KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11



PHYSICAL SCIENCES P1 (PHYSICS)

MARKING GUIDELINE

NOVEMBER 2024

MARKS: **150**

These marking guidelines consist of 10 pages.

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QUESTION 1

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

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QUESTION 2

2.1

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

Resultant force is the vector sum✓ of two or more forces acting together✓

OR

That single force having the same effect✓ as two or more forces acting together. ✓ (2)

2.2.1

Vector	F_1 = 6 N	F_2 = 3 N	F_3 = 4 N	Resultant
x-component	0 N	3 N ✓	4cos 45°✓	5,83 N ✓ (to the right)
y-component	6 N	0 N ✓	-4sin 45°✓	3,17 N ✓ (Upwards)

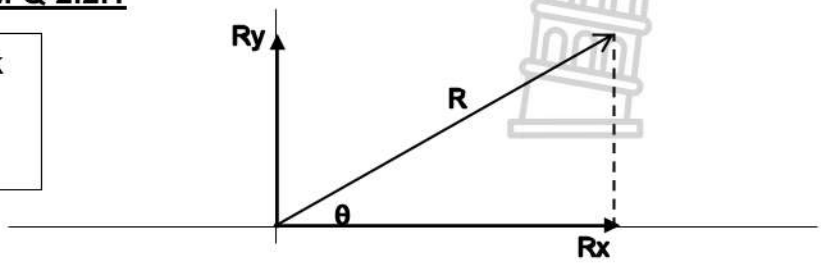
NOTE: If the 0 N is implied for the x–component of F_1, and the y–component of F_2, award the marks indicated by the rings.

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$R^2 = R_X^2 + R_Y^2$
$R^2 = 5{,}83^2 + 3{,}17^2$✓
$R = 6{,}64$ N ✓ (8)

2.2.2 **POSITIVE MARKING FROM Q 2.2.1**

NOTE: Award the formula mark to the substitution if formula is not given.



$\tan\theta = \frac{R_y}{R_x}$✓ :
$\tan\theta = \frac{3{,}17}{5{,}83}$✓
θ = 28,53° North of East ✓ OR θ = 61,47° East of North / Bearing. (3)

[13]

QUESTION 3

3.1 Inertia is the resistance of an object to any changes in its state of motion. ✓✓ (2 OR 0). (2)

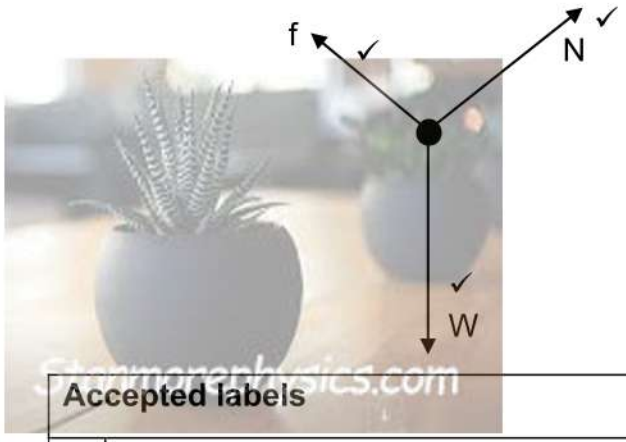
3.2
- Passenger and taxi move with the same velocity before brakes are applied. ✓
- When brakes are applied, the net force acts on the taxi✓ (and not the passenger).
- Due to inertia the passenger continues to move forward.✓ (3)

3.3 The occupant moving forward exerts a force on the seat belt. By Newton's third law, the seat belt exerts an equal force in the opposite direction✓ to prevent the occupant from moving forward.✓ (2)

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

Static frictional force is the force that opposes the tendency of motion of a stationary object relative to a surface. ✓✓ (2)

3.4.2



Accepted labels	
w	F_g /F_w /$F_{earth\ on\ P}$ /weight /mg /784 N /gravitational force
f	F_f /f_s /(static) friction
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 $^2/_3$
- If everything correct, but no arrows: Max $^2/_3$
- If force(s) do not make contact with the dot: Max $^2/_3$

(3)

3.4.3 **Marking criteria**
If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark (3)

