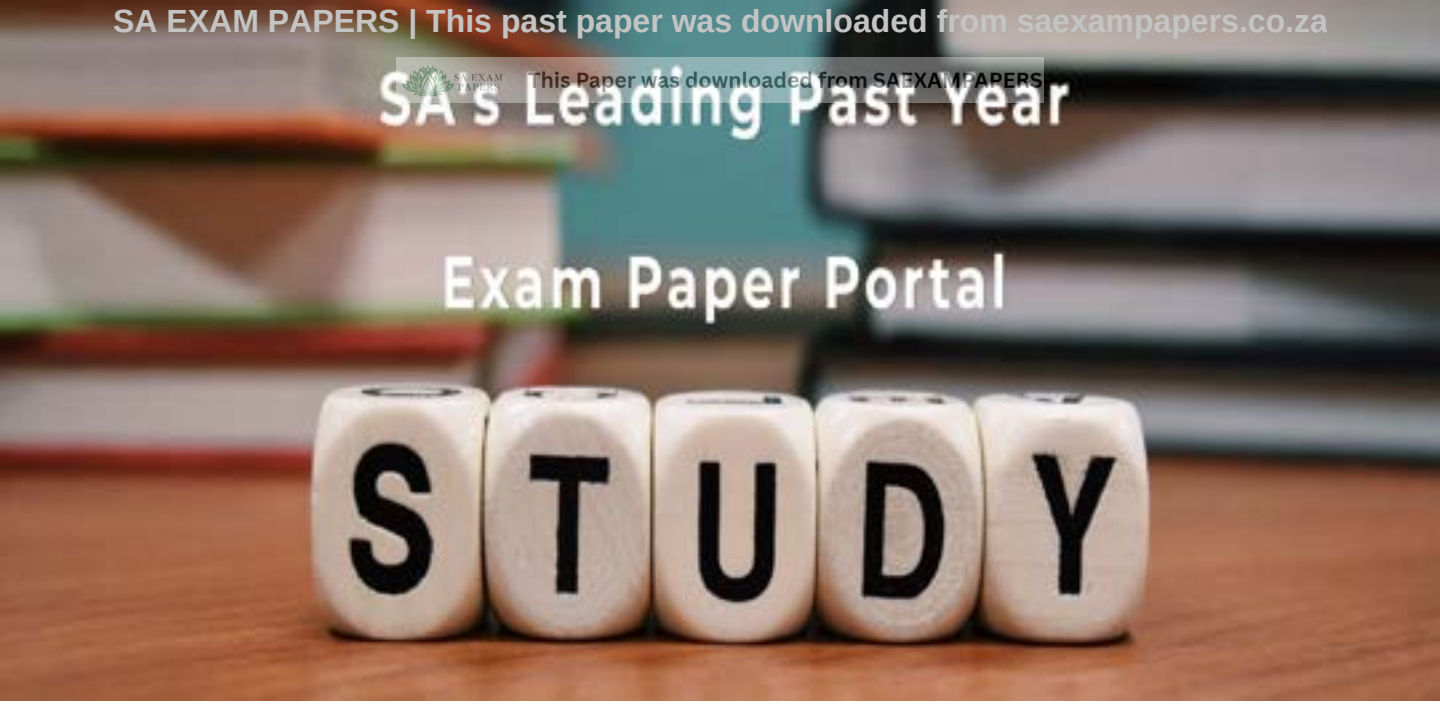


KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES P1 (PHYSICS)

PREPARATORY EXAMINATION

MARKING GUIDELINES

SEPTEMBER 2025

MARKS: 150

These marking guidelines consist of 9 pages.

QUESTION 1

1.1 D✓✓ (2)

1.2 D✓✓ (2)

1.3 B ✓✓ (2)

1.4 D ✓✓ (2)

1.5 A ✓✓ (2)

1.6 C✓✓ (2)

1.7 B✓✓ (2)

1.8 A✓✓ (2)

1.9 A✓✓ (2)

1.10 C✓✓ (2)

[20]

QUESTION 2

2.1

Accept force diagram:

Accepted labels	
F	F_a/applied force/50 N✓
f	(kinetic) friction/F_f/f_k✓
T	F_T /Tension/$F_{tension}$ ✓

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 ⅔

(3)

2.2 When a net force is applied on an object, the object will accelerate in the direction of the force and the acceleration is directly proportional to the force✓ and inversely proportional to the mass of the object.✓ (2)

Accept Newton's second law in terms of momentum

2.3.1 $f_k = \mu_k N$✓

$= 0,3[(6)(9,8) + (3)(9,8)]$✓

= 26,46 N✓ (3)

