

# higher education & training

Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

## **MARKING GUIDELINE**

**ENGINEERING SCIENCE N2**

**NOVEMBER EXAMINATION**

**NATIONAL CERTIFICATE**

**19 NOVEMBER 2014**

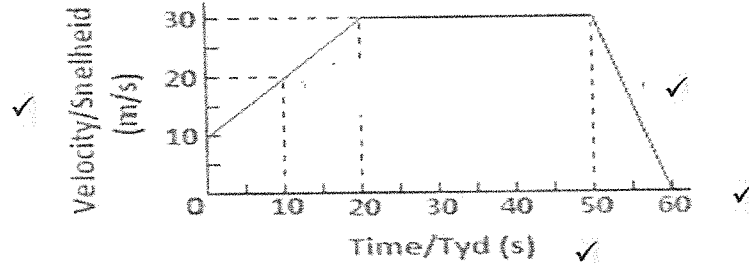
**This marking guideline consists of 10 pages**

**QUESTION 1**

1.1 1.1.1 • Speed in a given direction ✓ (1)

1.1.2 • The distance covered regardless of direction ✓ (1)

1.2 1.2.1



(2)

1.2.2 The gradient represents acceleration (1)

1.2.3 (a)  $a = \frac{v - u}{t}$

$$= \frac{30 - 10}{20}$$

$$= 1 \text{ m/s}^2$$

(2)

(b)  $S_{\text{tot}} = S_{\text{rect}} + S_{\text{triangle}}$

$$= (20 \times 10) + \left(\frac{1}{2} \times 1 \times 20\right)$$

$$= 400\text{m}$$

(3)

(c) Time for deceleration  
(from graph) = 10 s

(2)

[12]

## QUESTION 2

2.1 2.1.1 Take moments about L

$$\sum_{ACM} = \sum_{CM}$$

$$R(8) = 100(2) + 200(6) + 7(9)$$

$$R(8) = 200 + 1200 + 675$$

$$R = 259,375 \text{ N}$$

Take moments about R

$$\sum_{ACM} = \sum_{CM}$$

$$200(2) + 100(6) = 75(1) + L(8)$$

$$L = \frac{1000 - 75}{8}$$

$$L = 115,625 \text{ N}$$

(3)

(3)

2.1.2

$$\sum_{F\uparrow} = \sum_{F\downarrow}$$

$$259,375 + 115,625 = 100 + 200 + 75$$

$$375 = 375$$

(1)

2.2

- Wing-nut ✓
- Tap
- Stock and die
- Wheel spanner

any one

(1)

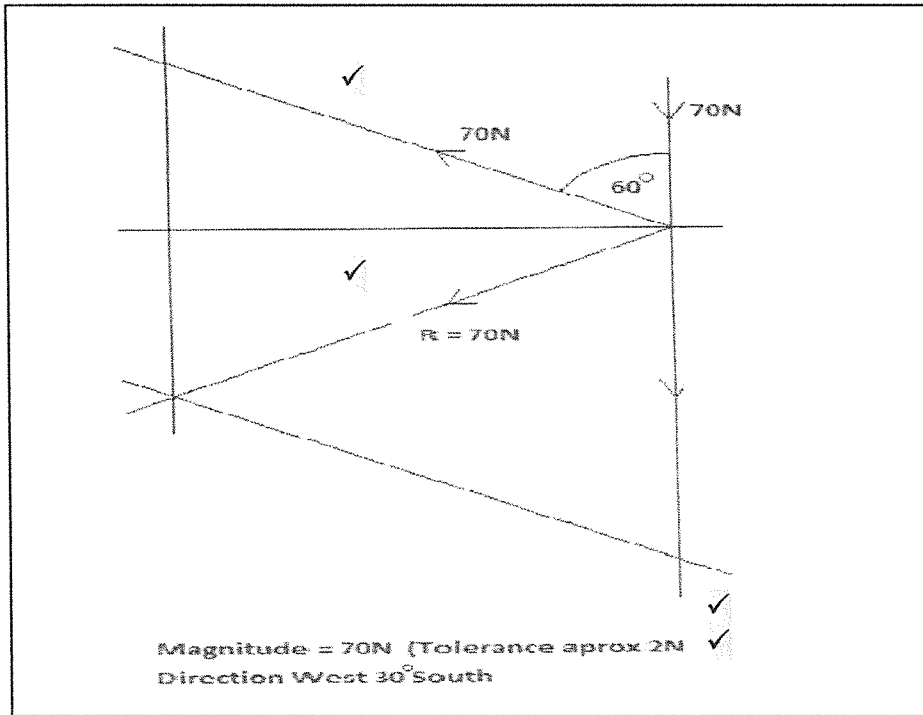
2.3  $F \sin 60^\circ = 200$

$$F = \frac{200}{\sin 60^\circ}$$

$$F = 230,9 \text{ N}$$

(2)

