

# Hillcrest High School

## PHYSICAL SCIENCE P1

Nov 2025

Grade 11

**MARKS:** 125  
**TIME:** 2,5 Hours

**EXAMINER:** Ms N. Badenhorst  
**MODERATOR:** Mrs J. Knox-Whitehead

### Question 1

- 1.1 C
- 1.2 C
- 1.3 D
- 1.4 B
- 1.5 B
- 1.6 B
- 1.7 D
- 1.8 A
- 1.9 A

## Question 2

2.1  $0 \text{ N}$  ✓ (1)

2.2 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)

2.3.1  $T_{x1} = T_1 \times \cos 30^\circ$   
 $= 381,05 \times \cos 30^\circ$  ✓  
 $= 330 \text{ N West/ left}$  ✓

$T_{y1} = T_1 \times \sin 30^\circ$  (4)  
 $= 381,05 \times \sin 30^\circ$  ✓  
 $= 190,53 \text{ N North/ up}$  ✓

2.3.2  $T_{y2} = T_2 \times \sin 60^\circ$   
 $= 660 \times \sin 60^\circ$  ✓  
 $= 571,58 \text{ N North/ up}$  (3)

$T_{xnet} = 0 \text{ N}$  and  $T_{ynet} = 0 \text{ N}$  Equilibrium

$\therefore T_{y2} + T_{y1} = F_g = m \times g$   
 $571,58 + 190,53 = m \times 9,8$  ✓

$m = 77,77 \text{ kg}$

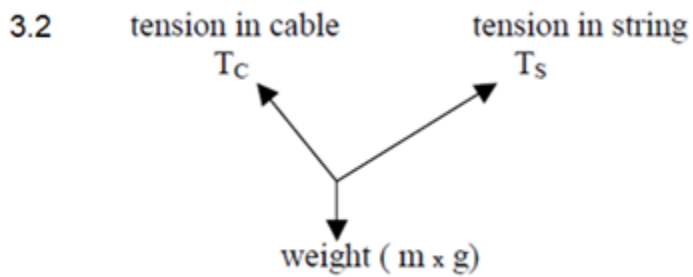
**Or**

$F_g^2 = T_1^2 + T_2^2$   
 $= 381,05^2 + 660^2$  ✓  
 $F_g = 762,1018 \text{ N}$

$F_g = m \cdot g$   
 $762,1018 = m (9,8)$  ✓  
 $m = 77,77 \text{ kg}$  ✓

### Question 3

3.1  $F_g = m \cdot g$   
 $= 0,8 (9,8)$   
 $= 7,84 \text{ N}$



3.3  $\frac{\sin \theta}{F_t} = \frac{\sin \theta}{F_g}$

$$\frac{\sin 50}{F_c} \checkmark = \frac{\sin 100}{7,84} \checkmark$$

$$F_c = 6,1 \text{ N} \checkmark$$

$$\frac{\sin \theta}{F_t} = \frac{\sin \theta}{F_g}$$

$$\frac{\sin 50}{F_t} \checkmark = \frac{\sin 100}{7,84} \checkmark$$

$$F_t = 3,98 \text{ N} \checkmark$$

3.4  $\frac{\sin \theta}{F_c} = \frac{\sin \theta}{F_g}$

$$\frac{\sin 50}{8} \checkmark = \frac{\sin 100}{F_g} \checkmark$$

$$F_g = 10,2846 \text{ N}$$

$$F_g = m \cdot g$$

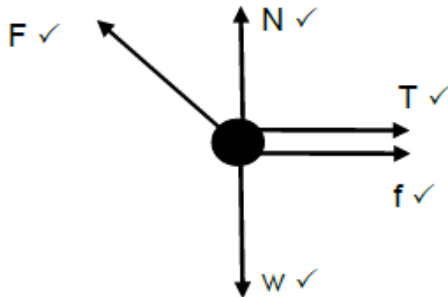
$$10,2846 = m(9,8) \checkmark$$

$$m = 1,05 \text{ kg} \checkmark$$

**Question 4**

4.1 When a net force acts on an object, the object will accelerate in the direction of the force and the acceleration is directly proportional to the resultant/net force and inversely proportional to the mass of the object. ✓✓

