



GAUTENG PROVINCE

EDUCATION

REPUBLIC OF SOUTH AFRICA

**JUNE EXAMINATION
*JUNIE EKSAMEN***

GRADE/GRAAD 12

2023

**MARKING GUIDELINES/
*NASIENRIGLYNE***

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

(PAPER/VRAESTEL 1)

14 pages/*bladsye*

QUESTION/VRAAG 1

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

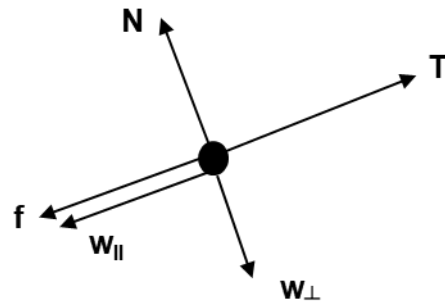
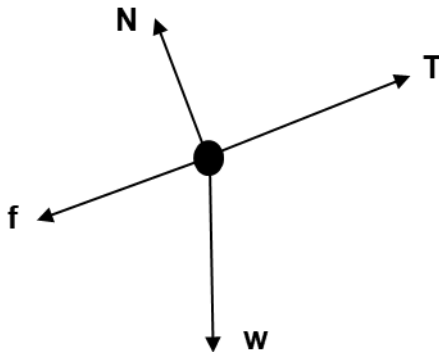
QUESTION/VRAAG 2

- 2.1 A body continues at rest or constant velocity unless acted on by a net (external) force. ✓✓

'n Liggaam bly in rus of beweeg teen konstante snelheid tensy 'n nie-nul resultante (netto eksterne) krag daarop inwerk.

(2)

2.2



OR/OF

Accepted labels/Aanvaarde byskrifte	
w ✓	F_g/F_w /weight/mg/gravitational force F_g/F_w /gewig/ gravitasiekrag
f ✓	F_{friction}/F_f /friction/ f_k F_{wrywing}/F_f / wrywing/ f_k
N ✓	F_N/F_{normal} /normal force F_N/F_{normaal} /normaalkrag
T ✓	F_T /tension F_T /spanning/ spankrag
	Deduct 1 mark for any additional force. Marks are given for both arrow and label. If everything is correct, but no arrows, deduct a mark.
	Trek een punt af vir enige addisionele kragte. Punte word gegee vir beide pylpunt en byskrif. Indien alles korrek is, maar geen pyle, trek 'n punt af.

(4)

- 2.3 In x-direction:/In x-rigting:

$$F_{\text{net}} = ma \quad \checkmark$$

$$T - f_k - W_{||} = 0$$

$$1\,570 - 0,3(m)(9,8)\cos 12^\circ \checkmark - m(9,8)\sin 12^\circ \checkmark = 0 \quad \checkmark$$

$$1\,570 = 2,876\,m + 2,039\,m$$

$$1\,570 = 4,914\,m$$

$$m = 319,495\,\text{kg} \quad \checkmark$$

(5)

2.4 2.4.1 REMAINS THE SAME ✓ *BLY DIESELFDE* (1)

2.4.2 DECREASES ✓ *VERLAAG* (1)

2.5 There is an external force of friction exerted ✓ on the body and not only gravitational force. ✓

Daar word 'n eksterne krag van wrywing toegepas op die voorwerp en nie slegs gravitasiekrag nie.

(2)
[15]

QUESTION/VRAAG 3

3.1 A moving object that is only influenced by gravity and starts with an initial velocity. ✓✓

'n Bewegende voorwerp wat slegs onder die invloed van gravitasie beweeg en begin met 'n aanvanklike snelheid.

