



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

26 March 2026

This marking guideline consists of 6 pages.

QUESTION 1

- 1.1 The moment of a force is the turning effect that is caused by the force ✓ about its axis of rotation. ✓ (2)
- 1.2 The resultant is a single force ✓ which can replace two or more forces ✓ working on a body and produce the same effect as those forces. ✓ (3)
- 1.3 If more than three coplanar concurrent forces acting on a point are in equilibrium, ✓ they can be represented in magnitude and direction ✓ by the side of a closed polygon taken in order. ✓ (3)
- 1.4 The centroid of a body is that point about which the mass of the body is ✓ considered to act. ✓ (2)
- 1.5 If a system of forces is in equilibrium ✓ the sum of the clockwise moments taken about a point ✓ will be equal to the anti-clockwise moments taken about the same point. ✓ (3)
- [13]

QUESTION 2

- 2.1 Take moments about R_R to calculate the magnitude of R_L
- $$\begin{aligned}\sum \text{CW Moments} &= \sum \text{ACW Moments} \checkmark \\ (R_L \times 9) &= [(10 \times 3.5) \times 7.25] + (50 \times 4.5) + [(15 \times 4.5) \times 2.25] \checkmark \\ (R_L \times 9) &= 253.75 + 225 + 151.875 \checkmark \\ R_L &= \frac{630.625}{9} \checkmark \\ R_L &= 70.069 \text{ kN} \checkmark\end{aligned}$$
- (5)
- 2.2 Take moments about R_L to calculate the magnitude of R_R
- $$\begin{aligned}\sum \text{ACW Moments} &= \sum \text{CW Moments} \checkmark \\ (R_R \times 9) &= [(15 \times 4.5) \times 6.75] + (50 \times 4.5) + [(10 \times 3.5) \times 1.75] \checkmark \\ (R_R \times 6.5) &= 455.625 + 225 + 61.25 \checkmark \\ R_R &= \frac{741.875}{9} \checkmark \\ R_R &= 82.431 \text{ kN} \checkmark\end{aligned}$$
- (5)
- 2.3 Test the answer to prove equilibrium:
- $$\begin{aligned}\sum \text{Upwards Forces} &= \sum \text{Downwards Forces} \\ (70.069 \text{ kN} + 82.431 \text{ kN}) &= (35 \text{ kN} + 50 \text{ kN} + 67.5 \text{ kN}) \checkmark \\ 152.5 \text{ kN} &= 152.5 \text{ kN} \checkmark\end{aligned}$$
- (2)
- [12]

QUESTION 3

3.1
$$L_u = L_{\text{FINAL}} - L_o$$
$$L_u = 235,33 - 235 \checkmark$$
$$L_u = 0,33 \text{ cm} \checkmark$$

$$L_u = L_o \times \alpha \times \Delta t$$

$$\alpha = \frac{L_u}{L_o \times \Delta t} \checkmark$$

$$= \frac{0,33}{235 \times 120} \checkmark$$

$$= 1,1702 \times 10^{-5} / ^\circ\text{C} \checkmark$$

5)

3.2
$$\% \text{ porosity} = \frac{\text{Bulk volume} - \text{Solid density} \times 100 \checkmark}{\text{Bulk density}}$$

$$= \frac{5,7 \text{ cm} - 4,5 \text{ cm} \times 100 \checkmark}{5,7 \text{ cm}}$$

$$= \frac{1,2 \text{ cm} \times 100 \checkmark}{5,7 \text{ cm}}$$

$$= 21,053\% \checkmark \checkmark$$

(5)
[10]

