PREPARATORY EXAMINATION
VOORBEREIDENDE EKSAMEN

GRADE 12/*GRAAD 12*

PHYSICAL SCIENCES P1 (PHYSICS)
FISIESE WETENSKAPPE V1 (FISIKA)

SEPTEMBER 2018

MEMORANDUM

MARKS/*PUNTE*: 150

This memorandum consists of 17 pages.
Hierdie memorandum bestaan uit 17 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 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 gepenaliseer word vir die herhaaldelike gebruik van 'n verkeerde eenheid **in 'n vraag/subvraag**.*

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 $m.s^{-1}$ 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 $m.s^{-1}$ 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 dit word korrek in 3.2 of 3.3 vervang, word* ***volpunte*** *vir die daaropvolgende subvrae 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.*

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

QUESTION 2/*VRAAG 2*

2.1   When a resultant/net force acts on an object, the object will accelerate in
       the direction of the force at <u>an acceleration directly proportional to the force</u>✓
       <u>and inversely proportional to the mass of the object.</u>   ✓
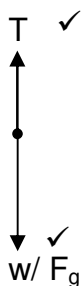   **OR**
       The resultant/net force acting on the object is equal (directly proportional)
       to the rate of change of momentum of an object (in the direction of the
       force).✓✓ (2 or 0)

       Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, versnel die
       voorwerp in die rigting van die krag <u>teen 'n versnelling direk eweredig aan</u>
       <u>die krag en omgekeerd eweredig aan die massa van die voorwerp</u>.
       OF
       Die resulterende/netto krag wat op die voorwerp inwerk, is gelyk (direk
       eweredig) aan die tempo van verandering van momentum van die voorwerp
       (in die rigting van die krag). (2 of 0)   (2)

2.2

	Notes/*Aantekeninge*:
T ✓ ↑ • ↓ ✓ w/ F_g	• Mark awarded for label and arrow./*Punt toegeken vir benoeming en pyltjie.* • Any other additional forces/*Enige ander addisionele kragte* $\frac{1}{2}$ • No arrows indicated/*Geen pyltjie aangedui nie.* $\frac{1}{2}$ • Ignore the relative lengths of arrows./*Ignoreer die relatiewe lengte van pyltjies.*

                                                                                                                            (2)

2.3 $f_K = \mu N$✓
          $= (0,15)(3,3)(9,8)$ ✓
          $= 4,85$ N✓

$F_N = mg$
$= 3,3 \times 9,8$
$= 32,34$ N
$f_K = \mu N$✓
$= (0,15)(32,34)$✓
$= 4,85$ N✓

(3)

2.4   **POSITIVE MARKING FROM QUESTION 2.3**
        POSITIEWE NASIEN VANAF VRAAG 2.3

OPTION 1/*OPSIE 1*
Right as positive/
Regs as positief

For/*Vir* K:

$F_{net} = ma$✓
$T - f = ma$
$\underline{T - 4,85}$✓ $= 3,3a$ .... (1)

For/*Vir* L:

$F_{net} = ma$
$w - T = ma$
$mg - T = ma$
$\underline{(2,1)(9,8) - T}$ ✓$= 2,1a$ .... (2)
$\underline{(1) + (2)}$

$T - 4,85 = 3,3a$
$\underline{-T + 20,58 = 2,1a}$
$5,4a = 15,73$
$a = 2,91$ m·s⁻¹

Substitute in 1/*Vervang in 1*

$T - 4,85 = (3,3)(2,91)$
$T = 14,46$ N✓
[Accept/*aanvaar*: 14,45 N]

OPTION 2/*OPSIE 2*
Left as positive/
Links as positief

For/*Vir* K:

$F_{net} = ma$✓
$\underline{-T + 4,85}$✓ $= 3,3a$

For/*Vir* L:

$F_{net} = ma$
$\underline{-(2,1)(9,8) + T}$ ✓$= 2,1a$
$\underline{(1) + (2)}$

$-T + 4,85 = 3,3a$
$\underline{+T - 20,58 = 2,1a}$
$5,4a = -15,73$
$a = -2,91$ m·s⁻¹

Substitute in 1/*Vervang in* 1

$-T + 4,85 = (3,3)(-2,91)$
$T = 14,46$ N✓
[Accept/*aanvaar*: 14,45 N]

(5)
[12]

