

higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA


MARKING GUIDELINE

NATIONAL CERTIFICATE AUGUST EXAMINATION ENGINEERING SCIENCE N2

29 JULY 2014

This marking guideline consists of 9 pages.

- | | | | |
|--------------|-----|---------------|------------|
| 1. Mutshinye | TF | | |
| 2. Kope | RIP | P/que | 07/08/2014 |
| 3. Cronje | SJP | florzi | 7/8/2014 |
| 4. Nkoadi | HI | HI | 07/08/2014 |

 DHEIT

NOTE: denotes half mark
QUESTION 1

1.1.1 Velocity is the rate✓ of displacement. ✓ (2)

1.1.2 Acceleration is the rate of change✓ of velocity. ✓ (2)

1.2 1.2.1 $a = \frac{v - u}{t}$
 $= \frac{0 - 25}{20}$ ✓
 $= -1,25 \text{ m/s}^2$ ✓ (2)

1.2.2 $S_{\text{total}} = S_{\text{rect}} + S_{\text{triangle}}$
 $= (25 \times 30) + (0,5 \times 20 \times 25)$ ✓
 $= 750 + 250$ ✓
 $= 1\,000 \text{ m}$ ✓ (3)

1.2.3 $v_{\text{av}} = \frac{s_{\text{tot}}}{t_{\text{tot}}}$
 $= \frac{1\,000}{50}$ ✓
 $= 20 \text{ m/s}$ ✓ (2)

1.3 1.3.1 $t = \frac{v - u}{a}$
 $= \frac{0 - 55,555}{-15}$ ✓
 $= 3,704 \text{ sec}$ ✓ (2)

1.3.2

Min. distance

$$s = ut + \frac{1}{2}at^2 \quad \checkmark$$

$$= 55,555 \times 3,704$$

$$+ \frac{1}{2}(-15)3,704^2$$

$$= 102,88 \text{ m} \quad \checkmark$$

OR

$$v^2 = u^2 + 2aS$$

$$0^2 = 55,555^2 + 2(-15)S$$

$$S = \frac{-3086,42}{-30} \quad \checkmark$$

$$S = 102,88 \text{ m} \quad \checkmark$$

OR

$$s = \left(\frac{u+v}{2}\right)t$$

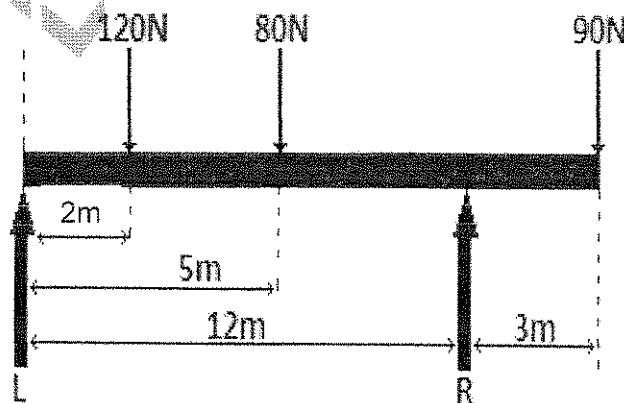
$$= \left(\frac{0+55,556}{2}\right) \times 3,704 \quad \checkmark$$

$$= 102,881 \text{ m} \quad \checkmark$$

(2)
[15]

QUESTION 2

2.1 2.1.1



- ✓ for the top forces
- ✓ for the bottom forces and distances

(2)

2.1.2 About L / OM L

$$\sum ACM = \sum CM$$

$$R \times 12 = 120(2) + 80(5) + 90(15) \quad \checkmark \checkmark$$

$$12R = 240 + 400 + 1350$$

$$R = 165,83N \quad \checkmark$$

About R / OM R

$$\sum ACM = \sum CM$$

$$(120)(10) + 80(7) = 90(3) + L(12) \quad \checkmark \checkmark$$

$$560 + 1200 = 270 + 12L$$

$$L = 124,17N \quad \checkmark$$

(6)

2.1.3

$$\sum F_{up} = \sum F_{down}$$

$$124,17 + 165,83 = 120 + 80 + 90 \quad \checkmark$$

$$290 = 290 \quad \checkmark$$

(1)