4.2



(5)

Accepted labels / Aanvaarde benoemings	
W	$F_g / F_w$ / force of earth on block / weight / mg / gravitational force / VALUE
F	$F_{\text{applied}} / F_A$ / Applied force
T	Tension in rope / $F_T$
F	$F_{\text{friction}} / F_f$ / frictional force /
N	Normal force / $F_N$

4.3.1 **Marking criteria/Nasienkriteria:**

- Formula for block A or block B ✓
- Substitution of  $F_{\text{net}}$  for block A ✓
- Substitution of  $F_{\text{net}}$  for block B ✓
- 8a OR 4a ✓
- Answer ✓

<p>For Block A:</p> $F_{\text{net}} = ma$ $F_x + (-T) + (-f) = ma$ $(75)\cos 25 - T - 11,76 \checkmark = 4a \checkmark$ $56,21 - T = 4a$ $T = -4a + 56,21$	<p>} Any one ✓</p>	<p>For Block B:</p> $F_{\text{net}} = ma$ $F_g + T + (-F) = ma$ $78,4 + T - 96 \checkmark = 8a$ $T - 17,6 = 8a$ $T = 8a + 17,6$
$\therefore -4a + 56,21 = 8a + 17,6$ $12a = 38,61$ $a = 3,22 \text{ m}\cdot\text{s}^{-2} \checkmark$		

(5)

4.3.2 **POSITIVE MARKING FROM QUESTION 2.3.1**

**Marking criteria/Nasienkriteria:**

- Substitution to calculate T ✓
- Answer ✓

<p>For Block A:</p> $T = -4a + 56,21$ $= (-4)(3,22) + 56,21 \checkmark$ $= 43,33 \text{ N} \checkmark$	<p>For Block B:</p> $T = 8a + 17,6$ $= (8)(3,22) + 17,6$ $= 43,36 \text{ N}$
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(2)

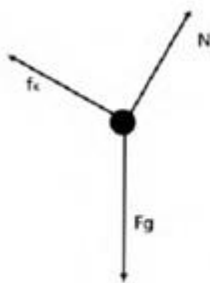
$$\begin{aligned}
 4.3.3 \quad F_N &= F_g - F_{AY} \\
 &= 4(9,8) - 75 \sin 25 \\
 &= 7,5 \text{ N}
 \end{aligned}$$

### Question 5

5.1 Kinetic friction/Kinetiese wrywing ✓✓

(1)

5.2



**Marking criteria/Nasien kriteria:**

All arrows, directions and headings should be correct.  
*Alle pyltjies, rigtings en byskrifte moet korrek wees.*

- ✓  $f_k$
- ✓  $N$
- ✓  $F_g$

(3)

5.3  $F_{\text{net } \perp} = 0 \text{ N}$  ✓

$$\therefore N = F_{g\perp}$$

$$= 41,5 \times 9,8 \times \cos 25^\circ \quad \checkmark$$

$$= 368,60 \text{ N } \perp \text{ up/opwaarts} \quad (368,595 \text{ N})$$

$$f_k = \mu_k N \quad \checkmark$$

$$= 0,12 \times 368,60$$

$$= 44,23 \text{ N up/incline/teen helling op} \quad \checkmark$$

(4)

5.4 DECREASE/AFNEEM ✓

The coefficient of friction is a constant for a specific surface. ✓ An increase of the incline will decrease  $F_{g\perp}$  and therefore the normal  $\therefore f_k$  will decrease as  $f_k$  is directly proportional to the normal. ✓

