higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

ENGINEERING PHYSICS N5

31 JULY 2018

This marking guideline consists of 8 pages.

Copyright reserved

QUESTION 1

1.1
1.1.1 True
1.1.2 True
1.1.3 True
1.1.4 True
1.1.5 False
1.1.6 True
1.1.7 False
1.1.8 True
1.1.9 False
1.1.10 False

(10 × 1) (10)

1.2 $P = \rho gh$

$= 13600 \times 9{,}8 \times 0.9$✓

$= 119952\ Pa$✓

$PV = mRT$

$V = \frac{4 \times 360 \times 373}{119952}$✓

$V = 4.478\ m^3$ ✓ (4)

1.3 1.3.1 $R = \frac{R_0}{M}$

$= \frac{8314}{28}$ ✓

$= 296{,}9$ J/Kg K ✓ (2)

1.3.2 $P_1V_1 = mRT_1$

$m_1 = \frac{2{,}1 \times 10^5 \times 0{,}4}{296{,}9 \times 291}$ ✓✓

$m_1 = 0{,}972\ kg$✓ (3)

1.3.3 $M_2 = 0{,}972 + 0{,}4 = 1{,}372$ kg

$V_1 = V_2$ and $T_1 = T_2$

$P_2V_2 = mRT_2$

$P_2 = \frac{1{,}372 \times 296{,}9 \times 291}{0{,}4}$ ✓✓

$P_2 = 296\,344{,}797\ Pa = 296{,}345\ kPa$ ✓ (3)

1.4 $F = \frac{Gm_1m_2}{r^2}$

$r = \sqrt{\frac{Gm_1m_2}{F}}$

$r = \sqrt{\frac{6{,}673 \times 10^{-11} \times 50 \times 0{,}3}{250 \times 1000}}$ ✓✓

$r = 6{,}328 \times 10^{-8} m$ ✓ (3)

[25]

QUESTION 2

2.1 2.1.1 $R = C_p - C_v$
$= 250 - 92$
$= 158$ J / kg K ✓

$PV = mRT$

$m = \frac{150 \times 1000 \times 0{,}4 \times 10^{-3}}{158 \times 303}$ ✓

$m = 1{,}253 \times 10^{-3} kg$ ✓ (3)

2.1.2 $\gamma = \frac{c_p}{c_v}$

$= \frac{250}{92}$

$= 2{,}717$ ✓

$P_1V_1^{\gamma} = P_2V_2^{\gamma}$

$V_2^{2{,}717} = \left(\frac{150}{500}\right) \times (0{,}4 \times 10^{-3})^{2{,}717} = 1{,}758 \times 10^{-10}$✓

$V_2 = 2{,}568 \times 10^{-4}\, m^3$✓ (3)

2.1.3 $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$T_2 = \frac{500 \times 2{,}568 \times 10^{-4} \times 303}{150 \times 4 \times 10^{-4}}$ ✓✓

$T_2 = 648{,}42\ °C$ ✓ (3)

2.1.4 $\rho = \frac{m}{V}$

$= \frac{1{,}253 \times 10^{-3}}{0.4 \times 10^{-3}}$

$= 3{,}133\ kg/m^3$ ✓

$\overline{v} = \sqrt{\frac{3P}{\rho}}$

$= \sqrt{\frac{3 \times 150 \times 1000}{3{,}133}}$ ✓

$= 378{,}989\ m/s$ ✓ (3)

