KWAZULU-NATAL PROVINCE

EDUCATION

REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES P1

2025 JUNE EXAMINATION

MARKING GUIDELINES

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MARKS: 150

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QUESTION 1

1.1 D✓✓ (2)

1.2 C ✓✓ (2)

1.3 A ✓✓ (2)

1.4 B ✓✓ (2)

1.5 C ✓✓ (2)

1.6 C ✓✓ (2)

1.7 A ✓✓ (2)

1.8 D ✓✓ (2)

1.9 C ✓✓ (2)

1.10 B ✓✓ (2)

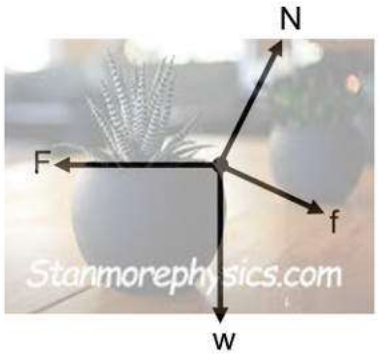
[20]

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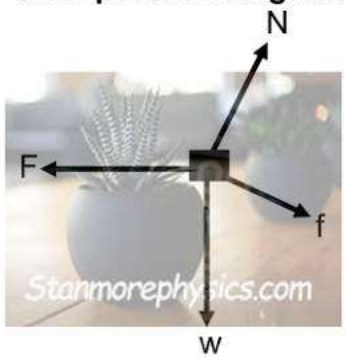
QUESTION 2

2.1 Force that opposes the motion of a moving object relative to the surface. ✓✓ (2)

2.2



Accept force diagram:



Accepted labels	
w	F_g/ F_w/ weight/gravitational force✓
F	F_a/applied force✓
f	(kinetic) friction/F_f/f_k✓
N	F_N /Normal/F_{normal} ✓

Notes
- Mark awarded for label and arrow.
- Do not penalise for length of arrows since drawing is not to scale.
- Any other additional force(s): Max $^{3}/_{4}$
- If everything correct, but no arrows: Max/*Maks* $^{3}/_{4}$

(4)

2.3.1 **Marking criteria**

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

A body will remain in its state of rest or motion at constant velocity unless a non-zero resultant/net force acts on it.✓✓ (2)

2.3.2

$F_{net} = ma$
$F\cos\Theta + mg\sin\Theta + f_k = ma$ } ✓ Any one

$F\cos30° - (15)(9,8)\sin30°$ ✓$- 0,2$✓✓$[F\sin30° + (15)(9,8)\cos30°)]$ ✓ $= 0$✓

$F = 129,19$ N ✓ (6)

2.4

OPTION 1 $g = \frac{G M_E}{r^2}$ $= \frac{(6,67\times10^{-11})((5,98\times10^{24})}{(6,38\times10^{6}+1000\times10^{3})^2}$ ✓ $= 7,32\ m\cdot s^{-2}$	$w = mg$ $3800 = m(7,32)$ ✓ $m = 518,88$ kg $w = mg$ ✓ $= (518,88)(9,8)$ ✓ $= 5085,02$ N ✓
OPTION 2 $F = \frac{GmM_E}{R^2}$ ✓ 3800 ✓$= \frac{GmM_E}{(R+1X10^6)^2}$ ✓ $3800\ (6,38x10^6 + 1x10^6)^2 = F(6,38x10^6)^2$ ✓ F=5084,58N✓	
OPTION 3 $3800 = \frac{GmM_E}{(R+1X10^6)^2}$ ✓ $3800 = \frac{(6,67X10^{-11})(m)(5,98\times10^{24})}{(6,38X10^6 + 1X10^6)^2}$ ✓ m = 518,88 kg w = mg ✓ = (518,88)(9,8) ✓ = 5085,02 N ✓	

(5)

[19]

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QUESTION 3

3.1 50 N✓ downwards✓ (2)