## Question 6

6.1 Each body 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. ✓ (2)

6.2

$$F = \frac{Gm_1m_2}{r^2} \checkmark$$

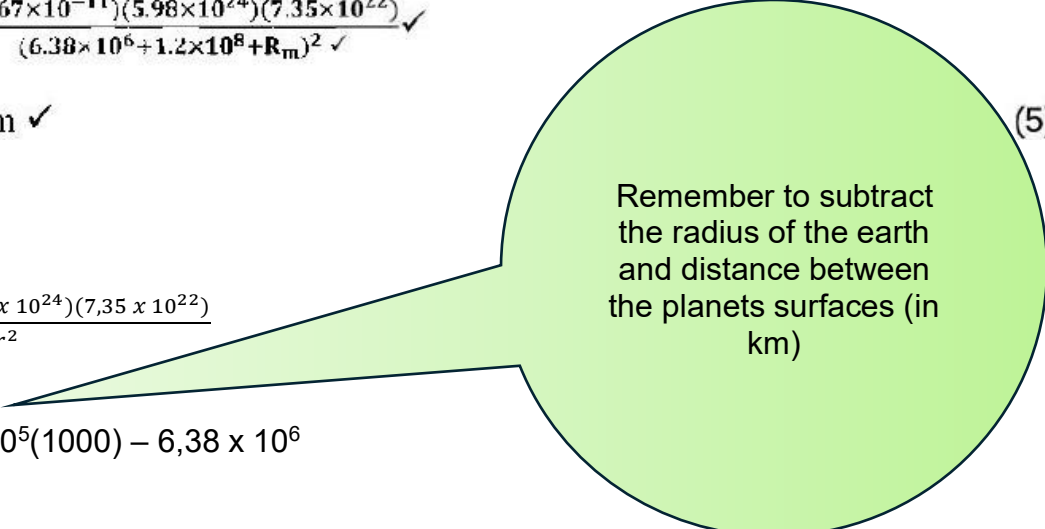
$$1.91 \times 10^{20} \checkmark = \frac{(6.67 \times 10^{-11})(5.98 \times 10^{24})(7.35 \times 10^{22})}{(6.38 \times 10^6 + 1.2 \times 10^8 + R_m)^2} \checkmark$$

$$R_m = 2.65 \times 10^8 \text{ m} \checkmark \quad (5)$$

Or

$$1,91 \times 10^{20} = \frac{6,67 \times 10^{-11} (5,98 \times 10^{24})(7,35 \times 10^{22})}{r^2}$$

$$\begin{aligned} r_{\text{moon}} &= 391778406 - 1,2 \times 10^5(1000) - 6,38 \times 10^6 \\ &= 2,65 \times 10^8 \text{ m} \end{aligned}$$



Remember to subtract the radius of the earth and distance between the planets surfaces (in km)

### Question 7

7.1.1 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)



7.1.3  $F_{\text{net}} = ma$

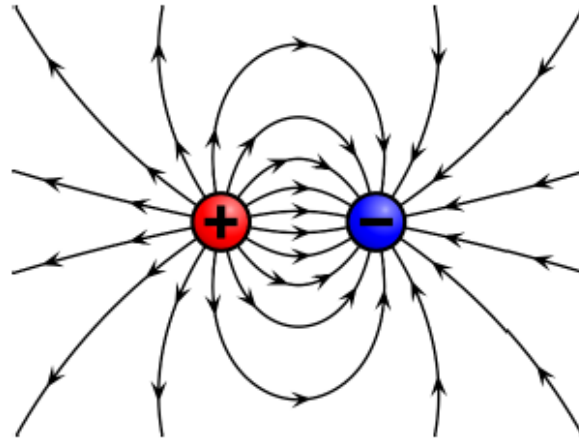
$$mg + (-T) + \left(-\frac{kQ_1Q_2}{r^2}\right) = ma \quad \left. \vphantom{mg + (-T) + \left(-\frac{kQ_1Q_2}{r^2}\right) = ma} \right\} \checkmark$$
$$\left[ m(9.8) - 8 \checkmark - \frac{(9 \times 10^9)(50 \times 10^{-9})(20 \times 10^{-9})}{(4 \times 10^{-2})^2} \right] \checkmark = 0 \checkmark$$
$$m = 0.82 \text{ kg } \checkmark$$
$$m_s = 0.82 \times 2 = 1.63 \text{ kg } \checkmark$$

