



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

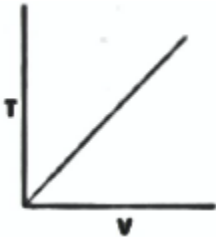
MARKING GUIDELINE

**NATIONAL CERTIFICATE
ENGINEERING PHYSICS N5**

2 AUGUST 2019

This marking guideline consists of 7 pages.

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 m³✓
(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]**

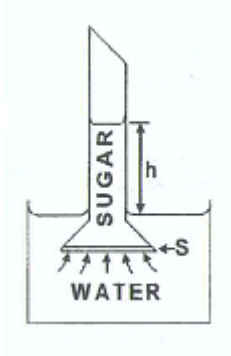
QUESTION 2

- 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 $A = 2\pi r^2 + 2\pi rh$
 $= 2\pi(0,4)^2 + 2\pi(0,4)(15)$ ✓
 $= 1,005 + 37,699$
 $= 38,704 \text{ m}^2$ ✓ (2)
- 2.2.2 $E = e\sigma T^4 At$
 $= 0,2 \times 5,67 \times 10^{-8} \times (303)^4 \times 38,704 \times 120$ ✓✓
 $= 443\,936,307 \text{ J}$ ✓ OR $443,936 \text{ kJ}$ (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

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

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

$$= 0,015 \text{ N/m} \checkmark$$

(2)

3.4

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

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

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

$$P_1 V_1 = m_1 R T_1$$

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

$$m_1 = 1,904 \text{ kg} \checkmark$$

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

$$\text{But } V_1 = V_2 \text{ and } T_1 = T_2$$

$$P_2 V_2 = m_2 R T_2$$

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

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

$$\begin{aligned}
 3.5 \quad 3.5.1 \quad R &= C_p - C_v \\
 &= 360 - 240 \\
 &= 120 \text{ J/kg.K} \checkmark \quad (1)
 \end{aligned}$$

$$\begin{aligned}
 3.5.2 \quad \gamma &= \frac{C_p}{C_v} \\
 &= \frac{360}{240} \\
 &= 1,5 \checkmark \quad (1)
 \end{aligned}$$

$$\begin{aligned}
 3.5.3 \quad PV &= mRT \\
 V &= \frac{0,68 \times 120 \times 313}{2,55 \times 1\,000} \checkmark \checkmark \\
 V &= 10,016 \text{ m}^3 \checkmark \quad (3)
 \end{aligned}$$

$$\begin{aligned}
 3.5.4 \quad P_1 V_1^\gamma &= P_2 V_2^\gamma \quad V_2 = \frac{1}{3} \times 10,016 = 3,339 \text{ m}^3 \\
 P_2 &= \left(\frac{V_1}{V_2}\right)^\gamma P_1 \\
 &= \left(\frac{10,016}{3,339}\right)^{1,5} \times 2,55 \times 1\,000 \checkmark \checkmark \\
 P_2 &= 13\,248,205 \text{ Pa} \checkmark \quad \text{OR} \quad 13,248 \text{ kPa} \quad (3)
 \end{aligned}$$

$$\begin{aligned}
 3.5.5 \quad \frac{P_1 V_1}{T_1} &= \frac{P_2 V_2}{T_2} \\
 T_2 &= \frac{13\,248,205 \times 3,339 \times 313}{2,55 \times 1\,000 \times 10,016} \checkmark \\
 T_2 &= 542 \text{ }^\circ\text{C} \checkmark \quad (2)
 \end{aligned}$$

$$\begin{aligned}
 3.5.6 \quad \rho &= \frac{m}{V_2} \\
 &= \frac{0,68}{3,339} \\
 &= 0,204 \text{ kg/m}^3 \checkmark \\
 \\
 V &= \sqrt{\frac{3 P_2}{\rho}} \\
 &= \sqrt{\frac{3 \times 13\,248,205}{0,204}} \checkmark \\
 &= 441,392 \text{ m/s} \checkmark
 \end{aligned}$$

(3)
[25]**QUESTION 4**

- 4.1 The incident light ray, the refracted ray \checkmark and the normal through the point of incident \checkmark on the interface between the media, all lie in the same plane. \checkmark (3)
- 4.2
- Tourmaline crystals
 - Polaroid plate
 - Sugar solution
- (3)
- 4.3
- Gas (air)
 - Liquid (water)
 - Solid (metal)
- (Any 2 \times 1) (2)
- 4.4 The amount of wave energy transmitted per unit time \checkmark (i.e. the power transmitted) per unit area perpendicular \checkmark to the direction of propagation \checkmark (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 \times 1) (6)

$$\begin{aligned}
 4.6 \quad E &= \frac{I}{r^2} \\
 &= \frac{95}{(0,5)^2} \checkmark \\
 &= 380 \text{ lux} \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 4.7 \quad v &= f \times \lambda \\
 &= 60 \times 4,8 \checkmark \\
 &= 288 \text{ m/s} \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 4.8 \quad n &= \frac{\sin \frac{(A + D_m)}{2}}{\sin \frac{A}{2}} \\
 1,5 &= \frac{\sin \frac{(45 + D_m)}{2}}{\sin \frac{45}{2}} \checkmark \\
 1,5 &= \frac{\sin \frac{(30 + D_m)}{2}}{0,383} \\
 \sin \frac{(45 + D_m)}{2} &= 1,5 \times 0,383 \\
 \sin \frac{(45 + D_m)}{2} &= 0,575 \checkmark \\
 \frac{(45 + D_m)}{2} &= 35,100 \\
 (45 + D_m) &= 2 \times 35,100 \checkmark \\
 D_m &= 70,2 - 45 \\
 D_m &= 25,2^\circ \checkmark
 \end{aligned}$$

(4)
[25]**TOTAL : 100**