(2)

$$\begin{aligned} v_f^2 &= v_i^2 + 2a\Delta y \quad \checkmark \\ &= (8,4)^2 + 2(9,8)(5) \quad \checkmark \\ v_f &= 12,983 \text{ m} \cdot \text{s}^{-1} \quad \checkmark \end{aligned}$$

(3)

3.3 OPTION 1:/OPSIE 1

$$\begin{aligned} \Delta y &= v_i \Delta t + \frac{1}{2} a \Delta t^2 \quad \checkmark \\ 5 \quad \checkmark &= 8,4t + \frac{1}{2} (9,8)t^2 \quad \checkmark \\ t &= 0,47 \text{ s} \end{aligned}$$

OPTION 2:/OPSIE 2

$$\begin{aligned} \Delta y &= \left(\frac{v_f + v_i}{2} \right) \Delta t \quad \checkmark \\ 5 \quad \checkmark &= \left(\frac{8,4 + 12,983}{2} \right) t \quad \checkmark \\ t &= 0,47 \text{ s} \end{aligned}$$

OPTION 3:/OPSIE 3 Positive marking from 3.2/Positiewe nasien vanaf 3.2

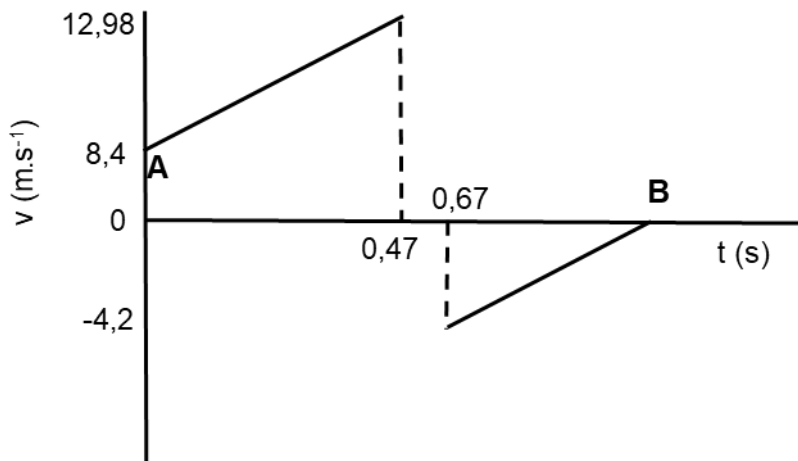
$$\begin{aligned} v_f &= v_i + a \Delta t \quad \checkmark \\ 12,983 \quad \checkmark &= 8,4 + (9,8)t \quad \checkmark \\ t &= 0,47 \text{ s} \end{aligned}$$

(3)

3.4 3.4.1 $9,8 \text{ m}\cdot\text{s}^{-2}$ ✓ Downwards ✓
Afwaarts (2)

3.4.2 $v_f^2 = v_i^2 + 2a\Delta y$ ✓
 $0 = (-4,2)^2 + 2(9,8)y$ ✓
 $y = 0,9 \text{ m}$ ✓ (3)

3.4.3 Taking down as positive/Neem af as positief



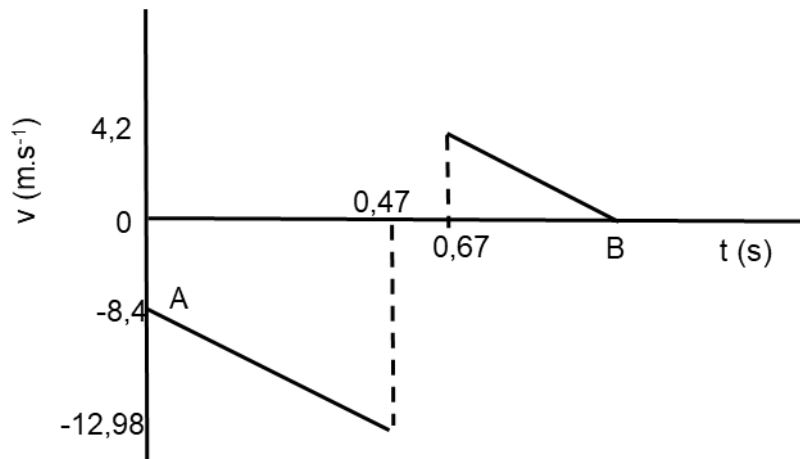
Marking guidelines:

- ✓ The velocity of the ball at **A**
- ✓ The velocity of the ball as it hits the ground
- ✓ Time taken for the ball to reach the ground **and** ✓ leave the ground
- ✓ The velocity at the maximum height of point **B**
- ✓ Correct shape – parallel lines

Nasienriglyne:

- ✓ Die snelheid van die bal by **A**.
- ✓ Die snelheid van die bal wanneer dit die grond tref
- ✓ Die tyd wat dit neem vir die bal om die grond te bereik **en** ✓ verlaat die grond.
- ✓ Die snelheid by die maksimum hoogte van punt **B**.
- ✓ Korrekte vorm – parallel lyne.

Taking down as negative./Neem afwaarts as positief. (6)



3.5.1 DECREASES ✓ *AFNEEM*

(1)

3.5.2 INCREASES ✓

The contact time is less, the force is more, the final velocity is more.
Higher kinetic energy ✓ (any one of the answers)

TOENEEM

*Die kontaktyd is minder, die krag is groter, die finale snelheid is meer.
Hoër kinetiese energie (enige een van die antwoorde)*

(2)

[22]

QUESTION/VRAAG 4

4.1 In an isolated system the total linear momentum remains constant. ✓✓

In 'n geïsoleerde sisteem bly die totale lineêre momentum konstant.

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.

(2)

4.2 OPTION 1:/OPSIE 1:

$$\begin{aligned}\Sigma p_{\text{before/ voor}} &= \Sigma p_{\text{after/ na}} \checkmark \\ m_x v_{xi} + m_y v_{yi} &= m_x v_{xf} + m_y v_{yf} \\ m(4,5) + 2m(-2,8) \checkmark &= m(-2,1) + 2mv_{yf} \checkmark \\ v_{yf} &= 0,5 \text{ m.s}^{-1} \checkmark \text{ to the right } \checkmark\end{aligned}$$

OPTION 2:/OPSIE 2:

$$\begin{aligned}\Sigma p_{\text{before/ voor}} &= \Sigma p_{\text{after/ na}} \checkmark \\ m_x v_{xi} + m_y v_{yi} &= m_x v_{xf} + m_y v_{yf} \\ 0,05(4,5) + 0,1(-2,8) \checkmark &= 0,05(-2,1) + 0,01v_{yf} \checkmark \\ v_{yf} &= 0,5 \text{ m.s}^{-1} \checkmark \text{ to the right } \checkmark\end{aligned} \quad (5)$$

4.3

$$\begin{aligned}\Sigma E_k \text{ before/ voor} &= \frac{1}{2}mv^2 + \frac{1}{2}mv^2 \checkmark \\ &= (0,5\text{m})(4,5)^2 + (0,5(2\text{ m}))(2,8)^2 \checkmark \\ &= 10,125 \text{ m} + 7,84 \text{ m} \\ &= 17,965 \text{ m J}\end{aligned}$$

$$\begin{aligned}\Sigma E_k \text{ after/ na} &= \frac{1}{2}mv^2 + \frac{1}{2}mv^2 \\ &= (0,5\text{m})(2,1)^2 + (0,5(2\text{ m}))(0,5)^2 \checkmark \\ &= 2,205 \text{ m} + 0,25 \text{ m} \\ &= 2,455 \text{ m J}\end{aligned}$$

$\Sigma E_k \text{ before/ voor} \neq \Sigma E_k \text{ after/ na} \checkmark$
INELASTIC COLLISION ✓/ ONELASTIESE BOTSING (5)

4.4 REMAINS THE SAME ✓

The system remains isolated, ✓ all momentum before and after the collisions will remain the same. There are no external forces. ✓

BLY DIESELFDE

Die sisteem bly geïsoleerd, al die momentum voor en na die botsings is dieselfde. Daar is geen eksterne kragte nie.

