higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE
(First paper)
NQF LEVEL 4

11 March 2020

This marking guideline consists of 8 pages.

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SECTION A

QUESTION 1

1.1 Impulse
1.2 Capacitor
1.3 Photon
1.4 Resistance
1.5 Fixed pulley

(5 × 1) **[5]**

QUESTION 2

2.1 F
2.2 J
2.3 E
2.4 I
2.5 H

(5 × 1) **[5]**

QUESTION 3

3.1 True
3.2 True
3.3 False
3.4 True
3.5 True

(5 × 2) **[10]**

QUESTION 4

4.1 C
4.2 B
4.3 C
4.4 A
4.5 D

(5 × 3) **[15]**

TOTAL SECTION A: 35

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SECTION B

QUESTION 5

5.1 $15 \times 10^{-3}\ dm^3$✓ OR $0,015\ dm^3$ (1)

5.2 $18 \times 10^3\ V$ ✓ OR 18 000 V (1)

5.3 $250\ pF = 250 \times 10^{-12}\ F$✓ OR $2,5 \times 10^{-10}\ F$ (1)
[3]

QUESTION 6

6.1 $0\ m \cdot s^{-1}$ (1)

6.2 $v_f = v_i + a\Delta t$✓
$v_f = 16 + (-9,8)(5)$ ✓
$v_f = -33\ m \cdot s^{-1}$ OR $v_f = 33\ m \cdot s^{-1}$✓ (3)

POSITIVE MARKING FROM 6.1 TO 6.2

6.3 $v_f^2 = v_i^2 + 2a\Delta y$✓
$(-33)^2 = (16)^2 + 2(-9,8)\Delta y$✓
$\Delta y = -42,5\ m$
A = 42,5 m✓ (3)

6.4 $v_f^2 = v_i^2 + 2a\Delta y$✓
$(0)^2$ ✓$= v_i^2 + 2(-9,8)(8)$. where $\Delta y = 42,5 - 34,5 = 8\ m$ ✓
$v_i = 12,52\ m \cdot s^{-1}$✓

$$F_{net} = \frac{mv_f - mv_i}{\Delta t}$$ ✓

$$F_{net} = \frac{(0,1)(12,52) - (0,1)(-33)}{0,08}$$ ✓

$$F_{net} = 56,9N$$ ✓ (7)

6.5 No (1)
[15]

QUESTION 7

7.1 In the absence of dissipative forces, the total mechanical energy of a closed system remains constant. (2)

POSITIVE MARKING FROM 7.2 TO 7.3

7.2

$E_{mech\ (TOP)}$	$= E_{mech\ (TOP)}$
$(E_k + E_p)_{TOP}$	$= (E_k + E_p)_{BOTTOM}$
$\frac{1}{2}mv^2_{TOP} + mgh_{TOP}$	$= \frac{1}{2}mv^2_{BOTTOM} + mgh_{BOTTOM}$ ✓
$\frac{1}{2}(0,2)(0)^2 + (0,2)(9,8)(0,149)$ ✓	$= \frac{1}{2}(0,2)(V_i)^2 + (0,2)(9,8)(0)$ ✓
$0,292$	$= 0,1\ V_i^2$
	$V_i = 1,71\ m\cdot s^{-1}$ ✓

(4)

7.3

$m_1v_{1i} + m_2v_{2i}$	$= m_1v_{1f} + m_2v_{2f}$ ✓
$(0,018)v_{1i} + (0,182)(0)$ ✓	$= (0,018 + 0,182)(1,71)$ ✓
V_{1i}	$= 19\ m\cdot s^{-1}$ ✓

(4)

7.4 Increases (1)
[11]

QUESTION 8

POSITIVE MARKING FROM 8.1 TO 8.2

8.1

$E_k = \frac{1}{2}\ mv^2$ ✓
$= 0,5(3\ 000)(25)^2$ ✓
$= 937\ 500$ J or $9,375 \times 10^5$ ✓

(3)

8.2

W_{net}	$= F_{net} \cdot \Delta x \cdot \cos\theta$ ✓
	$= 7\ 000\ \Delta x\ \cos 180^o$
	$= 7\ 000\ \Delta x\ (-1)$
	$= -7\ 000\ \Delta x$ ✓
ΔE_k	$= W_{net}$
$0 - 9,375 \times 10^5$	$= -7\ 000\ \Delta x$ ✓
$\Delta x \cdot$	$= 133,9$ m ✓ therefore the taxi <u>will not</u> stop in time ✓

(5)
[8]

QUESTION 9

9.1 9.1.1 Clockwise (2)

9.1.2 Speed ratio = $\frac{driverteeth}{driventeeth}$ ✓
= $\frac{\mathbf{90}}{\mathbf{54}}$ ✓
= 1.7✓ (3)

9.1.3 Faster (1)

9.2 9.2.1 $AMA = \frac{F_R}{F_E}$ ✓
= $\frac{600}{250}$ ✓
= 2,4✓ (3)

9.2.2 $IMA = \frac{Radiusofwheel}{Radiusofaxle}$ ✓
= $\frac{300}{100}$ ✓
= 3✓ (3)
[12]

