Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE / *NASIONALE SENIORSERTIFIKAAT*

GRADE/*GRAAD* 12

JUNE/*JUNIE* 2024

PHYSICAL SCIENCES P1 / *FISIESE WETENSKAPPE V1* MARKING GUIDELINE / *NASIENRIGLYN*

MARKS/*PUNTE*: **150**

This marking guideline consists of 11 pages./
Hierdie nasienriglyn bestaan uit 11 bladsye.

QUESTION 1/*VRAAG 1*

1.1 D ✓✓ (2)

1.2 C ✓✓ (2)

1.3 C ✓✓ (2)

1.4 B ✓✓ (2)

1.5 D ✓✓ (2)

1.6 C ✓✓ (2)

1.7 C ✓✓ (2)

1.8 B ✓✓ (2)

1.9 A ✓✓ (2)

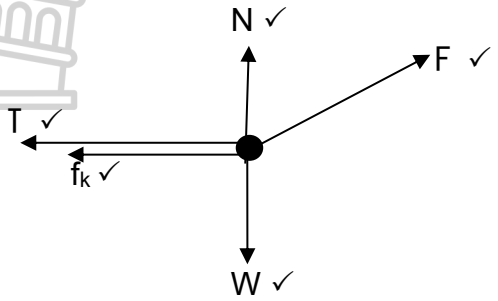
1.10 A ✓✓ (2)

[20]

QUESTION 2/*VRAAG 2*

2.1 The force that opposes the motion of a moving object relative to the surface. ✓✓
Die krag wat die beweging van 'n bewegende voorwerp relatief tot die oppervlakte teenwerk. (2)

2.2



(5)

2.3 2.3.1 $f_k = \mu_k N$ } Any one / *Enige een* ✓
$f_k = \mu_k mg - F\sin\theta$ }
$f_k = [0,2 \times 20 \times 9,8 - \underline{105\sin 25^o}$ ✓] ✓
$f_k = 30,33$ N ✓ (4)

2.3.2 **<u>2 kg block / *2 kg-blok*</u>**
Fnet = ma
$F\cos\theta - T - f = ma$ } Any one / *Enige een* ✓
$[\underline{105\cos 25^o}$ ✓ $- T - 30,33 = 20 \times 2]$ ✓
T = 24,83 N ✓ (4)

2.3.3 Fnet = ma
T – W = ma
T – mg = ma
$\underline{24,83 - m \times 9,8 = m \times 2}$ ✓
m = 2,10 kg ✓ (2)
[17]

QUESTION 3/*VRAAG 3*

3.1 Each particle in the universe attracts every other body with a force that is directly proportional to the product of their masses ✓ and inversely proportional to the square of the distance between their centres. ✓

Elke liggaam in die heelal trek elke ander liggaam met 'n krag direk eweredig aan die produk van hul masse, ✓ en omgekeerd eweredig aan die kwadraat van die afstand tussen hul middelpunte aan.✓ (2)

3.2 $F = \frac{Gm_1m_2}{r^2}$ ✓

$F = \frac{(6{,}67 \times 10^{-11})(5{,}98 \times 10^{24})(1\,500)}{(2 \times 10^{8})^2}$ ✓ ✓

$F = 14{,}96$ N ✓ (4)

3.3 EQUAL TO / *GELYK AAN*. ✓ Newton's 3rd law / *Newton se 3de wet.* ✓

OR/*OF*

When object A exerts a force on object B, object B simultaneously exerts an oppositely directed force on object A of equal magnitude. ✓✓

Wanneer voorwerp A 'n krag op voorwerp B uitoefen, sal voorwerp B gelyktydig 'n krag van gelyke grootte en in die teenoorgestelde rigting op voorwerp A uitoefen. ✓✓ (2)

3.4 $F_{net} = ma$ ✓

[(4 x 14,98) ✓= 1 500a] ✓

$a = 3{,}99 \times 10^{-2}$ N ✓

OR/*OF*

$g = \frac{GM}{r^2}$ ✓

$g = \frac{6{,}67 \times 10^{-11} \times 5{,}98 \times 10^{24}}{(1 \times 10^{8})^2}$ ✓ ✓

