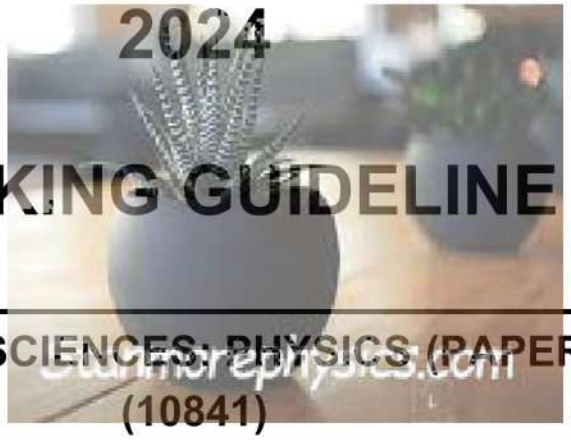
GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

2024



MARKING GUIDELINE

PHYSICAL SCIENCES: PHYSICS (PAPER 1)
(10841)

16 pages

QUESTION 1/*VRAAG 1*

1.1 B ✓✓ (2)

1.2 C ✓✓ (2)

1.3 B ✓✓ (2)

1.4 B ✓✓ (2)

1.5 A ✓✓ (2)

1.6 C ✓✓ (2)

1.7 C✓✓ (2)

1.8 D ✓✓ (2)

1.9 C ✓✓ (2)

1.10 B ✓✓ (2)

[20]

QUESTION 2 / *VRAAG 2*

2.1 The net force acting on a body is the vector sum ✓ of two or more forces ✓ acting on that body.
Die netto krag wat op 'n liggaam inwerk is die vektor som ✓ van twee of meer kragte ✓ wat op die liggaam inwerk.

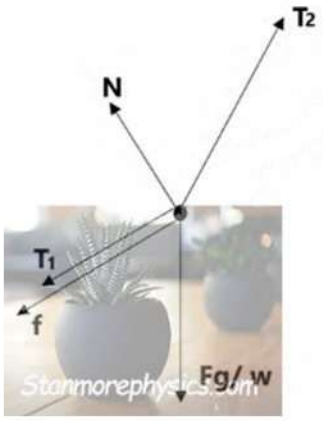
OR/*OR*

A single vector having the same effect as two or more vectors together.
Die enkel vektor wat dieselfde effek het as twee of meer vektore saam. (2)

Marking criteria/ *Nasienkriteria*:

Mark for scientifically correct explanation of the net force. Exact wording is not required.
Merk vir wetenskaplik korrekte verduideliking van netto krag. Bewoording hoef nie identies soos bo te wees nie.

2.2



Accepted labels/ *Aanvaarde benoemings*	
w	Fg/Fw/weight/gravitational force/*gewig/gravitasiekrag*
N	N/F_N/Normal Force/*Normaalkrag*
f	f_s/f_k/friction /*wrywing*
T_2	T/T/F_A/Force applied/tension at an angle/or its components/ *Krag toegepas/spanning teen 'n hoek*
T_1	T/T/F_A/Force applied/tension/ *Krag toegepas/spanning*

Notes:
- Mark awarded for label and arrow.
- Do not penalise for length of arrows, drawing is not to scale.
- Any other additional force(s) Max $^4/_5$
- If force(s) do not make contact with body Max $^4/_5$
- If no arrows indicated and all forces correctly drawn deduct 1 mark $^4/_5$
- Diagram must preferably not be in pencil

Aantekeninge:
- *Punt toegeken vir benoeming en pyltjie.*
- *Moenie penaliseer vir lengte van pyle nie; skets is nie volgens skaal nie.*
- *Enige ander addisionele krag(te) Maks* $^4/_5$
- *Indien krag(te) nie kontak maak met liggaam nie Maks* $^4/_5$
- *Indien geen pyle nie, maar alle kragte is reg geteken, trek 1 punt af Maks* $^4/_5$
- *Diagram moet verkieslik nie in potlood wees nie.*

(5)