(3)
[15]

QUESTION/VRAAG 5

- 5.1 The total mechanical energy at any given point is the same and conserved in a closed system. ✓✓

Die totale meganiese energie by enige gegewe oomblik is dieselfde en bly behoue in 'n geslote sisteem.

(2)

- 5.2 E mechanical /meganies = E mechanical /meganies

$$(E_k + E_p)_A = (E_k + E_p)_B \quad \checkmark$$

$$\left(\frac{1}{2}mv^2 + mgh\right)_A = \left(\frac{1}{2}mv^2 + mgh\right)_B$$

$$\checkmark \frac{1}{2}(0,030)v^2 + (0,03)(9,8)(0,31) = 0,12 + 0 \quad \checkmark$$

$$v = 1,387 \text{ m.s}^{-1} \quad \checkmark$$

$$\text{accept/ aanvaar } v = 1,39 \text{ m.s}^{-1}$$

(4)

- 5.3 5.3.1

$$E_k = \frac{1}{2}mv^2$$

$$0,12 = \frac{1}{2}(0,03)v^2$$

$$v = 2,828 \text{ m.s}^{-1}$$

$$F_{\text{net}}\Delta t = \Delta p \quad \checkmark$$

$$\Delta p = m(v_f - v_i)$$

$$-0,096 \checkmark = 0,03(v_f - 2,828) \quad \checkmark$$

$$v_f = -0,372 \text{ m.s}^{-1}$$

$$v = 0,372 \text{ m.s}^{-1} \quad \checkmark$$

(4)

- 5.3.2

$$F_{\text{net}}\Delta t = \Delta p \quad \checkmark$$

$$F_{\text{net}}(0,02) \checkmark = 0,096 \quad \checkmark$$

$$F_{\text{net}} = 4,8 \text{ N} \quad \checkmark$$

OR/OF

$$F_{\text{net}}\Delta t = \Delta p \quad \checkmark$$

$$F_{\text{net}}(0,02) \checkmark = -0,096 \quad \checkmark$$

$$F_{\text{net}} = -4,8 \text{ N}$$

$$F_{\text{net}} = 4,8 \text{ N} \quad \checkmark$$

(4)

[14]

QUESTION/VRAAG 6

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

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

(2)

6.2

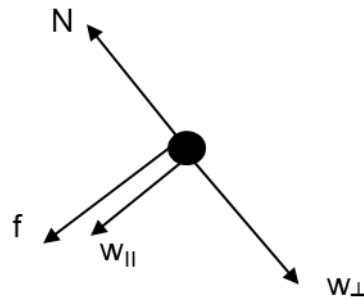
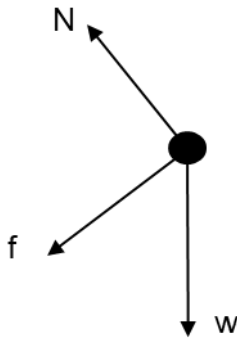
$$K = \frac{1}{2}mv^2 \quad \checkmark$$

$$= \frac{1}{2}(600)(9,5)^2 \quad \checkmark$$

$$= 27\,075 \text{ J} \quad \checkmark$$

(3)

6.3



Accepted labels/Aanvaarde byskrifte	
w ✓	F_g/F_w /weight/mg/gravitational force F_g/F_w /gewig/ gravitasiekrag
f ✓	F_{friction}/F_f /friction/ f_k F_{wrywing}/F_f / wrywing/ f_k
N ✓	F_N/F_{normal} /normal force F_N/F_{normaal} /normaalkrag
	Deduct 1 mark for any additional force. Marks are given for both arrow and label. If everything is correct, but no arrows, deduct a mark.
	Trek een punt af vir enige addisionele kragte. Punte word gegee vir beide pylpunt en byskrif. Indien alles korrek is, maar geen pyle, trek 'n punt af.

