higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

18 November 2022

This marking guideline consists of 7 pages.

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QUESTION 1

1.1 4 °C ✓ (1)

1.2 Heat energy ✓ (1)

1.3 1.3.1
- If a system of forces is in equilibrium, the sum of the clockwise moments about any turning point is equal to the anticlockwise moments about the same point. OR
- It is the rotational effect of a force acting on a body. OR
- It is the applied force, multiplied by the perpendicular distance measured from the fulcrum to the work line of the force. (3)

1.3.2 Capillary action is the rising of liquids such as water and oil that can wet the surfaces through the fine pores of certain solid substances. (3)

1.3.3 Torque is the effect of a force on an object fixed at a turning point that will produce rotation movement about that fixed point. (3)

1.3.4 It is to push up, keep up or bring to the surface. (2)

[13]

QUESTION 2

2.1
$$\sum \text{CW moments} = \sum \text{ACW moments} \checkmark$$
$$(R_L \times 16) = (140 \times 18) + (180 \times 12) + (230 \times 4) \checkmark$$
$$(R_L \times 16) = 2\,520 + 2\,160 + 920 \checkmark$$
$$R_L = \frac{5\,600}{16} \checkmark$$
$$R_L = 350 \text{ kN} \checkmark$$ (5)

2.2
$$\sum \text{ACW moments} = \sum \text{CW moments} \checkmark$$
$$(R_R \times 16) + (140 \times 2) = (180 \times 4) + (230 \times 12) \checkmark$$
$$(R_R \times 6) = 720 + 2\,760 - 280 \checkmark$$
$$R_R = \frac{3\,200}{16} \checkmark$$
$$R_R = 200 \text{ kN} \checkmark$$ (5)

2.3
$$\sum \text{Upwards forces} = \sum \text{Downwards forces}$$
$$(350 \text{ kN} + 200 \text{ kN}) \checkmark = (140 \text{ kN} + 180 \text{ kN} + 230 \text{ kN}) \checkmark$$
$$550 \text{ kN} = 550 \text{ kN} \checkmark$$ (3)

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QUESTION 3

3.1
- Soundproof
- Hail-resistant
- Water-resistant
- Withstand climate changes
- Withstand reflection/absorption of heat and cold
- Relatively cheap / cost effective / minimal cost to construction
- Attractive
- Accommodate roof construction
- Durable
- Light in mass / light weight
- Rust-resistant
- Easily available
- Low maintenance
- Terminal ability Alternatives (Any 4 × 1) (4)

3.2
- No, it is not suitable. ✓
- It rusts easily. ✓
- The maintenance is high. ✓ (3)

3.3 3.3.1 Heat capacity ✓
3.3.2 Conduction ✓
3.3.3 Specific heat capacity OR SHC ✓ (3 × 1) (3)
[10]

QUESTION 4

MEMBER	4.1 AREA	4.2 METAL PLATE DISTANCE	4.3 AREA × DISTANCE
1	60 × 70 = 4 200 mm^2✓	35 mm✓	4 200 mm^2 × 35 mm = 147 000 mm^3✓
2	Π × 13^2 = -530,929 mm^2✓	28 mm✓	530,929 mm^2 × 28 mm = -14 866,012 mm^3✓
3	½ × 21 × 21 = -220,5 mm^2✓	68 mm✓	220,5 mm^2 × 68 mm = -14 994 mm^3✓
4	80 × 22 = 1 760 mm^2✓	81 mm✓	760 mm^2 × 81 mm = 142 560 mm^3✓
TOTALS	**= 5 208,571 mm^2**✓		**= 259 699,988 mm^3** ✓✓
MARKS	(5)	(4)	(6)

4.4 $\dot{y} = \frac{\text{(Total area} \times \text{Distance)}}{\text{Total area}}$ ✓

$\dot{y} = \frac{259\,699{,}988\ mm^3}{5\,208{,}571\ mm^2}$ ✓

$\dot{y}$ = 49,860 mm 'X-X'✓✓ (4)