2.2 $V_c = 200 \sin 30^\circ \quad \checkmark$
 $= 100 \text{ N} \quad \checkmark$ full mark for correct answer (1)
[10]

QUESTION 3

- 3.1 3.1.1 Potential energy is the energy a body possesses due to its mass and height. (2)
- 3.1.2 Law of conventional energy states that energy cannot be created or destroyed but can be changed from one form to another. (2)

- 3.2 3.2.1 $E_p = m \times g \times h$
 $= 1600 \times 9.8 \times 1250 \checkmark$
 $= 19600000 \text{ J } \checkmark$
 $E_p = 19.6 \text{ MJ}$ (2)
- 3.2.2 $K_e \text{ at bottom} = P_e \text{ at top}$
 $= 19600000 \text{ J } \checkmark$ (1)
- [7]**

QUESTION 4

- 4.1 Work is done when a force is applied to an object \checkmark and the object is moved over a distance. \checkmark (Or Work done is the product of the force and distance) (2)
- 4.2 4.2.1 Weight of cable per metre
 $W = w \times L$
 $3\,000 \checkmark = w \times 280$
 $w = 3\,000 / 280$
 $= 10.7143 \text{ N/m } \checkmark$ if only correct answer - give full mark (1)
- 4.2.2 $WD_{\text{total}} = WD_{\text{rectangle}} + WD_{\text{triangle}}$
 $= (3\,000 \times 280) + (0.5 \times 280 \times 3\,000)$
 $= 1260000 \text{ J } \checkmark$ (3)
- 4.2.3 On Afrikaans question paper there is a translation error so give marks for force or power
 $F_c = W_L + W_c$
 $= 3\,000 + (10.7143 \times 100) \checkmark$
 $= 4017.43 \text{ N } \checkmark$ if only correct answer – give full mark
 $P_o = F_c \times V$
 $= 4017.43 \times 6 \checkmark$ (2)
 $= 24\,428 \text{ W } \checkmark$ if only correct answer - give full mark

4.3 $T = F \times r$
 $800 = F \times 0.6 \checkmark$
 $F = 1333.333 \text{ N} \checkmark$

(2)
[10]

QUESTION 5

- 5.1
- Gear drives \checkmark
 - Belt drives \checkmark any two
 - Chain drives \checkmark

(2)

- 5.2
- Tension the belt properly \checkmark
 - Increase the arc of contact \checkmark any two
 - Increase the coefficient of friction \checkmark

(2)

- 5.3
- Gear drives have more torque \checkmark
 - There is no slip in gear drives \checkmark any two
 - Gear drives use a smaller space \checkmark
 - There is less maintenance in gear drives

(2)

5.4 5.4.1

Tight side tension

$$T_1 = 3 \times T_2$$

$$= 3 \times 300 \checkmark$$

$$= 900 \text{ N} \checkmark$$

(2)

5.4.2

$$P_0 = (T_1 - T_2)V$$

$$= (900 - 300)35 \checkmark$$

$$= 21\,000 \text{ W} \checkmark$$

On Afrikaans question paper there is a translation error so give marks for force or power

5.5 5.5.1 $D_1 \times N_1 = D_2 \times N_2$

(2)

$$N_2 = \frac{20 \times 20}{60} \checkmark$$

$$= 6.67 \text{ r/s} \checkmark$$

(3)

5.5.2 $N_1 / N_2 = 20 / 6.67 \checkmark$

$$= 3 : 1 \checkmark \text{ accept } 2.99 : 1$$

(2)

5.5 The unit pascal is when a load of 1 N \checkmark is applied over an area of 1 m² \checkmark .

(2)
[17]

QUESTION 6

- 6.1
- Make the surfaces smoother ✓
 - Use lubricants ✓
 - Use bearings ✓
- (3)

6.2 6.2.1 $F_s = mg \times \sin \theta$

$$= 600 \times \sin 12^\circ \checkmark$$

$$= 124.74 \text{ N } \checkmark$$

(2)

6.2.2 $F_c = mg \times \cos \theta$

$$= 600 \times \cos 12^\circ \checkmark$$

$$= 586.888 \text{ N } \checkmark$$

(2)

6.2.3 $F_{up} = F_u + F_s$

$$= 95 + 124.74 \checkmark \checkmark$$

$$= 219.747 \text{ N } \checkmark$$

(3)
[10]