$g = 3{,}99 \times 10^{-2}$ N ✓ (4)

[12]

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QUESTION 4/*VRAAG 4*

4.1 The motion of an object upon which the only force acting on it is gravitational force. ✓✓
Die beweging waartydens die enigste krag wat op 'n voorwerp inwerk gravitasiekrag is. ✓✓ (2)

4.2 4.2.1

OPTION 1/*OPSIE 1*

Upwards positive / *Opwaarts as positief*
$v_f = v_i + a\Delta t$ ✓
$0 = (15) + (-9,8)\,\Delta t$ ✓
$\Delta t = 1,53$ s
$\Delta t_{total/totaal} = 2 \times 1,53 = 3,06$ s ✓

Downwards positive / *Afwaarts as positief*
$v_f = v_i + a\Delta t$ ✓
$0 = (-15) + (9,8)\,\Delta t$ ✓
$\Delta t = 1,53$ s
$\Delta t_{total/totaal} = 2 \times 1,53 = 3,06$ s ✓

OPTION 2/*OPSIE 2*

Upwards positive / *Opwaarts as positief*
$v_f = v_i + a\Delta t$ ✓
$-15 = (15) + (-9,8)\,\Delta t$ ✓
$\Delta t = 3,06$ s ✓

Downwards positive / *Afwaarts as positief*
$v_f = v_i + a\Delta t$ ✓
$15 = (-15) + (9,8)\,\Delta t$ ✓
$\Delta t = 3,06$ s ✓ (3)

4.2.2

Upwards positive / *Opwaarts as positief*
$v_f = v_i + a\Delta t$ ✓
$[0 = (v_i) + (-9,8)(1,03)$ ✓$]$ ✓
$v_i = 10,094$ m.s^{-1} upwards/ *opwaarts* ✓

Downwards positive / *Afwaarts as positief*
$v_f = v_i + a\Delta t$ ✓
$[0 = v_i + (9,8)(1,03)$ ✓$]$ ✓
$v_i = -10,094$
$v_i = 10,094$ m.s^{-1} upwards / *opwaarts* ✓ (4)

4.2.3

Upwards positive / *Opwaarts as positief*

Ball A height above the ground / *Hoogte van bal A bo die grond*:
$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$0 = (15)^2 + 2(-9,8)\,\Delta y$ ✓
$\Delta y = 11,48$ m

Ball B height above the ground/ *Hoogte van bal B bo die grond*:
$v_f^2 = v_i^2 + 2a\Delta y$
$0 = (10,094)^2 + 2(-9,8)\,\Delta y$ ✓
$\Delta y = 5,20$ m

Height of the building / *Hoogte van die gebou*:
Height/*Hoogte* (h) = 11,48 -5,20 ✓
h = 6,28 m ✓

Downwards positive / *Afwaarts as positief*

Ball A height above the ground/ *Hoogte van bal A bo die grond*:
$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$0 = (-15)^2 + 2(9,8)\,\Delta y$ ✓
$\Delta y = 11,48$ m

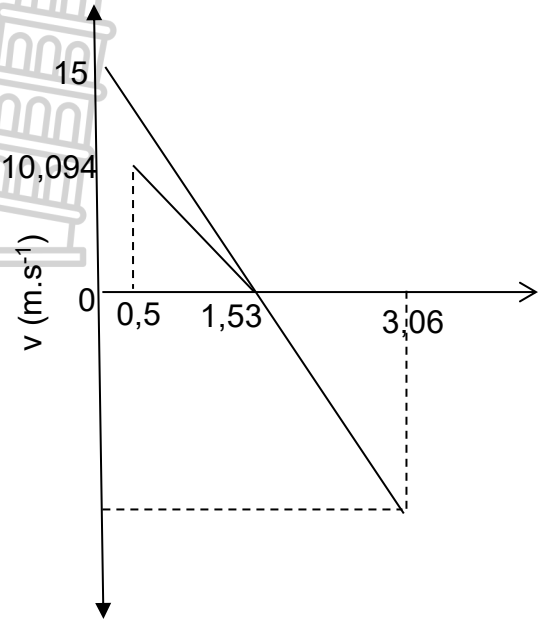
Ball B height above the ground/ *Hoogte van bal B bo die grond*:
$v_f^2 = v_i^2 + 2a\Delta y$
$0 = (-10,094)^2 + 2(9,8)\,\Delta y$ ✓
$\Delta y = 5,20$ m

