higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

ENGINEERING PHYSICS N5

23 November 2022

This marking guideline consists of 9 pages.

Copyright reserved

QUESTION 1

1.1 1.1.1 False
1.1.2 True
1.1.3 True
1.1.4 True
1.1.5 True
(5 × 1) (5)

1.2 1.2.1 The volume of a given mass of a gas kept at constant pressure✓ is directly proportional to the absolute temperature.✓ (2)

1.2.2 It is the force of attraction between molecules of a liquid of the same substance.✓ (1)

1.2.3 When the substances are placed next to each other,✓ the movement of their molecules may cause them to form one homogeneous mixture.✓ (2)

1.2.4 The incident light ray, the refracted ray and the normal through the point of incidence✓ on the interface between the two media all lie in the same plane.✓ (2)

1.3 1.3.1 Cd
1.3.2 Watt
1.3.3 m/s
(3 × 1) (3)

1.4 1.4.1 To determine the wavelength of the light
1.4.2 To determine the pole strength of the magnet
1.4.3 To polarise the light
1.4.4 To produce the velocity, frequency and period of the sound
(4 × 1) (4)

1.5 1.5.1
- Flames
- Candles
- Electrical light (Any 1 × 1) (1)

1.5.2 Binocular (1)

1.5.3
- Trumpet
- Recorder
- Motorcar exhaust pipe
- Organ (Any 1 × 1) (1)

1.6 $E = \frac{I}{r^2}$

$I = E \times r^2$

$= 1000 \times (20)^2$✓✓

$= 400\,000$ cd✓ (3)

[25]

QUESTION 2

2.1 2.2.1 D
2.2.2 A
2.2.3 B
2.2.4 E
2.2.5 C

(5 × 1) (5)

2.2
- It may be allowed to pass through.
- It may be totally reflected.
- Light may be both reflected and allowed to pass through. (3)

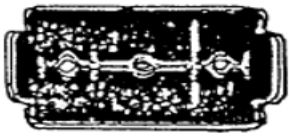
2.3 2.3.1 T = surface tension
r = radius of the tube
ρ = density of the liquid
α = angle of contact between the surface of the liquid and the container (4)

2.3.2 $= \frac{T \times \cos\alpha}{r\rho g}$

$= \frac{3000 \times \cos 20}{0.04 \times 1400 \times 9{,}8}$ ✓✓

$= 5{,}137\ m$✓ (3)

2.4



(TWO marks for correct diagram and ONE mark for label) (3)

2.5 $F = \frac{Gm_1m_2}{r^2}$

$r = \sqrt{\frac{Gm_1m_2}{F}}$

$= \sqrt{\frac{6{,}673 \times 10^{-11} \times 4 \times 4}{2 \times 10^6}}$ ✓✓✓

$r = 2{,}31 \times 10^{-8}\ m^3$✓ (4)

2.6 $B = \frac{\mu_{0 \times I}}{2\pi r}$

$= \frac{4\pi \times 10^{-7} \times 12}{2\pi(0{,}09)}$ ✓

$= 2{,}667 \times 10^{-5} Wb/m^2$ ✓ (3)

[25]

QUESTION 3

3.1 3.1.1

$$\frac{1}{F} = \frac{1}{a} + \frac{1}{b}$$

$$\frac{1}{125} = \frac{1}{250} + \frac{1}{b} \checkmark$$

$$\frac{1}{b} = \frac{1}{250}$$

$$b = 250 \text{ mm} \checkmark$$ (2)

3.1.2
- Image is real
- Image is inverted (2)

3.1.3

$$V = \frac{b}{a}$$

$$= \frac{250}{250} \checkmark$$

$$= 1 \checkmark$$

$$\text{Size of the image} = V \times \text{Size of the object}$$

$$= 1 \times 50$$

$$= 50 \text{ mm} \checkmark$$ (3)

3.2

$$n = \frac{PV}{RT}$$

$$= \frac{1,2 \times 10^5 \times 0,08}{8,314 \times 298} \checkmark$$

$$= 3,875 \text{ moles} \checkmark$$ (2)

