



# higher education & training

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

## **MARKING GUIDELINE**

**NATIONAL CERTIFICATE**

**BUILDING SCIENCE N2**

**4 February 2022**

**This marking guideline consists of 8 pages.**

**QUESTION 1**

- 1.1 True✓ (1)
- 1.2 True✓ (1)
- 1.3 False✓ – Medical personnel✓ use clinical thermometers✓ on a daily basis. (3)
- 1.4 False✓ – A conductor✓ is an object or material that allows thermal energy to transfer easily.✓ (3)

**OR**

An insulator is an object or material that minimises the transfer of thermal energy. (3)

- 1.5 False✓ – Temperature✓ is the condition of a substance with regard to its degree of coldness or hotness.✓ (3)

**OR**

Heat is the transfer of energy from one substance to another. (3)

- 1.6 True✓ (1)
- 1.7 True✓ (1)
- 1.8 False✓ – The symbol for the SI unit of mass✓ is kg or g.✓ (3)
- 1.9 True✓ (1)
- 1.10 True✓ (1)

**[18]****QUESTION 2**

- 2.1 Take moments about  $R_R$  to calculate the magnitude of  $R_L$ :

$$\sum \text{CW moments} = \sum \text{ACW moments}✓$$

$$(R_L \times 9) = ((20 \times 3) \times 1,5) + (62 \times 3) + (60 \times 5) + ((10 \times 4) \times 7)✓$$

$$(R_L \times 9) = 90 + 186 + 300 + 280✓$$

$$R_L = \frac{856}{9}✓$$

$$R_L = 95,111 \text{ kN}✓$$

**OR**

$$\sum \text{CW moments} = \sum \text{ACW moments} \checkmark \quad \checkmark$$

$$(R_L \times 9\text{m}) = (60\text{KN} \times 1.5\text{m}) + (62\text{KN} \times 3\text{m}) + (60\text{KN} \times 5\text{m}) + (40\text{KN} \times 7\text{m})$$

$$(R_L \times 9\text{m}) = 90 \text{ KNm} + 186\text{KNm} + 300\text{KNm} + 280\text{KNm} \checkmark$$

$$R_L = \frac{856}{9} \checkmark$$

$$R_L = 95,111 \text{ kN} \checkmark$$

OR

$$R_R \times 9\text{m} = (40\text{KN} \times 2\text{m}) + (60\text{KN} \times 4\text{m}) + (62\text{KN} \times 6\text{m}) + (60 \times 7,5\text{m}) \checkmark$$

$$(R_R \times 9) = 80 \text{ KNm} + 240\text{KNm} + 372\text{KNm} + 450\text{KNm} \checkmark$$

$$R_R = \frac{1\,142\text{KNm}}{9\text{m}} \checkmark$$

$$R_R = 126,989 \text{ kN} \checkmark$$

(5)

2.2 Take moments about  $R_L$  to calculate the magnitude of  $R_R$ :

$$\sum \text{ACW moments} = \sum \text{CW moments} \checkmark$$

$$(R_R \times 9) = ((10 \times 4) \times 2) + (60 \times 4) + (62 \times 6) + ((20 \times 3) \times 7,5) \checkmark$$

$$(R_R \times 9) = 80 + 240 + 372 + 450 \checkmark$$

$$R_R = \frac{1\,142}{9} \checkmark$$

$$R_R = 126,9 \text{ kN} \checkmark$$

(5)

2.3 Test the answer to prove equilibrium:

$$\sum \text{Upward forces} = \sum \text{Downward forces}$$

$$(95,111 \text{ kN} + 126,989 \text{ kN}) \checkmark = (40 \text{ kN} + 60 \text{ kN} + 62 \text{ kN} + 60 \text{ kN}) \checkmark$$

$$222 \text{ kN} = 222 \text{ kN} \checkmark$$

(3)

[13]

### QUESTION 3

3.1 The density of a substance is the mass per unit volume of the substance and is expressed in  $\text{g/cm}^3$  or  $\text{kg/m}^3$ .