QUESTION 3/*VRAAG 3*

3.1.1

OPTION 1/*OPSIE* 1

$$v_f^2 = v_i^2 + 2a_{\Delta y}$$

$$= 0 + 2(9,8)(19,6) \checkmark$$

$$v_f = 19,6 \text{ m·s}^{-1} \checkmark$$

OPTION 2/*OPSIE* 2

$$\Delta y = V_1 \Delta t + \frac{1}{2} a\Delta t^2$$

$$19,6 = 0 + \frac{1}{2}(9,8)\Delta t^2$$

$$\Delta t = 2s$$

$$V_f = V_i + a\Delta t \checkmark$$

$$= 0 + (9,8)(2) \checkmark$$

$$= 19,6 \text{ m·s}^{-1} \checkmark$$

(3)

POSITIVE MARKING FROM 3.1.1
POSITIEWE MERK VANAF 3.1.1

3.1.2 **OPTION 1/*OPSIE* 1**

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

$$19,6 = 0 + \frac{1}{2}(9,8)\Delta t^2 \checkmark$$

$$\overline{\Delta t = 2 \text{ s}}$$

$$\Delta t_A = \Delta t_B$$

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

$$29,6 \checkmark = v_i(2) + \frac{1}{2}(9,8)(2^2) \checkmark$$
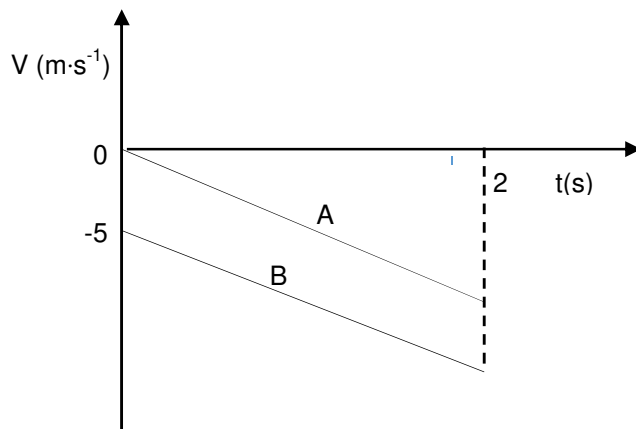
$$\overline{v_i = 5 \text{ m·s}^{-1} \checkmark}$$

OPTION 2/*OPSIE* 2

For/*Vir* A:

$$v_{fA} = v_i + a\Delta t$$

$$19,6 = 0 + 9,8\Delta t \checkmark$$

$$\Delta t = 2 \text{ s}$$

$$\Delta t_A = \Delta t_B$$

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

$$29,6 \checkmark = v_i(2) + \frac{1}{2}(9,8)(2^2) \checkmark$$

$$\overline{v_i = 5 \text{ m·s}^{-1} \checkmark}$$

(5)

3.2   **POSITIVE MARKING FROM 3.1.2**
       POSITIEWE MERK VANAF 3.1.2
       Downwards positive/*Afwaarts positief*

Marking criteria/*Nasienkriteria*	Marks/*Punte*
A starts at 0 m·s^{-1} with positive gradient. *A begin by 0 s^{-1} met 'n positiewe gradiënt.*	✓
Graphs for A and B stop at 2s. *Grafiek A en B stop by 2s.*	✓
B starts at -5 m·s^{-1} with positive gradient. *B begin by -5m·s^{-1} met 'n positiewe gradiënt.*	✓
Lines parallel to each other. *Lyne loop parallel.*	✓

Upwards positive/*Opwaarts positief*

Marking criteria/*Nasienkriteria*	Marks/*Punte*
A starts at 0 m·s^{-1} with negative gradient. *A begin by 0 m·s^{-1} met 'n negatiewe gradient.*	✓
Graphs for A and B stop at 2 s. *Grafiek A en B stop by 2 s.*	✓
B starts at -5 m·s^{-1} with negative gradient. *B begin by -5 m·s^{-1} met 'n negatiewe gradiënt.*	✓
Lines parallel to each other. *Lyne loop parallel.*	✓

(4)

[12]

QUESTION 4/*VRAAG 4*

4.1 The product of the resultant/net force ✓ acting on an object and the time the resultant (or net) force acts on the object. ✓