3.3 3.3.1

$$R = C_p - C_v$$

$$C_v = C_p - R$$

$$= 279 - 74$$

$$= 205 \frac{J}{Kg}.K \checkmark$$

$$\gamma = \frac{C_p}{C_v}$$

$$= \frac{279}{205}$$

$$\gamma = 1,361 \checkmark$$ (2)

Copyright reserved

3.3.2 $$V = \frac{mRT}{P}$$

$$= \frac{0,44 \times 74 \times 319}{3000}$$ ✓✓

$$= 3,462 \text{ m}^3$$ ✓ (3)

3.3.3 $$P_1 V_1^{\gamma} = P_2 V_2^{\gamma}$$

$$(3 \times 1000)(3,462)^{1,361} = P_2 \times (3,462 \times 3)^{1,361}$$ ✓

$$P_2 = \frac{16260,930}{24,176}$$ ✓

$$P_2 = 672,606 \text{ Pa}$$ ✓ (3)

3.3.4 $$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$T_2 = \frac{672,606 \times 3 \times 3,462 \times 319}{3000 \times 3,462}$$ ✓

$$T_2 = 214,56 \text{ K}$$ ✓ (2)

3.3.5 $$\rho = \frac{m}{V}$$

$$= \frac{0.68}{3 \times 3,462}$$

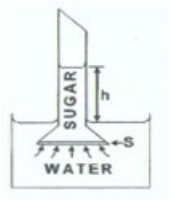
$$= 0,065 \text{ kg/m}^3$$ ✓

$$V = \sqrt{\frac{3 P_2}{\rho}}$$

$$= \sqrt{\frac{3 \times 672,606}{0,065}}$$ ✓

$$= 176,191 \text{ m/s}$$ ✓ (3)

3.4



One mark for correct diagram
One mark each for labelling sugar and water (3)
[25]

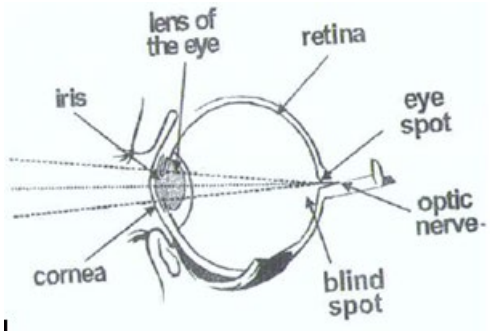
QUESTION 4

4.1 $E_k = \frac{1}{2}mv^2$

$= \frac{1}{2} \times 0{,}04 \times (300)^2$ ✓✓

$= 1800\ J$ ✓ (3)

4.2



(7)

4.3 4.3.1 $\frac{N_p}{N_s} = \frac{V_p}{V_s}$

$V_s = \frac{120 \times 500}{3000}$ ✓

$V_s = 20\ V$ ✓

4.3.2 $\frac{N_p}{N_s} = \frac{I_s}{I_p}$

$I_s = \frac{3 \times 3000}{500}$ ✓

$I_s = 18\ A$ ✓

4.3.3 $\text{Turn ratio} = \frac{N_p}{N_s}$

$= \frac{3000}{500}$ ✓

$= 6$ ✓

$\text{Turn ratio} = 6:1$

(3 × 2) (6)

4.4 $F = BLI \sin\theta$

$= 1{,}17 \times 5 \times 10 \times \sin 90$ ✓

$= 58{,}5\ N$ ✓ (2)

4.5 $$\frac{v}{v_0} = \sqrt{\frac{T}{T_0}}$$

$$v = v_0\sqrt{\frac{T}{T_0}}$$

$$v = 330 \times \sqrt{\frac{301}{273}}\checkmark$$

$$= 315{,}009 \text{ m/s}\checkmark$$

$$\lambda = 2L$$

$$= 2 \times 0{,}55$$

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

$$f_0 = \frac{v}{\lambda}$$

$$= \frac{315{,}009}{1{,}7}\checkmark$$

$$= 185{,}299 \text{ Hz}\checkmark$$

First overtone:

$$f_1 = \frac{v}{\lambda}$$

$$= \frac{315{,}009}{0{,}55}\checkmark$$

$$= 572{,}744 \text{ Hz}\checkmark$$ (7)

[25]

TOTAL: 100

Copyright reserved