2.3.2

POSITIVE MARKING FROM Q 2.3.1
LEFT AS NEGATIVE

Block X
$F_{net} = ma$ ✓
$-F + T + f = ma$
$-50 + T + 26{,}46$ ✓$= -6a$✓.....(1)

Block Y
$F_{net} = ma$
$T = 3a$✓.....(2)

Solving equation (1) and (2):
$-50 + 3a + 26{,}46 = -6a$✓
$a = 2{,}62\ m{\cdot}s^{-2}$ ✓ (6)

POSITIVE MARKING FROM Q 2.3.1
LEFT AS POSITIVE

Block X
$F_{net} = ma$ ✓
$F - T - f = ma$
$50 - T - 26{,}46$ ✓$= 6a$✓.....(1)

Block Y
$F_{net} = ma$
$T = -3a$ ✓ ..... (2)

Solving equation (1) and (2):
$+50 - 3a - 26{,}46 = +6a$✓
$a = 2{,}62\ m{\cdot}s^{-2}$ ✓

2.4.1 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)

If charges are mentioned $\frac{0}{2}$

2.4.2

OPTION 1
$F_{planet\ M} = \frac{1}{2}F_{Earth}$ ✓
$\frac{G(2M_E)(m)}{x^2}$ ✓$= \frac{\frac{1}{2}G(M_E)(m)}{R^2}$ ✓
$x = 2R$✓

OPTION 2
$g_{planet\ M} = \frac{1}{2}g_{Earth}$ ✓
$\frac{G(2M_E)}{x^2}$ ✓$= \frac{\frac{1}{2}G(M_E)}{R^2}$ ✓
$x = 2R$✓ (4)

[20]

QUESTION 3

3.1 0,6 m✓ (1)

3.2.1

DOWNWARD AS POSITIVE	DOWNWARD AS NEGATIVE
$v_f^2 = v_i^2 + 2a\Delta y$✓ $= \underline{(1,5)^2 + 2(9,8)(2)}$ ✓ $v_f = 6,44\ m\cdot s^{-1}$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ $= \underline{(-1,5)^2 + 2(-9,8)(-2)}$ ✓ $v_f = 6,44\ m\cdot s^{-1}$ ✓

(3)

3.2.2

OPTION 1 POSITIVE MARKING FROM Q 3.2.1 DOWNWARD AS POSITIVE	OPTION 1 POSITIVE MARKING FROM Q 3.2.1 DOWNARD AS NEGATIVE
$v_f = v_i + a\Delta t$ ✓ $\underline{6,44 = 1,5 + (9,8)\Delta t}$ ✓ $\Delta t = 0,50$ s✓	$v_f = v_i + a\Delta t$ ✓ $\underline{-6,44 = -1,5 + (-9,8)\Delta t}$ ✓ $\Delta t = 0,50$ s✓
OPTION 2 **POSITIVE MARKING FROM Q 3.2.1** **DOWNWARD AS POSITIVE**	**OPTION 2** **POSITIVE MARKING FROM Q 3.2.1** **DOWNWARD AS NEGATIVE**
$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $[2 = \left(\frac{1,5 + 6,44}{2}\right)]$✓ Δt $\Delta t = 0,50$	$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $[-2 = \left(\frac{-1,5 + (-6,44)}{2}\right)]$ ✓ Δt $\Delta t = 0,50$ s ✓
OPTION 3 **DOWNWARD AS POSITIVE**	**OPTION 3** **DOWNWARD AS NEGATIVE**
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$✓ $[2 = 1,5\ \Delta t + \frac{1}{2}(9,8)]$✓$\Delta t^2$ $\Delta t = 0,50$ s ✓	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$✓ $[-2 = -1,5\ \Delta t + \frac{1}{-2}(-9,8)]$✓$\Delta t^2$ $\Delta t = 0,50$ s ✓

(3)

3.2.3

OPTION 1 DOWNWARD AS POSITIVE	OPTION 1 DOWNWARD AS NEGATIVE
$v_f^2 = v_i^2 + 2a\Delta y$ ✓ 0^2✓ $= v_i^2 + 2(9,8)(-0,8)$ ✓ $v_i = \underline{3,96\ m\cdot s^{-1}, \text{upwards}}$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓ 0^2✓ $= v_i^2 + 2(-9,8)(0,8)$ ✓ $v_i = \underline{3,96\ m\cdot s^{-1}, \text{upwards}}$ ✓

(4)

3.3 **POSITIVE MARKING FROM QUESTION 3.2.1 & QUESTION 3.2.3**

$F_{net}\ \Delta t = m(v_f - v_i)$ ✓

$F_{net}(0,2)$ ✓ $= 0,5(3,96 - (-6,44))$ ✓

$F_{net} = \underline{26\ N, \text{upwards}}$ ✓

(4)

