education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES P1 (PHYSICS)

MARKING GUIDELINE

HALF - YEARLY EXAMINATIONS

JUNE 2020

SECTION A

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

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

[20]

SECTION B

QUESTION 2

2.1.1 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. ✓✓

OR

The resultant/net force acting on an object is equal to the rate of change of momentum of the object in the direction of the resultant/net force. ✓✓ (2)

2.1.2 Kinetic (friction) ✓ (1)

2.1.3 $f_3 = \mu N$ ✓
$= \mu mg$
$= (0,1)(3)(9,8)$ ✓
$= 2,94$ N (2)

2.1.4 **OPTION 1**
Right: Positive

Trailer: $F_{net} = ma$ ✓
$T + f_3 = ma$
$\underline{T - 2,94}$ ✓ $= 3a$

Car: $F_{net} = ma$ ✓
$F + f_5 + T = ma$
$\underline{40 - 4,9 - T}$ ✓ $= 5a$
$a = 4,02\ m \cdot s^{-2}$ ✓

OPTION 2
Right: Negative

Trailer: $F_{net} = ma$ ✓
$T + f_3 = ma$
$-T + 2,94$✓ $= -3a$

Car: $F_{net} = ma$ ✓
$F + f_5 + T = ma$
$\underline{-40 + 4,9 + T}$✓ $= -5a$
$a = 4,02\ m \cdot s^{-2}$✓

OPTION 3
Right Positve

SYSTEM METHOD
$F_{net} = ma$ ✓
$F + f_5 + f_3 = ma$
$40 - 4,9 - 2,94 = 8a$ ✓
$a = 4,02\ m \cdot s^{-2}$ ✓

Max:3/5

(5)

2.1.5 **POSITIVE MARKING FROM 2.1.4**

OPTION 1 (Car)
Right Positve

$F_{net} = ma$
$F + f_5 + F_T = ma$
$\underline{40 + (-4,9) + F_T = 5(4,02)}$ ✓
$F_T = -15$ N
$F_T = 15$ N✓; left ✓

OPTION 1 (Car)
Right Positve

$F_{net} = ma$
$F + f_5 + F_T = ma$
$\underline{-40 + 4,9 + F_T = 5(-4,02)}$ ✓
$F_T = 15$ N
$F_T = 15$ N✓; left ✓

OPTION 3 (Trailer)
Right Positve

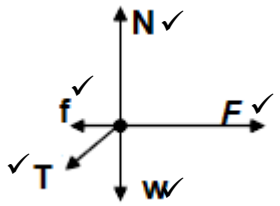
$F_{net} = ma$
$f_3 + F_T = ma$
$\underline{-2,94 + F_T = 3(4,02)}$ ✓
$F_T = 15$ N
F_T on car = 15 N✓; left ✓

OPTION 4 (Trailer)
Right Negative

$F_{net} = ma$
$f_3 + F_T = ma$
$\underline{2,94 - F_T = 3(-4,02)}$ ✓
$F_T = 15$ N
F_T on car = 15 N✓; left ✓

(3)

2.1.6



	Acceptable Symbols
N	F_{Normal}, F_N
T	Tension, F_T, $F_{tension}$
f	F_f,f_k, $F_{friction}$
w	F_g, $F_{gravity}$
F	F_{app}

(5)

2.1.7 Less than✓✓ (2)

2.1.8 Greater than✓✓ (2)

2.2 $g \equiv G\frac{M}{r^2}$ ✓

$g = 6{,}67 \times 10^{-11}\frac{6{,}39 \times 10^{23}}{(3{,}39 \times 10^{6})^2}$ ✓✓

$g = 3{,}71\ m \cdot s^{-2}$ ✓ (4)

[25]

