higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

APRIL EXAMINATION

ENGINEERING SCIENCE N2

4 APRIL 2013

This marking guideline consists of 6 pages.

ALTERNATE CORRECT ANSWERS MUST BE CONSIDERED

QUESTION 1

1.1 1.1.1 40 km/h = 40/3,6 = 11,11 m/s ✓

1.1.2 127 cm = 127/100 m = 1,27 m ✓

1.1.3 1,2 GPa = 1200 MPa ✓

(3 × 1) (3)

1.2 1.2.1 Acceleration = $\Delta V/\Delta t$ = (23 – 16)/ 10 ✓ = 0,7 m/s^2 ✓ (2)

1.2.2 Distance = (16 × 20) + [(23 + 16) × 10]/2 = 320 + 195 = 515 m ✓✓✓ (3)

1.2.3 Av. vel. = 515/30 ✓ = 17,17 m/s ✓ (2)

1.3 1.3.1 Deceleration = $\Delta V/\Delta t$ = (15 – 0)/3 ✓ = 5 m/s^2 ✓ (2)

1.3.2 Distance = 0,5 a t^2 = 0,5 x 5 x 3^2 ✓ = 22,5 m ✓ (2)

1.4 Distance covered regardless of direction (1)

[15]

QUESTION 2

2.1 It is <u>the turning effect</u> of a <u>force about a point</u>.✓✓ (2)

2.2 The resultant and the equilibrant have the same value but act in opposite directions. ✓ (1)

2.3 2.3.1 Moments about L
CWM = ACWM
30 x 1 + 40 x 3 + 25 x 10 = R x 7
30 + 120 + 250 = 7 R R = 57,14 kN ✓

Moments about R
CWM = ACWM
L x 7 + 25 x 3 = 40 x 4 + 30 x 6
L = (160 + 180 – 75)/7
L = 37,86 kN ✓ (6)

2.3.2 57,14 + 37,86 = 30 + 40 + 25 o.k ✓ (1)

[10]

QUESTION 3

3.1 P.E = mgh = 5 × 9,8 × 15 sin 10° ✓✓ = 127,63 J ✓ (3)

3.2 mgh = 0,5 mv^2, v=$\sqrt{2gh}$ = $\sqrt{2\times9{,}8\times15\sin10°}$ ✓ = 7,145 m/s ✓

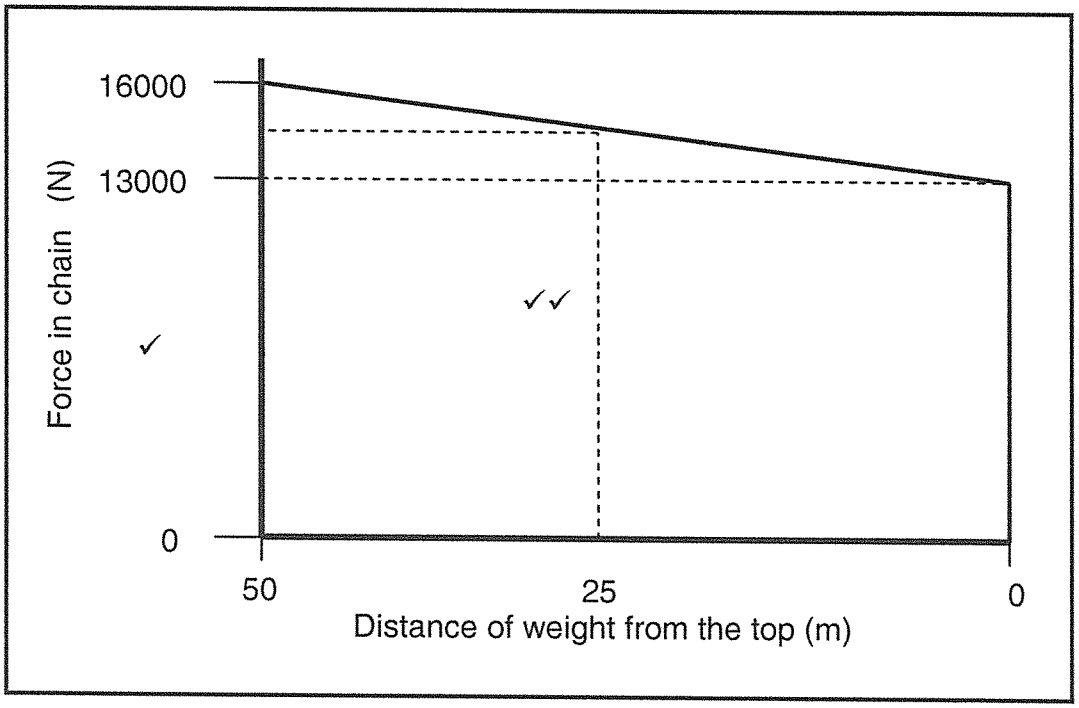
or v= $\sqrt{\frac{127{,}63}{0{,}5\times5}} = 7{,}145 m/s$ (2)

