higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

ENGINEERING PHYSICS N5

30 November 2023

This marking guideline consists of 9 pages.

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QUESTION 1

1.1 1.1.1 True
1.1.2 True
1.1.3 False
1.1.4 False
1.1.5 False

(5 × 1) (5)

1.2 1.2.1 It is the force of attraction between the molecules of different substances.

1.2.2 It is the relationship of the speed of light in a specific medium.

(2 × 2) (4)

1.3
- Step-up transformer
- Step-down transformer

(2)

1.4 1.4.1 m/s and scalar
1.4.2 N and vector

(2 × 2) (4)

1.5 1.5.1 Periscope

1.5.2
- Flames
- Electric light
- Candles

(Any 1 × 1)
(2 × 1) (2)

1.6 1.6.1 $\text{Ratio} = \frac{N_p}{N_s}$ or $\text{Ratio} = \frac{N_1}{N_2}$

$= \frac{3600}{800}$ ✓

$= 4 : 1$ ✓

1.6.2 $\frac{N_p}{N_s} = \frac{V_p}{V_s}$ or $\frac{N_1}{N_2} = \frac{V_1}{V_2}$

$N_p \times V_s = V_p \times N_s$ or $N_1 \times V_2 = V_1 \times N_2$

$\frac{V_s}{900} = \frac{220}{3600}$ ✓

$V_s = 55\ V$ ✓

1.6.3 $\frac{N_p}{N_s} = \frac{I_s}{I_p}$ or $\frac{N_1}{N_2} = \frac{I_2}{I_1}$

$N_p \times I_p = N_s \times I_s$ or $N_1 \times I_1 = N_2 \times I_2$

$\frac{I_s}{3600} = \frac{4}{900}$ ✓

$I_s = 16$ A✓

1.6.4 $P = V_1 \times I_1$ or $P = V_p \times I_p$

$= 55 \times 16$✓

$P = 880$ W✓

$P = V_2 \times I_2$ or $P = V_s \times I_s$

$= 220 \times 4$✓

$P = 880$ W✓

(4 × 2) (8)
[25]

QUESTION 2

2.1 2.1.1 $R = C_p - C_v$

$= 385 - 210$

$= 175$ J/Kg. K✓ (1)

2.1.2 $\gamma = \frac{C_p}{C_v}$

$= \frac{385}{210}$

$= 1.833$✓ (1)

2.1.3 $PV = mRT$

$V = \frac{0.8 \times 175 \times 283}{4 \times 1000}$ ✓✓

$V = 9.905$ m^3 ✓ (3)

2.1.4 $P_1V_1^{\gamma} = P_2V_2^{\gamma}$ $V_2 = \frac{1}{3} \times 9.905 = 3.302\ m^3$ m³

$P_2 = (\frac{V_1}{V_2})^{\gamma} P_1$

$= (\frac{9.905}{3.302})^{1.833} \times 4 \times 1000$ ✓✓

$P_2 = 29960.074$ Pa ✓

OR

$P_2 = 299.6$ KPa ✓ (3)

2.1.5 $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$T_2 = \frac{29960.074 \times 3.302 \times 283}{4 \times 1000 \times 9.905}$ ✓

$T_2 = 706.629$ K ✓

Or

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$T_2 = \frac{29.96 \times 3.302 \times 283}{4 \times 9.905}$ ✓

$T_2 = 706.628$ K ✓ (2)

2.2 2.2.1 $B = \frac{\mu_0 \times I}{2r}$

$= \frac{4\pi \times 10^{-7} \times 9}{2\times(0.18)}$✓

$= 3.142 \times 10^{-5}$ Wb/m✓ (2)

2.2.2 $N = 1440 \times 07 = 1008$ turns✓

$B = \frac{\mu_0 \times N I}{L}$

$= \frac{4\pi \times 10^{-7} \times 1008 \times 9}{0.7}$✓

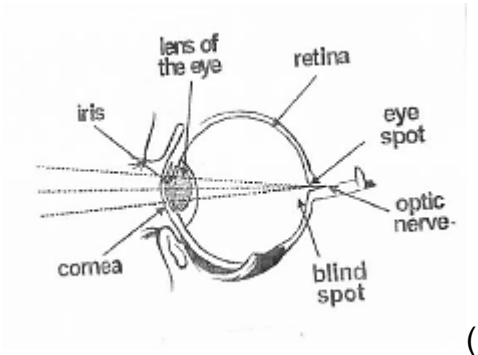
$= 0.016$ Wb/m✓ (3)

2.3 2.3.1 To find the plane of polarisation of polarised rays of light
2.3.2 To produce velocity, frequency and period of the sound

(2 × 1) (2)

2.4
- Tourmaline crystals
- Polaroid plate
- Sugar solution (3)

2.5



(1,5 mark for the correct diagram) (1,5)
(½ mark for each correctly labelled part) (3,5) (5)
[25]