Height of the building / *Hoogte van die gebou* :
Height/*Hoogte* (h) = 11,48 – 5,20 ✓
h = 6,28 m ✓ (5)

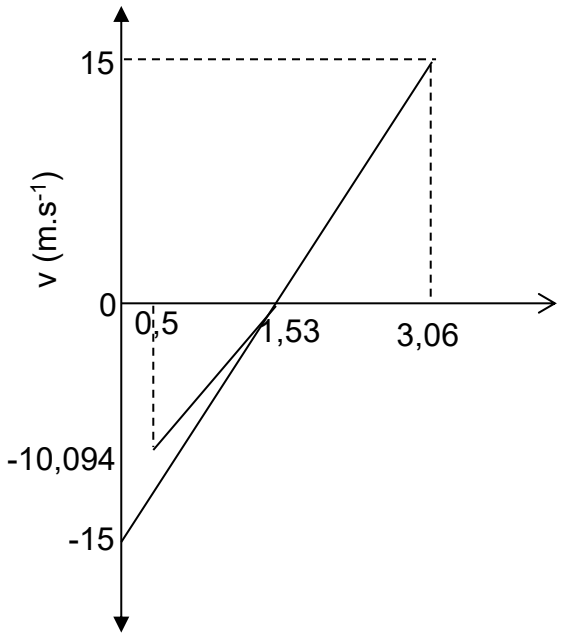
4.2.4 They will have the same velocity. ✓ They are both undergoing free fall motion. ✓ /
Hulle sal dieselfde snelheid het. ✓ *Albei ondergaan vryval beweging.* ✓ (2)

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4.3 **Upwards positive /**
Opwaarts as positief



Downwards positive /
Afwaarts as positief



Marking criteria for sketch/ ***Nasienkriteria vir skets***	**Marks/*Punte***
Initial velocity of ball A./ *Aanvanklike snelheid vir bal A.*	✓
Initial velocity of ball B./ *Aanvanklike snelheid vir bal B.*	✓
Shape of both graphs with graph of B starting at 0,5 s/ *Vorm van beide grafieke met beginpunt van grafiek B by 0,5 s*	✓
Time at maximum height/ *Tyd by maksimum hoogte*	✓
Final velocity and time when balls reach the ground/ *Finale snelheid en tyd wanneer die balle die grond bereik*	✓

(5)
[21]

QUESTION 5/*VRAAG 5*

5.1 A system in which the net external force is equal to zero./ ✓✓
'n Stelsel waar die netto eksterne krag gelyk aan nul is. (2)

5.2 The total linear momentum in an isolated system remains constant (is conserved). ✓✓
Die totale lineêre momentum in 'n geïsoleerde stelsel bly konstant (is behoue). (2)

5.3 5.3.1 $\Sigma p_i = \Sigma p_f$

$m_1v_{f1} + m_2v_{f2} = (m_1 + m_2)\, v_i$ } Any one/ *Enige een* ✓

$1\ 500 \times 20$ ✓ $+ 0 = (1\ 500 + 900)\, v_i$ ✓

$v_i = 12{,}5\ m.s^{-1}$ ✓ (4)

5.3.2

$F_{net}.\ \Delta t = \Delta p$ ✓
$F_{net} . 0{,}2$ ✓ $= 900\ (12{,}5 - 0)$ ✓
$F_{net} = 56\ 250$ N left/*links* ✓

$F_{net}.\ \Delta t = \Delta p$ ✓
$F_{net} . 0{,}2$ ✓ $= 1\ 500\ (12{,}5 - 20)$ ✓
$F_{net} = 56\ 250$ N left/*links* ✓ (4)