(3)

$$\begin{aligned} \Delta L &= L_o \times \Delta T \times \alpha \\ &= 500,595 \times 0,000017 \times 70 \checkmark \\ &= 0,596 \text{ cm} \checkmark \end{aligned}$$

$$\begin{aligned} L_f &= L_o - L_u \\ &= 500,595 - 0,596 \checkmark \\ &= 500 \text{ cm} \checkmark \checkmark \end{aligned}$$

(5)

3.3      3.3.1       $D = \frac{m}{V}$   
 $V = \frac{m}{D}$   
 $= \frac{210}{8\,500}$   
 $= 0,025 \text{ m}^3$  (3)

3.3.2      Apparent loss of mass of steel = Mass of a liquid displaced  
 $\text{Mass}_{\text{Liquid}} = D_{\text{Liquid}} \times \text{Volume}$   
 $= 710 \times 0,025$   
 $= 17,75 \text{ kg}$  (3)  
**[14]**

#### QUESTION 4

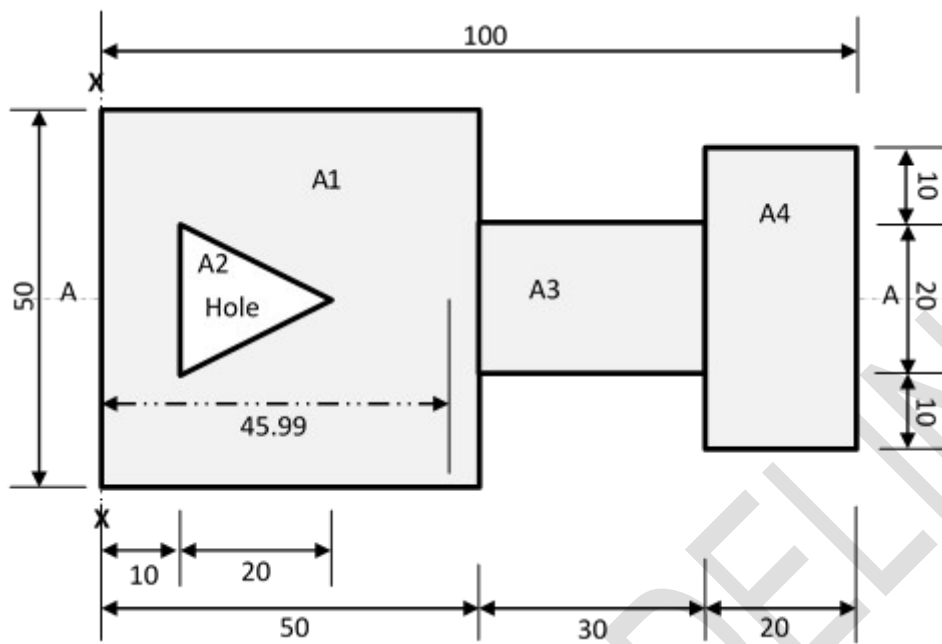
4.1

| MEMBER        | 4.1.1<br>AREA                                         | 4.1.2<br>X-X<br>DISTANCE | 4.1.3<br>MOMENTS                                                  |
|---------------|-------------------------------------------------------|--------------------------|-------------------------------------------------------------------|
| 1             | $50 \times 50 = 2\,500 \text{ mm}^2$                  | $25 \text{ mm}$          | $2\,500 \text{ mm}^2 \times 25 \text{ mm} = 62\,500 \text{ mm}^3$ |
| 2             | $\frac{1}{2} \times 20 \times 20 = -200 \text{ mm}^2$ | $16,7 \text{ mm}$        | $200 \text{ mm}^2 \times 16,7 \text{ mm} = -3\,340 \text{ mm}^3$  |
| 3             | $30 \times 20 = 600 \text{ mm}^2$                     | $65 \text{ mm}$          | $600 \text{ mm}^2 \times 65 \text{ mm} = 39\,000 \text{ mm}^3$    |
| 4             | $20 \times 40 = 800 \text{ mm}^2$                     | $90 \text{ mm}$          | $800 \text{ mm}^2 \times 90 \text{ mm} = 72\,000 \text{ mm}^3$    |
| <b>TOTALS</b> | <b><math>3\,700 \text{ mm}^2</math></b>               |                          | <b><math>170\,160 \text{ mm}^3</math></b>                         |
| <b>marks</b>  | (5)                                                   | (4)                      | (6)                                                               |

4.1.4       $\bar{y} = \frac{\Sigma \text{MOMENTS}}{\Sigma \text{AREA}}$   
 $\bar{y} = \frac{170\,160 \text{ mm}^3}{3\,700 \text{ mm}^2}$   
 $\bar{y} = 45,99 \text{ mm X-X}$  (4)