QUESTION 3

3.1 The total linear momentum of a closed system remains constant (is conserved). ✓✓ (2)

3.2

OPTION 1
Right Positive

$\Sigma p_f = \Sigma p_i$ ✓

$m_1v_1 + m_2v_2 = (m_1+m_2)v$

$60v_f + 2(4)$ ✓ $= 62(1{,}5)$ ✓

$v_f = 1{,}42\ m \cdot s^{-1}$

$v_f = 1{,}42\ m \cdot s^{-1}$✓; forward / to the right ✓

OPTION 1
Right Negative

$\Sigma p_f = \Sigma p_i$ ✓

$m_1v_1 + m_2v_2 = (m_1+m_2)v$

$60v_f + 2(-4)$ ✓ $= 62(-1{,}5)$ ✓

$v_f = -1{,}42\ m \cdot s^{-1}$

$v_f = 1{,}42\ m \cdot s^{-1}$✓; forward / to the right ✓

OPTION 3

Right Positive

$\Delta p_1 = -\Delta p_2$

$m_1\Delta v_1 = -m_2\Delta v_2$ ✓

$60(v_f - 1,5)$ ✓ $= -2(4 - 1,5)$ ✓

$v_f = 1,42\ m\cdot s^{-1}$

$v_f = 1,42\ m\cdot s^{-1}$✓; forward / to the right ✓

OPTION 3

Right Negative

$\Delta p_1 = -\Delta p_2$

$m_1\Delta v_1 = -m_2\Delta v_2$ ✓

$60[v_f - (-1,5)]$ ✓ $= -2[-4 - (-1,5)]$ ✓

$v_f = -1,42\ m\cdot s^{-1}$

$v_f = 1,42\ m\cdot s^{-1}$✓; forward / to the right ✓

(5)

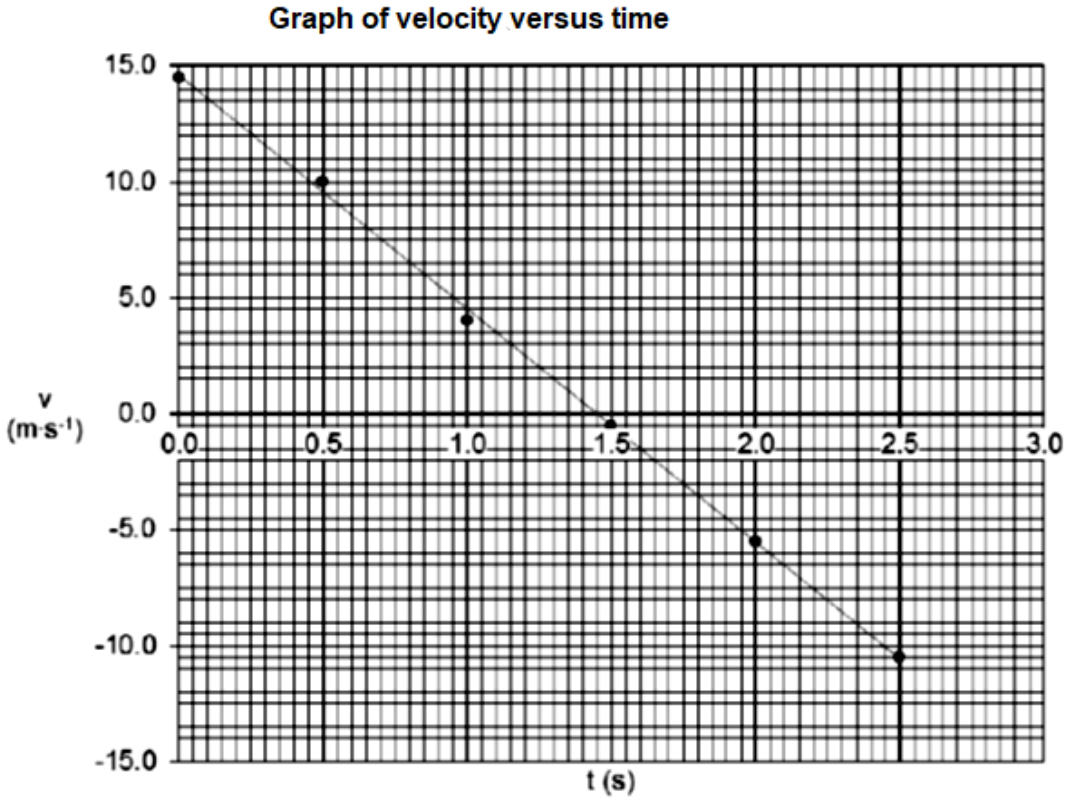
3.3.1 Greater than ✓ (1)