3.2.1

OPTION 1 (Accept if 0^2 is omitted) **UPWARDS AS POSITIVE**	**OPTION 2** (Accept if 0^2 is omitted) **UPWARDS AS NEGATIVE**
$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $= \underline{(0)^2 + (2)(-9,8)(-1,2)}$ ✓ $v_f = 4,85\ m{\cdot}s^{-1}$ ✓ downwards✓	$V_f^2 = v_i^2 + 2a\Delta y$ ✓ $= \underline{(0)^2 + (2)(9,8)(1,2)}$ ✓ $v_f = 4,85\ m{\cdot}s^{-1}$ ✓ downwards✓

(4)

3.2.2

OPTION 1 **UPWARDS AS POSITIVE** **POSITIVE MARKING FROM Q 3.2.1**	**OPTION 1** **UPWARDS AS NEGATIVE** **POSITIVE MARKING FROM Q 3.2.1**
$v_f = v_i + a\Delta t$ ✓ $[\underline{-4,85 = 0 + (-9,8)\ \Delta t}\ ]$✓ $\Delta t = 0,49$ s ✓	$v_f = v_i + a\Delta t$ ✓ $[\underline{4,85 = 0 + (9,8)\ \Delta t}\ ]$✓ $\Delta t = 0,49$ s ✓
OPTION 2 **UPWARDS AS POSITIVE** **POSITIVE MARKING FROM Q 3.2.1**	**OPTION 2** **UPWARDS AS NEGATIVE** **POSITIVE MARKING FROM Q 3.2.1**
$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $[-1,2 = \left(\frac{0 - 4,85}{2}\right)\Delta t]$ ✓ $\Delta t = 0,49$ s ✓	$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $[1,2 = \left(\frac{0 + 4,85}{2}\right)\Delta t\ ]$✓ $\Delta t = 0,49$ s ✓
OPTION 3 **UPWARDS AS POSITIVE**	**OPTION 3** **UPWARDS AS NEGATIVE**
$\Delta y = v_i\,\Delta t + \frac{1}{2}a\,\Delta t^2$ ✓ $[-1,2 = 0 + \frac{1}{2}(-9,8)\,\Delta t^2]$ ✓ $\Delta t = 0,49$ s ✓	$\Delta y = v_i\,\Delta t + \frac{1}{2}a\,\Delta t^2$ ✓ $[1,2 = 0 + \frac{1}{2}(9,8)\,\Delta t^2]$ ✓ $\Delta t = 0,49$ s ✓

(3)

3.2.3

OPTION 1 **UPWARDS AS POSITIVE**	**OPTION 1** **UPWARDS AS NEGATIVE**
$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $\underline{0 = v_i^2 + (2)(-9,8)(0,8)}$ ✓ $v_i = 3,96\ m{\cdot}s^{-1}$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $\underline{0 = v_i^2 + (2)(9,8)(-0,8)}$ ✓ $v_i = -3,96\ m{\cdot}s^{-1}$ $v_i = 3,96\ m{\cdot}s^{-1}$ ✓
OPTION 2 $(U + K)_{top} = (U + K)_{bottom}$ ✓ $(mgh + \frac{1}{2}mv^2)_{top} = (mgh + \frac{1}{2}mv^2)_{bottom}$ $[(0,5)(9,8)(0,8) + 0 = 0 + (\frac{1}{2})(0,5)\,v^2]$✓ $v = 3,96\ m{\cdot}s^{-1}$✓	

(3)