2.4



(4)  
[14]

**QUESTION 3**

3.1 The energy a body possesses due to its mass and height. (2)

3.2 3.2.1  $PE = mg h$   
 $PE = 4 \times 9,8 \times 400$   
 $PE = 15680 \text{ J}$

OR

$P_E = 15,68 \text{ KJ}$  (2)

- 3.2.2. Velocity with which the stone hits the ground  
 $E_k = \frac{1}{2} mv^2$

$$V = \sqrt{\frac{2 E_k}{m}}$$

$$= \frac{\sqrt{2 \times 15660}}{4}$$

$$= 88,544 \text{ m/s}$$

OR

$$V = \sqrt{2gh}$$

$$= \sqrt{2 \times 9,8 \times 400}$$

$$= 88,544 \text{ m/s} \quad (2)$$

- 3.2.3. Time

$$V = u + at$$

$$T = \frac{v - u}{a}$$

$$T = \frac{88,544 - 0}{9,8}$$

$$T = 9,035 \text{ s} \quad (2)$$

- 3.3 Momentum is the product of the mass and velocity of an object. (2)

- 3.4 Momentum of truck

$$P = m \times v$$

$$P = 2500 \times 40$$

$$P = 100\,000 \text{ kg. m/s} \quad (2)$$

**[12]**

#### QUESTION 4

- 4.1 Work done per second ✓✓ or  
 Rate at which work is done (2)

- 4.2 4.2.1 Weight of cable per metre

$$W = w \times L$$

$$4\,000 = w \times 100$$

$$W = 40 \text{ N/m} \quad (1)$$

4.2.2 Work done  
 WD tot = WD rect + WD triangle  

$$= (10\,000 \times 100) + (\frac{1}{2} \times 100 \times 4\,000) \checkmark$$

$$= 1\,200\,000 \text{ J} \checkmark$$

OR

$$\frac{1}{2} \sum 11 \times \perp h$$

$$= 100 \left( \frac{10\,000 + 14\,000}{2} \right)$$

$$= 1\,200\,000 \text{ J} \quad (2)$$

4.2.3 F cable = WL + Wc  

$$= 10\,000 + (40 \times 50)$$

$$= 12\,000 \text{ N}$$

$$P = F \times V$$

$$P = 12\,000 \times 12$$

$$P = 144\,000 \text{ W} \quad (2)$$

4.3 4.3.1 T = F x r

$$T = 500 \times 0,4$$

$$T = 200 \text{ Nm} \quad (2)$$

4.3.2 WD = F x π x D x n

$$WD = 500 \times \pi \times 0,8 \times 200 \checkmark$$

$$WD = 251\,327 \text{ J} \checkmark \quad (2)$$

**[11]**

**QUESTION 5**

- 5.1
- Gear drives  $\checkmark$
  - Belt drives  $\checkmark$
  - Chain drives  $\checkmark$
- (3)

- 5.2
- More torque (power) ✓
  - Last longer ✓
  - Use less space
  - Less stretch
- (any 2 x 1)
- (2)
- 5.3      5.3.1      Load =  $m \times g$
- $= 400 \times 9,8$
- $= 3920 \text{ N}$
- MA =  $L/E$
- $= 3920/40 \checkmark$
- $= 98 \checkmark$
- (2)
- 5.3.2       $VR = \frac{2}{1} \frac{d_1}{(d_1 - d_2)}$
- $= \frac{2 \times 400}{200 - 100} \checkmark$
- $= 8 \checkmark$
- (3)
- 5.4      5.4.1       $P = \rho \times g \times h$
- $900\,000 = 1030 \times 9,8 \times h \checkmark$
- $H = 89,1619 \text{ m} \checkmark$
- (2)
- 5.4.2      Absolute pressure
- $P_{abs} = P_g + P_{atm}$
- $= 900 + 101,3 \text{ Kpa}$
- $= 1001,3 \text{ Kpa}$
- (1)  
[13]

**QUESTION 6**

- 6.1
- Nature of surface
  - Weight
- (2)