QUESTION 10

10.1 10.1.1 The change in observed frequency ✓due to the relative motion of a source and an observer ✓. (2)

10.1.2 Towards (1)

10.1.3
- Higher frequency is due to a lower wavelength
- Lower wavelength is caused by motion towards an observer (2)

10.1.4 $v = f\lambda$ ✓
340 = f (0,4)✓
f = 850 Hz✓ (3)

POSITIVE MARKING FROM 10.4 TO 10.5

10.1.5 $F_L = (\frac{v \pm v_L}{v \mp v_S})F_S$ ✓

✓ $870 = (\frac{340}{340 - x})850$ ✓

Speed of patrol car (x) = 7,8 m·s^{-1}✓ (4)

10.1.6 Meteorology/Radar/position of flaws in metals and wooden poles/ Medical examination (e.g. flow of blood) (Any 2 × 1) (2)

10.2 10.2.1 Ultra-violet light; X-rays; Gamma Rays

10.2.2 Infra-red radiation

(2 × 1) (2)
[16]

QUESTION 11

11.1 The release of photoelectrons by certain metals when they are irradiated by light of a suitable frequency (2)

11.2
$W_0 = h f$ ✓
$3,36 \times 10^{-19} = (6,63 \times 10^{-34})f$✓
$f = 5,07 \times 10^{14}$ Hz✓ (3)

11.3 **OPTION 1**

$hf = W_0 + E_k$ ✓
$hf = W_0 + ½ mv^2$
$(6,63 \times 10^{-34}) f$✓ $= 3,36 \times 10^{-19} + ½(9,11 \times 10^{-31})(2,5 \times 10^7)^2$✓
$f = 4,3 \times 10^{17}$ Hz✓

OPTION 2

E_k of electron $= ½ mv^2$
$= ½(9,11 \times 10^{-31})(2,5 \times 10^7)^2$✓
$=2,85 \times 10^{-16}$ J

$hf = W_0 + E_k$ ✓
$(6,63 \times 10^{-34}) f$✓ $= 3,36 \times 10^{-19} + 2,28 \times 10^{-16}$
$f = 4,3 \times 10^{17}$ Hz✓ (4)

11.4 Light behaves like a particle/particle nature of light (1)

11.5 11.5.1 Increases
11.5.2 Remains the same

(2 × 2) (4)
[14]

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QUESTION 12

12.1 V = I R✓
= (1,6)(7)✓
=11,2 V✓ (3)

12.2 P = I^2 R Δt✓
= $(1,6)^2$ (7) (5 × 60)✓
= 5 376 J✓ (3)

12.3 $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓

$\frac{1}{R_p} = \frac{1}{7} + \frac{1}{3+4}$ ✓

R_p = 3,5 Ω✓

EMF = I (R + r)✓
EMF = 1,6 (7 + r)✓
EMF = 3 (3,5 + r)✓

solving for r = 0,5 Ω✓ (7)

12.4 E = 1,6(7 + 0,5)✓
= 12 V✓

OR

E = 3(3,5 + 0,5)✓
= 12 V✓ (2)

12.5 Goes off (1)

12.6
- The bulb is short-circuited
- Current follows the path of zero resistance

(Any 1 × 2) (2)

[18]

QUESTION 13

13.1 13.1.1 South pole (1)

13.1.2 S to R (1)

POSITIVE MARKING FROM 13.2.1 TO 13.2.2

13.2 13.2.1 $I_{RMS} = \frac{I_{MAX}}{\sqrt{2}}$ ✓

$= \frac{10}{\sqrt{2}}$

= 7,07 A✓

V = IR✓
220 = (7,07) R✓
R = 31,12 Ω✓ (5)

13.2.2 **OPTION 1**

$W = I^2 R \Delta t$✓

$= (7,07)^2 (31,12)$✓ (60×60)

$= 5599908,32$ J $= 5,6 \times 10^6$ J✓

OPTION 2

$W = \frac{V^2}{R}\Delta t$ ✓

$= \frac{220^2}{31,12}(60 \times 60)$ ✓

$= 5598971,72$ J $= 5,6 \times 10^6$ J✓

OPTION 3

$W = VI \Delta t$✓

$= (220)(7,07)\ (60 \times 60)$✓

$= 5599440$ J $= 5,6 \times 10^6$ J✓ (3)

[10]

QUESTION 14

14.1 14.1.1

$$C = \frac{Q}{V}\checkmark$$

$$30 \times 10^{-6} = \frac{Q}{6}\checkmark$$

$$Q = 1,8 \times 10^{-4}\ C\checkmark$$ (3)

POSITIVE MARKING FROM 14.1.1 TO 14.1.2

14.1.2 No of excess electrons $= \frac{ch\arg e}{1,6 \times 10^{-19}}$

$= \frac{1,8 \times 10^{-4}}{1,6 \times 10^{-19}}$ ✓

$= 1,125 \times 10^{15} = 1,13 \times 10^{15}$✓ (2)

14.2 14.2.1 Diode (1)

14.2.2 No (1)

14.2.3 The diode is in reverse bias (1)

[8]

TOTAL SECTION B: 115

GRAND TOTAL: 150

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