QUESTION 4

MEMBER	4.1 AREA	4.2 DISTANCE	4.3 AREA × DISTANCE
A1	$100 \times 60 = 6000 \text{ cm}^2 \checkmark$	$50 \text{ cm} \checkmark$	$6000 \text{ cm}^2 \times 50 \text{ cm} = 300\,000 \text{ cm}^3 \checkmark$
A2	$\frac{1}{4} \times \pi \times 20^2 = -314.159 \text{ cm}^2 \checkmark$	$20 \text{ cm} \checkmark$	$314.159 \text{ cm}^2 \times 20 \text{ cm} = -6283.18 \text{ cm}^3 \checkmark$
A3	$\frac{1}{4} \times \pi \times 20^2 = -314.159 \text{ cm}^2 \checkmark$	$50 \text{ cm} \checkmark$	$314.159 \text{ cm}^2 \times 50 \text{ cm} = -15707.95 \text{ cm}^3 \checkmark$
A4	$20 \times 30 = -600 \text{ cm}^2 \checkmark$	$80 \text{ cm} \checkmark$	$600 \text{ cm}^2 \times 80 \text{ cm} = -48\,000 \text{ cm}^3 \checkmark$
TOTALS	$= 4\,771.682 \text{ cm}^2 \checkmark$		$= 230\,008.87 \text{ cm}^3 \checkmark \checkmark$
Marks	(5)	(4)	(6)

4.4
$$\hat{y} = \frac{(\text{TOTAL AREA} \times \text{DISTANCE}) \checkmark}{\text{TOTAL AREA}}$$

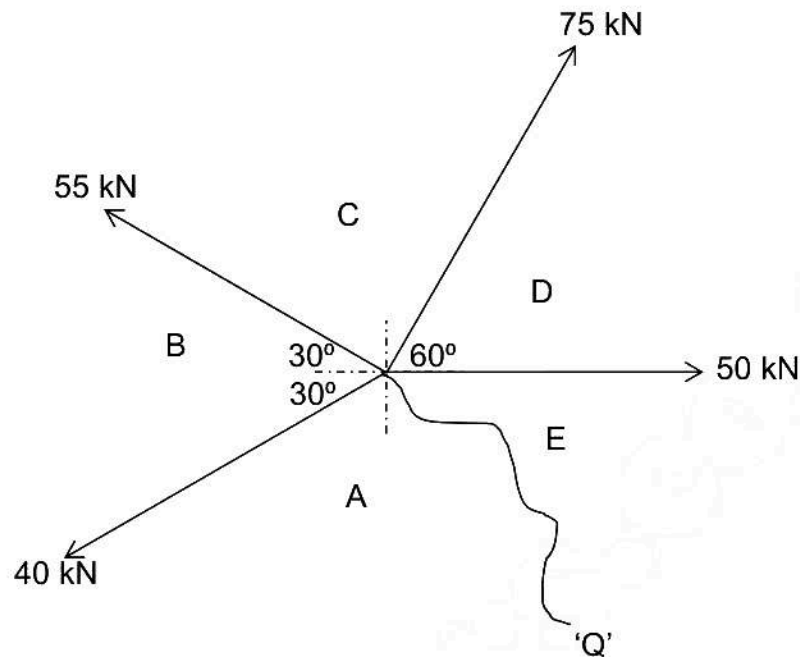
$$\hat{y} = \frac{230\,008.87 \text{ cm}^3 \checkmark}{4\,771.682 \text{ cm}^2}$$

$$\hat{y} = 48.203 \text{ cm} \checkmark \checkmark$$

(4)
[19]

QUESTION 5

5.1



(2 marks for Bows Notation) (2)

5.2

Force	Vertical Component		Horizontal Component	
AB	$40 \times \sin 30^\circ$	-20	$40 \times \cos 30^\circ$	-34.641
BC	$55 \times \sin 30^\circ$	27.5	$55 \times \cos 30^\circ$	-47.631
CD	$75 \times \sin 60^\circ$	64.952	$75 \times \cos 60^\circ$	37.5
DE	$50 \times \sin 0^\circ$	0	$50 \times \cos 0^\circ$	50
	ΣVC	72.452	ΣHC	5.228

$$\begin{aligned}
 R^2 &= VC^2 + HC^2 \\
 &= (72.452)^2 + (5.228)^2 \\
 &= 72.64 \text{ kN}
 \end{aligned}$$