3.3 Momentum = m x v = 5 × 7,145 ✓ = 35,725 kgm/s ✓ (2)
[7]

QUESTION 4

4.1 Power is the rate of work done ✓✓ (2)

4.2 4.2.1



(4)

4.2.2 Work done = Area under graph = $\frac{16\,000+13\,000}{2}\times50=725\,kJ$ ✓✓

OR

Work done = (13 000 x 50) + (0,5 x 3 000 x 30)
= 725 000 J
= 725 kJ (2)

4.2.3 Power = w.d./sec.= $\frac{16\ 000\ +13\ 000}{2}\times1{,}5\ =\ 21{,}75\,kW$ ✓✓ (2)
[10]

QUESTION 5

5.1 Velocity ratio is the ratio of the distance moved by the effort as opposed to the corresponding distance moved by the load. (2)

5.2 5.2.1 $\frac{n_1}{n_2}=\frac{t_1}{t_2}, n_1=\frac{n_2 t_1}{t_2}=\frac{6\times100}{60}=10\ r/s$ ✓✓ (2)

5.2.2 $t_3=\frac{n_3 t_2}{n_2}=\frac{15\times60}{6}=150\ teeth$ ✓✓ (2)

5.3 5.3.1 M.A. = Load/Effort = 900/60 ✓= 15 ✓ (2)

5.3.2 V.R.(D.R.) = $\frac{2D}{d_1-d_2}=\frac{2\times620}{500-460}=31$ ✓✓ (2)

5.3.3 Efficiency % = (M.A./V.R.) × 100 = 15/31 × 100 ✓ = 48,4 % ✓ (2)

5.4 5.4 1 T_{tight} = 4,2 × 500 = 2 100 N ✓ (1)

5.4.2 Belt speed = πdn/60 = π × 0,35 × 550/60 ✓ = 10,08 m/s ✓ (2)

5.4.3 Power = $(T_1 - T_2) \times v$ = (2 100 – 500) × 10,08 ✓
= 16,127 kW ✓ (2)
[17]

QUESTION 6

6.1 The pascal is 1 N/m^2 ✓✓ (2)

6.2 6.2.1 Gauge pressure = ρgh = 820 × 9,8 × 50 ✓ = 401,8 kPa ✓ (2)

6.2.2 Atmospheric pressure = 401,8 + 101,3 = 503,1 kPa ✓ (1)

6.3 6.3.1 $F_s = w \sin\theta$ = 18 × 9,8 × sin 8° = 24,55 N ✓ (1)

6.3.2 $F_c = w \cos\theta$ = 18 × 9,8 × cos 8° = 174,68 N ✓ (1)

6.3.3 $F_m = m \times w \cos\theta$ = 0,25 × 174,68 N = 43,67 N ✓ (1)

6.3.4 $F_{down} = F_m - F_s$ = 43,67 – 24,55 ✓ = 19,12 N ✓ (2)
[10]

QUESTION 7

7.1 The amount of heat required to change the temperature of unit mass (1 kg) by unit temperature (1°) ✓✓ (2)

7.2 7.2.1 $Q = m \times h.v. = 10 \times 30 = 300$ MJ ✓✓ (2)

7.2.2 $h \times Q = m \times c \times \Delta t$, $t_2 = (h \times Q)/m \times c + t_1$
$t_2 = 0,8 \times 300 \times 10^6/500 \times 500 + 15$ ✓✓ = 975 °C ✓ (3)

7.3 $\Delta l = l \times c \times \Delta t$ $0,12 = 18 \times 23 \times 10^{-6} \times (t_2 - 20)$ ✓