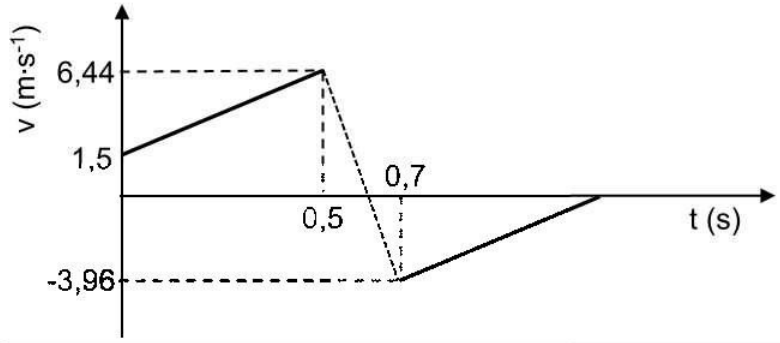
3.4

POSITIVE MARKING FROM QUESTION 3.1 TO QUESTION 3.3

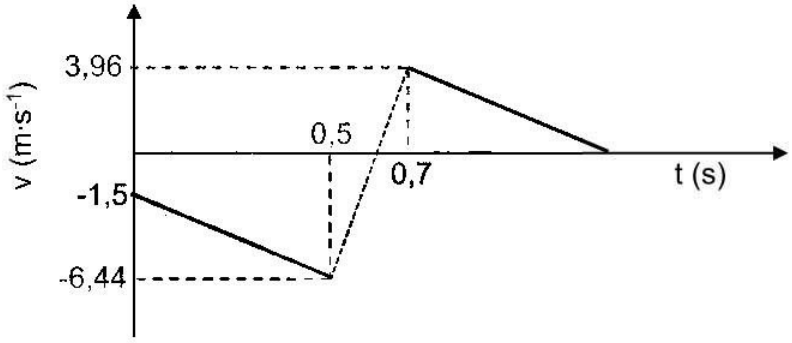
Criteria

- First part of starts at v = 1,5 m·s^{-1} and ends at 6,44 m·s^{-1} ✓
- Second part starts at v = 3,96 m·s^{-1} until v= 0 m·s^{-1} ✓
- Shape (parallel lines) ✓
- Both axes labelled ✓

DOWNWARD AS POSITIVE



DOWNWARD AS NEGATIVE



(4)
[19]

QUESTION 4

4.1 East✓ (1)

4.2 Newton's Third Law (of Motion) ✓
(Mark independently)
When object A exerts a force on object B, object B simultaneously exerts an oppositely directed force of equal magnitude on object A. ✓ ✓ (3)

4.3

OPTION 1 **TO THE LEFT AS POSITIVE**	**OPTION 1** **TO THE LEFT AS NEGATIVE**
$\sum p_i = \sum p_f$ $m_t v_{it} = m_1 v_{f1} + m_2 v_{f2}$ } ✓Any one $0✓ = \underline{60 v_{f1} + (4)(3)}$ ✓ $v_f = -0,20$ $\therefore v_f = 0,20\ m{\cdot}s^{-1}$ ✓	$\sum p_i = \sum p_f$ $m_t v_{it} = m_1 v_{f1} + m_2 v_{f2}$ } ✓Any one $0✓ = \underline{60 v_{f1} + (4)(-3)}$ ✓ $v_f = 0,20\ m{\cdot}s^{-1}$ ✓
OPTION 2 $\Delta p_{boy} = -\Delta p_{object}$ $m_b(v_{bf} - v_{bi}) = -m_o(v_{of} - v_{oi})$ } ✓ Any one $60(v_{bf} - 0)✓ = -4(3-0)✓$ $v_{bf} = -0,20$ $\therefore v_{bf} = 0,20\ m{\cdot}s^{-1}$ ✓	

(4)

4.4.1 Increases ✓ (1)

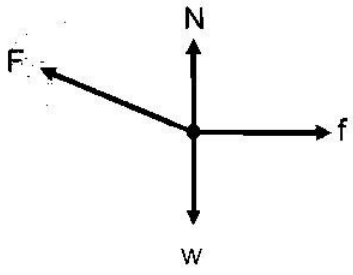
4.4.2 Increases ✓ (1)

4.4.3 Δp_{object} increases✓, which causes Δp_{boy} to increase✓ (2)

