higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

ENGINEERING PHYSICS N5

4 August 2021

This marking guideline consists of 8 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 The amount of refraction that rays undergo differs from one optical medium to another.

1.2.2 Adhesion is the force of attraction between molecules of different substances.

1.2.3 Is the amount of light radiated by a black container/body with a surface area of 100 mm^2 filled with liquid platinum allowed to set at 2 500 °C.

1.2.4 Magnetic flux is an induction of the number of lines passing through a given area.

1.2.5 The product of the absolute pressure and the volume of a gas of a closed system at a constant temperature.

(5 × 2) (10)

1.3
1.3.1 Adiabatic
1.3.2 Isothermic
1.3.3 Adiabatic
1.3.4 Polytropic
1.3.5 Adiabatic

(5 × 1) (5)

1.4
- Sun
- Stars
- Discharge of electricity
- Some living organisms

(Any × 3) (3)

1.5
- Red
- Green
- Blue

(Any × 2) (2)
[25]

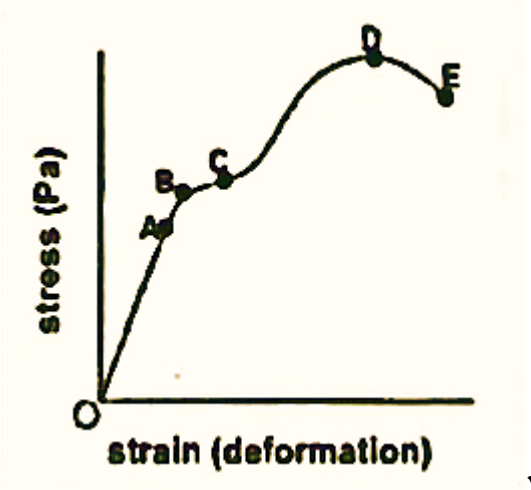
QUESTION 2

2.1 2.1.1 The ring method (2)

2.1.2 To determine the force required to pull a ring from a liquid✓✓ (2)

2.1.3
$$T = \frac{F}{2L}$$
$$= \frac{0.0095✓}{2(0.2)✓}$$
$$= 0.024\ N/m✓$$ (3)

2.2

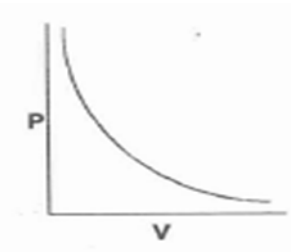


✓

OA = elastic area✓
B = limit of elasticity✓
C = yield point✓
CD = plastic area✓
D = maximum tensile stress✓
E = breaking point✓ (7)

2.3 2.3.1 A = 25 KPa
B = 0.75 m^3 (2)

2.3.2



(3)

2.4
- Each substance diffuses at a rate characteristic to that substance.
- Different concentrations of a substance diffuse differently.
- The time required for the complete diffusion increases with the depth of the container and is proportional to the square of the depth.
- A rise in temperature increases the rate of diffusion.
- Crystals diffuse more rapidly than colloids.
- At a specific temperature, the diffusion rates of various gas molecules are inversely proportional to the square root of the molecular masses.

(Any 4 × 1) (4)

2.5
- Longitudinal wave
- Transverse wave

(2)
[25]

QUESTION 3

3.1 3.1.1 $V_1 = 5\ m^3$✓ (1)

3.1.2 $P_1V_1^{1.3} = P_2V_2^{1.3}$

$$\frac{4.5 \times 1000 \times (5)^{1.3}}{9 \times 1000} = V_2^{1.3}$$✓

$$V_2^{1.3} = 4.052$$✓

$$V_2 = (4.052)^{\frac{1}{1.3}}$$

$$V_2 = 2.934\ m^3$$✓ (3)

3.1.3 $$m = \frac{PV}{RT}$$

$$= \frac{4.5 \times 1000 \times 5}{0.185 \times 1000 \times 293}$$✓

$$m = 0.415\ Kg$$✓ (2)

3.1.4 $$\rho = \frac{m}{V}$$

$$= \frac{0.415}{5}$$✓

$$= 0.083\ Kg/m^3$$✓ (2)

3.2
- Image is in front of the mirror
- Image is real
- Image is inverted
- Image is enlarged

