higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

APRIL EXAMINATION

ENGINEERING SCIENCE N2

21 JULY 2015

Hierdie nasien riglyn bestaan uit 10 bladsye.

DHET Kopieregvoorbehou

✓ = 1 Mark

√ = $^1/_2$ Mark

QUESTION1

1.1.1 The complete length of the route of the object covers regardless of the direction. ✓ (1)

1.1.2 A straight line distance between two points regardless the route that was followed in a specific direction. ✓ (1)

1.2

1.2.1 40 Seconds ✓ (1)

1.2.2 Velocity A to B $= \frac{\Delta y}{\Delta X} = \frac{30}{40}$ ✓

Velocity = 0,75 m/s ✓

$V_A = V_B$ Average velocity = $\frac{0,75 + 0,75}{2}$ ✓ = 0,75 m/s ✓ (4)

1.2.3 30 seconds ✓ (1)

1.2.4 s = 15 m ✓ (1)

1.3 $V = \frac{90}{3.6} = 25\ m/s$ ✓ (1)

1.4

1.4.1 $t = \frac{v-u}{a} = \frac{0-27.778}{-10}$ ✓ $= 2.778\ seconds$ ✓ (2)

1.4.2 $\therefore s = ut + \frac{1}{2}at^2$

$\therefore s = 27.778 \times 2.778 + \frac{1}{2} \times (-10)(2.778)^2$ ✓

$\therefore s = 38.580\ m$ ✓ (2)

[14]

QUESTION 2

✓ = 1 Mark

√ = $^1/_2$ Mark

2.1

2.1.1 $\sum \ _{Anti-clockwise\ moment} = \sum M_{clockwise\ moment}$

$8 \times R$ ✓ $= 100 \times 2 + 200 \times 6 + 75 \times 9$ ✓

$R = 259.375N$ ✓

$\sum M_{Anti-clockwise@R} = \sum M_{clockwise@R}$

$100 \times 6 + 200 \times 2$ ✓ $= L \times 8 + 75 \times 1$ ✓

$R = 115.625N$ ✓ (6)

2.2.2 $\sum F \uparrow = \sum F \downarrow$

$115.625 + 259.375 = 100 + 200 + 75$

$375N = 375N$ ✓ (1)

2.3 2.3.1 $\sum F \rightarrow = \sum F \leftarrow$

$F + 50 = 800 + 250$ ✓

$F = 1000\ N$ ✓ (2)

2.3.2 Equilibrant ✓ (1)

[10]

QUESTION 3

✓ = 1 Mark

√ = $^1/_2$ Mark

3.1 3.1.1

$$h = 12\sin 10° \quad ✓$$
$$= 2{,}084\,m$$
$$E_P = mgh \quad ✓$$
$$= 2 \times 9{,}8 \times 2{,}084 \quad ✓$$
$$= 40{,}846\ J$$

(3)

3.1.2

$$E_P = E_K$$
$$= 40{,}842\ J \quad ✓$$

(1)

3.1.3

$$E_K = \frac{1}{2}mv^2$$
$$v = \sqrt{\frac{2 \times E_K}{m}}$$

V = √2 x g x h

V = √2 x 9,8 x 2,084

V = 6,391 m/s

✓

$$= \sqrt{\frac{2 \times 40{,}842}{2}} \quad ✓$$
$$= 6{,}387\ m/s$$

(2)

3.1.4

$$E_K = \frac{1}{2}mv^2$$
$$= \frac{1}{2}(2)(20)^2 \quad ✓$$
$$= 400\ J$$
$$E_K = E_P = mgh$$
$$h = \frac{E_K}{mg} \quad ✓$$
$$= \frac{400}{2 \times 9{,}8}$$
$$= 20{,}408\ m$$

(2)

[08]

