higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

31 JULY 2019

This marking guideline consists of 6 pages.

QUESTION 1

1.1 1.1.1 False✓
Absorption✓ is the quantity of water which is retained by a material.✓
OR
Absorptive solid✓ is the material that absorbs water.✓ (3)

1.1.2 False✓
Absorption is the quantity of water which is retained by a material.✓
Permeability is measured by the quantity of water which passes through a material. ✓ (3)

1.1.3 True (1)

1.2 A burnt clay brick has many pores or voids✓ which are interconnected.✓ The rising of water into these pores or voids is called capillarity.✓ (3)

1.3 When clay bricks are burnt✓ the water in the mixture evaporates✓ and leaves pores or voids in the bricks.✓ (3)

1.4 ✓

$$\%\ porosity\ = \frac{Bulk\ volume\ -\ Solid\ volume}{Bulk\ volume}\ x\ 100\%$$

% porosity = $\frac{6{,}4\ cm^3 - 4{,}5\ cm^3}{6{,}4\ cm^3} \times 100$ ✓
% porosity = $\frac{1{,}9\ cm^3}{6{,}4\ cm^3} \times 100$ ✓
% porosity = 29,67 ✓ (4)
[17]

QUESTION 2

2.1 Take moments about R_R to calculate the magnitude of R_L
∑ CW Moments = ∑ ACW Moments ✓
$(R_L x7) = (20 \times 9) + [(9 \times 7) \times 3{,}5] + (55 \times 1)$✓
$(R_L x7) = 180 + 220{,}5 + 55$✓
$R_L = \frac{455{,}5}{7}$ ✓
R_L = 65,07 kN✓ (5)

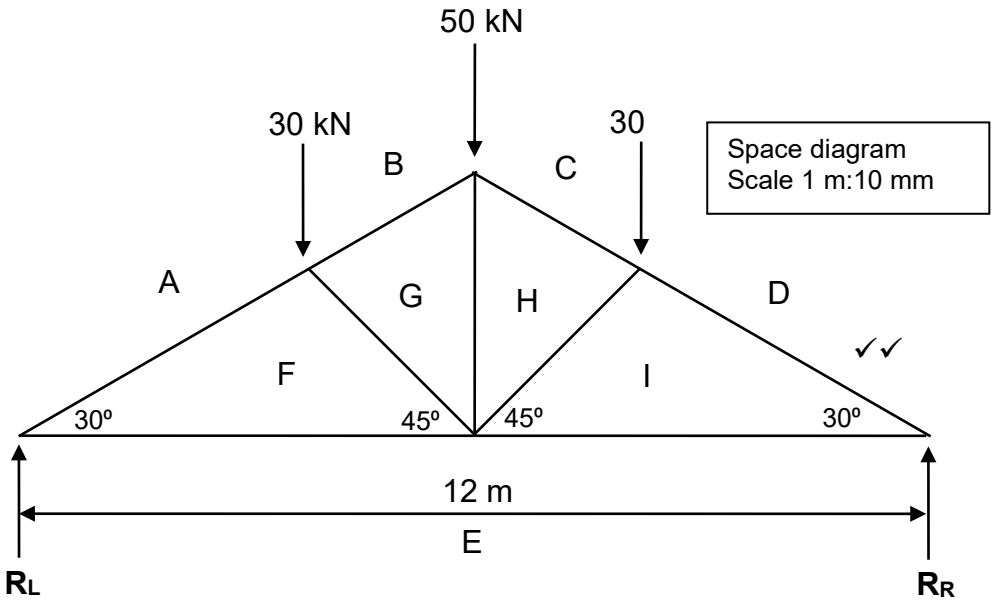
2.2 Take moments about R_L to calculate the magnitude of R_R
∑ ACW Moments = ∑ CW Moments✓
$(R_R \times 7) + (20 \times 2) = [(9 \times 7) \times 3{,}5] + (55 \times 6)$✓
$(R_R \times 7) = 220{,}5 + 330 - 40$✓
$R_R = \frac{510{,}5}{7}$ ✓
R_R = 72,93 kN✓ (5)