4.2

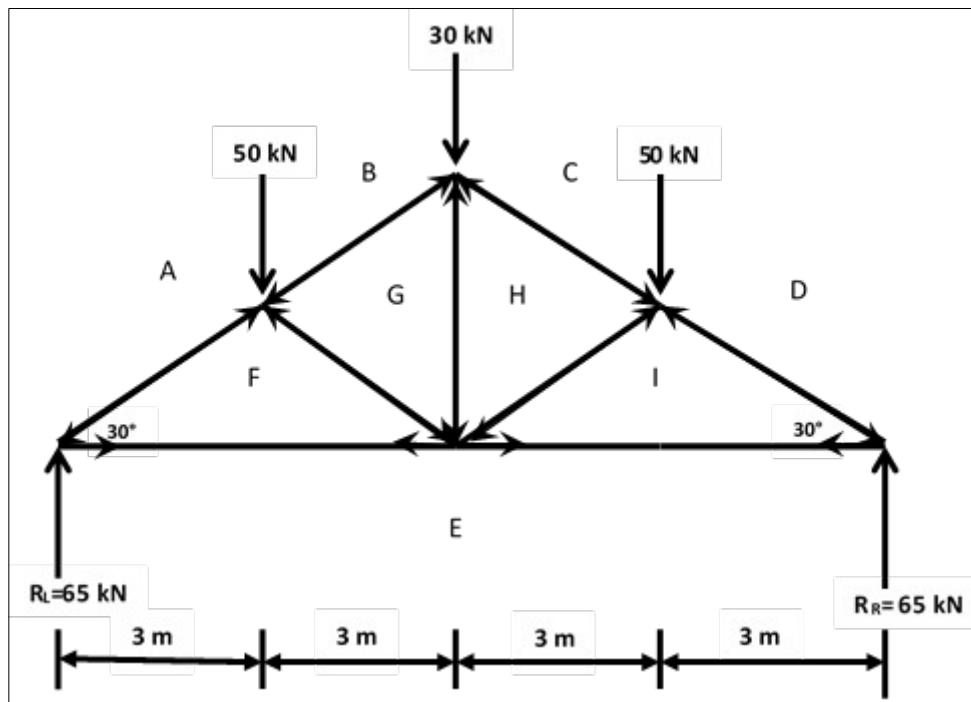
Space diagram = 2 marks  
Position of centroid = 2 marks



(4)  
[23]

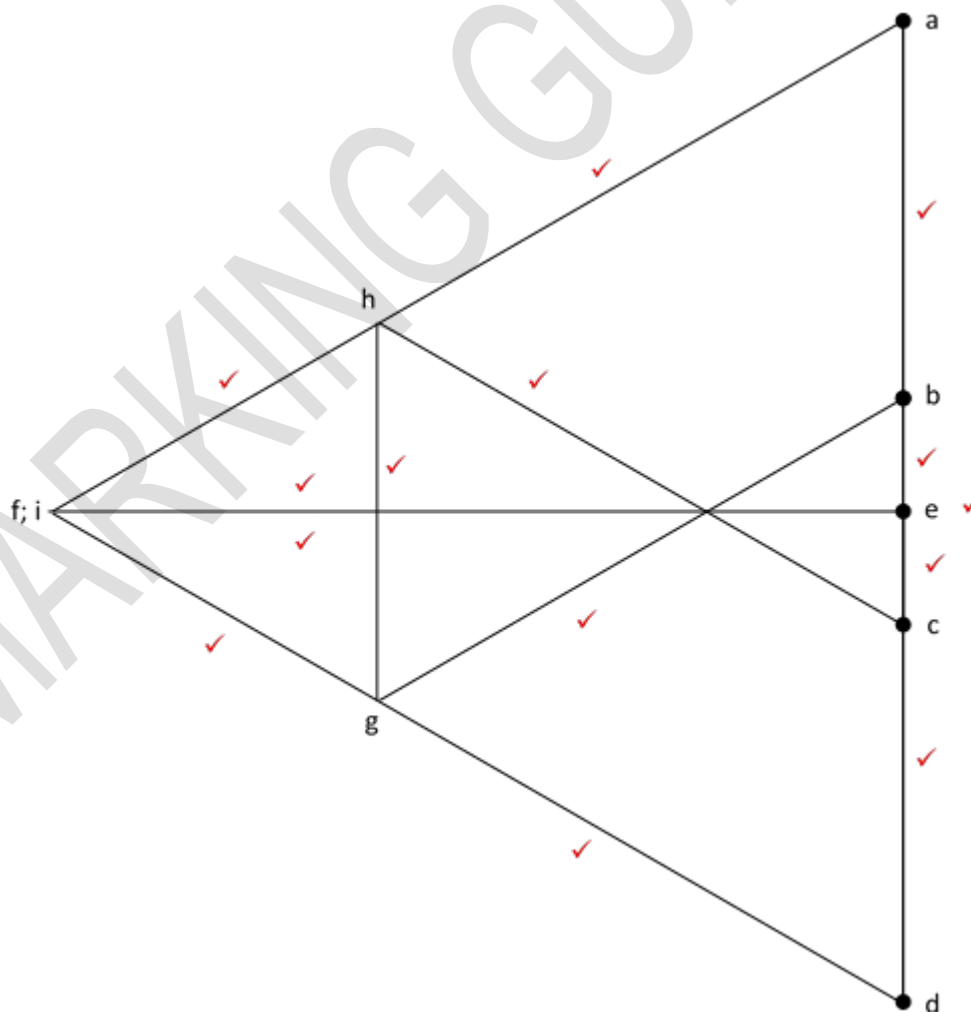
### QUESTION 5

## 5.1



(4)