2.2 A – Thermometer
B – Capillary tube
C – Mercury
D – Ruler
E – Stirrer
F – Gas burner (6)

2.3 F = 140 mm , a = 300 mm

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

$\frac{1}{100} = \frac{1}{220} + \frac{1}{b}$ ✓

$\frac{1}{b} = \frac{1}{100} - \frac{1}{220}$

$\frac{1}{b} = \frac{3}{550}$ ✓

$b = 183{,}333\ mm$ ✓

$Size : V = \frac{b}{a} = \frac{183{,}333}{220}$ ✓

$V = 0{,}833$ ✓

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

$0{,}833 \times Size\ of\ the\ object = Size\ of\ the\ image$

$Size\ of\ the\ image = 0{,}833 \times 50$ ✓

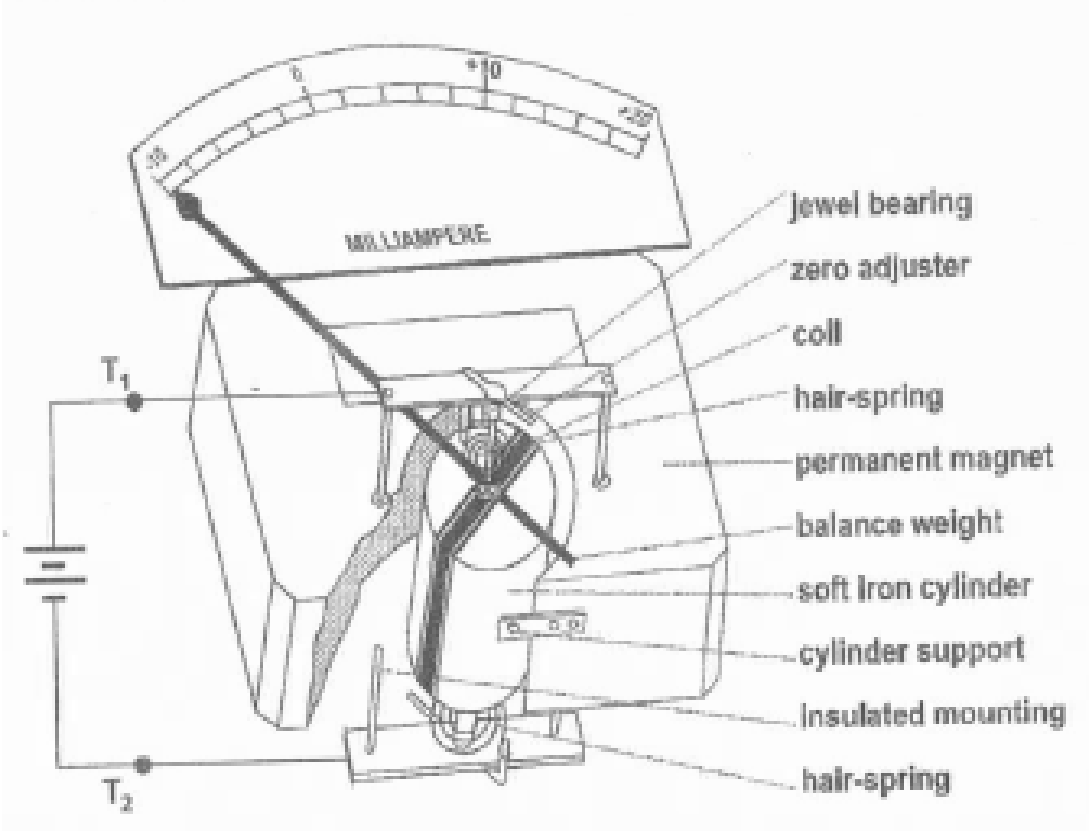
$Size\ of\ the\ image = 41{,}65\ mm$ ✓ (7)

[25]

QUESTION 3

3.1 A – Lens of the eye
B – Retina
C – Eye spot
D – Optic nerve
E – Blind spot
F – Cornea
G – Iris (7)

3.2



(10)

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

$= \frac{0,098}{2 \times 0,16}$ ✓

$= 0,306\ N/m$ ✓ (2)

3.4 3.4.1 Surface tension is the lateral force of attraction between the molecules on the surface of a liquid that causes the liquid to behave as if it were covered with a membrane.

3.4.2 When two different substances are placed next to each other, the movement of their molecules may cause them to form a homogeneous mixture.

3.4.4 Osmosis is diffusion that takes place in one direction only.

(3 × 2) (6)

[25]

QUESTION 4

4.1 4.1.1 Meniscus convex lens

4.1.2 One-sided convex lens

(2 × 1) (2)

4.2 $\frac{1}{F} = \frac{1}{a} + \frac{1}{b}$

$\frac{1}{-200} = \frac{1}{100} + \frac{1}{b}$ ✓

$\frac{1}{b} = \frac{1}{-200} - \frac{1}{100}$

$\frac{1}{b} = \frac{-3}{200}$ ✓

$b = -66{,}667\ mm$ ✓

$b = 66{,}667\ mm\ behind\ the\ mirror$ ✓ (4)

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

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

$1{,}5 = \frac{Sin\ \frac{(30 + D_m)}{2}}{0{,}259}$ ✓

$Sin\ \frac{(30\ +\ D_m)}{2} = 1{,}5\ \times 0{,}259$

$Sin\ \frac{(30 + D_m)}{2} = 0{,}389$ ✓

$\frac{(30\ +\ D_m)}{2} = 22{,}892$

$(30\ +\ D_m) = 2\ \times 22{,}982$ ✓

$D_m = 45{,}784 - 30$
$D_m = 15{,}784\ °$ ✓ (4)

4.4 $Sin\theta_c = \frac{1}{n}$

$Sin\ \theta_c = \frac{1}{1,47}$ ✓

$\theta_c = 42,865°$ ✓ (2)

4.5 $D = \frac{1}{f}$

$= \frac{1}{0,2}$

$= 5\ diopters$ ✓ (1)

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

$= \frac{72}{(0,6)^2}$ ✓

$= 200\ lux$ ✓ (2)

4.7 4.7.1 To determine the wavelength of a light

4.7.2 To find the plane of polarisation of a polarised ray of light

4.7.3 To determine the strength of the poles of a magnet

4.7.4 To measure the consumption of electricity or electrical energy

4.7.5 To test the radiation of various surfaces

(5 × 1) (5)

4.8 $B = \frac{\mu_o I}{2\pi r}$

$= \frac{4\pi \times 10^{-7} \times 18}{2\pi \times \frac{80}{1000}}$ ✓

$= 4,5 \times 10^{-5} Wb/m^2$ ✓ (3)

4.9 $r = 2f$

$= 2 \times 300$ ✓

$= 600\ mm$ ✓ (2)

[25]

TOTAL: 100

Copyright reserved