2.3 $\sum$ Upwards forces = $\sum$ Downwards forces
(65,07 kN + 72,93 kN)✓ = (20 kN + 63 kN + 55 kN)✓
138 kN = 138 kN✓ (3)
[13]

QUESTION 3

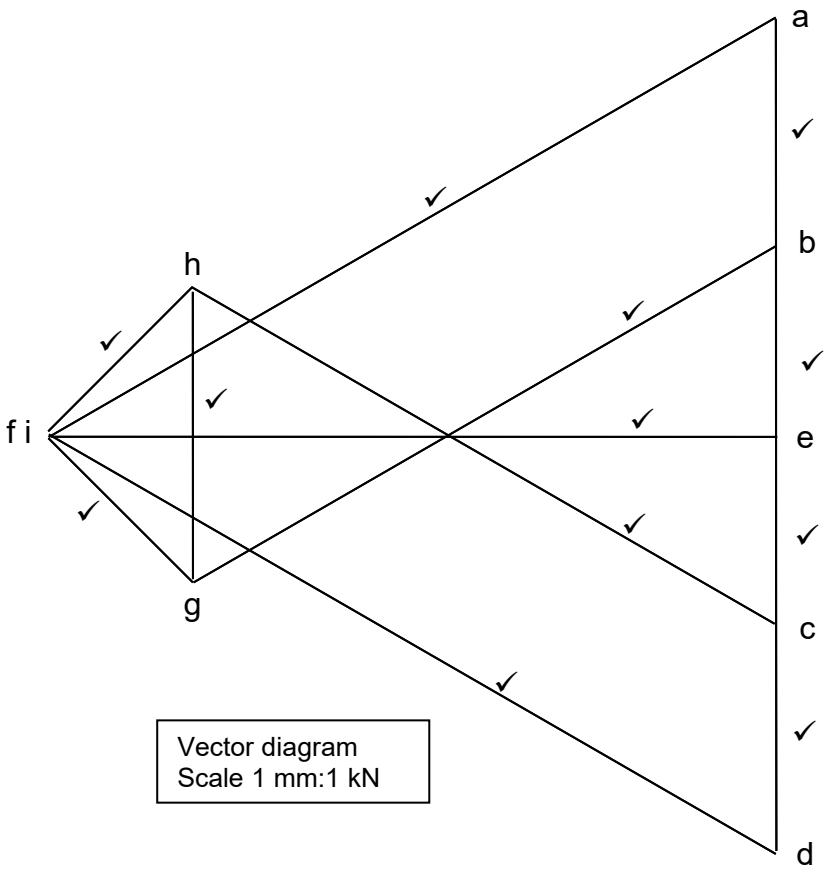
3.1
- Tensile forces are forces which exert a pulling action✓ on one or both ends of the member in the frame.✓
- Compressive forces are forces acting towards one another✓ as pushing forces.✓ (4)

3.2 3.2.1



(2)

3.2.2



(12 × 1 = 12 ÷ 2) (6)

3.2.3

MEMBER	MAGNITUDE	NATURE
AF	110 kN√	strut√
BG	89 kN√	strut√
CH	89 kN√	strut√
DI	110 kN√	strut√
EI	96 kN√	tie√
EF	96 kN√	tie√
FG	27 kN√	strut√
GH	38 kN√	tie√
HI	27 kN√	strut√

(18 × ½) (9)
[21]

QUESTION 4

4.1–4.3

MEMBER	4.1 AREA	4.2 METAL PLATE DISTANCE	4.3 AREA × DISTANCE
1	60 × 15 = 900 mm²✓	7,5 mm✓	900 mm² × 7.5 mm = 6750 mm³✓
2	30 × 20 = 600 mm²✓	25 mm✓	600 mm² × 25 mm = 15000 mm³✓
3	-(¼ π × 15² = 176,715 mm²)✓ or use π(r)²	22,5 mm✓	-(176,715 mm² × 22,5 mm = 3976,088 mm³)✓
4	½ × 30 × 20 = 300 mm²✓	41,667 mm✓	300 mm² × 41,667 mm = 12500,1 mm³✓
TOTALS	**= 1 623,285 mm² ✓**		**= 30 274,012 mm³ ✓✓**
marks	(5)	(4)	(6)