(6)

### Question 8

8.1 The electric field is an area in space where an electric charge experiences a force. ✓✓

8.2



Criteria for sketch/Kriteria vir skets	Marks/Punte
Correct shape as shown. Korrekte vorm soos getoon.	✓
Direction away from positive to negative. Rigting weg van positief na negatief.	✓
Field lines start on spheres and do not cross for correct diagram. Veldlyne begin op elke sfeer en kruis nie vir korrekte diagram.	✓

(3)

8.3

$$E_{net} = E_1 + E_2$$

$$E_{net} = \frac{kQ}{r^2} - \frac{kQ}{r^2} \quad (\text{Mark for/Punt vir } \frac{kQ}{r^2})$$

$$\checkmark 4\,128 = \frac{(9 \times 10^9)(5 \times 10^{-9})}{r^2} \checkmark - \checkmark \frac{(9 \times 10^9)(4 \times 10^{-9})}{(4r)^2} \checkmark$$

$$4\,128 = \frac{45}{r^2} - \frac{36}{16r^2}$$

$$r = 0,10 \text{ m } \checkmark$$

(6)  
[11]

## Question 9

9.1 The potential difference across a conductor is directly proportional to the current in the conductor at constant temperature. ✓✓

9.1.2

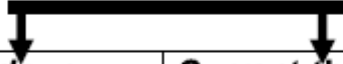
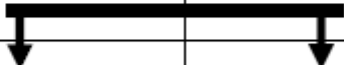
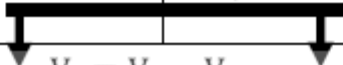
OPTION/OPSIE 1 1	OPTION 2/OPSIE 2
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} \checkmark$ $= \frac{1}{7+6} \checkmark + \frac{1}{4+6} \checkmark$ $R_p = 5,65 \Omega \checkmark$	$R_p = \frac{R_1 \times R_2}{R_1 + R_2} \checkmark$ $= \frac{13 \times 10}{13+10} \checkmark \checkmark$ $R_p = 5,65 \Omega \checkmark$

(4)

9.1.3 **POSITIVE MARKING FROM/POSITIEWE NASIEN VANAF 8.2**

OPTION/OPSIE 1 1	OPTION 2/OPSIE 2
$\mathcal{E} = I(R_{\text{ext}} + r_{\text{int}}) \checkmark$ $15 = I(5,65 + 0,45) \checkmark$ $I = 2,46 \text{ A} \checkmark$	$R_T = \frac{V_T}{I} \checkmark$ $(5,65 + 0,45) = \frac{15}{I} \checkmark$ $I = 2,46 \text{ A} \checkmark$

(3)

<b>OPTION/OPSIE 1</b>	
$r = \frac{V_{\text{int}}}{I} \checkmark$ $0,45 = \frac{V_{\text{int}}}{2,46} \checkmark$ $V_{\text{int}} = 1,11 \text{ V}$ $V_T = V_{\text{ext}} + V_{\text{int}}$ $15 = V_{\text{ext}} + 1,11$ $V_{\text{ext}} = 13,89 \text{ V}$	$R = \frac{V_{\text{ext}}}{I} \checkmark$ $5,65 = \frac{V_{\text{int}}}{2,46} \checkmark$ $V_{\text{ext}} = 13,89 \text{ V}$
	
<b>Current through/Stroom deur 7Ω &amp; 6Ω</b> $R = \frac{V}{I}$ $13 = \frac{13,89}{I} \checkmark$ $I = 1,07 \text{ A}$	<b>Current through/ Stroom deur 4Ω &amp; 6Ω</b> $R = \frac{V}{I}$ $10 = \frac{13,89}{I} \checkmark$ $I = 1,39 \text{ A}$
	