(3)

6.4 **OPTION 1:/OPSIE 1**

$$W_{nc} = \Delta K + \Delta U \quad \text{or/of} \quad W_{nc} = \Delta E_k + \Delta E_p \quad \checkmark$$

$$W_f = -\frac{1}{2}mv_i^2 + mgh$$

$$f\Delta x \cos \theta = -27\,075 + 600(9,8)(4,1) \quad \checkmark$$

$$f\left(\frac{h}{\sin 30^\circ}\right) \checkmark \cos 180^\circ \checkmark = -27\,075 + 24\,108$$

$$f\left(\frac{4,1}{\sin 30^\circ}\right) \cos 180^\circ = -2\,967$$

$$f = \frac{-2\,967}{-8,2}$$

$$= 361,83 \text{ N} \quad \checkmark$$

OPTION 2:/OPSIE 2

$$W_{net} = \Delta K \quad \checkmark$$

$$W_N + W_f + W_w = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$0 + f\Delta x \cos \theta + mg\Delta x \cos 120^\circ = 0 - 27\,075 \quad \checkmark$$

$$f\left(\frac{4,1}{\sin 30^\circ}\right) \checkmark \cos 180^\circ \checkmark + (600)(9,8)\left(\frac{4,1}{\sin 30^\circ}\right) \cos 120^\circ = -27\,075$$

$$f = 361,83 \text{ N} \quad \checkmark$$

OPTION 3:/OPSIE 3

$$W_{net} = \Delta K \quad \checkmark$$

$$W_N + W_f + W_{w\perp} + W_{w\parallel} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$0 + f\Delta x \cos \theta + 0 + mg \sin 30^\circ \Delta x \cos 0^\circ = 0 - 27\,075$$

$$f\left(\frac{4,1}{\sin 30^\circ}\right) \checkmark \cos 180^\circ \checkmark + (600)(9,8)\left(\frac{4,1}{\sin 30^\circ}\right) \cos 120^\circ \checkmark = -27\,075$$

$$f = 361,83 \text{ N} \quad \checkmark$$

(5)

- 6.5 6.5.1 A force for which the work done in moving an object between two points depends on the path taken. ✓✓

'n Krag waarvoor die arbeid wat verrig word om die voorwerp te beweeg tussen twee punte afhang van die padroete gevolg. (2)

$$\begin{aligned} 6.5.2 \quad W_F &= F \Delta x \cos \theta \\ &= (300)(850) \cos 0^\circ \checkmark \\ &= 255\,000 \text{ J} \end{aligned}$$

$$\begin{aligned} P &= \frac{W}{\Delta t} \checkmark \\ 9000 &= \frac{255000}{t} \checkmark \\ t &= 28,33 \text{ s} \checkmark \end{aligned} \quad (4)$$

- 6.5.3 DECREASES ✓

The work done on the carriage stays the same. ✓

The time and power are inversely proportional. If the power increases, then the time will decrease. ✓

VERLAAG

Die arbeid verrig op die karretjie bly dieselfde.

Die tyd en drywing is omgekeerd eweredig. Indien die drywing verhoog, dan sal die tyd verlaag.

(3)
[22]

QUESTION/VRAAG 7

- 7.1 An electric field is a region or space in which an electric charge experiences a force. ✓✓

’n Elektriese veld is ’n area of gebied waarin ’n elektriese lading ’n krag sal ondervind. (2)

7.2
$$E_{\text{net}} = \frac{kQ_A}{r^2} - \frac{kQ_B}{r^2} \quad \checkmark$$

$$0 = \frac{9 \times 10^9 (3 \times 10^{-12})}{(0,05)^2} \checkmark - \frac{(9 \times 10^9) Q_B}{(0,10)^2} \checkmark$$

$$Q_B = 1,2 \times 10^{-11} \text{ C} \quad \checkmark$$
 (5)

- 7.3 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 groottes van die ladings en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle. (2)

7.4
$$F = \frac{kQ_A Q_B}{r^2} \quad \checkmark$$

$$= \frac{9 \times 10^9 (3 \times 10^{-12}) (12 \times 10^{-12})}{(0,15)^2} \quad \checkmark$$

$$= 1,44 \times 10^{-11} \text{ N} \quad \checkmark$$
 (3)

- 7.5 **INCREASES** ✓
 The force is inversely proportional to the squared distance between the charges. ✓
 The charges remain the same. ✓

VERHOOG

Die krag is omgekeerd eweredig aan die kwadraat van die afstand tussen die ladings.

