



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.

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 | <ul style="list-style-type: none"> • Flames • Candles • Electrical light | (Any 1 × 1) | (1) |
| | 1.5.2 | Binocular | | (1) |
| | 1.5.3 | <ul style="list-style-type: none"> • Trumpet • Recorder • Motorcar exhaust pipe • Organ | (Any 1 × 1) | (1) |
| 1.6 | | $E = \frac{I}{r^2}$ $I = E \times r^2$ $= 1000 \times (20)^2 \checkmark \checkmark$ $= 400\,000 \text{ cd} \checkmark$ | | |
| | | | | (3) |

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

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

$$= 5,137 \text{ m} \checkmark \quad (3)$$

- 2.4 

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

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

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

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

$$r = 2,31 \times 10^{-8} \text{ m}^3 \checkmark \quad (4)$$

2.6
$$B = \frac{\mu_0 \times I}{2\pi r}$$

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

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

QUESTION 3

$$3.1 \quad 3.1.1 \quad \frac{1}{F} = \frac{1}{a} + \frac{1}{b}$$

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

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

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

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

$$3.1.3 \quad V = \frac{b}{a}$$

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

$$= 1 \checkmark$$

Size of the image = $V \times$ Size of the object

$$= 1 \times 50$$

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

$$3.2 \quad n = \frac{PV}{RT}$$

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

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

$$3.3 \quad 3.3.1 \quad R = C_p - C_v$$

$$C_v = C_p - R$$

$$= 279 - 74$$

$$= 205 \frac{\text{J}}{\text{kg}} \cdot \text{K} \checkmark$$

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

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

$$\gamma = 1,361 \checkmark$$

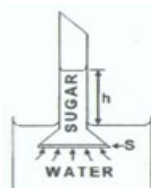
$$\begin{aligned}
 3.3.2 \quad V &= \frac{mRT}{P} \\
 &= \frac{0,44 \times 74 \times 319}{3000} \checkmark \checkmark \\
 &= 3,462 \text{ m}^3 \checkmark
 \end{aligned} \tag{3}$$

$$\begin{aligned}
 3.3.3 \quad P_1 V_1^\gamma &= P_2 V_2^\gamma \\
 (3 \times 1000)(3,462)^{1,361} &= P_2 \times (3,462 \times 3)^{1,361} \checkmark \\
 P_2 &= \frac{16260,930}{24,176} \checkmark \\
 P_2 &= 672,606 \text{ Pa} \checkmark
 \end{aligned} \tag{3}$$

$$\begin{aligned}
 3.3.4 \quad \frac{P_1 V_1}{T_1} &= \frac{P_2 V_2}{T_2} \\
 T_2 &= \frac{672,606 \times 3 \times 3,462 \times 319}{3000 \times 3,462} \checkmark \\
 T_2 &= 214,56 \text{ K} \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 3.3.5 \quad \rho &= \frac{m}{V} \\
 &= \frac{0,68}{3 \times 3,462} \\
 &= 0,065 \text{ kg/m}^3 \checkmark \\
 V &= \sqrt{\frac{3 P_2}{\rho}} \\
 &= \sqrt{\frac{3 \times 672,606}{0,065}} \checkmark \\
 &= 176,191 \text{ m/s} \checkmark
 \end{aligned} \tag{3}$$

3.4



One mark for correct diagram
 One mark each for labelling sugar and water

(3)
[25]

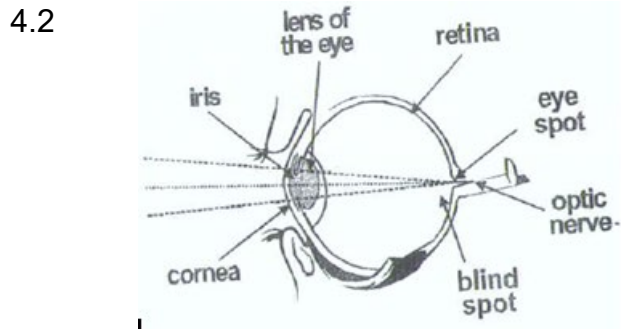
QUESTION 4

4.1

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

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

$$= 1800 \text{ J} \checkmark \quad (3)$$



4.3

4.3.1

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

$$V_s = \frac{120 \times 500}{3000} \checkmark$$

$$V_s = 20 \text{ V} \checkmark$$

4.3.2

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

$$I_s = \frac{3 \times 3000}{500} \checkmark$$

$$I_s = 18 \text{ A} \checkmark$$

4.3.3

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

$$= \frac{3000}{500} \checkmark$$

$$= 6 \checkmark$$

Turn ratio = 6:1

(3 × 2) (6)

4.4

$$F = BLI \sin \theta$$

$$= 1,17 \times 5 \times 10 \times \sin 90 \checkmark$$

$$= 58,5 \text{ N} \checkmark \quad (2)$$

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**