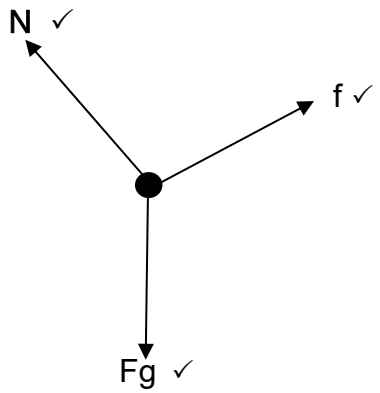
5.4 $E_k = \frac{1}{2}mv^2$ ✓
$E_{ki} = \underline{\frac{1}{2} \times 1\ 500 \times 20^2}$ + 0 ✓
$E_{ki} = 300\ 000$ J
$E_{kf} = \underline{\frac{1}{2} \times 1\ 500 \times 12{,}5^2 + \frac{1}{2} \times 900 \times 12{,}5^2}$ ✓
$E_{kf} = 187\ 500$ J
$E_{ki} \neq E_{kf}$ ✓
Inelastic collision / *Onelastiese botsing* ✓ (5)

5.5 The bubble wrap provides a soft surface ✓ which increases the contact time of the collision, ✓ and decreases the net force exerted on the equipment. ✓ /
Die borrelplastiek verskaf 'n sagte oppervlakte wat die kontaktyd van die botsing verhoog en verlaag die netto krag wat op die toerusting uitgeoefen word. (3)
[20]

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QUESTION 6/*VRAAG 6*

6.1



(3)

6.2 $W_{net} = \Delta E_K$
$W_f + W_{Fg} = ½ mv^2_f – ½ mv^2_i$ } Any one / *Enige een* ✓
$W_f + (-\Delta E_p) = ½ mv^2_f – ½ mv^2_i$

$[50(\frac{10}{sin30^o}) ✓ \times cos180^o] ✓ + 60 \times 9,8sin30^o(\frac{10}{sin30^o})cos0^o ✓ = ½ \times 60 \times v_f^2 – 0 ✓$

$v_f = 12,75 \text{ m.s}^{-1}$ ✓

OR/*OF*

$W_{nc} = \Delta E_p + \Delta E_k$
$W_f = mgh_2 – mgh_1 + ½ mv^2_f – ½ mv^2_i$ } Any one / *Enige een* ✓

$[50(\frac{10}{sin\theta}) ✓ \times cos180^o] ✓ = \underline{0 – 60 \times 9,8 \times 10} ✓ + \underline{½ \times 60 \times v_f^2 – 0} ✓$

$v_f = 12,75 \text{ m.s}^{-1}$ ✓ (6)

6.3 6.3.1 The net work done on an object is equal to the change in kinetic energy of an object./ ✓✓
Die netto arbeid wat op 'n voorwerp verrig is, is gelyk aan die verandering in kinetiese energie van 'n voorwerp. (2)

6.3.2 $W_{net} = \Delta E_K$
$W_f = ½ mv_f^2 – ½ mv_i^2$
$f.\Delta x cos\theta = ½ mv^2_f – ½ mv^2_i$ } Any one / *Enige een* ✓

$\underline{(0,15 \times 60 \times 9,8)} ✓ \times \Delta x cos180^o] ✓ = 0 – \underline{½ \times 60 \times 12,74^2} ✓$

$\Delta x = 55,29 \text{ m}$ ✓ (5)

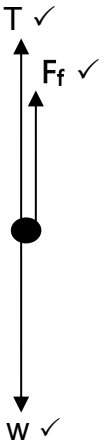
[16]

QUESTION 7/*VRAAG 7*

7.1 A force in which the work done by the net force depends on the path taken./ ✓✓
'n Krag waarvoor die arbeid verrig deur die netto krag afhanklik is van die roete wat gevolg word. (2)

7.2 (Air) friction ✓ and tension/ ✓
(Lug) wrywing en spanning (2)

7.3



(3)

7.4 **OPTION 1/*OPSIE 1***

$W_{net} = \Delta E_k$
$T.\Delta x\cos\theta + f.\Delta x \cos\theta = \Delta E_k$ } Any one / *Enige een* ✓
$T.\Delta x\cos\theta + f.\Delta x \cos\theta = ½mv_f^2 – ½mv_i^2$