(4)

3.3 3.3.1

$P = 2 \times 10^5$ Pa

$T = 48 + 273 = 321$ K

$m = \frac{15}{1000} = 0.015$ Kg

$V = 0.0042$ m^3

$R = \frac{PV}{mT}$

$= \frac{2 \times 10^5 \times 0.0123}{0.015 \times 321}$ ✓✓

$= 510.903$ J/Kg.K✓ (3)

3.3.2

$P_2 = 0.25 \times 10^5$ Pa

$R = 510.903$ J/Kg.K

$m = \frac{15}{1000} = 0.015$ Kg

$V_2 = 0.0318$ m^3

$T_2 = \frac{P_2 V_2}{mR}$

$= \frac{0.25 \times 10^5 \times 0.0318}{0.015 \times 510.903}$ ✓

$= 103.737$ K✓

$U = mc_v \Delta t$

$= 0.015 \times 1540 \times (321 - 103.737)$ ✓✓

$= 5018.775$ J✓ (5)

3.3.3

$U = mR\Delta t$

$= 0.015 \times 510.903 \times (321 - 103.737)$ ✓✓

$= 1665.005$ J✓ (3)

3.4 By mixing one part of red and two parts of peacock. (2)
[25]

QUESTION 4

4.1 $$\frac{v}{v_0} = \sqrt{\frac{T}{T_0}}$$

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

$$= 330 \times \sqrt{\frac{25 + 273}{0 + 273}}$$

$$= 330 \times \sqrt{\frac{298}{273}} \checkmark$$

$$v = 344.779 \text{ m/s} \checkmark$$

$$\lambda = 2L$$

$$= 2 \times 0.7$$

$$\lambda = 1.4 \text{ m} \checkmark$$

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

$$= \frac{344.779}{1.4}$$

$$f_0 = 246.271 \text{ m} \checkmark$$

First overtone:

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

$$= \frac{344.779}{0.7}$$

$$f_1 = 492.541 \text{ Hz} \checkmark$$ (5)

4.2 4.2.1 $$\frac{N_1}{N_2} = \frac{V_1}{V_2}$$

$$N_1 V_2 = N_2 V_1$$

$$V_2 = \frac{800 \times 220}{3600} \checkmark\checkmark$$

$$= 48.889\ V \checkmark$$

4.2.2 $\frac{N_1}{N_2} = \frac{I_2}{I_1}$

$= \frac{3600 \times 4}{800}$ ✓✓

$= 18$ A ✓

4.2.3 $ratio = \frac{N_1}{N_2}$

$= \frac{3600}{800}$ ✓✓

$= 4.5 : 1$ ✓

(3 × 3) (9)

4.3 $= \frac{Sin \frac{(A + D_m)}{2}}{Sin \frac{A}{2}}$

$1.5 = \frac{Sin \frac{(40 + D_m)}{2}}{Sin \frac{40}{2}}$ ✓

$1.5 = \frac{Sin \frac{(40 + D_m)}{2}}{0.342}$ ✓

$Sin \frac{(40 + D_m)}{2} = 1.5 \times 0.342$

$Sin \frac{(40 + D_m)}{2} = 0.513$ ✓

$\frac{(40 + D_m)}{2} = 30.864$

$(40 + D_m) = 2 \times 30.864$ ✓

$D_m = 61.728 - 40$
$D_m = 27.784°$ ✓ (4)

4.4 4.4.1 F = 200 mm , a = 300 mm

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

$\frac{1}{140} = \frac{1}{300} + \frac{1}{b}$ ✓

$\frac{1}{b} = \frac{1}{200} - \frac{1}{300}$

$\frac{1}{b} = \frac{1}{600}$ ✓

$b = 600\ mm$ ✓ (2)

4.4.2 Size: $V = \frac{b}{a}$

$= \frac{600}{200}$✓

$V = 3$ ✓ (2)

4.4.3 $V = \frac{\text{size of the image}}{\text{size of the object}}$

$3 \times \text{size of the object} = \text{size of the image}$✓

$\text{Size of the image} = 3 \times 80$✓

$\text{Size of the image} = 240 \text{ mm}$✓ (3)

[25]

TOTAL : 100

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