- 6.2      6.2.1       $\mu = \tan Q$   
 $\mu = \tan 20^\circ$   
 $\mu = 0,364$  (1)
- 6.2.2       $F = mg \cos \theta$   
 $= 40 \times 9,8 \times \cos 20^\circ$   
 $= 368,36 \text{ N}$  (2)
- 6.2.3       $F_s = mg \sin \theta$   
 $= 40 \times 9,8 \times \sin 20^\circ$   
 $= 130,07 \text{ N}$  (2)
- 6.2.4       $F_{up} = F_s + F_\mu$   
 $= 134,07 + 134,07$   
 $= 268,14 \text{ N}$   
 $F_\mu = \mu (NR)$   
 $= 0,364 \times 368,37$   
 $= 134,07 \text{ N}$  (3)
- [10]**

**QUESTION 7**

- 7.1      The amount of heat energy released when 1 kg of a fuel is completely burnt. (2)
- 7.2       $\Delta T = T_H - T_L$   
 $= 80 - 0$   
 $= 80^\circ\text{C}$   
 $Q = m \times c \times \Delta t$   
 $Q = 6 \times 4187 \times 80$   
 $Q = 2009760$   
 $Q = 2009,76 \text{ kJ}$

(3)



7.3 Heat lost = Heat gained

$$M \times c \times \Delta t = M \times c \times \Delta t$$

$$6 \times 500 \times 55 = m \times 4187 \times 20$$

$$M = 1,97 \text{ kg} \quad (3)$$

7.4 The amount by which a material will expand ✓ when heated by 1°C. ✓  
The increase in length of a substance per unit length when its temperature is increased by 1°C any one (2)

7.5  $\Delta L = L_0 \times \alpha \times \Delta t$

$$\Delta L = 450\,000 \times 0,000012 \times (500 - 22)$$

$$\Delta L = 2581,2 \text{ mm} \quad (2)$$

[12]

### QUESTION 8

- 8.1
- 8.1.1 • Positive
  - 8.1.2 • Negative
  - 8.1.3 • Neutral
- (3)

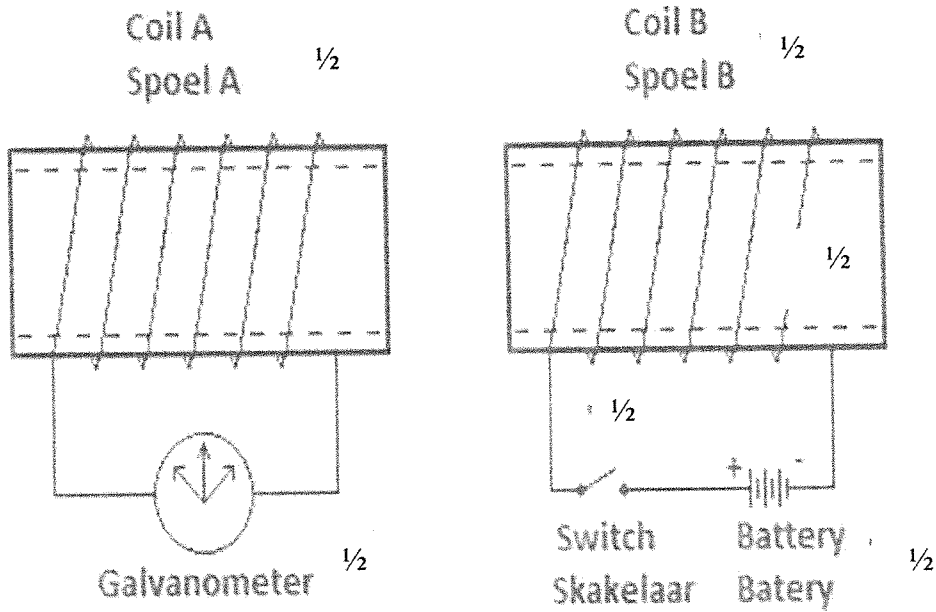
8.2 An electrolyte is a solution able to conduct electric current (1)

- 8.3
- Electroplating
  - Electrorefining
- (2)  
[6]

### QUESTION 9

9.1 A coulomb is the quantity of electric charge that passes any point in a circuit in one second when a steady current of one ampere is flowing. (2)

9.2



(3)

9.3

- Resistivity
- Length
- Area
- Temperature

(Any 2 x 1)

(2)

9.4

$$R_p = \frac{R_1 \times R_2}{R_1 + R_2}$$

$$= \frac{3 \times 3}{3 + 3}$$

$$= 1,5 \Omega$$

$$R_{total} = R_p + R_3$$

$$= 1,5 \Omega + 4$$

$$= 5,5 \Omega$$

(3)

[10]

**TOTAL: 100**