Normal force is the force (or the component of a force) which a surface exerts on an object in contact with it,✓and which is perpendicular to the surface.✓ (2)

3.4.4 $N = F_{g\perp} / mg \cos \theta$✓
$= 80 \times 9.8 \times \cos 25°$✓
$= 710,55$ N✓ (3)

3.4.5 $f_s^{max} = F_{g//} / mg \sin \theta$✓
$= 80 \times 9.8 \times \sin 25°$✓
$= 331,33$ N✓ (3)

3.4.6 **POSITIVE MARKING FROM Q3.4.4 and Q3.4.5**
$f_s^{max} = \mu_s \times N$✓
$331,33 = \mu_s \times 710,55$✓
$\mu_s = 0.47$✓ (0,466) (3)

3.4.7 Yes.✓
The component of the gravitational force parallel to the incline / $F_{g//}$ / mg sinθ increases✓ while f_s^{max} acting up the incline cannot increase. ✓
∴ There is a net force / acceleration down the incline. (3)

3.4.8 Decreases. ✓
The component of the gravitational force parallel to the incline / $F_{g//}$ / mgsinθ decreases✓and f_s can be less than f_s^{max} ✓so that $f_s = F_{g//}$. (3)
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Q3.4.7
Correct answer is :
NO.✓Both the parallel component of the gravitational force and the maximum static frictional force increase✓ by the same magnitude.✓

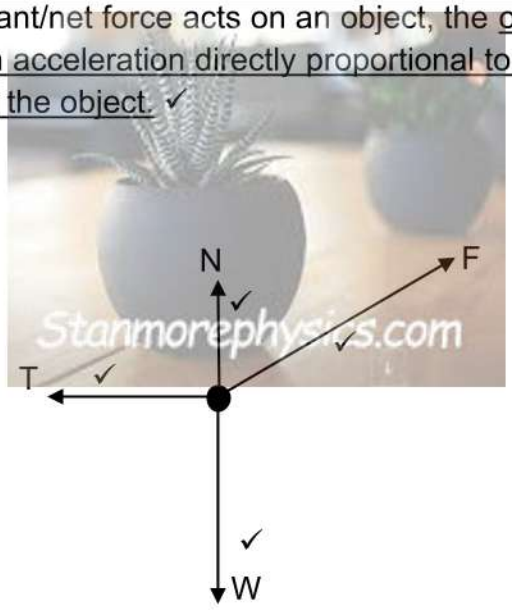
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QUESTION 4

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

4.1 When a resultant/net force acts on an object, the object will accelerate in the direction of the force at an acceleration directly proportional to the force✓ and inversely proportional to the mass of the object. ✓ (2)

4.2



Accepted labels	
w	F_g /F_w /$F_{earth\ on\ P}$ /weight /mg /88,2 N /gravitational force
T	F_T /F_{string} /F_t /tension.
F	$F_{applied}$ / F_{app} / 9 N
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 $^3/_4$
- If force(s) do not make contact with the dot: Max $^3/_4$

(4)

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4.3.1 **MARKING CRITERIA**

- F_{net} = ma (for either block)✓
- Substitution of T and mass for 1 kg block✓
- Substitution on the left-hand side for the 3 kg block.✓
- Substitute 3 kg on the right-hand side for the 3 kg block. ✓
- Answer. ✓

For the 1 kg block

F_{net} = ma ✓

T = 1a✓----------eqn. 1

For the 3 kg block

F_{net} = ma

F_x – T = ma

(9 cos25° - T)✓= 3a✓----------eqn. 2

Therefore a = 2,04 $m \cdot s^{-2}$✓ (5)

4.3.2 **POSITIVE MARKING FROM Q 4.3**

OPTION 1:	**OPTION 2:**
T = 1a	F_{app} - T= m a
T = 1(2,04)	(9 cos25° - T) = 3 (2,04)✓
T = 2,04 N✓✓	T = 2,04 N✓

(2)

4.4 Increase✓

The increased mass of the smaller block increases the load, ✓ requiring a bigger force to pull it.✓ OR

T = Fcos25 – 3a. ✓ Acceleration decreases, ✓ hence T increases. (3)