$t_2 = \frac{0,12}{18 \times 23 \times 10^{-6}} + 20$ ✓ = 309,855 °C ✓

(3)
[10]

QUESTION 8

8.1 Superheated steam is steam above the saturation temperature (above the boiling temperature) of water ✓ (1)

8.2 Proton ✓ Positive ✓
Neutron ✓ Neutral ✓
Electron ✓ Negative ✓ (½ × 6) (3)

8.3 Electrolyte is a <u>solution</u> able to <u>conduct electric current</u>. ✓✓ (2)

8.4
- Produce more durable surfaces ✓
- Beautify certain articles ✓
- Protect metals against corrosion ✓
- (Any 2 × 1) (2)

[8]

QUESTION 9

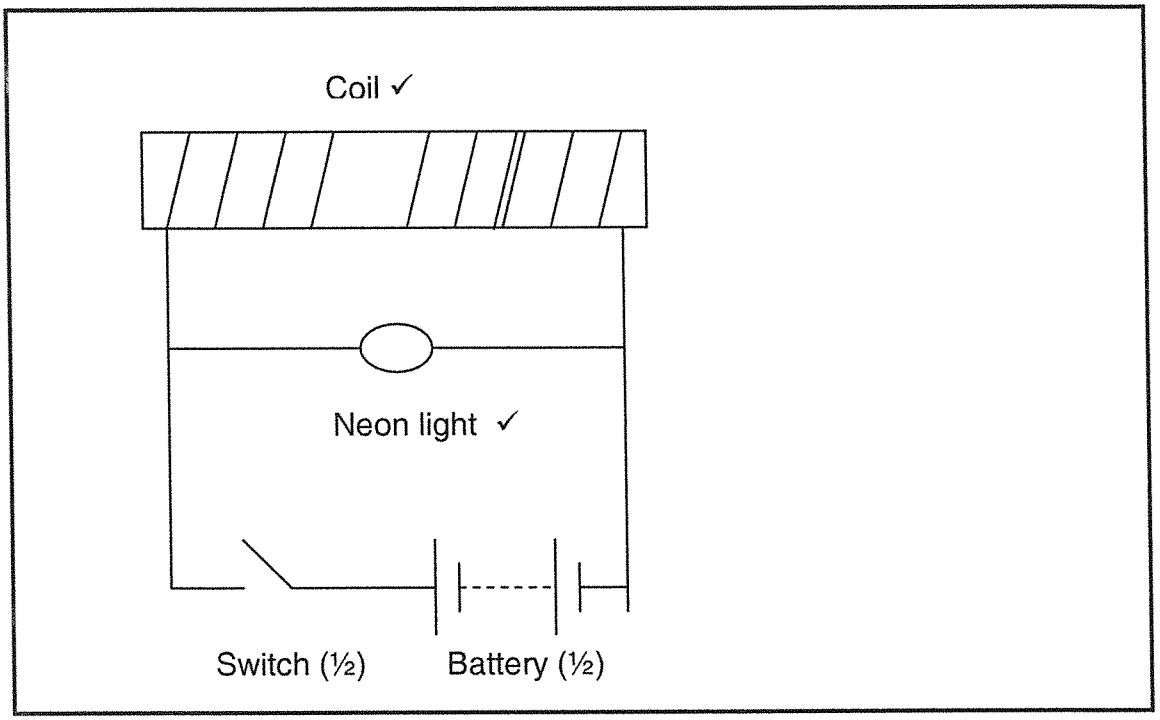
9.1 Resistivity of a substance is the <u>resistance</u> across <u>opposite sides of a 1 m^3 cube</u> of that substance at a specific temperature. (20 °C) (2)

9.2 $\frac{1}{6} = \frac{1}{8} + \frac{1}{X} \times = \frac{6 \times 8}{8 - 6}$ ✓ = 48/2 = 24 Ω ✓ (2)

9.3 $R = \frac{\rho l}{a}$ $\rho = \frac{R \times a}{l} = \frac{2x(\pi x 0,003^2)}{4 \times 785,4} = 18 \times 10^{-9}$ ✓✓

Material = copper ✓✓ (4)

9.4



(3)

9.5
- Ignition coils in motor vehicles ✓
- Starters of neon lights

(Any 1 × 1) (1)

9.6 In the opposite direction ✓ (1)

[13]

TOTAL: 100