higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

ENGINEERING PHYSICS N5

12 April 2021

This marking guideline consists of 6 pages.

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QUESTION 1

1.1 1.1.1 True
1.1.2 False
1.1.3 True
1.1.4 True
1.1.5 False

(5 × 1) (5)

1.2 1.2.1 The amount of light radiated by a black container✓ with a surface area of 100 mm^2✓ filled with liquid platinum allowed to set at 2 500 ˚C✓ (3)

1.2.2 The force of attraction between two bodies is directly proportional✓ to each other and inversely proportional✓ to the square of their radius✓ (3)

1.2.3 A person who will be able to see an object which is close by clearly✓ but not an object which is far away✓ (2)

1.2.4 The lateral force of attraction between the molecules of liquid✓ on the surface of the liquid✓ that causes the liquid to behave as if it were covered with a membrane✓ (3)

1.2.5 The force of attraction✓ between the molecules of different substances✓ (2)

1.3 1.3.1 Siren

1.3.2 Binoculars

1.3.3
- Violin
- Guitar
- Mandolin (Any ONE)

(3 × 1) (3)

1.4 1.4.1 To measure consumption of electricity or electrical energy

1.4.2 To produce velocity, frequency and period of sound

(2 × 2) (4)

[25]

QUESTION 2

2.1
- Transverse wave is a wave that oscillates at a right angle to its direction of travel.
- Longitudinal wave is a wave that pulses along its direction of travel. (2)

2.2
- Image is behind the object
- Image is virtual
- Image is upright
- Image is enlarged (4)

2.3 2.3.1 Use the formula $P_1V_1 = P_2V_2$

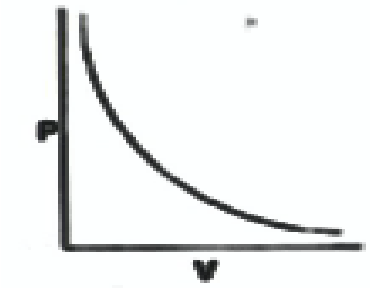
A = 8.75KPa✓
B = 3.5 m^3✓ (2)

2.3.2 In a closed system, the product of the absolute pressure✓ and volume of a given mass of a gas✓ remains constant✓ if the temperature is constant.

OR

The product of the absolute pressure✓ and volume of a given mass of a gas✓ in a closed system remains constant at constant temperature.✓ (3)

2.3.3



ONE mark for labelled axes
TWO marks for correct shape (3)

2.4 2.4.1 Galvanometer (1)

2.4.2
A – Jewel bearing
B – Zero adjuster
C – Coil
D – Hair spring
E – Permanent magnet
F – Balance weight
G – Soft iron cylinder
H – Cylinder support
I – Insulated mounting
J – Hair spring (10)

[25]

QUESTION 3

3.1 3.1.1

$$P_1V_1^{\gamma} = P_2V_2^{\gamma}$$
$$(3.3 \times 1000)(4)^{1.25} = (6 \times 1000)V_2^{1.25} \checkmark$$
$$18667.619 = (6000)V_2^{1.25}$$
$$V_2^{1.25} = 3.111$$
$$V_2 = \sqrt[1.25]{3.111} \checkmark$$
$$V_2 = 2.479\ m^3 \checkmark$$ (3)

3.1.2

$$m = \frac{PV}{RT}$$
$$= \frac{3.3 \times 1000 \times 4}{0.187 \times 1000 \times 300} \checkmark$$
$$m = 0.235\ Kg \checkmark$$ (2)

3.1.3

$$\rho = \frac{m}{V}$$
$$= \frac{0.235}{4} \checkmark$$
$$\rho = 0.059\ Kg/m^3 \checkmark$$ (2)

3.2

- Larger coil surface
- More turns in the coil
- High flux magnet
- A weaker hair string

(4)

3.3

$$\frac{v}{v_0} = \sqrt{\frac{T}{T_0}}$$
$$\frac{v}{330} = \sqrt{\frac{303}{273}} \checkmark$$
$$v = 347{,}659 m/s \checkmark$$
$$\lambda = 2x\ 0{,}75m$$
$$= 1{,}5m \checkmark$$
$$f_0 = \frac{v}{\lambda}$$
$$= \frac{347{,}659}{1{,}5} \checkmark$$
$$= 231{,}773Hz \checkmark$$
$$f_1 = \frac{v}{\lambda}$$
$$= \frac{347{,}659}{0{,}75} \checkmark$$
$$= 463{,}545Hz \checkmark$$ (7)

3.4.1 3.4.1

$$\frac{1}{F} = \frac{1}{a} + \frac{1}{b}$$
$$\frac{1}{200} = \frac{1}{400} + \frac{1}{b} \checkmark$$
$$\frac{1}{b} = \frac{1}{200} - \frac{1}{400}$$
$$b = \textbf{400 mm} \checkmark$$

(2)

3.4.2

- Image is real
- Image will be inverted

(2)

3.4.3

$$V = \frac{b}{a}$$
$$= \frac{400}{200}$$
$$V = 2 \checkmark$$
$$V = \frac{\text{size of image}}{\text{size of object}}$$
$$V \times \text{size of object} = \text{size of image}$$
$$\text{size of image} = 2 \times 50$$
$$\text{size of image} = 100 \text{ mm} \checkmark$$

Image is larger than object✓

(3)

[25]

QUESTION 4

4.1

$$\frac{V_s}{V_p} = \frac{I_p}{I_s}$$
$$\frac{V_s}{240} = \frac{2}{12} \checkmark\checkmark$$
$$V_s = 40\,V \checkmark$$

(3)

4.2

$$P = \rho gh$$
$$1.85 \times 1000 \checkmark = \rho \times (9.8)(0.16) \checkmark$$
$$\rho = 1179.847 \text{ Kg}/m^3 \checkmark$$

(3)

4.3

- Number of turns
- The power of the magnet (flux)
- The rate of movement

(3)

4.4

$$\Delta\emptyset = 14 \times 10^{-5} - 5 \times 10^{-6}$$
$$\Delta\emptyset = 1.35 \times 10^{-4}\,Wb \checkmark$$
$$emf = \frac{200 \times 1.35 \times 10^{-4}}{0.6} \checkmark$$
$$emf = 0.045\,V \checkmark$$

(3)

4.5
- Concentration
- Temperature
- Molecular mass
- State (solid, liquid or gas) (4)

4.6 4.6.1
$$V = l \times b \times h$$
$$= 2.5 \times 1.2 \times 1.8 \checkmark$$
$$= 5.4\ m^3$$
$$= 5.4 \times 1000$$
$$= 5400\ L \checkmark$$
$$\text{Total volume} = 5400 + 180$$
$$\text{Total volume} = 5580\ \text{L} \checkmark$$ (3)

4.6.2
$$Q = \text{m c } \Delta\text{t}$$
$$= 5580 \times 4187 \times (55 - 10) \checkmark\checkmark$$
$$Q = 1051355700\ \text{J} \checkmark$$ (3)

4.6.3
$$\text{E} = \text{e}\delta\ \text{T}^4\ \text{A t}$$
$$1051355700 = 1 \times 5.67 \times 10^{-8} \times (328)^4 \times (2.5 \times 1.2)\ \text{t} \checkmark\checkmark$$
$$\text{t} = 534010.732\ \text{sec} \checkmark$$ (3)

[25]

TOTAL: 100

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