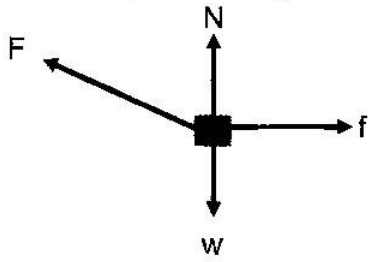
[12]

QUESTION 5

5.1



Accept force diagram:



Accepted labels	
w	F_g/ F_w/ weight/588 N/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)

5.2 Work done on an object by a constant force F is F Δx cos θ , where F is the magnitude of the force, Δx the magnitude of the displacement and θ the angle between the force and the displacement. ✓✓

OR

The work done on an object is the product of the force and the displacement of the object in the direction of the displacement. ✓✓

(2)

5.3

OPTION 1

$W_{net} = \Delta K$
$W_F + W_f = ½m(v_f^2 - v_i^2)$ } ✓ Any one
$(80)(2)\cos\Theta + (8)(2)\cos180^\circ$ ✓$= [½(7)(1,5^2 - 0^2)]$ ✓
$\Theta = 81,42^\circ$✓

OPTION 2

$W_{nc} = \Delta K + \Delta U$
$W_F + W_f = ½m(v_f^2 - v_i^2) + mg(h_f - h_i)$ } ✓ Any one
$(80)(2)\cos\Theta + (8)(2)\cos180^\circ$ ✓$= [½(7)(1,5^2 - 0^2) + 0]$ ✓
$\Theta = 81,42^\circ$✓

(4)

5.4 Increases✓✓ (2)

[12]

QUESTION 6

6.1 Frequency✓ (1)

6.2 The sound source (bat) and the listener (bird watcher) have different velocities relative to the medium of sound propagation. ✓✓ (2)

6.3 0,4 m✓ (1)

6.4.1 $v = f \times \lambda$✓

$340 = f \times 0,4$✓

$f = 850$ Hz✓ (3)

6.4.2 **POSITIVE MARKING FROM QUESTION 6.4.1**

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

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

✓ Any one

850✓ $= \frac{340}{340 + v_s}$ ✓(875) ✓

$v_s = 10$ m·s^{-1} (away from the batwatcher) ✓ (5)

[12]

QUESTION 7

7.1 $Q = \frac{Q_1 + Q_2}{2}$

$= \frac{(9\times10^{-6}) + (-5\times10^{-6})}{2}$ ✓

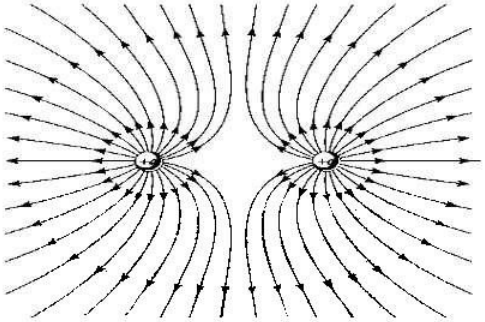
$= 2\times10^{-6}$ C ✓

Accept $Q = \frac{(9\mu C) + (-5\mu C)}{2}$ ✓

$= 2\mu C$ ✓ (2)

7.2

Criteria for sketch	Marks
Correct direction of field lines	✓
Shape of electric field	✓
Field lines not crossing each other / Field lines start from sphere / No field lines inside the spheres	✓



(3)

7.3

$F_{RT} = \frac{kQ_1Q_2}{r^2}$ ✓

$= \frac{(9\times10^{9})(2\times10^{-6})(1\times10^{-6})}{(0,1)^2}$ ✓

= 1,8 N to the right

$F_{ST} = \frac{(9\times10^{9})(2\times10^{-6})(1\times10^{-6})}{(0,2)^2}$ ✓

= 0,45 N to the left

F_{net} = 1,8 + (-0,45) ✓

= 1,35 N to the right ✓ (5)

7.4 Electrostatic force experienced per unit positive charge placed (at that point). ✓✓ (2)

7.5 **POSITIVE MARKING FROM QUESTION 7.3**

OPTION 1

$E = \frac{F}{q}$ ✓

$= \frac{1,35}{1\times10^{-6}}$ ✓

= $1,35\times10^{6}$ N·C^{-1} to the right ✓ (3)

OPTION 2

$E = \frac{kQ}{r^2}$

$E_1 = \frac{(9,0 \times 10^{9})(2 \times 10^{-6})}{(0,1)^2}$

= 1,80 x 10^{6} N·C^{-1} to the right ✓

$E_2 = \frac{(9,0 \times 10^{9})(2 \times 10^{-6})}{(0,2)^2}$

= *4,50 x 10^{5}* N·C^{-1} to the left ✓

E_{net} = 1,80 x 10^{6} N – *4,50 x 10^{5}*

= $1,35\times10^{6}$ N·C^{-1} to the right ✓ (3)