3.2.4 **POSITIVE MARKING FROM QUESTIONS 3.2.1 & 3.2.3**

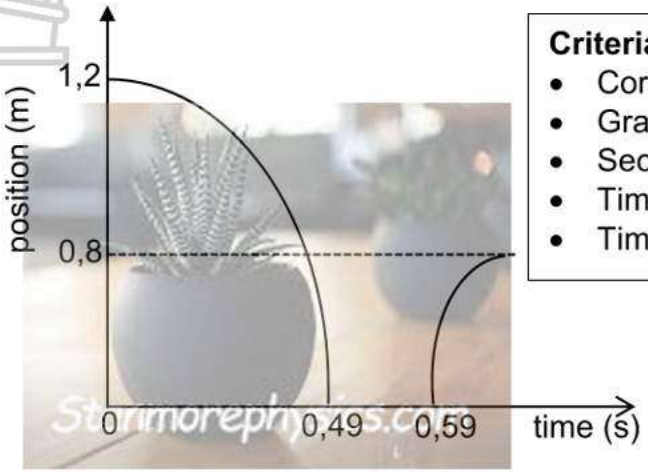
$F_{net}\Delta t = m(v_f - v_i)$ ✓

$F_{floor} + F_g = m(v_f - v_i)$

$\underline{50 - (0,5)(9,8)\Delta t}$ ✓ $= 0,5[3,96 - (-4,85)]$ ✓

$\Delta t = 0,098$ s ✓ (4)

3.3 **POSITIVE MARKING FROM Q 3.2.2**



Criteria
- Correct shape✓
- Graph starts at 1,2 m at t = 0✓
- Second maximum height at 0,8 m✓
- Time at which ball reaches the floor✓
- Time at which ball leaves the floor✓

(5)

[21]

QUESTION 4

4.1 **Marking criteria**
If any of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark
In an <u>isolated</u> system the total <u>linear momentum is conserved/remains constant</u>. ✓✓ (2)

4.2

TO THE RIGHT AS POSITIVE

$\sum p_i = \sum p_f$
$m_b v_{ib} + m_{bl} v_{ibl} = (m_b + m_{bl}) v_f$ } ✓Any one

$\underline{(0,006)(200)} + 0$ ✓ $= (0,006 + 0,194)\, v_f$ ✓

$v_f = 6$ m·s^{-1} ✓

TO THE RIGHT AS NEGATIVE

$\sum p_i = \sum p_f$
$m_b v_{ib} + m_{bl} v_{ibl} = (m_b + m_{bl}) v_f$ } ✓Any one

$\underline{(0,006)(-200)} + 0$ ✓ $= (0,006 + 0,194)\, v_f$ ✓

$v_f = -6$ m·s^{-1}

$= 6$ m·s^{-1} ✓ (4)

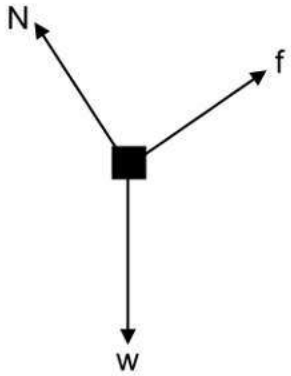
4.3

OPTION 1	OPTION 2
$v_f^2 = v_i^2 + 2a\Delta x$ ✓ 0^2✓ $= (6)^2 + 2a(5)$ ✓ $a = -3,6\ m{\cdot}s^{-2}$ $= \underline{3,6\ m{\cdot}s^{-2}, \text{ to the left}}$ ✓	$W_{net} = \Delta K$ $f\Delta x\cos\Theta = \frac{1}{2}m(v_f^2 - v_i^2)$ $f(5)(\cos 180°) = \frac{1}{2}(0,2)(0^2 - 6^2)$ ✓ $f = 0,72\ N$ $F_{net} = ma$ ✓ $\underline{-0,72 = 0,2a}$ ✓ $a = -3,6$ $= \underline{3,6\ m{\cdot}s^{-2}, \text{ to the left}}$ ✓

(4)

4.4.1





Accepted labels	
w	F_g/ F_w/ weight/gravitational force✓
f	(kinetic) friction/F_f/f_k✓
N	F_N /Normal/F_{normal} ✓

Notes

- Mark awarded for label and arrow.
- Do not penalise for length of arrows since drawing is not to scale.
- Any other additional force(s): Max ⅔
- If everything correct, but no arrows: Max/*Maks* ⅔

(3)

4.4.2 Normal force✓

(1)

4.4.3 $K = \frac{1}{2}mv^2$✓

$= \frac{1}{2}(60)(4)^2$✓

$= 480\ J$✓

(3)

4.4.4 $F_{net} = mg\sin\Theta - f$

$= \underline{(60)(9,8)(\sin 25°) - 180}$ ✓

$= 68,5\ N$✓

(2)