## 5.2


$$(14 \times \frac{1}{2}) \quad (7)$$

5.3

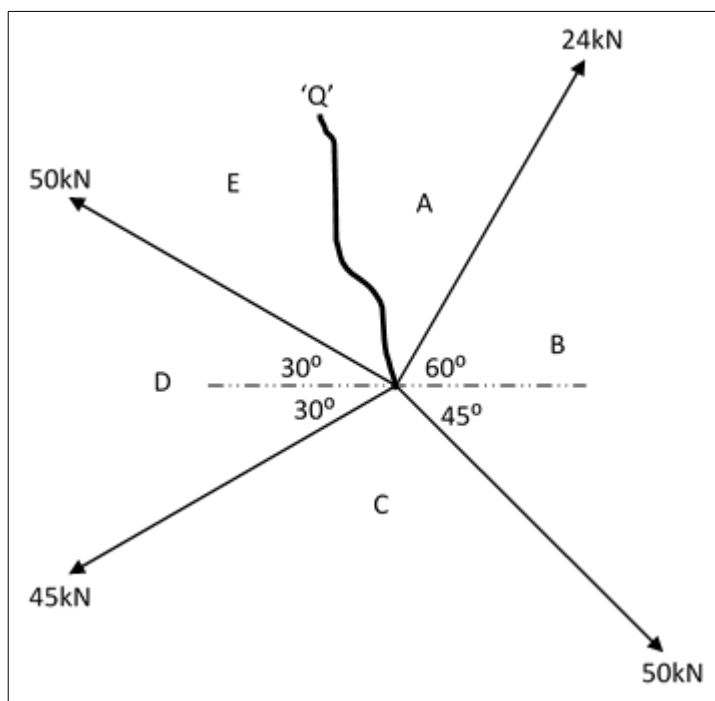
| MEMBER | MAGNITUDE | NATURE |
|--------|-----------|--------|
| AF     | 130 kN✓   | Strut✓ |
| BG     | 80 kN✓    | Strut✓ |
| CH     | 80 kN✓    | Strut✓ |
| DI     | 130 kN✓   | Strut✓ |
| EF     | 113 kN✓   | Tie✓   |
| FG     | 50 kN✓    | Strut✓ |
| GH     | 50 kN✓    | Tie✓   |
| HI     | 50 kN✓    | Strut✓ |
| IE     | 113 kN✓   | Tie✓   |

(18 × ½)

(9)  
[20]

## QUESTION 6

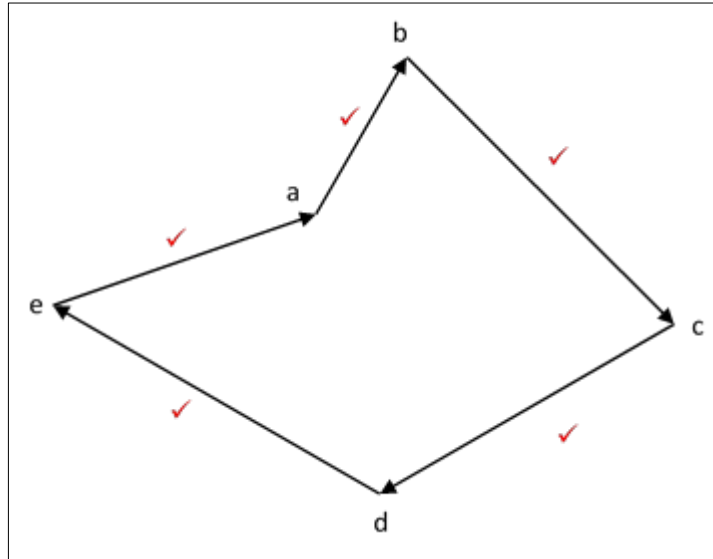
6.1



Space diagram = 1 mark  
Bow's notation = 2 marks

(3)

6.2



$Q = 36 \text{ kN}$  ✓✓ @  $18^\circ$  ✓ north of east ✓

(9)  
[12]

**TOTAL: 100**