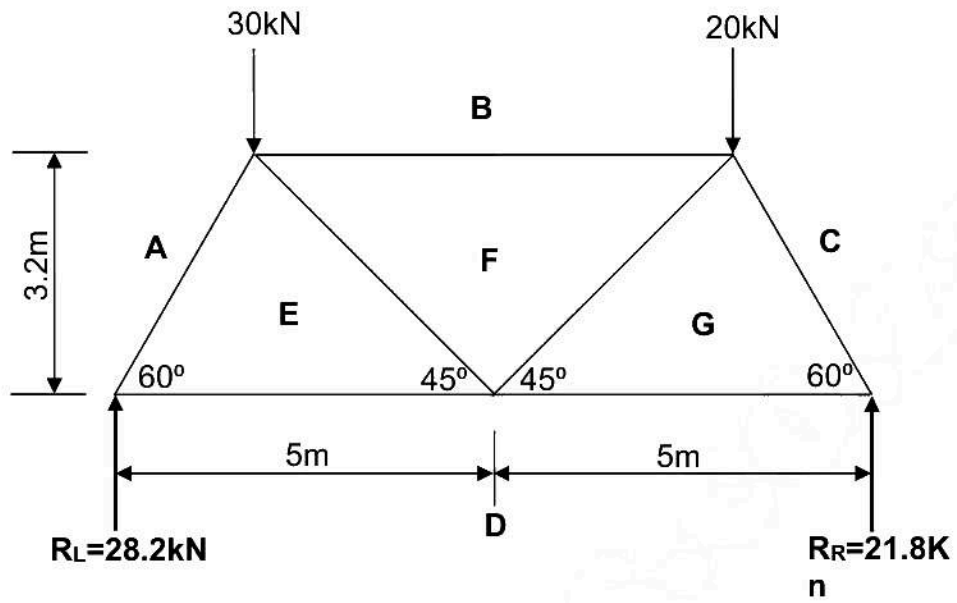
$$\begin{aligned}
 \tan \alpha &= \frac{\Sigma VC}{\Sigma HC} \\
 \tan \alpha &= \frac{72.452}{5.228} \\
 \tan \alpha &= 13.858 \\
 \alpha &= \tan^{-1} 13.858 \\
 \alpha &= 85.873^\circ
 \end{aligned}$$

"R" = 72.64 kN @ 85.873° (South of East or below horizontal to the right)

(30 × ½) (15)
[17]

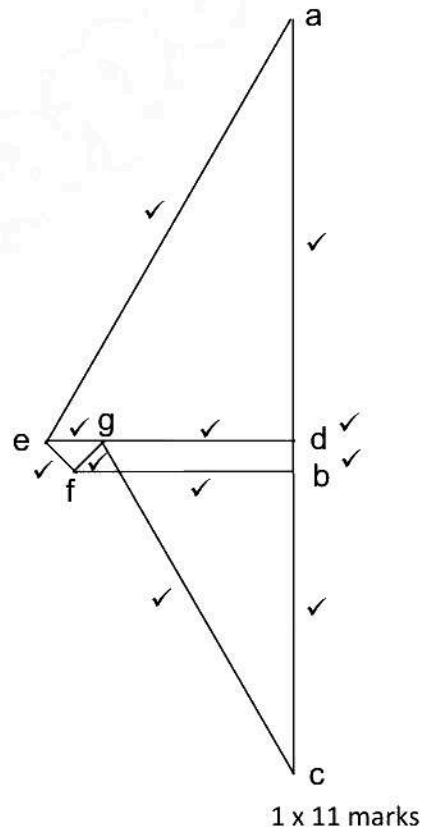
QUESTION 6

6.1



(2 marks Redraw)
(2 marks Bow's Notation) (4)

6.2



(11)

6.3

MEMBER	MAGNITUDE	NATURE
AE	32.5 kN✓	Strut✓
BF	14.5 kN✓	Strut✓
CG	25.5 kN✓	Strut✓
DG	12.5 kN✓	Tie✓
DE	16.5 kN✓	Tie✓
EF	3.3 kN✓	Strut✓
FG	3.3 kN✓	Tie✓

Tolerance = +/-3kN ($14 \times \frac{1}{2}$)

(7)
[22]

QUESTION 7

- 7.1 False✓
Heat can be transferred through liquids, vacuum and solids. ✓ (2)
- 7.2 True✓ (1)
- 7.3 False✓
Alcohol thermometer can only freeze at -130°C.✓ (2)
- 7.4 True✓ (1)
- 7.5 True✓ (1)
- [7]

TOTAL: 100