3.3.2 Greater than ✓ (1)

[9]

QUESTION 4

4.1.1



Marking criteria

- Any first point plotted correctly✓
- Any second point plotted correctly✓
- Any third and fourth points plotted correctly ✓
- Any fifth and six points plotted correctly✓
- Best-fit line drawn✓ (5)

4.1.2 **Positive marking from 4.1.1**

For triangle+rectangle	**For trapezium**
$\Delta y = \frac{1}{2}bh + \ell \times w$ ✓ (or similar)	$\Delta y = \frac{1}{2}(\Sigma_{//})\Delta t$ ✓ (or similar)
$= \underline{\frac{1}{2}(1)(-10)}$ ✓ + $\underline{(1)(-0,5)}$ ✓	$= \underline{\frac{1}{2}[-0,5 + (-10,5)]}$ ✓ x $\underline{(1)}$ ✓
= -5,5 m	= -5,5 m
Δy = 5,5 m✓; downwards ✓	Δy = 5,5 m✓; downwards ✓

(5)

4.1.3 When the only force acting on it is the force of gravity. ✓ (1)

4.2.1 **OPTION 1**
UPWARDS: POSITIVE

$V_f^2 = v_i^2 + 2a\Delta y$ ✓

0^2 ✓$= 40^2 + 2(-9,8)\Delta y$✓

$\Delta y = 81,6327$ m

Height = 81,63 +✓ 15

= 96,63 m ✓

OPTION 2
UPWARDS: NEGATIVE

$V_f^2 = v_i^2 + 2a\Delta y$ ✓

0^2 ✓$= -40^2 + 2(9,8)\Delta y$✓

$\Delta y = -81,6327$ m

Height = 81,63 +✓ 15

= 96,63 m ✓

(5)

4.2.2 **OPTION 1**
UPWARDS: POSITIVE

$v_f = v_i + a\Delta t$ ✓

$0 = 40 + (-9,8)\Delta t$ ✓

$\Delta t = 4,08$ s ✓

OPTION 2
UPWARDS: NEGATIVE

$v_f = v_i + a\Delta t$ ✓

$0 = -40 + (9,8)\Delta t$ ✓

$\Delta t = 4,08$ s ✓

(3)

POSITIVE MARKING FROM 4.2.1

OPTION 3
UPWARDS: POSITIVE

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓

$81,63 = 40\Delta t + \frac{1}{2}(-9,8)\Delta t^2$ ✓

$\Delta t = 4,08$ s ✓

OPTION 4
UPWARDS: NEGATIVE

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓

$-81,63 = -40\Delta t + \frac{1}{2}(9,8)\Delta t^2$ ✓

$\Delta t = 4,08$ s ✓

OPTION 5
UPWARDS: POSITIVE

$\Delta y = (\frac{v_i+v_f}{2})\Delta t$✓

$81,63 = (\frac{40+0}{2})\Delta t$✓

$\Delta t = 4,08$ s ✓

OPTION 6
UPWARDS: NEGATIVE

$\Delta y = (\frac{v_i+v_f}{2})\Delta t$✓

$-81,63 = (\frac{-40+0}{2})\Delta t$✓

$\Delta t = 4,08$ s ✓

4.2.3 **OPTION 1**
UPWARDS: POSITIVE

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$

-15✓ = +40Δt✓ + ½(-9,8)Δt^2✓

OPTION 2
UPWARDS: NEGATIVE

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$

15✓ = - 40Δt✓ + ½(9,8)Δt^2✓

(3)