[16]

QUESTION 5

5.1

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

Every particle in the universe attracts every other particle with a gravitational force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centres. ✓✓ (2)

5.2 Mass is the amount of matter contained in the body.✓ Weight is the force with which the Earth attracts the body.✓

NOTE: If candidate states: Mass is a scalar quantity, while weight it is a vector quantity, award 1 mark only. (2)

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5.3.1 $g = \frac{G\,M}{r^2}$ ✓

$= \frac{6{,}67 \times 10^{-11} \times 5{,}98 \times 10^{24}}{(6{,}38 \times 10^{6} + 8850)^2}$ ✓

$= 9{,}77\ m{\cdot}s^{-2}$ ✓ downwards / towards the Earth's centre (4)

5.3.2

OPTION 1 **POSITIVE MARKING FROM Q 5.3.1**	**OPTION 2**
$W = mg$ ✓ $= 70 \times 9{,}77$ ✓ $= 683{,}90$ N ✓	$F_g = \frac{G\,m_1 m_2}{r^2}$ ✓ $F_g = \frac{6{,}67 \times 10^{-11} \times 5{,}98 \times 10^{24} \times 70}{(6{,}38 \times 10^{6} + 8850)^2}$ ✓ $w = 684{,}04$ N ✓

(3)

5.4.1 The sensation experienced when all contact forces are removed / in free fall. ✓✓ (2 OR 0). (2)

5.4.2 No. ✓ The gravitational force exerted by Earth still exists in orbit. ✓ Astronauts experience weightlessness because the only force acting on them is the gravitational force. ✓ (3)

[16]

QUESTION 6

6.1

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 (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. ✓✓ (2)

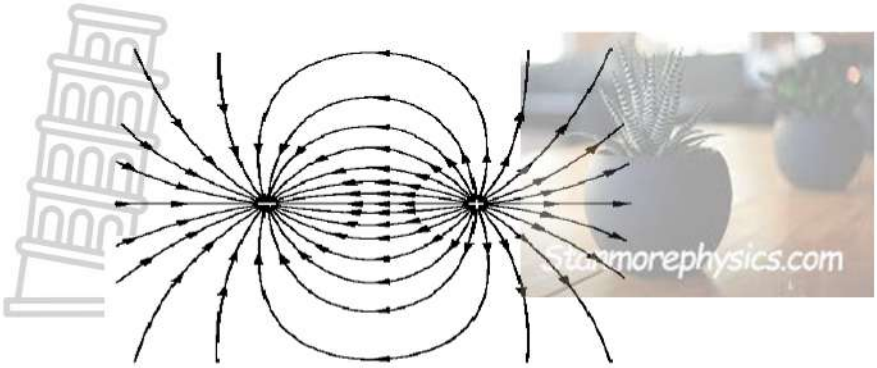
6.2 $F_e = \frac{k\,Q_1 Q_2}{r^2}$ ✓

$= \frac{9 \times 10^{9} \times 4 \times 10^{-6} \times 4 \times 10^{-6}}{(0{,}4)^2}$ ✓

$= 0{,}9$ N ✓ towards A / to the left ✓ (4)

NOTE: Direction must be marked independent of answer.

6.3 (3)



Marking Criteria:

- Correct direction of field – from positive to negative charge.✓
- Field lines not touching each other and starting from / touching the surfaces of the spheres. ✓
- Correct shape. ✓

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

The electric field at a point is the electrostatic force experienced per unit positive charge placed at that point. ✓✓ (2)

6.5

Marking Criteria:

- Correct vector equation equating E_A and E_B.✓
- Correct formula to calculate electric field. ✓
- Substitution to calculate E_A. ✓
- Substitution to calculate E_B. ✓✓
- Final answer (r = 0,16 m). ✓

$E_A + E_C = 0$
$E_A = E_C$
} Any one ✓

$$\frac{kQ_A}{r^2} \checkmark = \frac{kQ_B}{(0,4 - r)^2}$$

$$\frac{4 \times 10^{-6}}{r^2} \checkmark = \frac{9 \times 10^{-6} \checkmark}{(0,4 - r)^2 \checkmark}$$

$r = 0,16$ m✓

(6)
[17]