4.4.5 **Marking criteria**

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

Work done on an object by a net force is equal to the change in object's kinetic energy. ✓✓ (2)

4.4.6 **POSITIVE MARKING FROM QUESTIONS 4.4.3 & 4.4.4**

$W_{net} = \Delta K$ ✓

$F_{net}\Delta t = K_f - K_i$

$(68,5)(15)\cos 0° = [\frac{1}{2}(60)v^2 - 480]$ ✓✓

$v = 7,09\ m\cdot s^{-1}$ ✓ (4)

[25]

QUESTION 5

5.1 Rate at which work is done / energy is expended. ✓✓ (2)

5.2.1

$P = \frac{W}{\Delta t}$ ✓

$(0,85)(200) = \frac{W}{30}$ ✓

$W = 5100\ J$ ✓ (4)

5.2.2 $U = mgh$ ✓

$= (90)(9,8)(3)$ ✓

$= 2646\ J$ ✓ (3)

5.2.3

$P_{ave} = Fv_{ave}$

$(0,85)(200) = F(1,5)$ ✓

$F = 113,33\ N$

$v = \frac{\Delta x}{\Delta t}$

$1,5 = \frac{\Delta x}{30}$ ✓

$\Delta x = 45\ m$

$F_{net} = ma$ ✓Any one

$F + f + F_g = ma$

$[113,33 - f - (90)(9,8)(\frac{3}{45}) = 0]$ ✓

$f = 54,53\ N$ ✓

$Cos\theta = \frac{3}{45}$

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(5)

[14]

QUESTION 6

6.1 Doppler Effect. ✓ The change in frequency of sound detected by a listener because the sound source and the listener have different velocities relative to the medium of sound propagation. ✓✓ (3)

6.2 Doppler flow meter / Doppler ultrasound machine✓ (1)

6.3

$$f_L = \frac{v}{v - v_s} \cdot f_s \checkmark$$

$$1695 \checkmark = \frac{340}{340 - v_s} \cdot (1500) \checkmark$$

$$v_s = 39{,}12 \text{ m·s}^{-1}$$

OPTION 1

$$v = \frac{\Delta x}{\Delta t}$$

$$39{,}12 = \frac{\Delta x}{1{,}5} \checkmark$$

$$\Delta x = 58{,}68 \text{ m} \checkmark$$

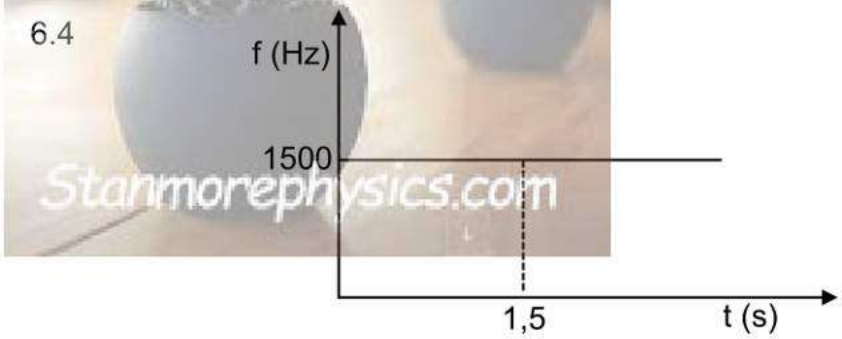
OPTION 2

$$\Delta x = \left(\frac{39{,}12 + 39{,}12}{2}\right)(1{,}5)$$

$$= 58{,}68\text{m}$$

(5)

6.4



Criteria
- Correct shape✓
- 1,5 s and 1500 Hz✓

(2)
[11]

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QUESTION 7

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

The (magnitude of the) electrostatic force exerted by one point charge on another point charge is directly proportional to the product of the (magnitudes of the) charges and inversely proportional to the square of the distance between them. ✓✓

(2)

