higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

ENGINEERING PHYSICS N5

2 AUGUST 2019

This marking guideline consists of 7 pages.

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QUESTION 1

1.1 1.1.1 Osmosis
1.1.2 Magnetic field line
1.1.3 Refraction rays of light
1.1.4 Stefan-Boltzmann law
1.1.5 Strain

(5 × 1) (5)

1.2 1.2.1 Test the radiation of various colours and surfaces

1.2.2 Find the plane of polarisation of a polarised ray of light

1.2.3 Determine the pole strength of a magnet

1.2.4 Measure the consumption of electricity

1.2.5 Produce velocity, frequency and period of sound

(5 × 1) (5)

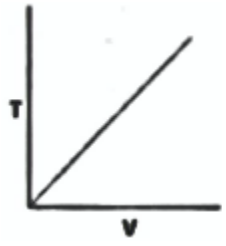
1.3 In the diffusion of gases, the rate of diffusion is inversely proportional to the square root of their respective densities✓ and also their respective molecular masses.✓ (2)

1.4 1.4.1 Use the formula $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

A = 600 K✓
B = 1,6 m^3✓ (2)

1.4.2 The volume of a given mass of gas kept at constant pressure✓ is directly proportional✓ to the absolute temperature.✓ (3)

1.4.3



(3)

1.5 1.5.1 Adiabatic process
1.5.2 Polytropic process
1.5.3 Isothermic process
1.5.4 Isobaric process
1.5.5 Isochoric process

(5 × 1) (5)
[25]

QUESTION 2

2.1 2.1.1 Total energy radiated (2)

2.1.2
- E = Energy radiated
- e = Radioactivity
- δ = Stefan-Boltzmann constant
- T = Temperature
- A = Area
- t = Time

(6 × 1) (6)

2.2 2.2.1
$$A = 2\pi r^2 + 2\pi rh$$
$$= 2\,\pi(0{,}4)^2 + 2\,\pi(0{,}4)(15)\checkmark$$
$$= 1{,}005 + 37{,}699$$
$$= 38{,}704\ m^2\checkmark$$ (2)

2.2.2
$$E = e\sigma T^4 At$$
$$= 0{,}2 \times 5{,}67 \times 10^{-8} \times (303)^4 \times 38{,}704 \times 120\checkmark\checkmark$$
$$= 443\,936{,}307\ J\checkmark \quad \textbf{OR} \quad 443{,}936\ kJ$$ (3)

2.3 2.3.1
- Violin
- Guitar
- Mandolin (Any TWO)

2.3.2
- Flames
- Electric lights
- Candles (Any TWO)

2.3.3
- Recorder
- Trumpet
- Organ
- Motorcar exhaust pipe (Any TWO)

(3 × 2) (6)

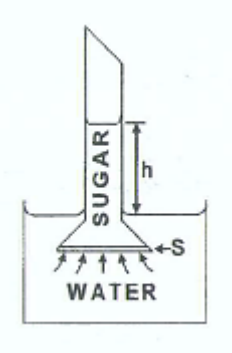
2.4
- The greater the number of turns✓ to the coil✓
- The stronger the flux✓ of the magnet✓
- The shorter the time taken✓ to cut through the magnetic field✓ (3 × 2) (6)

[25]

QUESTION 3

3.1
- Draw bench
- Suspended weight (2)

3.2



(1 for diagram + 2 for labels) (3)

3.3 $$T = \frac{F}{2l}$$

$$= \frac{0,0058}{2 \times 0,2}\checkmark$$

$$= 0,015\ N/m\checkmark$$ (2)

3.4 $$R = \frac{R_0}{M}$$

$$= \frac{8\ 314}{75}$$

$$= 110,853\ J/kg.K\checkmark$$

$$P_1V_1 = m_1RT_1$$

$$m_1 = \frac{0,6 \times 1,013 \times 10^5}{110,853 \times 288}$$

$$m_1 = 1,904\ kg\checkmark$$

$$m_2 = 0,4 + 1,904 = 2,304\ kg\checkmark$$

But $V_1 = V_2$ and $T_1 = T_2$

$$P_2V_2 = m_2RT_2$$

$$P_2 = \frac{1,904 \times 110,853 \times 288}{0,6}\checkmark$$

$$P_2 = 101\ 310,774\ Pa\checkmark \quad \textbf{OR} \quad 101,310\ kPa$$ (5)

3.5 3.5.1 $R = C_p - C_v$

$= 360 - 240$

$= 120$ J/kg.K✓ (1)

3.5.2 $\gamma = \frac{C_p}{C_v}$

$= \frac{360}{240}$

$= 1{,}5$✓ (1)

3.5.3 $PV = mRT$

$V = \frac{0{,}68 \times 120 \times 313}{2{,}55 \times 1\,000}$✓✓

$V = 10{,}016\ m^3$✓ (3)

3.5.4 $P_1V_1^{\gamma} = P_2V_2^{\gamma}$ $V_2 = \frac{1}{3} \times 10{,}016 = 3{,}339\ m^3$

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

$= (\frac{10{,}016}{3{,}339})^{1{,}5} \times 2{,}55 \times 1\,000$✓✓

$P_2 = 13\,248{,}205$ Pa✓ **OR** 13,248 kPa (3)

3.5.5 $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$T_2 = \frac{13\,248{,}205 \times 3{,}339 \times 313}{2{,}55 \times 1\,000 \times 10{,}016}$✓

$T_2 = 542$ °C✓ (2)

3.5.6 $\rho = \frac{m}{V_2}$

$= \frac{0,68}{3,339}$

$= 0,204\ kg/m^3$✓

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

$= \sqrt{\frac{3\ \times 13\ 248,205}{0,204}}$✓

$= 441,392\ m/s$✓ (3)

[25]

QUESTION 4

4.1 The incident light ray, the refracted ray✓ and the normal through the point of incident✓ on the interface between the media, all lie in the same plane.✓ (3)

4.2
- Tourmaline crystals
- Polaroid plate
- Sugar solution (3)

4.3
- Gas (air)
- Liquid (water)
- Solid (metal) (Any 2 × 1) (2)

4.4 The amount of wave energy transmitted per unit time✓ (i.e. the power transmitted) per unit area perpendicular✓ to the direction of propagation✓ (3)

4.5
4.5.1 Object at infinity
4.5.2 Object further than radius of curvature
4.5.3 Object at radius of curvature
4.5.4 Object between 2F and F
4.5.5 Object at F
4.5.6 Object closer than F

(6 × 1) (6)

4.6 $E = \frac{I}{r^2}$

$= \frac{95}{(0,5)^2}$ ✓

$= 380$ lux ✓ (2)

4.7 $v = f \times \lambda$

$= 60 \times 4,8$✓

$= 288$ m/s✓ (2)

4.8 $n = \frac{\text{Sin } \frac{(A + D_m)}{2}}{\text{Sin } \frac{A}{2}}$

$1,5 = \frac{\text{Sin } \frac{(45 + D_m)}{2}}{\text{Sin } \frac{45}{2}}$ ✓

$1,5 = \frac{\text{Sin } \frac{(30 + D_m)}{2}}{0,383}$

$\text{Sin } \frac{(45 + D_m)}{2} = 1,5 \times 0,383$

$\text{Sin } \frac{(45 + D_m)}{2} = 0,575$✓

$\frac{(45 + D_m)}{2} = 35,100$

$(45 + D_m) = 2 \times 35,100$✓

$D_m = 70,2 - 45$

$D_m = 25,2°$✓ (4)

[25]

TOTAL : 100

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