QUESTION 3

3.1 3.1.1

$$v = \frac{\text{height ofthe image}}{\text{height of the object}}$$

$$= \frac{800}{200}$$

$$= 4 \checkmark$$

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

$$4 = \frac{b}{200} \checkmark$$

$$b = -800 \text{ mm} \checkmark$$ (3)

3.1.2

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

$$\frac{1}{f} = \frac{1}{200} - \frac{1}{800} \checkmark$$

$$\frac{1}{f} = \frac{3}{800}$$

$$f = 266.667 \text{ mm} \checkmark$$ (2)

3.2 $$n = \frac{\text{Sin}\ \frac{(A\ +\ D_m)}{2}}{\text{Sin}\ \frac{A}{2}}$$

$$1.3 = \frac{\text{Sin}\ \frac{(20 + D_m)}{2}}{\text{Sin}\ \frac{20}{2}} \checkmark$$

$$1.3 = \frac{\text{Sin}\ \frac{(20 + D_m)}{2}}{0.174}$$

$$\text{Sin}\ \frac{(20\ +\ D_m)}{2} = 1.3\ \times 0.174$$

$$\text{Sin}\ \frac{(20 + D_m)}{2} = 0.226\ \checkmark$$

$$\frac{(20\ +\ D_m)}{2} = 13.062$$

$$(20\ +\ D_m) = 2\ \times 13.062 \checkmark$$

$$D_m = 26.124 - 20$$

$$D_m = 6.124\ ° \checkmark$$ (5)

3.3 3.3.1 $$E = \frac{\Delta L}{L_0}$$

$$\Delta L = E\ \times\ L_0$$

$$= 0.4\ \times 4 \checkmark$$

$$E = 1.6\ m \checkmark$$ (2)

3.3.2 $$A\ =\ \pi\ r^2$$

$$=\ \pi \times\ (\frac{15}{1000})^2 \checkmark$$

$$A\ = 7.069\ \times 10^{-4}\ m^2 \checkmark$$ (2)

3.3.3 $$\sigma = \frac{F}{A}$$

$$= \frac{45000}{7.067\ \times\ 10^{-4}} \checkmark\checkmark$$

$$\sigma = 63658226.06\ Pa \checkmark$$ (3)

3.4 3.4.1
- The shinier the surface area, the less heat will be absorbed
- The duller the surface area, the more heat will be absorbed

(Any 1 × 2)

3.4.2 The more heat radiated and the more it will be absorbed.

(2 × 2) (4)

3.5 $v = f.\lambda$

$= 45 \times 2.45$✓

$v = 110.25\ m/s$✓ (2)

3.6 Longitudinal wave✓
Transverse wave✓ (2)
[25]

QUESTION 4

4.1 4.1.1 $A = \pi \times D \times h$
$= \pi \times \frac{60}{1000}$✓ $\times 1.2$ ✓
$= 0.226\ m^2$ ✓

4.1.2 $Q = e\,\delta\,T^4\,A$

$= 0.3 \times 4.75 \times 10^{-8}$✓ $\times\ (301)^4 \times 0.226$ ✓

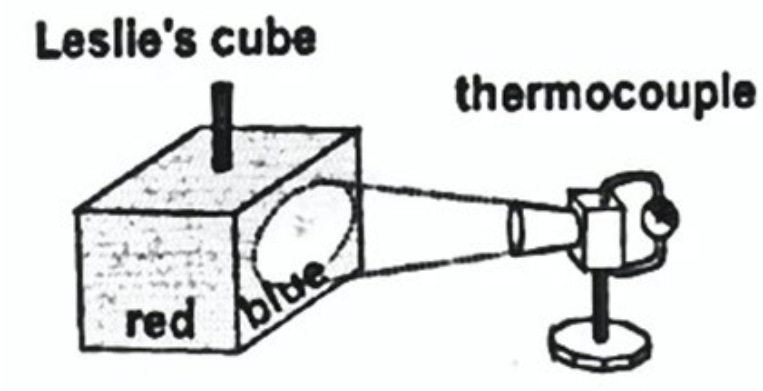
$= 26.436\ J/s$ ✓

4.1.3 Light energy = electrical energy – heat energy

$= 80 - 26.436$✓✓
$= 53.564\ J/s$✓

(3 × 3) (9)

4.2



(ONE mark for each correct label) (4)
(ONE mark for the correct diagram) (1) (5)

4.3
- It consists of a paper with a grease spot.
- Place a light (L_1) of unknown intensity at a distance of (r_1) from the screen.
- Place a light (L_2) of unknown intensity at a distance of (r_2) from the screen.
- If only L_1 is shining, the grease spot will appear dark when seen from the left and bright when seen from the right. (4 × 2) (8)

4.4 $$F = \frac{G \times m_1 \times m_2}{r^2}$$

$$= \frac{6.673 \times 10^{-11} \times 0.68 \times (3 \times 0.82)}{(2.4)^2} \checkmark\checkmark$$

$$F = 1.607 \times 10^{-11} N \checkmark$$ (3)

[25]

TOTAL: 100

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