2.3 **OPTION 1/ *OPSIE 1*:**

CAR/*kar*: F_{Net}=m x a ✓

$T_1 - F_{g//} - F_f = 1a$

$T_1 - 3,35 - 1,5 = 1a$

$T1 = 4,85 + a$ ✓

TRAIN/*Trein*: F_{NET}=ma

$F_{HORIZ} - T_1 - F_{g//} - F_f = 2a$

$19,696 - T_1 - 6,704 - 2 = 2a$

$T_1 = 10,992 - 2a$ ✓

CAR T_1=TRAIN T_1 ✓ /

Kar T_1= Trein T_1

$4,85 + 1a = 10,992 - 2a$

$a = 2,047\ m.s^{-2}$ ✓

OPTION 2/ *OPSIE 2*:

Car/*kar*: $F_{net} = ma = +T_1 - f - F_{g//}$ ✓

$1a = +T_1 - 1,5 - (1)(9,8)(\sin 20°)$

$1a = +T_1 - 5,5318$ ……..(1) ✓

Train /*trein*: $F_{net} = ma = +T_{2x} - f - F_{g//} - T_1$

$2a = +(20 \times \cos 10°) - 2 - (2)(9,8)(\sin 20°) - T_1$

$2a = 11,49 - T_1$ ……..(2) ✓

1+2 ✓

$1a = +T_1 - 5,5318$ ……..(1)

$2a = 11,49 - T_1$ ……..(2)

$3a = 6,141$

$a = 2,0468\ m.s^{-2}$ ✓

(5)

OPTION 3/ *OPSIE 3*:

$F_{net} = ma = +T_1 - f - Fg_{//}$ ✓

$1a = +T_1 - 1,5 - (1)(9,8)(\sin 20°)$

$T_1 = +1a + 4,85$ ……..(1) ✓

$F_{net} = ma = +T_{2x} - f - Fg_{//} - T_1$

$T_1 = -2a + (20)(\cos 10°) - 2 - (2)(9,8)(\sin 20°)$

$T_1 = -2a + 10,99$…….(2) ✓

$T_1 = T_1$ ✓

$1a + 4,85 = -2a + 10,99$

$3a = 6,141$

$a = 2,05\ m.s^{-2}$ ✓

Marking criteria/
***Nasienkriteria*:**

- ✓ Formula/*formula*
- ✓ Substitution for 1 kg/ *Vervanging vir 1 kg*
- ✓ Substitution for 2 kg/ *Vervanging vir 2 kg*
- ✓ Equating 1 and 2/ *Gelykstelling van 1 en 2*
- ✓ Answer $a = 2,05\ m.s^{-2}$ */ Antwoord a = 2,05 m.s^{-2}*

(5)

2.4 Remains the same ✓

- The normal force stays the same. ✓
- The frictional force is directly proportional to the normal force ∴ remains the same. ✓

OR

- Since the friction force is dependent on the normal force,
- and the NORMAL FORCE DOES NOT CHANGE.

OR (3)

- The coefficient of the surface remains constant, the incline stays constant, thus the normal stays constant.
- The frictional force is directly proportional to the coefficient, thus remains constant.

Bly dieselfde ✓
- *Die normaalkrag bly dieselfde.* ✓
- *Die wrywingskrag is direk eweredig aan die normaalkrag .: bly dieselfde.* ✓

OF
- *Aangesien die wrywingskrag afhanklik is van die normaalkrag,*
- *en die NORMAALKRAG VERANDER NIE.*

OF
- *Die koëffisiënt van die oppervlak bly konstant, die helling bly konstant, dus bly die normaalkrag konstant.*
- *Die wrywingskrag is direk eweredig aan die koëffisiënt, dus bly dit konstant*

[15]

QUESTION 3/*VRAAG 3*

3.1 Free fall is the motion of a body when the only force acting on it is its gravitational force. ✓✓ (2 or zero)
Vryval is beweging waartydens die enigste krag wat op 'n voorwerp inwerk, die gravitasiekrag is (2 of nul) (2)

Marking criteria/ *Nasienkriteria*:

If any of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark.
*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

3.2 **OPTION 1/*OPSIE 1***: (down positive/*af positief*)

$\Delta y = v_i \Delta t + \frac{1}{2} at^2$ ✓

44 ✓$= 0 + \frac{1}{2}(9,8)(6t)^2$ ✓

$44 = 176,4\ t^2$

$t = \sqrt{\frac{44}{176,4}} = 0,499$ s ✓

OPTION 2/*OPSIE 2*: (up positive/*op positief*)