4.5

Space diagram = 2 marks✓✓
Centroid = 2 marks✓✓

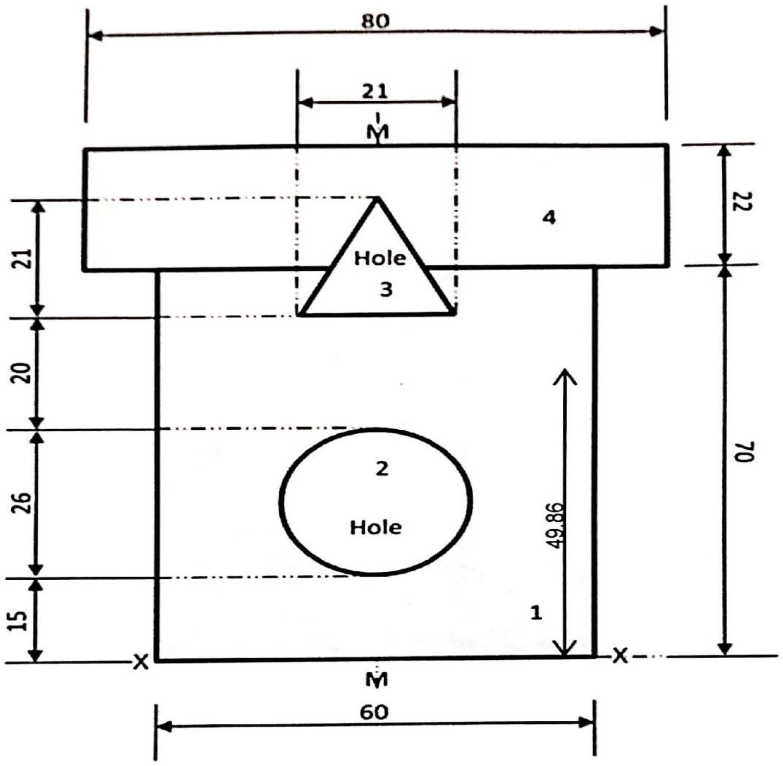
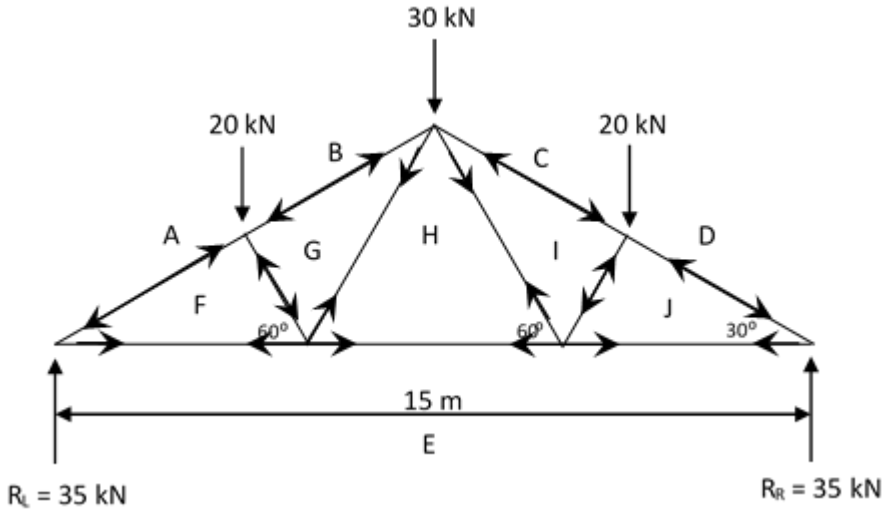


FIGURE 3

(4)
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QUESTION 5

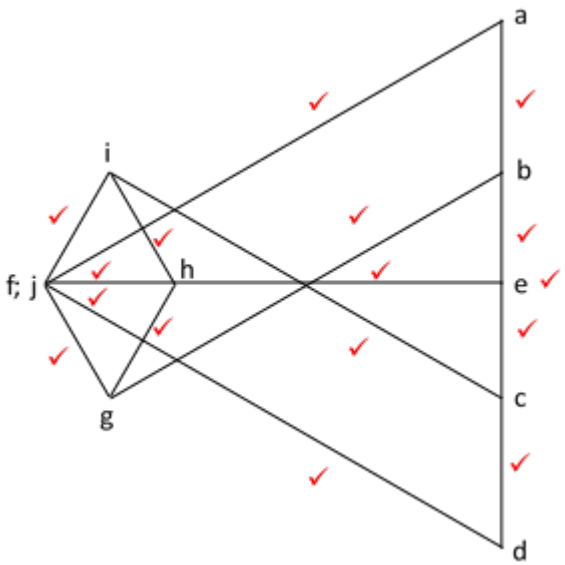
5.1



Space diagram = 2 marks ✓✓
Direction of members = 2 marks ✓✓

(4)

5.2



(16 × ½) (8)