[15]

QUESTION 8

8.1 12 V✓ (1)

8.2.1
$$I = \frac{V}{R} \checkmark$$
$$= \frac{6}{8} \checkmark$$
$$= 0{,}75\text{A} \checkmark$$
(3)

8.2.2

OPTION 1	OPTION 2
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ $= \frac{1}{14} + \frac{1}{12}$ ✓ $R_p = 6{,}46\ \Omega$ ✓	$R_p = \frac{R_1 \times R_2}{R_1 + R_2}$ ✓ $= \frac{14 \times 12}{14 + 12}$ ✓ $= 6{,}45\ \Omega$ ✓

(3)

8.2.3 **POSITIVE MARKING FROM QUESTION 8.1 & 8.2.2**

$\varepsilon = I(R+r)$ ✓

12✓ $= \underline{0{,}75(6{,}46 + 18 + r)}$ ✓

$r = 1{,}54\ \Omega$✓

(4)

8.2.4

OPTION 1 POSITIVE MARKING FROM QUESTION 8.2.1 & 8.2.2	OPTION 2 POSITIVE MARKING FROM QUESTION 8.2.1
$V_{//} = IR$ $= (0.75)(6{,}46)$ ✓ $= 4{,}845$ V $I_{12\Omega} = \frac{V}{R}$ ✓ $= \frac{4{,}845}{12}$ ✓ $= 0{,}404$ A✓	$V_{lost} = Ir$ $= (0{,}75)(1{,}54)$ $= 1{,}155$ V $V_{12\Omega} = \underline{12 - 1{,}155 - 6}$✓ $= 4{,}845$ V $I_{12\Omega} = \frac{V}{R}$ ✓ $I_{12\Omega} = \frac{4{,}845}{12}$ ✓ $= 0{,}404$ A ✓

(4)

8.3 $\text{Cost} = P \times \Delta t \times \text{tariff}$

$= 3{,}5$ ✓ $\times \frac{50}{60}$ ✓ $\times\ 2{,}65$ ✓

$= \text{R}7{,}73$ ✓

(4)

[19]

QUESTION 9

9.1 Split ring (commutator) ✓ **Accept: Commutator** (1)

9.2 Anticlockwise ✓✓ (2)

9.3 Electrical to mechanical✓ (1)

9.4.1
$$V_{rms} = \frac{V_{max}}{\sqrt{2}} \checkmark$$
$$= \frac{311}{\sqrt{2}} \checkmark$$
$$= 220\ V \checkmark$$
(3)

9.4.2

POSITIVE MARKING FROM QUESTION 9.4.1

$$P_{ave} = \frac{V_{rms}^2}{R}$$
$$= \frac{220^2}{30} \checkmark$$
$$= 1\ 613,33\ W$$

OPTION 1

$P_{ave} = I_{rms}V_{rms}$ ✓
$1\ 613,33 = I_{rms}(220)$ ✓
$I_{rms} = 7,33\ A$ ✓

OPTION 2

$P_{ave} = I^2_{rms}R$ ✓
$1\ 613,33 = I^2_{rms}(30)$ ✓
$I_{rms} = 7,33\ A$ ✓

OPTION 3

$$R = \frac{V_{rms}}{I_{rms}} \checkmark$$
$$30 \checkmark = \frac{220}{I_{rms}} \checkmark$$
$$I_{rms} = 7,33\ A \checkmark$$
(4)

[11]

QUESTION 10

10.1 Minimum frequency of light needed to emit electrons from a certain metal surface. ✓✓ (2)

10.2 $7,2\times 10^{14}$ Hz✓✓ (2)

10.3 **OPTION 1**
POSITIVE MARKING FROM QUESTION 10.2
$E_{k(max)} = hf - hf_o$ ✓
$X = (6,63\times 10^{-34})(1\times 10^{15})$✓$- (6,63\times 10^{-34})(7,2\times 10^{14})$✓
$= 1,86\times 10^{-19}$ J ✓ (4)

OPTION 2

$$\text{Gradient} = \frac{Ek(max)2 - Ek(max)1}{f_2 - f_1}$$ ✓✓

$$6,63 \times 10^{-34} = \frac{X - 0}{10 \times 10^{14} - 7,2 \times 10^{14}}$$ ✓

$x = 1,86\times 10^{-19}$ J ✓ (4)

10.4 Remains the same✓

Intensity does not affect kinetic energy of the photons✓
OR
Only frequency affects $E_{k(max)}$
OR
The frequency remains the same. (2)

[10]

TOTAL: 150