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

$-44 = 0 + \frac{1}{2}(-9,8)(6t)^2$

$-44 = -176,4\ t^2$

$t = 0,499$ s/0,5 s

(4)

OPTION 3/*OPSIE 3*: (up positive/*op positief*)

$x = v_i t + \frac{1}{2}at^2$

$-44 = 0 + \frac{1}{2}(-9,8)t^2$

$-44 = -4,9\ t^2$

$t = 3\ s \div 6$

$= 0,499\ s$

$= 0,5\ s$

Marking criteria/ *Nasienkriteria*:

- ✓ Formula / *Formule*
- ✓ Substitution left /*Vervanging links*
- ✓ (x and g same signs!)/ *Vervanging (x en g dieselfde tekens!)*
- ✓ Substitution right / *Vervanging regs*
- ✓ Answer (accept 0,5 s or 0,499 s)/ *Antwoord (aanvaar 0,5 s of 0,499 s)*

3.3 Positive marking from QUESTION 3.2
Positiewe merk van VRAAG 3.2

OPTION 1/*OPSIE 1*: (down positive/*af positief*)

$\Delta y = v_i \Delta t + \frac{1}{2}at^2$ ✓

$= 0 + \frac{1}{2}(9,8)(3\ x\ 0,499)^2$ ✓

$= 10,98\ m$

$\therefore h = 44 - 10,98$ ✓ $= 33,02\ m$ ✓

OPTION 2/*OPSIE 2*: (up positive/*op positief*)

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

$= 0 + \frac{1}{2}(-9,8)(3\ x\ 0,5)^2$ ✓

$= -\ 11,03$ m

$= 11,03$ m down

$\therefore h_B = 44 - 11,03$ ✓ $= 32,98$ m ✓

OPTION 3/*OPSIE 3*: (down positive/*af positief*)

$\boldsymbol{v_f = v_i + a\Delta t}$

$= 0 + (9,8 \times 1,5)$

$= 14,7\ m.s^{-1}$

Mark for both equations

$v_f^2 = v_i^2 + 2a\Delta y$ ✓

$14,7^2 = 0 + 2(9,8)\Delta \boldsymbol{y}$ ✓

$\Delta \boldsymbol{y} = 11,025\ m$

$\therefore \boldsymbol{h_B = 44 - 11,03}$ ✓ $\boldsymbol{= 32,98\ m}$ ✓

Marking criteria/ *Nasienkriteria*:

- ✓ Formula / *Formule*
- ✓ Substitution left / *Vervanging links*
- ✓ (x/y and g same signs!) / *Vervanging (x/y en g dieselfde tekens!)*
- ✓ h – *x* answer / *h – x antwoord*

(4)

OPTION 4/*OPSIE 4*: (down positive/*af positief*)

$v_f = v_i + a\Delta t$

= 0 + (9,8)(1,5)

= 14,7 $m.s^{-1}$ ✓

Mark for both equations

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

$= (14{,}7\ x\ 1{,}5) + \frac{1}{2}(9{,}8)1{,}5^2$ ✓

= 33,075 m (33,08 m) ✓

OPTION 5/*OPSIE 5*: (down positive/*af positief*)