[22]

QUESTION 5

5.1.1 A non-conservative force is a force for which the work done in moving an object between two points depends on the path taken. ✓✓ (2)

5.1.2

$W_{net} = \Delta K$ ✓

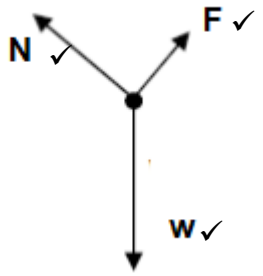
$W_{app} + W_w = K_f - K_i$

425 ✓$+ (0,20)(9,8)(29)(\cos 180°)$✓ $= ½(0,20)(v_p^2 - 0)$ ✓

$vp = 60,68\ m \cdot s^{-1}$ ✓

(5)

5.2.1



	Acceptable Symbols
N	F_N, F_{Normal}
w	F_g, $F_{gravity}$
F	F_{app}

(3)

5.2.2 The net/total work done on an object is equal to the change in the object's kinetic energy. ✓✓

OR

The work done on an object by a resultant/net force is equal to the change in the object's kinetic energy. ✓✓

(2)

5.2.3 No ✓

Weight is not the only force doing work on the crate. ✓

(2)

5.2.4 N is perpendicular to displacement. ✓ (1)

5.2.5 **OPTION 1**

$W_{net} = \Delta K$

$W_F + W_N + W_w = K_f - K_i$ ✓

F(3,5)cos0°+ 0✓ + [25x9,8x3,5sin30° ✓x cos180°] ✓= ½x25x[10,8^2- (12^2] ✓

F = 24,79 N✓

(6)

[21]

QUESTION 6

6.1 Speed ✓ (1)

6.2 3 ✓ (m•s^{-1}) (1)

6.3.1 It is the change in frequency (or pitch) of the sound detected by a listener because the sound source and the listener have different velocities *of* propagation✓✓ (2)

6.3.2 345 ✓ (m•s^{-1}) (1)

6.3.3 **POSITIVE MARKING FROM 6.3.2**

$f_L = \frac{v+v_L}{v-v_S} f_S$✓

$f_L = (\frac{345+0✓}{345-57,5✓})(1000)$✓

f_L = 1200 Hz✓ (5)

6.3.4 295 ✓ (K) Accept: The same temperature (1)

6.4.1 (Diagram) 3 ✓ (1)

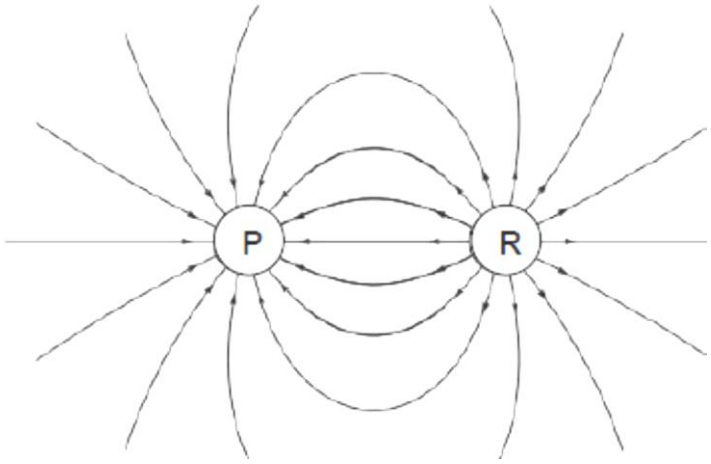
6.4.2 1 ✓
The source is stationary.✓ (2)

[14]

QUESTION 7

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

7.2

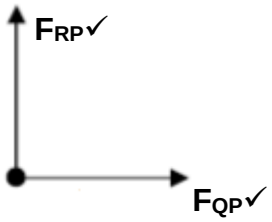


Marking criteria
Pattern ✓
Direction ✓
Field lines must touch charges at 90°. ✓

(3)

