More potato cells will increase the brightness of the bulb/

Meer aartappelselle sal die helderheid van die gloeilampie laat toeneem.

More potato cells will increase the current through the bulb/

Meer aartappelselle sal die grootte van die stroom deur die gloeilampie laat toeneem.

(2)

8.1.2 Dependent variable/Afhanklike veranderlike:

Bulb glows or not /Gloeilampie gloei of nie ✓

OR/OF

Current (strength) /Stroom(sterkte) ✓

(1)

8.2 1,6 V ✓

(1)

8.3 The battery has an internal resistance / ✓

Die battery het 'n interne weerstand ✓

(1)

8.4 **Option 1/Opsie 1**

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

$$P = \frac{(0.02)^2}{2}$$

$$P = 2 \times 10^{-4} W \quad \checkmark$$

Option 2/Opsie 2

$$I = \frac{V}{R}$$

$$I = \frac{0.02}{2}$$

$$I = 0.01 A$$

$$P = IV \checkmark$$

$$P = 0.01 \times 0.02 \checkmark$$

$$P = 2 \times 10^{-4} W \quad \checkmark$$

Option 3/Opsie 3

$$I = \frac{V}{R}$$

$$I = \frac{0.02}{2}$$

$$I = 0.01 A$$

$$P = I^2 R \checkmark$$

$$P = (0.01)^2 (2) \checkmark$$

$$P = 2 \times 10^{-4} W \quad \checkmark$$

(3)

[8]

QUESTION 9 / VRAAG 9

9.1

The potential difference across a conductor is directly proportional to the current in the conductor✓ at constant temperature. ✓

Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom in die geleier✓ by konstante temperatuur✓.

(2)

9.2

$$R = \frac{V}{I} \quad \checkmark$$

$$R = \frac{12.9}{1.5} \quad \checkmark$$

$$R = 8.6 \, \Omega \quad \checkmark$$

(3)

9.3 POSITIVE MARKING FROM QUESTION 9.2 POSITIEWE NASIEN VAN VRAAG 9.2

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_5} \quad \checkmark$$

$$\frac{1}{R_T} = \frac{1}{8.6} + \frac{1}{(4+5)} \quad \checkmark$$

$$\frac{1}{R_T} = \frac{88}{387}$$

$$R_T = 4.4 \, \Omega \quad \checkmark$$

(3)

9.4 POSITIVE MARKING FROM QUESTION 9.3 POSITIEWE NASIEN VAN VRAAG 9.3

Option 1/Opsie 1	Option 2/Opsie 2
$R = \frac{V}{I} \quad \checkmark$	$R = \frac{V}{I} \quad \checkmark$
$4.4 = \frac{12.9}{I} \quad \checkmark$	$4.4 = \frac{12.9}{I} \quad \checkmark$
$I = 2.93 \, A$	$I = 2.93 \, A$

$r = \frac{V}{I}$ $r = \frac{15-12.9}{2.93} \checkmark$ $r = 0,72 \Omega \checkmark$	$\varepsilon = I(R + r)$ $15 = 2.93(4.4 + r) \checkmark$ $r = 0,72 \Omega \checkmark$
Option 3/Opsie 3	Option 4/Opsie 4
$R = \frac{V}{I} \checkmark$ $9 = \frac{12.9}{I} \checkmark$ $I = 1.43 A$ $I = 1.5 + 1.43$ $I = 2.93 A$ $r = \frac{V}{I}$ $r = \frac{15-12.9}{2.93} \checkmark$ $r = 0,72 \Omega \checkmark$	$R = \frac{V}{I} \checkmark$ $9 = \frac{12.9}{I} \checkmark$ $I = 1.43 A$ $I = 1.5 + 1.43$ $I = 2.93 A$ $\varepsilon = I(R + r)$ $15 = 2.93(4.4 + r) \checkmark$ $r = 0,72 \Omega \checkmark$

(4)
[12]**QUESTIONS 10 / VRAAG 10**

10.1 Direct Current Generator ✓ / Gelykstroom-generator ✓

OR/OF

DC generator/ GS generator

(1)

10.2 Alternating Current Generator ✓ / Wisselstroom-generator ✓

OR/OF

AC generator/WS generator

(1)