(15)

4.4 $\dot{y} = \frac{\text{(TOTAL AREA × DISTANCE)}}{\text{TOTAL AREA}}$

$\dot{y} = \frac{30\,274{,}012\ mm^3}{1\,623{,}285\ mm^2}$✓

$\dot{y}$ = 18,65 mm M-M✓✓ (3)

[18]

QUESTION 5

5.1

FORCE	VERTICAL COMPONENT		HORIZONTAL COMPONENT	
AB	25 × Sin 15°✓	6.47✓	25 × Cos 15°✓	24,148✓
BC	50 × Sin 60°✓	-43,301✓	50 × Cos 60°✓	25✓
CD	40 × Sin 45°✓	-28,284✓	40 × Cos 45°✓	-28,284✓
DE	35 × Sin 30°✓	17,5✓	35 × Cos 30°✓	-30,311✓
	∑VC	**-47,615**✓	**∑HC**	-9,447✓

$R^2 = VC^2 + HC^2$
$= (-47{,}615)^2 + (-9{,}447)^2$✓
= 48,543 kN✓

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

$\tan \alpha = \frac{-47{,}615}{-9{,}447}$✓

$\tan \alpha$ = 5,04

$\alpha = \tan^{-1} 5{,}04$✓

α = 78,778°✓

'R' = 48,543 kN @ 78,778° (North of East or above horizontal to the right)✓

(24 × 1 = 24 ÷ 2) (12)

5.2 Coplanar forces are forces which lie or act✓ in the same plane,✓ and concurrent forces are two or more forces which act at, or form,✓ the same point.✓ (4)

[16]

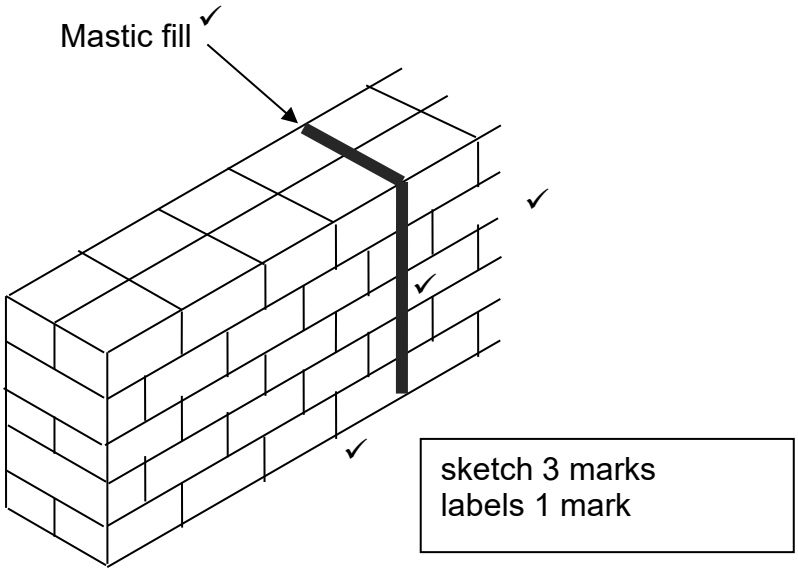
QUESTION 6

6.1 Specific heat capacity (1)

6.2 The coefficient of linear expansion of a substance is the increase or change in length✓ per unit length✓ per temperature one degree rise.✓ (3)

6.3
- Temperature
- Volume
- Physical properties
- State or phase
- Electrical properties
- Magnetic properties (Any 3 × 1) (3)

6.4



sketch 3 marks
labels 1 mark

(4)

6.5 $\Delta L = Lo \times \Delta T \times \alpha$

$\alpha = \frac{\Delta L}{Lo \times \Delta T}$

$\alpha = \frac{0{,}004\ m}{6\ m \times (55\ °C - 30\ °C)}$ ✓

$\alpha = \frac{0{,}004\ m}{15\ m.°C}$ ✓

$\alpha = 2{,}6 \times 10^{-5}/°C$ ✓✓ (4)

[15]

TOTAL: 100