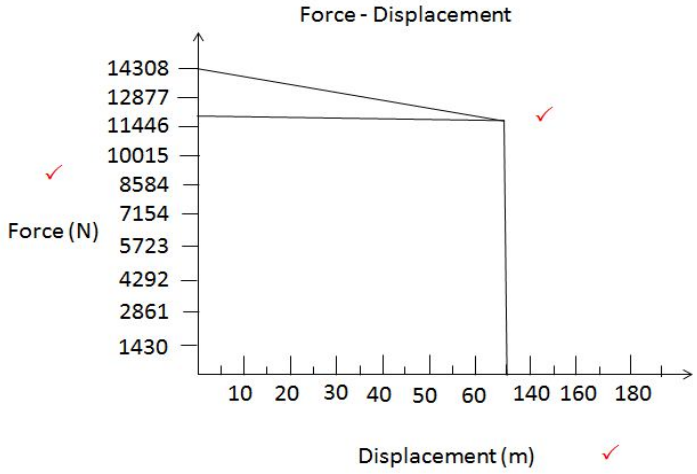
QUESTION 4

✓ = 1 Mark

4.1 **4.1.1** $W_{Chain} = 4 \times 9.8 \times 65 = 2548N$ ✓ √= $^1/_2$Mark

$W_{Bricks} = 1200 \times 9.8 = 11760N$ ✓ (2)

4.1.2



(3)

4.1.3 $WORKDONE = total\ area\ under\ the\ graph$

$WORKDONE = Area\triangle + Area\square$

$WORKDONE = 0.5 \times 65 \times 2548 + 11760 \times 65$ ✓✓ (3)

$WORKDONE = 847210 Joules$ ✓

4.1.4 $P = (11760 + 4 \times 9.8 \times 35) \times 10$ ✓

$P = 131320\ Watts$ ✓ (2)

[09]

QUESTION 5

✓ = 1 Mark

√ = $^1/_2$ Mark

5.1

5.1.1

$N_A T_A = N_B T_B$

$N_A \times 60 = 140 \times 85$ ✓

$N_A = 198.333\, r/s$ ✓ (2)

5.1.2

$N_c T_c = N_D T_D$

$140 \times 120 = 400 \times T_D$ ✓

$T_D = 42$ ✓ (2)

5.2

5.2.1

$\frac{T_1}{T_2} = \frac{8}{3}$ ✓

$T_2 = \frac{8}{3}(360) = 135N$ ✓ (2)

5.2.2

$F_e = (T_1 - T_2)$

$F_e = (360 - 135) = 225N$ ✓ (1)

5.2.3

$P_e = (T_1 - T_2) \times v$

$P_e = 225 \times 12$ ✓ (2)

$P_e = 2700\, Watts$ ✓

5.3

5.3.1

$MA = \frac{LOAD}{EFFORT}$

$LOAD = 40 \times 300$ ✓

$LOAD = 12000N$ ✓ (2)

5.3.2

$\eta = \frac{MA}{VR}$ x 100

$VR = \frac{40}{68}$ x 100 ✓

$VR = 58.824$ ✓ (2)

5.3.3

$VR = \frac{2S}{S-s}$

$58.824 = \frac{2(22)}{22-s}$ ✓

$s = 21$ ✓ (2)

[15]

QUESTION 6

✓ = 1 Mark

√ = $^1/_2$ Mark

6.1

6.1.1 $\boldsymbol{W_{\parallel} = 15 \times 9.8 \sin 15}$ ✓ (2)

$\boldsymbol{W_{\parallel} = 38.046\ N}$ ✓

6.1.2 $W_{\perp} = 15 \times 9.8 \cos 15$ ✓ (2)

$W_{\perp} = 141.991\ N$ ✓

6.1.3 $F_{\mu} = 65\ N$

$F_A = -\boldsymbol{W_{\parallel}} + F_{\mu}$ from Newton's Third law

$F_A = -\mathbf{38.046} + 65$ ✓ (2)