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

= 0 + 2(9,8)(44)✓

v_f = 29,37 m.s^{-1}

Mark for both equations
Punt vir albei vergelykings

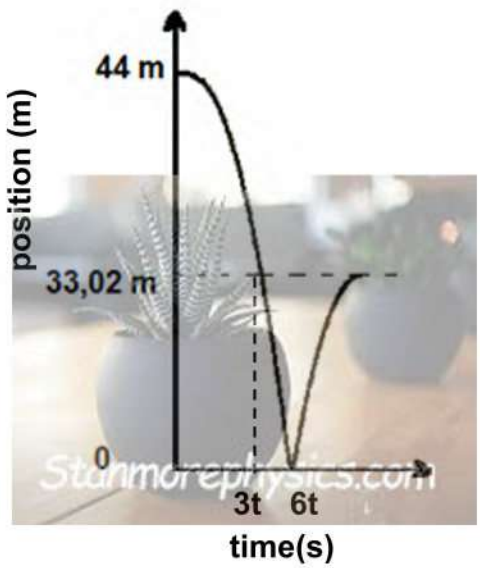
$v_f = v_i + at$ ✓

29,37 = 0 + 9,8 t ✓

t_{total} = 3 s = 6t

t = 0,5 s ✓

3.4 **OPTION 1/*OPSIE 1*:** up positive



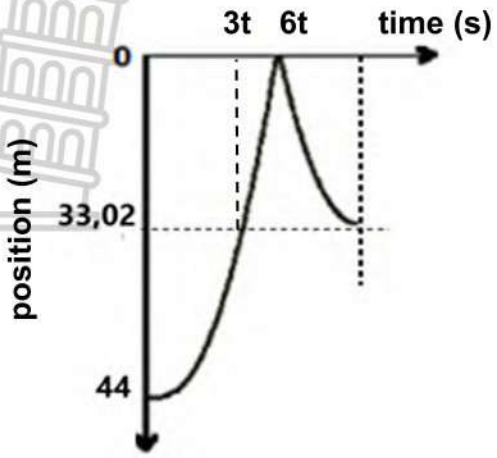
Marking criteria/ *Nasienkriteria*:

Positive marking from QUESTIONS 3.2 and 3.3 for values:
Positiewe merk van VRAAG 3.2 en 3.3

- ✓ 44 m initial height/ *aanvanklike hoogte*
- ✓ Height after bounce/ *hoogte na bons*
- ✓ Time for bounce (6t or 3 s as calculated)
  Tyd vir bons (6t of 3 s soos bereken)
- ✓ Time at C before bounce (3t or 1,5 s as calculated)
  Tyd by C voor bons (3t of 1,5 s soos bereken)
- ✓ Correct shape/ *Regte vorm*

Accept contact time – did not specify hard or soft ball /*Aanvaar kontak tyd – vraag spesifiseer nie harde of sagte bal nie*

OPTION 2/*OPSIE 3*: down positive/ *af positief*



(5)
[15]

QUESTION 4

4.1 The total linear momentum of an isolated system remains constant (is conserved).
Die totale lineêre momentum van 'n geïsoleerde sisteem bly konstant (behoue).

Marking criteria/ *Nasienkriteria*:
If any of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark. If closed system is used – no marks *Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af. Indien geslote sisteem gebruik word – geen punte.*

(2)

4.2 $$\sum \mathbf{p}_{\mathbf{before}/voor} = \sum \mathbf{p}_{\mathbf{after}/na}$$

$m_B v_{iB} + m_b v_{ib} = M v_f$ ✓

(0,15)(0) + (0,05)(200) ✓ = (0,2)v_f ✓

$v_f = 50\ m.s^{-1}$ ✓

Marking criteria:

- ✓ Formula/*formula*
- ✓ Substitution right/ *Vervanging regs*
- ✓ Substitution left / *Vervanging links*
- ✓ Answer/ *Antwoord*

(4)

4.3 INELASTIC ✓ / *ONELASTIES*

$\sum E_{k\ before} = \frac{1}{2} m_B v^2 + \frac{1}{2} m_b v^2$ ✓

$= ½ (0,15)(0)^2 + ½ (0,05)(200)^2$ ✓

$= 1000$ J

$Ek_{after} = \frac{1}{2} m_{(B+b)} v^2$

$= \frac{1}{2}\left(\frac{200}{1000}\right) \times (50)^2$ ✓

$= 250$ J

Since total E_k before collision ≠ total E_k after collision, the collision is INELASTIC.
Aangesien E_k voor botsing ≠ E_k na botsing is die botsing, ONELASTIES (4)

Marking criteria/ *Nasienkriteria*:

- ✓ INELASTIC/ *ONELASTIES*
- ✓ Formula / *Formule*
- ✓ Substitution BEFORE / *Vervanging VOOR*
- ✓ Substitution AFTER/ *Vervanging NA*
- ✓ Answer/ *Antwoord*

4.4 Positive marking from QUESTION 4.2 and 4.3 / *Positiewe merk van VRAAG 4.2 en 4.3*

$F_{NET} = \frac{\Delta p}{\Delta t}$ ✓

$-5 = \frac{(0,05)(195) - (0,05)(200)}{\Delta t}$ ✓

$\Delta t = 0,05$ s ✓

(3)
[13]

Marking criteria/ *Nasienkriteria*:

- ✓ Formula/ *Formule*
- ✓ Substitution/ *Vervanging*
- ✓ Answer/ *Antwoord*

QUESTION 5

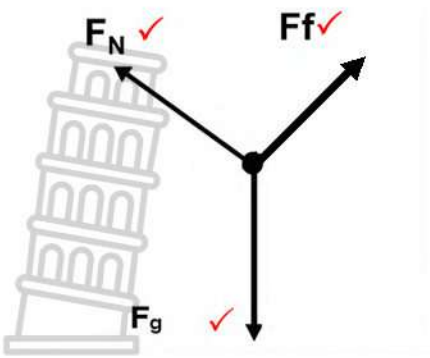
5.1 The (total) net work done is equal to the change in kinetic energy. ✓✓
OR
The work done by a net force is equal to the change in kinetic energy.

Die netto arbeid verrig op 'n voorwerp is gelyk aan die verandering in kinetiese energie van die voorwerp.
OF
Die netto arbeid verrig deur 'n netto krag is gelyk aan die verandering in kinetiese energie (2)

Marking criteria/ *Nasienkriteria*:

If any of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark.
If work is omitted, then zero marks
*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*
Indien werk uitgelaat word, geen punte.

5.2



Accepted labels	
w	Fg/Fw/weight/gravitational force
N	N/F_N/Normal Force
f	f_s/Ff/friction

(3)

5.3 A non-conservative force is the force for which the work done is dependent on the path taken. ✓✓ (2)

Marking criteria

If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark

5.4 **OPTION 1/*OPSIE 1*:**

$W_{nc} = \Delta Ep + \Delta Ek$ ✓

$F_f \Delta x \cos 180^o = (53)(9,8)(1,5 - 0)$✓ + ½ $(53)(0^2 - 6^2)$✓

$20\Delta x \cos 180^o$ ✓$= 779,1 - 954$

$-20x = -174,9$

$\Delta x = 8,745$ m

$\sin\theta = \frac{1,5}{8,745}$ ✓

$\theta = 9,88^o$ ✓

Marking criteria/*Nasienriglyn*:

- ✓ Formula/*Formule*
- ✓ Substitution (Wnc) / *Vervanging van* W_{nc}
- ✓ Substitution E_p/ *Vervanging van* E_p
- ✓ Substitution E_k/ *Vervanging van* E_k
- ✓ Angle substitution/*Hoek vervanging*
- ✓ answer

OPTION 2/*OPSIE 2*:

$W_{net} = \Delta E_k$ ✓

$F_{net} = f + F_{g//}$ (friction and $F_{g//}$ must have the same sign)

$= 20 + (53 \times 9,8 \times \sin\theta)$

$W_{net} = F_{net}\, x \cos 180° = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$

$(20 + (53 \times 9,8 \times \frac{1,5}{x}))\ x \cos 180°$ ✓$= 0 - (½ \times 53 \times 6^2)$ ✓

$-20x = -174,9$

$x = 8,745$ m ✓

(6)

$\sin\theta = \frac{1,5}{8,745}$ ✓

$= 9,88^\circ$ ✓ (accept range 9,87 – 9,88)

[13]

QUESTION 6/*VRAAG 6*

6.1 The change in frequency (or pitch) of the sound detected by a listener, because the sound source and the listener have different velocities relative to the medium of sound propagation. ✓✓
Die verandering in frekwensie (of toonhoogte) van die klank waargeneem deur 'n luisteraar omdat die klankbron en die luisteraar verskillende snelhede relatief tot die medium waarin die klank voortgeplant word, het (2)

Marking criteria/ *Nasienkriteria*:

If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark
*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

6.2 Graph B. ✓
The frequency recorded is lower than the emitted frequency. ✓

OR

Lower frequency gives a longer wavelength, thus moving away. ✓

OR

Frequency decreases compared to emitted frequency

Grafiek B. ✓
Die waargenome frekwensie is laer as die bron se frekwensie.

OF

Laer frekwensie gee 'n langer golflengte, dus beweeg weg.