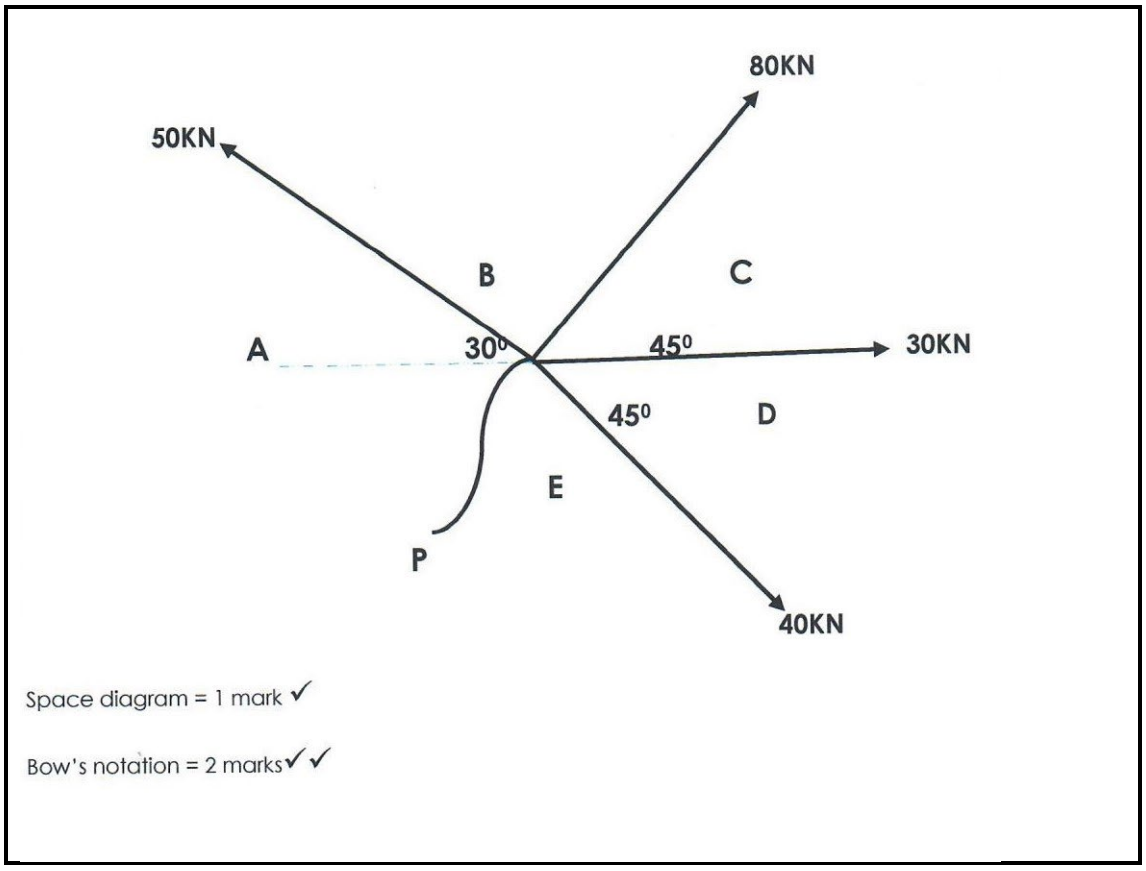
5.3

MEMBER	MAGNITUDE	NATURE
AF	70 kN✓	Strut ✓
BG	60 kN✓	Strut ✓
CI	60 kN✓	Strut ✓
DJ	70 kN✓	Strut ✓
FG	17 kN✓	Strut✓
IJ	17 kN✓	Strut ✓
FE	60 kN✓	Tie ✓
HE	43 kN✓	Tie ✓
JE	60 kN✓	Tie ✓
GH	17 kN✓	Tie ✓
HI	17 kN✓	Tie ✓

(22 × ½) (11)
[23]

QUESTION 6

6.1



Space diagram = 1 mark ✓

Bow's notation = 2 marks✓✓

(3)

6.2

FORCE			VERTICAL COMPONENT (F × Sin θ)	HORIZONTAL COMPONENT (F × Cos θ)
AB	50 kN	30°	+ 25 ✓	- 43.301✓
BC	80 kN	45°	+ 56.569 ✓	W - 56.569 ✓
CD	30 kN	0°	+ 0 ✓	E + 30 ✓
DE	40 kN	45°	- 28.284 ✓	E + 28.284 ✓
			N + 53.285 ✓✓	**E + 71.552** ✓✓

(12 × ½) (6)

OR

- VC = 50KN Sin 30^0 + 80KN sin 45^0 + 30KN sin 0^0 - 40KN sin 45^0
  = 25KN✓ + 56.569 KN✓+ 0 KN✓ – 28.284 KN✓
  = 53.285 KN ✓✓

- HC = 80 kN cos 45^0 + 30 kN cos 0^0 + 40 cos 45^0 - 50 cos 30^0
  = 43.301 kN✓ + 56.569 kN✓ – 30 kN✓ – 28.284 kN✓
  = 71.552 KN ✓✓ (12 x ½) (6)

$R^2 = VC^2 + HC^2$

$R = \sqrt{53.285^2 + 71.552}$✓

R = 89.213 kN✓✓

$\tan\theta = \frac{\sum VC}{\sum HC}$

$\tan\theta = \frac{53.285}{71,552}$ ✓

$\theta = 0.745$✓

= 36.686°✓

'P' = 89.213 kN✓ @ 36.686^0✓ north of east✓ (9)

TOTAL: 100

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