$F_A = \mathbf{26.954\ N}$ ✓

6.3 $P_{ABS} = P_{ATM} + P_{MET}$

$P_{ABS} = P_{ATM} + \rho gh$

$P_{ABS} = 101.33 \times 10^3 + 13534 \times 9.8 \times 0.4$ ✓

$P_{ABS} = 154353{,}28\ Pa$ ✓ (3)

$P_{ABS} = 154.353 \times 10^3\ Pa$ ✓

[09]

QUESTION 7

✓ = 1 Mark

7.1 Is the amount of heat energy required to the raise the temperature of 1kg of a substance by $1\ ^{o}C$. √ = $^{1}/_{2}$Mark (1)

7.2 Water is reasonably available and relatively cheap ✓

Steam is clean ✓ (3)

Steam can be used repeatedly ✓

7.3

7.3.1 $Q_{COAL} = mHV$

$Q_{COAL} = 9kg \times 30\ MJ/kg$ ✓

$Q_{COAL} = 270MJ$ ✓ (2)

7.3.2 $\eta = \frac{Q_{OUT}}{Q_{IN}}$

$0.4 = \frac{Q_{OUT}}{270MJ}$ ✓ (4)

$Q_{OUT} = 108MJ = Q_{IN\ water}$ ✓

$Q_{IN\ water} = \boldsymbol{mc\Delta t}$

$108 \times 10^{6} = m \times 4187(100 - 14)$ ✓

$\therefore m = 299.932kg$ ✓

7.3.3 Efficiency = 40% ✓ (1)

7.4 $Q_{IN\ water} = mc\Delta t$

$Q_{IN\ water} = 0.79 \times 4187(29 - 18)$ ✓

$Q_{IN\ water} = Q_{steel} = 36385.9\ Joules$ ✓

$Q_{out\ from\ steel} = 36385.9 = m \times 500(750 - 29)$ ✓

$m = 0.101kg$ ✓ (4)

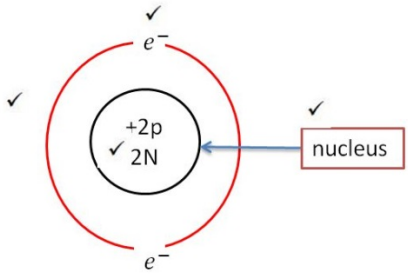
[15]

QUESTION 8

✓ = 1 Mark

√ = $^{1}/_{2}$ Mark

8.1



- e^- electron
- $N = Neutron$
- $p^+ = Proton$

(4)

8.2 The process of coating a metal object with a thin layer of another metal by means of electrolysis ✓ (1)

8.3 oil or grease

- Electroplating ✓
- Barrier protection-painting ✓ (any two)
- Sacrificial coating ✓

(2)

[07]

QUESTION 9

✓ = 1 Mark

√ = $^1/_2$ Mark

- Type of material ✓
  - Length of the conductor ✓
  - Thickness of the conductor ✓

(3)

9.2 Insulators: rubber ✓
PVC ✓
AIR, etc. ✓

(take only two) (2)

9.3 Conductors: Iron ✓
Copper ✓
Silver ✓

(take only two) (2)

9.4
- Generate ignition spark ✓
- transformer ✓
- Generators ✓

take only one) (1)

9.5 $\frac{1}{Rp} = \frac{1}{R_{1+2}} + \frac{1}{R_3}$

$\frac{1}{Rp} = \frac{1}{25} + \frac{1}{20}$ ✓

$R_p = 11.111\Omega$ ✓ (3)

$R_T = R_P + R_S$

$= 11{,}111 + 20$

$= 31.111\ \Omega$ ✓

9.6 $R = \frac{\rho \,.\, l}{a}$

$2{,}1 = \frac{0.000\ 000\ 028 \times l}{2 \times 10^{-4}}$ ✓✓

$l = 15000\ m$ ✓ (3)

[14]

TOTAL = 100