$950 \times 30 \cos180^\circ$ ✓ $+ f \times 30 \cos180^\circ$ ✓ $+ 150 \times 9,8 \times 30\cos0^\circ = 0$ ✓

$f = 520$ N ✓

OPTION 2/*OPSIE 2*

$W_{nc} = \Delta E_p + \Delta E_k$
$W_f + W_T = mgh_2 – mgh_1 + ½ mv_f^2 – ½ mv_i^2$ } Any one / *Enige een* ✓
$f \times 30\cos180^\circ$ ✓ $+ 950 \times 30\cos180^\circ$ ✓ $= 0 – \underline{150 \times 9,8 \times 30}$ ✓ $+ 0$
$f = 520$ N ✓ (5)

[12]

QUESTION 8/*VRAAG 8*

8.1 The Doppler Effect is 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 Doppler-effek is die verandering in frekwensie (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.

OR / *OF*

The apparent change in the (observed) frequency when there is relative motion between the sound source and the observer. ✓✓
Die skynbare verandering in (waargenome) frekwensie (toonhoogte) as daar relatiewe beweging tussen die bron en die waarnemer (luisteraar) is. (2)

8.2 As the observer moves towards the sound source the wavefronts ahead become compressed, ✓ the wavelength decreases ✓ and the frequency increases. ✓/
Soos die waarnemer na die klankbron beweeg, word die golffront saamgepers, die golflengte neem af en die frekwensie neem toe. (3)

8.3 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$

$f_L = \frac{v + v_L}{v} f_s$

Any one / *Enige een* ✓

$2\,500$ ✓ $= \frac{340 + v_L}{340}$ ✓ x 2 450 ✓

$v_L = 6{,}94\ m \cdot s^{-1}$ ✓ (5)

8.4 8.4.1 Stays the same / *Bly dieselfde* ✓ (1)

8.4.2 Decreases / *Verlaag* ✓ (1)

8.5 8.5.1 Increase / *Verhoog* ✓ (1)

8.5.2 Stays the same / *Bly dieselfde* ✓ (1)

8.5.3 Stays the same / *Bly dieselfde* ✓ (1)

8.6 To measure the heart beat of a foetus in the womb. ✓/
To measure the speed of blood in the veins. ✓/
Om die hartklop van 'n fetus in die baarmoeder te meet.
Om die spoed van bloed in die are te meet. (2)
[17]

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QUESTION 9/*VRAAG 9*

9.1 The electrostatic force between two-point charges is directly proportional to the product of the magnitude of the charges, and inversely proportional to the square of the distance between the charges. ✓✓/
Die elektrostatiese krag tussen twee puntladings is direk eweredig aan die produk van die groottes van die ladings, en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle. (2)

9.2 NEGATIVE / *NEGATIEF* ✓✓ (2)

9.3 9.3.1 $F = \frac{kQ_1Q_2}{r^2}$ ✓

$0{,}012$ ✓ $= \frac{9 \times 10^9 \times 2 \times 10^{-6} \times Q}{2{,}5^2}$ ✓

$Q = 4{,}17 \times 10^{-6}$ C ✓ (4)

9.3.2 The electrostatic force experienced per unit positive charge. ✓✓/
Die elektrostatiese krag per eenheidspositiewe-lading ervaar. (2)

9.3.3 $E = \frac{kQ}{r^2}$ ✓

$E_1 = \frac{9 \times 10^9 \times 2 \times 10^{-6}}{1{,}5^2}$ ✓

$E_1 = 8\,000$ N.C^{-1} Left/*Link*

$E_2 = \frac{9 \times 10^9 \times 4{,}17 \times 10^{-6}}{1{,}0^2}$ ✓

$E_2 = 37\,530$ N.C^{-1} Right/*Regs*

$E_{net} = E_2 - E_1$
$E_{net} = 37\,530 - 8\,000$ ✓
$E_{net} = 29\,530$ N.C^{-1} Right/*Regs* ✓ (5)
[15]

TOTAL/*TOTAAL*: 150

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