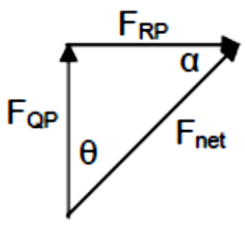
7.3 The magnitude of the electrostatic forces exerted by two point charges on each other is directly proportional to the product of the magnitudes of the charges and inversely proportional to the square of the distance between them. ✓✓ (2)

7.4



(2)

7.5 $F = k\frac{q_1 q_2}{r^2}$✓



$F_{QP} = 9 \times 10^9 \frac{45\times10^{-6}\times20\times10^{-6}}{(0{,}09)^2}$✓ = 1 x 10^3 N

$F_{RP} = 9 \times 10^9 \frac{30\times10^{-6}\times20\times10^{-6}}{(0{,}07)^2}$✓ = 1,102 x 10^3 N

$F_{net}^{\ 2} = F_{RP}^{\ 2} + F_{QP}^{\ 2}$ ✓

$= (1{,}102 \times 10^3)^2 + (1 \times 10^3)^2$ ✓

F_{net} = 1,49 x 10^3 N ✓

$\theta = \tan^{-1}(1{,}102 \times 10^3/1 \times 10^3)$ ✓
= 47,78° ✓

If α is used:
$\alpha = \tan^{-1}(1 \times 10^3/1{,}102 \times 10^3)$ ✓
= 42,22° ✓

Accept correct trigonometry if F_{net} and F_{QP} or F_{net} and F_{RP} are used.

(8)

[17]

QUESTION 8

8.1 The battery can supply a maximum of 12 J of (electrical) energy to every 1 C of charge. ✓✓ (2)

8.2 The potential difference across a conductor is directly proportional to the current in the conductor at constant temperature. ✓✓ (2)

8.3

OPTION 1	**OPTION 2**	
P = I^2R ✓ 5 = I^2(5) ✓ I = 1 A✓	$P = \frac{V^2}{R}$ $5 = \frac{V^2}{5}$ V = 5 V	
	P = VI ✓ 5 = 5 I✓ I = 1 A ✓	V = IR✓ 5 = I. 5✓ I = 1A✓

(3)

8.4 _____

OPTION 1	**OPTION 2**

$V = I \times R_{bulb}$ ✓
$V = 1 \times 5$ ✓
$V = 5$ V
$V_{//} = 12 - 5 = 7$ V
$V_{//} = I \times R_{(3+11)}$
 	
7 ✓$= I \times 14$ ✓
 	
I = 0,5 A
$I_{AB} = 1 - 0,5 = 0,5$ A
$R_{AB} = \frac{V_{//}}{I}$
$R_{AB} = \frac{7✓}{0,5✓}$
 	
$R_{AB} = 14\ \Omega$
 	
$R_Y = 14 - 4 = 10\ \Omega$ ✓
	$E = I(R + r)$ ✓
	$12 = 1(R + 0)$ ✓
	$R = 12\ \Omega$
	$R_T = R_{Bulb} + R_{//}$
	12✓ = 5✓ + $R_{//}$
	$R_{//} = 7\ \Omega$
	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$
	
	$\frac{1}{R//} = \frac{1}{R_{3+11}} + \frac{1}{R_{AB}}$
	
	$\frac{1}{7}✓ = \frac{1}{14}✓ + \frac{1}{R_{AB}}$
	$R_{AB} = 14\ \Omega$
	
	$R_Y = 14 - 4 = 10\ \Omega$ ✓

(7)

8.5 Cost = energy used x tariff per kWh
= Pt x tariff per kWh

$Cost = (\frac{5}{1000})(\frac{1400}{6})✓(180)✓$

Cost =R0,21 ✓

(3)

8.6.1 No ✓

- Total resistance increases. ✓
- Current through bulb/main current decreases. ✓
- According to $P = I^2R$ power decreases. ✓

(4)

8.6.2 Greater than ✓ (1)

[22]

[150]