Die ladings bly dieselfde.

(3)
[15]

QUESTION/VRAAG 8

- 8.1 The electric field at a point is the electrostatic force experienced per unit of positive charge placed at that point. ✓✓

Die elektriese veld by 'n punt is die elektrostatiese krag ondervind per eenheid van positiewe lading geplaas by daardie punt. (2)

- 8.2 Force is directly proportional to charge. ✓
OR Charge is directly proportional to force.

Straight line through the origin. ✓

Krag is direk eweredig aan die lading.
OF *Lading is direk eweredig aan die krag.*

Reguit lyn deur die oorsprong. (2)

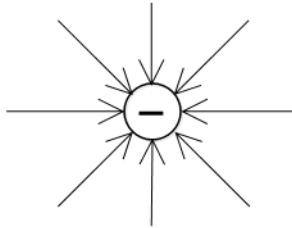
- 8.3 8.3.1 Any values in the table may be used./*Enige waardes in die tabel kan gebruik word.*

$$\begin{aligned}\text{gradient/g radiënt} &= \frac{\Delta y}{\Delta x} \\ &= \frac{0,35 - 0}{53,2 \times 10^{-9} - 0} \checkmark \\ &= 6,58 \times 10^6 \text{ (N.C}^{-1}\text{)} \checkmark\end{aligned}$$
 (3)

- 8.3.2 Positive marking from 8.3.1/*Positiewe nasien vanaf 8.3.1*

$$\begin{aligned}E &= \frac{F_x}{q} \checkmark \\ 6,58 \times 10^6 \checkmark &= \frac{F_x}{63,8 \times 10^{-9}} \checkmark \\ F_x &= 0,42 \text{ N} \checkmark\end{aligned}$$
 (4)

8.4



Marking guidelines:

- ✓ Arrows towards the charge
- ✓ All lines touch the charge at an angle of 90°
- ✓ Correct pattern and around the charge.

Nasieriglyne:

- ✓ Pyle na die lading
- ✓ Alle lyne raak die lading teen 'n hoek van 90°
- ✓ Korrekte patroon en rondom die lading

(3)
[14]

QUESTION/VRAAG 9

- 9.1 9.1.1 The change in the observed 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 die waarneembare frekwensie (of toonhoogte) van die klank waargeneem deur 'n luisteraar aangesien die klankbron en die luisteraar verskillende snelhede relatief tot die klankbeweging het.

(2)

- 9.1.2 The mosquito is flying away from you. ✓ The observed frequency is ✓ lower than the actual frequency. ✓

Die muskiet vlieg weg van jou af. Die waargenome frekwensie is laer as die werklike frekwensie.

(3)

9.1.3
$$f_L = \frac{v \pm v_L}{v \pm v_s} f_s \quad \checkmark$$

$$1034 \checkmark = \frac{330 + 0}{330 + v_s} \checkmark 1050 \checkmark$$

$$v_s = 5,106 \text{ m} \cdot \text{s}^{-1}$$

$$v_s = 5,11 \text{ m} \cdot \text{s}^{-1} \quad \checkmark$$

(5)

- 9.2 9.2.1 Away from the earth ✓ *Van die aarde af weg te beweeg*

(1)

- 9.2.2 – It monitors foetal heart beat ✓ (Do not accept observing the baby.)
Dit monitor die fetus se hartklop. (Moenie aanvaar om baba te sien nie.)

- It detects flow of blood. ✓
Dit neem bloedvloei waar.

(2)

[13]

TOTAL/TOTAAL: 150