7.2

OPTION 1	OPTION 2
$F = \frac{kQ_1Q_2}{r^2}$ ✓ $F_{XZ} = \frac{(9\times10^9)(3\times10^{-6})(9\times10^{-6})}{(0,15)^2}$ ✓ $= 10,8$ N $F_{YZ} = \frac{(9\times10^9)(6\times10^{-6})(9\times10^{-6})}{(0,1)^2}$ ✓ $= 48,6$ N $F_{net} = 48,6 - 10,8 = 37,8$ N to the right ✓	$E = \frac{kQ}{r^2}$ $E_{XZ} = \frac{(9\times10^9)(3\times10^{-6})}{(0,15)^2}$ ✓ $= 1,2\times10^6$ N·C^{-1} $E_{YZ} = \frac{(9\times10^9)(6\times10^{-6})}{(0,1)^2}$ ✓ $= 5,4\times10^6$ N·C^{-1} $E_{net} = 5,4\times10^6 - 1,2\times10^6$ $= 4,2\times10^6$ N·C^{-1} $F_{net} = QE$ ✓ $= (9\times10^{-6})(4,2\times10^6)$ ✓ = 37,8 N to the right ✓

(5)

7.3.1 X to Y ✓ (1)

7.3.2 $Q = \frac{Q_1 + Q_2}{2}$
$= \frac{(-3\times10^{-6}) + (6\times10^{-6})}{2}$ ✓
$= 1,5\times10^{-6}$ C

$n = \frac{Q}{q_e}$ ✓
$= \frac{(1,5\times10^{-6}) - (-3\times10^{-6})}{1,6\times10^{-19}}$ ✓
$= 2,81\times10^{13}$ (electrons) ✓

(4)

7.3.3 $E = \frac{kQ}{r^2}$ ✓

$$\frac{(9\times10^9)(1,5\times10^{-6})}{r^2} \checkmark = \frac{(9\times10^9)(9\times10^{-6})}{(0,15 - r)^2} \checkmark$$

$r = 0,04$ m ✓

(4)
[16]

QUESTION 8

8.1 **Marking criteria**
If any of the underlined key words/phrases in the correct context is omitted, deduct 1 mark
The potential difference across a conductor is directly proportional to the current in the conductor at constant temperature. ✓✓

(2)

8.2.1

OPTION 1	OPTION 2
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ $= \frac{1}{13} + \frac{1}{7}$ ✓ $R_p = 4{,}55\ \Omega$ ✓	$R_p = \frac{R_1 \times R_2}{R_1 + R_2}$ ✓ $= \frac{13 \times 7}{13 + 7}$ ✓ $= 4{,}55\ \Omega$ ✓

(3)

8.2.2 **POSITIVE MARKING FROM QUESTION 8.2.1**

$\varepsilon = I(R+r)$ ✓
$12 = I(4{,}55 + 0{,}3)$ ✓
$I = 2{,}47$ A ✓

(3)

8.2.3 $V_{external} = IR$
$= (2{,}47)(4{,}55)$ ✓
$= 11{,}24$ V

I through 8 Ω
$I = \frac{V}{R}$ ✓
$= \frac{11{,}24}{13}$ ✓
$= 0{,}8646$ A ✓

(4)

8.3 **POSITIVE MARKING FROM QUESTION 8.2.3**

$V_{5\Omega} = IR$ $= (0{,}8646)(5)$ ✓ $= 4{,}323$ V	$I_{3\Omega} = 2{,}47 - 0{,}8646 = 1{,}6054$ $V_{3\Omega} = IR$ $= (1{,}6054)(3)$ ✓ $= 4{,}816$ V
$\therefore V_2 = 4{,}816 \overset{\checkmark}{-} 4{,}323$ $= 0{,}49$ V ✓ **(Range: 0,49 – 0,53 V)**	

(4)

8.4
- Total resistance increases ✓
- Total current decreases ✓
- $V_{internal}$ (lost volts) decreases ✓

(3)

8.5 Cost = energy × tariff

$300 \checkmark = (P \times \underline{8 \times 30}) \times 2{,}59 \checkmark$

$P = 482{,}625\ W \checkmark$

$\text{no. of bulbs} = \frac{482{,}625}{80} \checkmark$

$= 6 \checkmark$

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(5)
[24]

TOTAL: 150