OF

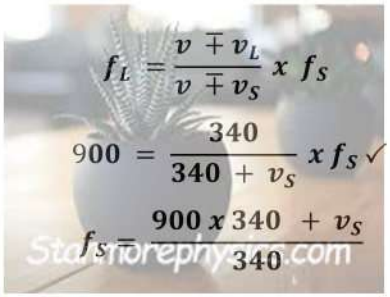
Frekwensie is laer as die bron frekwensie (2)

6.3 **OPTION 1/*OPSIE 1*:**

$$f_L = \frac{v \mp v_L}{v \mp v_S} x\ f_S \checkmark$$

$$1100 = \frac{340}{340 - v_S} x\ f_S \checkmark$$

$$f_S = \frac{1100\ x\ 340 - v_S}{340}$$



$$f_s = f_s$$

$$\frac{(1100)\ 340 - v_s}{340} = \frac{(900)\ 340 + v_s}{340} \checkmark$$

$$v_s = 34\ m.s^{-1} \checkmark$$

Marking criteria:

- ✓ Complete Doppler formula
- ✓ Substitution (towards) / *Vervanging (na)*
- ✓ Substitution (away)
- ✓ Equate f_s

(5)

6.4 6.4.1 B ✓ Red shifted / *Rooi verskuiwing* (1)

6.4.2 High frequency ✓ Short wavelength ✓
Hoë frekwensie ✓Kort golflengte ✓ (2)

[12]

QUESTION 7

7.1 The electric field at a point is the electrostatic force experienced per unit positive charge placed at that point. ✓✓
Die elektriese veld by 'n punt is die elektrostatiese krag wat per eenheidspositiewe-lading wat by daardie punt geplaas is, ondervind word. ✓✓ (2)

Marking criteria/ *Nasienkriteria*:

If any of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark
*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

7.2 Take direction of E_A as positive
$E_{net} = E_A - E_B$ ✓ for subtraction

$= \frac{kQ_A}{r^2} - \frac{kQ_B}{r^2}$ ✓formula

$= \frac{(9x10^9)(6x10^{-6})}{4^2}$ ✓ $- \frac{(9x10^9)(3x10^{-6})}{1^2}$ ✓

$= -23\ 625\ N{\cdot}C^{-1}$

E_{net} is 23 625 $N{\cdot}C^{-1}$ to the left/ towards P ✓

Marking criteria/ *Nasienkriteria*:

- ✓ Formula /*Formule*
- ✓ Substitution Q_A/ *Vervanging* Q_A
- ✓ Substitution Q_B/ *Vervanging* Q_A
- ✓ Answer with direction / *Antwoord met rigting.*

Direction of E_B can also be taken as positive. Signs will then be different.

OPTION 2:

$E = \frac{kQ_A}{r^2}$ ✓

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

= 3 375 N.C^{-1} to the right

$E = \frac{kQ_B}{r^2}$

$= \frac{9 \times 10^9 \times 3 \times 10^{-6}}{(1)^2}$ ✓

= 27 000 N.C^{-1} to the left

E_{net} = EA – EB (take right as positve) ✓

= 3 375 – 27 000

= –23 625

= 23 625 N·C^{-1} to the left ✓ (5)

7.3 Positive marking from QUESTION 7.2 /*Positiewe merk van VRAAG 7.2*

$E = \frac{F}{q}$ ✓

$23\,625 = \frac{F}{1{,}6 \times 10^{-19}}$ ✓

F is 3,78 x 10^{-15} N

$F_{net} = ma$

3,78 x 10^{-15} = 1,67 x 10^{-27}a ✓

a = 2,26 x 10^{12} m·s^{-2} ✓ (4)

Marking criteria:

- ✓ Formula to calculate F
- ✓ Substitution / *Vervanging*
- ✓ Substitution mass of proton
- ✓ Answer for acceleration

7.4 Larger acceleration ✓ as mass of electron is smaller. (a $\alpha \frac{1}{m}$)
Opposite direction ✓
Groter versnelling ✓ omdat die massa van die elektron kleiner is. (a $\alpha \frac{1}{m}$)
Teenoorgestelde rigting ✓ (2)
[13]

QUESTION 8/*VRAAG 8*

8.1 The maximum energy provided by a battery per unit charge passing through it.✓✓
Die maksimum energie wat 'n battery lewer per eenheidslading wat daardeur vloei (2)

Marking criteria/ *Nasienkriteria*:

If any of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark
*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af*

8.2 8.2.1 3 V ✓ (1)

8.2.2 0,4 A ✓ (1)

8.3 Positive marking from QUESTION 8.2
Positiewe nasien van VRAAG 8.2

$R = \frac{V}{I}$ ✓

$= \frac{6 + 3}{0,2}$ ✓

= 45 Ω ✓ (3)