10.3 DC (Direct Current) generator – has a splitting commutator ✓

GS (Gelykstroom) generator – bevat 'n splitting – kommutator ✓

AC (Alternating Current) generator – has slip rings ✓

WS (Wisselstroom) generator – bevat sleepinge ✓

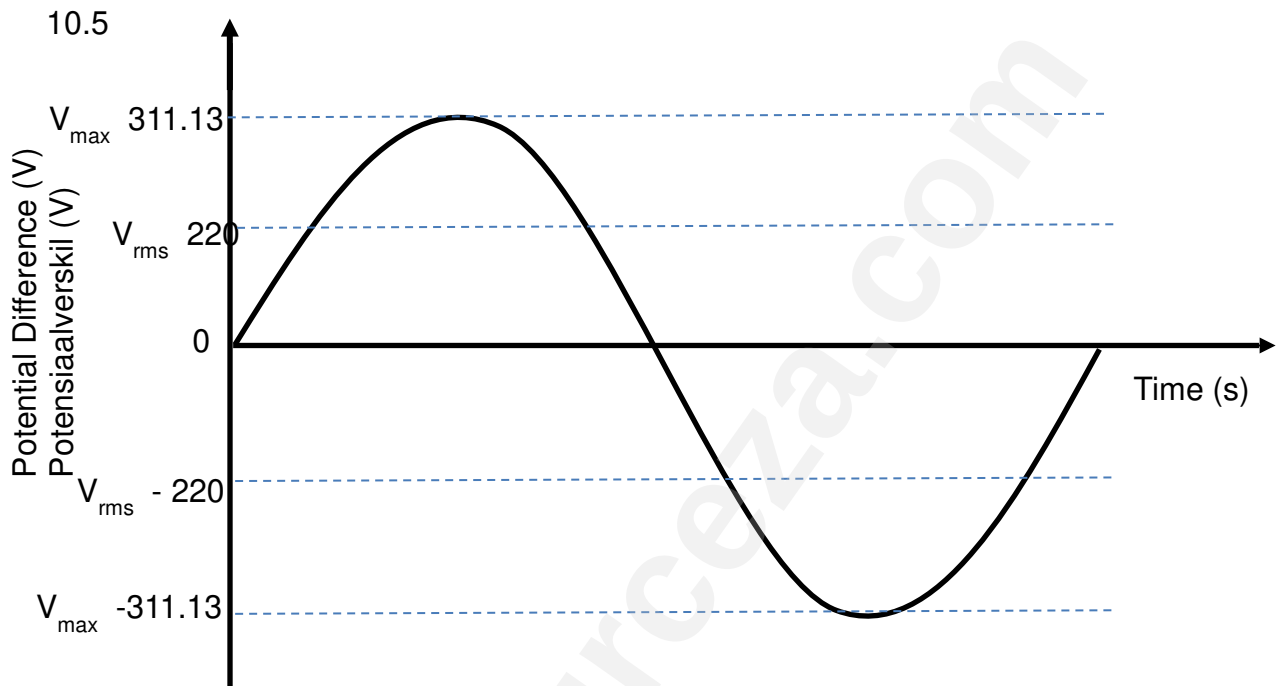
(2)

10.4

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

$$220 = \frac{V_{max}}{\sqrt{2}} \checkmark$$

$$V_{max} = 311.13 \text{ V} \checkmark \quad (3)$$



Criteria	Marks
Shape / Vorm	✓
One cycle / Een siklus	✓
Both rms – values / Beide wgk-waardes	✓
Both peak – values / Beide piek-waardes	✓

(4)

10.6 ANY TWO CORRECT APLICATIONS ✓✓

- Car alternator
- Bicycle dynamo
- Hybrid electric vehicle (HEV) drive systems,
- Aircraft auxiliary power generation,
- Wind generators,
- High speed gas turbine generators

ENIGE TWEE KORREKTE TOEPASSINGS

- Motor alternator /
- Fiets dinamo
- Hibriede elektriese voertuig (HEV) dryfstelsels,

- Vliegtuig hulp kragopwekkers,
- Windgenerators,
- Hoë spoed gas turbine kragopwekkers.

▪ (2)

[13]

QUESTION 11 / VRAAG 11

11.1 Photoelectric effect ✓
Fotoëlektriese effek ✓

(1)

11.2 What effect will light of different frequencies ✓ have on the emission of electrons from a metal. ✓
Wat is die effek van verskillende frekwensie ✓ van lig op die vrystelling van elektrone uit 'n metaal. ✓

(2)

11.3.1 light of different frequencies ✓
Lig van verskillende frekwensies ✓

(1)

11.3.2 emission of electrons ✓
Vrystelling van elektrone ✓

(1)

11.3.3 Type of metal/work function /threshold (cut off) frequency ✓

(1)

11.4.1
work function is the minimum energy that an electron in the metal needs to be emitted from the metal surface. ✓✓

Werkfunksie is die minimum energie benodig om 'n elektron uit die oppervlak van 'n metaal vry te stel. ✓✓

OR/OF

Minimum energy needed to eject electrons from the surface of a certain metal. ✓✓
Minimum energie benodig om elektrone uit 'n metaaloppervlak vry te stel. ✓✓
(2)

11.4.2 $E = W_o + \frac{1}{2} mv^2$ ✓

$$\frac{hc}{\lambda} = W_o + E_k$$

$$\frac{(6,63 \times 10^{-34})(3 \times 10^8) \checkmark}{7,8 \times 10^{-7} \checkmark} = 1,8 \times 10^{-19} + E_k \checkmark$$

$$E_k = 7,5 \times 10^{-20} J \checkmark$$

(5)
[13]

TOTAL/TOTAAL: 150