<b>Potential difference across/ Potensiaalverskil oor 7Ω</b> $R_{7\Omega} = \frac{V}{I}$ $7 = \frac{V}{1,07} \checkmark$ $V = 7,49 \text{ V}$ $V_A = 13,89 - 7,49$ $= 6,40 \text{ V}$	<b>Potential difference across/ Potensiaalverskil oor 4Ω</b> $R = \frac{V}{I}$ $4 = \frac{V}{1,39} \checkmark$ $V = 5,56 \text{ V}$ $V_B = 13,89 - 5,56$ $= 8,33 \text{ V}$
	
$V_2 = V_B - V_A$ $V_2 = 8,33 - 6,40$ $V_2 = 1,93 \text{ V} \checkmark$	

OPTION/OPSIE 2	
$r = \frac{V_{\text{int}}}{I} \checkmark$ $0,45 = \frac{V_{\text{int}}}{2,46} \checkmark$ $V_{\text{int}} = 1,11 \text{ V}$	$R = \frac{V_{\text{ext}}}{I} \checkmark$ $5,65 = \frac{V_{\text{int}}}{2,46} \checkmark$ $V_{\text{ext}} = 13,89 \text{ V}$
<p><b>Current through/Stroom deur 7Ω &amp; 6Ω</b></p> $R = \frac{V}{I}$ $13 = \frac{13,89}{I} \checkmark$ $I = 1,07 \text{ A}$	<p><b>Current through/Stroom deur 4Ω &amp; 6Ω</b></p> $R = \frac{V}{I}$ $10 = \frac{13,89}{I} \checkmark$ $I = 1,39 \text{ A}$
<p><b>Potential difference across/ Potensiaalverskil oor 6Ω</b></p> $R_{6\Omega} = \frac{V(B)}{I}$ $6 = \frac{V}{1,39} \checkmark$ $V = 8,34 \text{ V}$	<p><b>Potential difference across/ Potensiaalverskil oor 6Ω</b></p> $R = \frac{V(A)}{I}$ $6 = \frac{V}{1,07} \checkmark$ $V = 6,42 \text{ V}$
$V_2 = V_B - V_A$ $V_2 = 8,34 - 6,42 \checkmark$ $V_2 = 1,92 \text{ V} \checkmark$	

(7)

9.2 Increases/Verhoog ✓

(1)

9.3 Total resistance increases and total current decreases. ✓  
 V lost decreases ✓  
 Totale weerstand neem toe en totale stroom neem af.  
 V neem af

(2)

Question 10

10.1.1  $12 \text{ V} \checkmark$  (1)

10.1.2  $12 - 8$   
 $= 4 \text{ V} \checkmark$  (1)

10.1.3

**Option 1**

$$\text{gradient} = \frac{\Delta I}{\Delta V} \checkmark$$

$$-\frac{1}{r} \checkmark = \frac{0-6}{12-0} \checkmark \text{ [or any suitable co-ordinates]}$$

$$-\frac{1}{r} = -\frac{6}{12}$$

$$r = 2 \Omega \checkmark$$

**Option 2**

$$r = -\frac{1}{\text{gradient}} \checkmark$$

$$r = -\frac{1}{\frac{\Delta I}{\Delta V}} \checkmark$$

$$r = -\frac{1}{\frac{0-6}{12-0}} \checkmark \text{ [or any suitable co-ordinates]}$$

$$r = 2 \Omega \checkmark$$

**Option 3**

$$V_{\text{int}} = Ir \quad \text{[lose formula mark]}$$

$$4 \checkmark = 2r \checkmark \quad \text{[or any suitable co-ordinates]}$$

$$r = 2 \Omega \checkmark \quad \text{[max 3 marks]}$$

(4)