Marking criteria/ **Nasienkriteria**:

- ✓ Formula/*Formule*
- ✓ Substitution/ *Vervanging*
- ✓ Answer/*Antwoord*

Stanmorephysics.com

8.4 Positive marking from QUESTION 8.2
Positiewe nasien van VRAAG 8.2

OPTION 1/*OPSIE 1*:

$\frac{1}{R_p} = \frac{1}{R_1 + R_2} + \frac{1}{R_3}$ ✓

$= \frac{1}{15+7,5} + \frac{1}{45}$ ✓

R_p = 15 Ω

$R_T = R_s + R_p$

= 4 + 15 ✓

= 19 Ω

emf = I(R+r) ✓

= (0,6)(19 + 1) ✓

= 12 V ✓ (6)

Marking criteria/ *Nasienkriteria*:

- ✓ Formula R_P / *Formule* R_P
- ✓ Substitution / *Vervanging*
- ✓ Substitution R_T
- ✓ Formule EMF/
- ✓ Substitution
- ✓ Answer

OPTION 2:

$V_p = 6+3 = 9V$ ✓

$I_p = 0,2 + 0,4 = 0,6\ A$ ✓

$R_P = \frac{V_p}{I_p}$

$= \frac{9}{0,6}$

$= 15\ \Omega$ ✓

$R_T = R_s + R_P$

$= 4 + 15$

$= 19\ \Omega$

emf = I(R+r) ✓

= (0,6)(19 + 1) ✓

= 12 V ✓

8.5 Gradient = $\frac{\Delta y}{\Delta x} = V^2$ ✓

$V^2 = \frac{600-0}{6-0}$ ✓

V = 10 V ✓

OR

Gradient = $\frac{\Delta y}{\Delta x} = V^2$ ✓ from $P = \frac{V^2}{R}$

$V^2 = \frac{800-200}{8-2}$ ✓

V = 10 V ✓

Marking criteria:

- ✓ Substitution top/ *Vervanging bo*
- ✓ Substitution bottom/ *Vervanging onder*
- ✓ V^2 answer / *V^2 antwoord*

(4)
[17]

QUESTION 9

9.1 AC ✓ as there are sliprings ✓
WS omdat daar sleepringe is (2)

9.2 Mechanical energy to electrical energy ✓
Meganiese energie na elektriese energie (1)

9.3 a to b ✓
a na b (1)

9.4 **OPTION 1:**

$I_{rms} = \frac{I_{max}}{\sqrt{2}}$

$I_{max} = (4{,}55)\sqrt{2}$ ✓

$= 6{,}434$ A

$R = \frac{V_{max}}{I_{max}}$ ✓

$= \frac{150}{6{,}434}$ ✓

$= 23{,}31\ \Omega$ ✓ (4)

Marking criteria:

- ✓ Formula
- ✓ First substitution
- ✓ Second substitution
- ✓ Answer

OPTION 2:

Calculate V_{rms} and use rms values to calculate resistance.

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

$= \frac{150}{\sqrt{2}}$ ✓

$= 106{,}07$ V

$R = \frac{V_{rms}}{I_{rms}}$ ✓ (subscripts optional)

$= \frac{106{,}07}{4{,}55}$ ✓

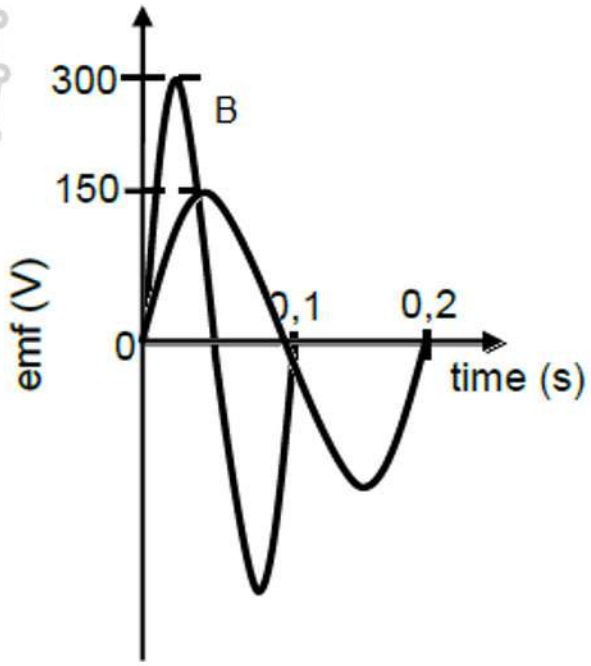
$= 23{,}31\ \Omega$ ✓

9.5 $W = P\Delta t$ ✓

$= (400)(3 \times 60)$ ✓

$= 72\,000$ J ✓ (3)