QUESTION 7

7.1.1 $P = \frac{V^2}{R}$ ✓

$12 = \frac{18^2}{R}$ ✓

$R = 27\Omega$ ✓ (3)

7.1.2

OPTION 1:	**OPTION 2:**
POSITIVE MARKING FROM Q7.1.1:	$I_R = \frac{V}{R}$ ✓
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ OR $R_p = \frac{R_1 \times R_2}{R_1 + R_2}$ ✓	$P = VI$ ✓ OR
$\frac{1}{R_p} = \frac{1}{27} + \frac{1}{12}$ ✓ $= \frac{27 \times 12}{27+12}$ ✓	$12 = 18\ I_R$ ✓ $= \frac{18}{27}$ ✓
$R_p = 8,31\ \Omega$	$I_R = 0,67$ A
$I_p = \frac{V_2}{R_p}$ ✓	$I_{12} = \frac{V_2}{R}$ ✓
$= \frac{18}{8,31}$ ✓	$I_{12} = \frac{18}{12}$ ✓
$= 2,17$ A ✓ ∴ ammeter reading is 2,17 A	$I_{12} = 1,5$ A
	Ammeter reading = 0,67 + 1,5 = 2,17A ✓

(5)

7.1.3 **POSITIVE MARKING FROM Q7.1.2:**

$V = IR$ ✓

$V = 2,17 \times 10$ ✓

$V = 21,7$ V ✓ (3)

7.2

OPTION 1:	**OPTION 2:**
POSITIVE MARKING FROM Q7.1.2 & Q7.1.3	**POSITIVE MARKING FROM Q7.1.2**
$V_{lost} = \underline{41,9 - (21,7 + 18)}$ ✓	$\varepsilon = I(R + r)$ ✓
$= 2,20$ V	$41,9$ ✓ $= \underline{2,17((8,31+10) + r)}$ ✓
$V_{lost} = Ir$ ✓	→ $r = 1,00\ \Omega$ ✓
$2,20 = 2,17r$ ✓	**OR** $\varepsilon = V_{ext} + Ir$ ✓
$r = 1,01\ \Omega$ ✓	$41,9$ ✓ $= \underline{(21,7+18) + 2,17r}$ ✓

(4)

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7.3 Decrease. ✓ R_{TOT} increases. ✓ (2)

7.4.1

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)

7.4.2 Gradient $= \frac{\Delta V}{\Delta I}$ ✓

$= \frac{(12-0)}{(0,9-0)}$ ✓ $= 13,33\ \Omega$

Therefore, the resistance of Y is 13,33 Ω ✓ (4)

NOTES:
Any ordered pair, correctly read from the graph can be used.
The fourth mark is for clearly indicating that the gradient is the resistance.

7.4.3 Y. ✓ The higher the resistance the higher the power output / $P \propto R$ ✓ (I is constant) thus more energy dissipated in the resistor per unit time / per second / in a given time. ✓ (3)

[26]

QUESTION 8

8.1 Magnetic force. ✓ (1)

8.2 A to B✓✓ (2)

8.3 Zero. ✓ (1)

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

The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linked with the conductor. ✓✓ (2)

8.4.2

$$\varepsilon = -N\frac{\Delta\emptyset}{\Delta t}$$

$$\varepsilon = -N\frac{(\emptyset_{70^o}-\emptyset_{30^o})}{\Delta t}$$

$$\varepsilon = -N\frac{(BACos\ 70 - BACos30)}{\Delta t}$$

Any one ✓

$$\varepsilon = -100\frac{(3{,}9\times10^{-4}\times4{,}8\times10^{-4}\ Cos\ 70\checkmark - 3{,}9\times10^{-4}\times4{,}8\times10^{-4}\ Cos30\checkmark)}{0{,}2}$$

$\varepsilon = 4{,}90\times10^{-5}$ V✓ (4)

8.4.3 **POSITIVE MARKING FROM Q8.4.2**

$\varepsilon = IR / V = IR$✓

$4{,}90\times10^{-5} = I(2)$ ✓

$I = 2{,}45\times10^{-5}$ A✓ (3)

[13]

TOTAL: 150

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