QUESTION 7

- 7.1 The amount of heat energy (in joules) required to heat a body with a mass of 1 kg ✓ at a temperature of 1°C ✓
- (2)

7.2 7.2.1 Heat energy from coal

$$Q = m \times HV$$

$$= 0.75 \times 30 \checkmark$$

$$= 22.5 \text{ MJ } \checkmark$$

(2)

7.2.2 Heat to rod

$$Q_{\text{rod}} = 40\% (Q_{\text{coal}})$$

$$= 0.4 \times 22.5 \checkmark$$

$$= 9 \text{ MJ } \checkmark$$

(2)

7.2.3 $Q = m \times c \times \Delta t$

$$9000\ 000 = 10 \times 900 \times \Delta t$$

$$\Delta t = 1\ 000^\circ\text{C } \checkmark$$

$$t_f = \Delta t + 25$$

$$t_f = 1\ 000 + 25$$

$$= 1025^\circ\text{C } \checkmark$$

(2)

$$\begin{aligned}
 7.2.4 \quad \Delta L &= L_0 \times \alpha \times \Delta t \\
 &= 2\,000 \times 0.000017 \times 1\,000 \\
 &= 34 \text{ mm } \checkmark
 \end{aligned}$$

$$\begin{aligned}
 L_f &= L_0 + \Delta L \\
 &= 2\,000 + 46 \\
 &= 2\,034 \text{ mm } \checkmark \\
 &= 2.034 \text{ m}
 \end{aligned}$$

(2)

- 7.3
- Steam is relatively cheap ✓
 - Steam is clean – pollution free.
 - Steam can be used repeatedly

(Any 1 x 1)

(1)
[11]**QUESTION 8**

8.1 8.1.1 Positive ✓

8.1.2 Neutral (no charge) ✓

8.1.3 Negative ✓

(3)

8.2 An electrolyte is a solution that is able to conduct an electric current. ✓

(1)

8.3 Electroplating is the process of covering metal ✓ with a hard, durable coating.

(1)

8.4 Electroplating makes the surface hard and wear-resistant. ✓
 Electroplating makes the material corrosion-resistant. ✓
 Electroplating beautifies the object.

(Any 2 x 1)

(2)
[7]**QUESTION 9**

- 9.1
- Resistivity/type of material
 - Length
 - Area/diameter/thickness
 - Temperature

(2)

9.2 9.2.1 Increase ✓

(1)

9.2.2 Total Resistance

$$\begin{aligned}
 R_p &= \frac{R_A \times R_B}{R_A + R_B} \\
 &= \frac{5 \times 9}{5 + 9} \\
 &= 3,214 \Omega \quad \checkmark
 \end{aligned}$$

$$\begin{aligned}
 R_{total} &= R_p + R_c \quad \checkmark \\
 &= 3,214 + 10 \\
 &= 13,214 \Omega \quad \checkmark
 \end{aligned}$$

(3)

9.3

$$R = \frac{\rho \times l}{A}$$

$$= \frac{18 \times 10^{-9} \times 5500}{176,714 \times 10^{-6}}$$

$$= 0,56 \Omega$$

$$A = \frac{\pi}{4} d^2$$

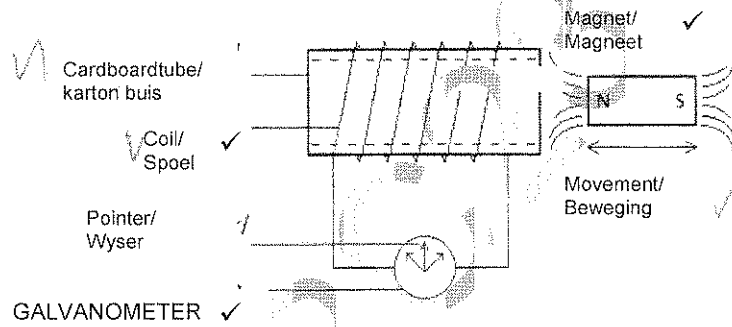
$$= \frac{\pi}{4} (0,015)^2$$

$$= 176,714 \times 10^{-6} m^2$$

(3)

9.4

SELF-INDUCTION/SELF-INDUKSIE



(3)

9.5

- Transformers ✓
- Generators
- Electric motors

(1)

[13]

TOTAL: 100