Die produk van die resulterende/netto krag wat op die voorwerp inwerk en die tyd wat die resulterende (of netto) krag op die voorwerp inwerk. (2)

4.2
Impulse/*Impulse* = F∆t ✓ = $(2,5 \times 10^3)(1 \times 10^{-3})$ ✓ = 2,5 N·s ✓

Impulse = area under the graph *Impulse = area onder die grafiek* $\quad$ = l x b ✓ $\quad$ = $(2,5 \times 10^3)(1 \times 10^{-3})$✓ $\quad$ = 2,5 N·s✓

(3)

POSITIVE MARKING FROM 4.2
POSITIEWE MERK VANAF 4.2

4.3.1
OPTION 1/*OPSIE 1* **Right as positive/** ***Regs as positief*** F∆t = mv_f - mv_i ✓ ✓2,5 = $2(v_f − 4)$ ✓ v_f = 5,25 m·s⁻¹ right ✓.

OPTION 2/ *OPSIE 2* **Left as positive/** ***Links as positief*** F∆t = mv_f - mv_i✓ -2,5 ✓= $2(v_f − (- 4))$✓ v_f = -5,25 m·s⁻¹ v_f = 5,25 m·s⁻¹ right✓

(4)

POSITIVE MARKING FROM 4.2
POSITIEWE MERK VANAF 4.2

4.3.2
OPTION 1/*OPSIE 1* **Right as positive/** ***Regs as positief*** F∆t = mv_f - mv_i ✓-2,5 = $2(v_f − 4)$ ✓ v_f = 2,75 m·s⁻¹ right ✓.

OPTION 2/ *OPSIE 2* **Left as positive/** ***Links as positief*** F∆t = mv_f - mv_i -2,5 ✓= $2(v_f − (- 4))$✓ v_f = -2,75m·s⁻¹ v_f = 2,75m·s⁻¹ right✓.

(3)

[12]

QUESTION 5/*VRAAG 5*

5.1.1 W = F ∆x cos θ ✓
$\quad$ = (60)(20)cos 60° ✓
$\quad$ = 600 J ✓ (3)

5.1.2 No ✓
The force of gravity acts at right angles (is perpendicular) to the displacement✓ of the cart.
Nee.
Die gravitasiekrag werk teen regte hoeke (loodreg) tot die verplasing van die kar. (2)

5.2.1 A force for which the work done in moving an object between two points, is independent of the path taken. ✓✓ (2 or 0)
'n Krag waarvoor arbeid verrig word deur 'n voorwerp tussen twee punte te beweeg, is onafhanklik van die pad wat gevolg is. (2 or 0)   (2)

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

$mgh_i + \frac{1}{2}mV_i^2 = mgh_f + \frac{1}{2}mV_f^2$ ✓

$(0,3)(9,8)(1,2) + \frac{1}{2}(0,3)(2^2)$ ✓ $= 0 + \frac{1}{2}(0,3)V_f^2$ ✓

$v_f = 5,25$ m·s^{-1}✓

OPTION 2/*OPSIE 2*
$W_{net} = \Delta K$ ✓

$mg\Delta x \cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$(0,3)(9,8)(1,2)\cos 0°$✓ $= \frac{1}{2}(0,3)V_f^2 - \frac{1}{2}(0,3)(2^2)$ ✓

$v_f = 5,25$ m·s^{-1} ✓

OPTION 3/*OPSIE 3*
$W_{nc} = \Delta K + \Delta U$ ✓

$W_{nc} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 + mgh_f - mgh_i$

0 ✓ $= \frac{1}{2}(0,3)V_f^2 - \frac{1}{2}(0,3)(2^2) + 0 - (0,3)(9,8)(1,2)$ ✓

$v_f = 5,25$ m·s^{-1} ✓   (4)

5.2.3 The <u>total linear momentum</u> ✓ of a <u>closed system</u> ✓ remains constant (is conserved).
Die <u>totale liniêre momentum</u> vir 'n <u>geslote stelsel</u> bly konstant (bly behoue).   (2)