9.6 9.6.1



✓ double the emf/amplitude/300

✓ half the frequency
Do not penalise if more than one wave is shown.

dubbel die emk/amplitude
die helfte van die frekwensie
Moenie penaliseer as meer as een golf geteken is nie (2)

9.6.2 With a factor 4W ✓

$\varepsilon \alpha 1/\Delta t$ ✓ if N and flux stay constant.

If the rotation doubles, the induced emf will double ✓

$W \alpha V^2$ if R and Δt stay constant ✓

and energy emitted will quadruple (4x)
Note: Correct calculations can be accepted as an explanation. (4)
[17]

QUESTION 10 /*Vraag 10*

10.1 The minimum energy that an electron in the metal needs to be emitted from the metal surface. ✓✓ (exact words not needed as definition was not asked)
Die minimum energie benodig om 'n elektron uit die oppervlak van 'n metaal vry te stel. ✓✓ (presiese woorde is nie nodig nie aangesien definisie nie gevra word nie) (2)

10.2 $E = W_o + E_{k\,max}$ ✓
$hf = hf_o + E_{k\,max}$
$(6{,}63 \times 10^{-34})(6{,}3 \times 10^{14})$ ✓ $= W_o + 1{,}2 \times 10^{-19}$ ✓
$W_o = 2{,}98 \times 10^{-19}$ J ✓'

Marking criteria / *Nasienkriteria*:

- ✓ Formula/*Formule*
- ✓ Substitution left / *Vervanging links*
- ✓ Substitution right/ *Vervanging links*
- ✓ Answer /*Antwoord*

(4)

10.3 Positive marking from QUESTION 10.2

OPTION 1/OPSIE 1

YES ✓ /*Ja*

$W_o = hf_o$ ✓

$2{,}98 \times 10^{-19}$ ✓$= (6{,}63 \times 10^{-34})f_o$ ✓

$f_o = 4{,}49 \times 10^{14}$ Hz ✓

Electrons will be emitted as the threshold frequency is lower than the frequency of the radiation. ✓

OPTION 2/*OPSIE 2*

$E = hf$ ✓
$= (6{,}63 \times 10^{-34})\ (3 \times 10^{16})$ ✓
$= 1{,}99 \times 10^{-17}$ J ✓

$E > W_0$ ✓ $\quad 1{,}99 \times 10^{-17}$ J $>$ $2{,}98 \times 10^{-19}$ J

Yes ✓ electrons will be emitted from this metal. ✓

OPTION 3/*OPSIE 3*:

$E = W_0 + E_{kmax}$ ✓
$(6{,}63 \times 10^{-34})\ (3 \times 10^{16})$ ✓ $= 2{,}98 \times 10^{-19} + E_{kmax}$ ✓
$E_{kmax} = 1{,}96 \times 10^{-17}$ J ✓

$E > W_0$ ✓ $\quad 1{,}96 \times 10^{-17}$ J $>$ $2{,}98 \times 10^{-19}$ J

Yes ✓ electrons will be emitted from this metal. ✓ (6)

10.4 When UV light shines on metal, energy is transferred to electrons on surface of metal ✓. If plate is positive, electrons will be attracted to the plate ✓ as opposite charges attract one another ✓

OR

Plate is positive, few electrons are available ✓ to be emitted by the UV light. ✓
No change in charge of the plate will be observed. ✓

(3)

Wanneer UV lig op die metaal skyn, word energie oorgedra na die elektrone in die oppervlakte van die metaal. As die plaat positief gelaai is, sal die elektrone aangetrek word na die plaat toe aangesien teenoorgestelde ladings mekaar aantrek

OF

Plaat is positief, dus min elektrone beskikbaar om deur die UV lig vrygestel te word nie. Geen verandering in die lading van die plaat sal waargeneem word nie.

[15]

TOTAL: 150