5.2.4 **POSITIVE MARKING FROM 5.2.2**
POSITIEWE NASIEN VANAF 5.2.2

OPTION 1/*OPSIE 1* **Right as positive/** ***Regs as positief***	**OPTION 2/*OPSIE 2*** **Left as positive/** ***Links as positief***
$\sum p_{before} = \sum p_{after}$ ✓ $m_1v_1i + m_2v_2i = (m_1 + m_2)v_f$ $(0,3)(5,25) + (0,4)(0)$ ✓ $= 0,7v_f$ ✓ $v_f = 2,25$ m·s^{-1} ✓	$\sum p_{before} = \sum p_{after}$ ✓ $m_1v_1i + m_2v_2i = (m_1 + m_2)v_f$ $(0,3)(-5,25) + (0,4)(0)$ ✓ $= 0,7v_f$ ✓ $v_f = -2,25$ m·s^{-1} $v_f = 2,25$ m·s^{-1}✓

(4)

5.2.5 **POSITIVE MARKING FROM 5.2.4**
POSITIEWE NASIEN VANAF 5.2.4

OPTION 1/*OPSIE 1*

$W_{net} = \Delta K$ ✓

$W_g + W_f = \dfrac{1}{2}mv_f^2 - \dfrac{1}{2}mv_i^2$

$mgh\cos\theta + f\,\Delta x\cos\theta = \dfrac{1}{2}mv_f^2 - \dfrac{1}{2}mv_i^2$

$(0,7)(9,8)h\cos 180°$✓ $+ (0,5)(0,3)\cos 180°$✓ $= \dfrac{1}{2}(0,7)(0) - \dfrac{1}{2}(0,7)(2,25)^2$✓

$h = 0,24$ m ✓

> **Notes/*Aantekeninge*:**
> Ignore zeros if not substituted./*Ignoreer nul indien nie vervang is nie.*

OPTION 2/*OPSIE 2*

$W_{net} = \Delta K$ ✓

$W_{w//} + W_f = \dfrac{1}{2}mv_f^2 - \dfrac{1}{2}mv_i^2$

$mg\sin\alpha\,\Delta x\cos\theta + f\,\Delta x\cos\theta = \dfrac{1}{2}mv_f^2 - \dfrac{1}{2}mv_i^2$

$(0,7)(9,8)(\dfrac{h}{0,3})x(0,3)\cos 180°$✓$+ (0,5)(0,3)\cos 180°$✓ $= 0 - \dfrac{1}{2}(0,7)(2,25)^2$ ✓

$h = 0,24$ m ✓

OPTION 3/*OPSIE 3*

$W_{nc} = \Delta K + \Delta U$✓

$f\,\Delta x\cos\theta = \dfrac{1}{2}mv_f^2 - \dfrac{1}{2}mv_i^2 + mgh_f - mgh_i$

$(0,5)(0,3)\cos 180°$✓ $= 0 - \dfrac{1}{2}(0,7)(2,25)^2$ ✓ $+(0,7)(9,8)h - 0$ ✓

$h = 0,24$ m ✓

(5)
[22]

QUESTION 6/*VRAAG 6*

6.1   It is the <u>change in frequency</u> <u>(or pitch)</u> of the <u>sound detected by a</u>
<u>listener</u>✔because <u>the sound source and the listener have different</u>
<u>velocities relative to the medium of sound propagation</u>. ✔

*Dit is die <u>verandering in frekwensie (of toonhoogte) van klank wat die</u>
<u>luisteraar waarneem</u> omdat <u>die klankbron en die luisteraar verskillende</u>
<u>snelhede relatief tot die medium van klankvoortplanting het</u>.*   (2)

6.2 $f_L = \left(\dfrac{v \pm v_L}{v \pm v_s} \right) f_s$ ✔   **OR/*OF*** $f_L = \left(\dfrac{v}{v \pm v_s} \right) f_s$

$f_L = \left(\dfrac{343 - 0}{343 + 40} \right)$ ✔ 320 ✔

$f_L = 286{,}58$ Hz

$f = \dfrac{v}{\lambda}$ ✔

$286{,}58 = \dfrac{343}{\lambda}$ ✔

$\lambda = 1{,}2$ m ✔   (6)

6.3   **Any ONE of the following/*Enige EEN van die volgende:***
To determine the heartbeat of a foetus./*Om die hartklop van 'n fetus vas te
stel.* ✔
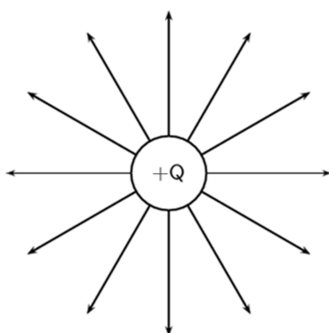To determine the rate of blood flow in arteries./*Om die tempo waarteen
bloed in are vloei, vas te stel.*   (1)
                                                                                    [9]

QUESTION 7/*VRAAG 7*

7.1.1

Marking criteria *Nasienkriteria*	Marks/*Punte*
Direction of field lines *Rigting van veldlyne*	✔
Pattern (radiating from centre) *Patroon (invallend uit die middel)*	✔
Field lines not touching sphere or crossing each other/*Veldlyne raak nie aan die sfeer nie en kruis nie mekaar nie*: max/*maks* $\frac{1}{2}$	

                                                                                    (2)

7.1.2 $F_{13} = k\dfrac{Q_1 Q_2}{r^2}$ ✓

$= (9 \times 10^9)\ \dfrac{(1 \times 10^{-9})(4 \times 10^{-9})}{(2 \times 10^{-2})^2}$ ✓
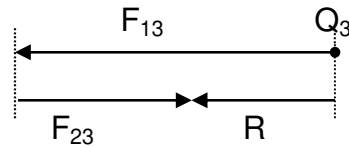
$= 9 \times 10^{-5}$ N

$F_{23} = k\dfrac{Q_1 Q_2}{r^2}$

$= (9 \times 10^9)\ \dfrac{(3 \times 10^{-9})(4 \times 10^{-9})}{(4 \times 10^{-2})^2}$ ✓

$= 6{,}75 \times 10^{-5}$ N

Left as positive/
Links as positief

$F_{net} = 9 \times 10^{-5} -$✓$6{,}75 \times 10^{-5}$
$= 2{,}25 \times 10^{-5}$ N ✓ left. ✓

Right as positive/
Regs as positief

$F_{net} =$ ✓$-9 \times 10^{-5} + 6{,}75 \times 10^{-5}$
$= -2{,}25 \times 10^{-5}$ N

$F_{net} = 2{,}25 \times 10^{-5}$ ✓ N left. ✓

(6)

7.2.1 The electric field at a point is the electrostatic force experienced per <u>unit positive</u> charge placed at that point. ✓✓
Die elektriese veld by 'n punt is die elektrostatiese krag per <u>eenheids positiewe</u> lading geplaas by daardie punt. (2)

NOTE/LET WEL:
Deduct 1 mark for every underlined key word omitted (in the correct context).
Trek 1 puint af vir elke onderstreepte sleutelwoord wat uitgelaat is (in die korrekte konteks).

7.2.2 $E = k\dfrac{Q_1}{r^2}$ ✓

$= (9 \times 10^9)\ \dfrac{4 \times 10^{-6}}{(30 \times 10^{-3})^2}$ ✓

$= 4 \times 10^7$ N·C^{-1} ✓, to the right/*na regs* ✓ (4)

7.2.3 **POSITIVE MARKING FROM 7.2.2**
 POSITIEWE NASIEN VANAF 7.2.2

OPTION 1/*OPSIE 1*
$F = Eq$ ✔
$= (4 \times 10^7)(2,5 \times 10^{-9})$ ✔
$= 0,1 \text{ N}$ ✔

OPTION 2/*OPSIE 2*
$F = \dfrac{KQ_aQ_p}{r^2}$ ✔
$= (9 \times 10^9) \dfrac{(4 \times 10^{-6})(2,5 \times 10^{-9})}{(0,03)^2}$ ✔
$= 0,1 \text{ N}$ ✔

(3)
[17]

QUESTION 8/*VRAAG 8*

8.1.1 The <u>potential difference</u> across a conductor <u>is directly proportional</u> <u>to the current</u> ✔ in the conductor <u>at constant temperature.</u> ✔
 Die <u>potensiaalverskil</u> oor 'n geleier <u>is direk eweredig</u> <u>aan die stroom in die geleier</u> <u>by konstante temperatuur</u>. (2)

8.1.2 **Diagram 1:**
$R_Y = \dfrac{V}{I}$ ✔

$= \dfrac{6}{2}$ ✔

$= 3 \text{ Ω}$ ✔

Diagram 2:
$V_Y = emf - V_X$
$= 6 - 4$
$= 2 \text{ V}$

$I_Y = \dfrac{V_Y}{R_Y}$

$= \dfrac{2}{3}$ ✔

$= 0,67 \text{ A}$

$R_X = \dfrac{V_X}{I_x}$

$= \dfrac{4}{0,67}$ ✔

$= 5,97 \text{ Ω}$ ✔ (**Accept/*Aanvaar*** 6 Ω) (6)

8.2.1 12,6 V ✔ (1)

8.2.2 $\varepsilon = I(R + r)$ ✓
     $12{,}6$✓ $= I(5 + 0{,}08)$ ✓
     $I = 2{,}48$ A

     $V_{ext} = IR$
     $= (2{,}48)(5)$ ✓
     $= 12{,}4$ V ✓   (5)

8.2.3   Decrease/*Verminder* ✓
- Resistance decreases and I_t increases✓/*Weerstand verlaag en I_t verhoog*
- V_i will increase and V_{ext} will decrease (with emf constant) ✓/ *V_i sal verhoog en V_{ext} sal verlaag (met emf konstant)*
- (According to $P = \dfrac{V^2}{R}$) <u>power will decrease</u> ✓

     (Volgens $P = \dfrac{V^2}{R}$) <u>sal drywing verlaag</u>

                                                (4)
                                            [18]

QUESTION 9/*VRAAG 9*

9.1.1   AC ✓   Uses slip rings./*Gebruik sleepringe.* ✓   (2)

9.1.2   From X to W/*vanaf X tot W* ✓   (1)

9.1.3   Electromagnetic induction/*Elektromagnetiese induksie*✓   (1)

9.2.1 $P_{ave} = \dfrac{V_{rms}^2}{R}$ ✓

     $1500 = \dfrac{(240)^2}{R}$ ✓
     $R = 38{,}4\ \Omega$ ✓   (3)

9.2.2 $P_{ave} = V_{rms}I_{rms}$ ✓ | $P_{ave} = I_{rms}^2\ R_{rms}$ ✓
     $1500 = 240I_{rms}$ ✓ $1500 = I_{rms}^2\ (38{,}4)$✓
     $I = 6{,}25$ A $I = 6{,}25$ A

     I_{rms}✓ $= \dfrac{I_{max}}{\sqrt{2}}$

     ✓ $6{,}25 = \dfrac{I_{max}}{\sqrt{2}}$
     $I_{max} = 8{,}84$ A ✓   (5)
                                             [12]

QUESTION 10/*VRAAG 10*

10.1 M (must be positive/*moet positief wees*) ✓✓   (2)

10.2 The process whereby <u>electrons are ejected from a metal surface</u> ✓ when
       <u>light of suitable frequency is incident on that surface</u>. ✓
       Die proses waartydens <u>elektrone uit 'n metaaloppervlak vrygestel word</u>
       wanneer <u>lig van geskikte frekwensie invallend op daardie oppervlak is</u>.   (2)

10.3.1 The <u>minimum energy that an electron in the metal needs</u> ✓ to be <u>emitted</u>
       <u>from the metal surface</u>. ✓
       Die <u>minimum energie wat 'n elektron in die metaal nodig</u> het om <u>vanuit die</u>
       <u>metaaloppervlak vrygestel te word</u>.   (2)

10.3.2 For silver/*Vir silwer*
           $W_0 = hf_0$ ✓
           $7{,}42 \times 10^{-19} = (6{,}63 \times 10^{-34})f_0$ ✓
           $f_0 = 1{,}12 \times 10^{15}$ Hz

           $f = \dfrac{c}{\lambda}$ ✓

           $= \dfrac{3 \times 10^8}{300 \times 10^{-9}}$ ✓
           $= 1{,}0 \times 10^{15}$ Hz

       $f < f_0;$ ✓therefore NO ammeter reading will be effected. ✓
       $f < f_0;$ daarom sal GEEN ammeterlesing gekry word nie.   (6)

10.4.1 Increase ✓
       The number of photons per second incident on the metal surface
       increase. ✓
       Therefore the number of photo-e emtitted per second also increase. ✓
       Verhoog
       Die aantal invallende fotone per sekonde op die metaaloppervlak verhoog.
       Daarom sal die aantal foto-e per sekonde vrygestel, ook verhoog.   (3)

10.4.2 Remain the same/*Bly dieselfde* ✓   (1)
                                                                                    [16]

                                                              TOTAL/*TOTAAL*: 150