higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

APRIL EXAMINATION

BUILDING SCIENCE N2

7 April 2015

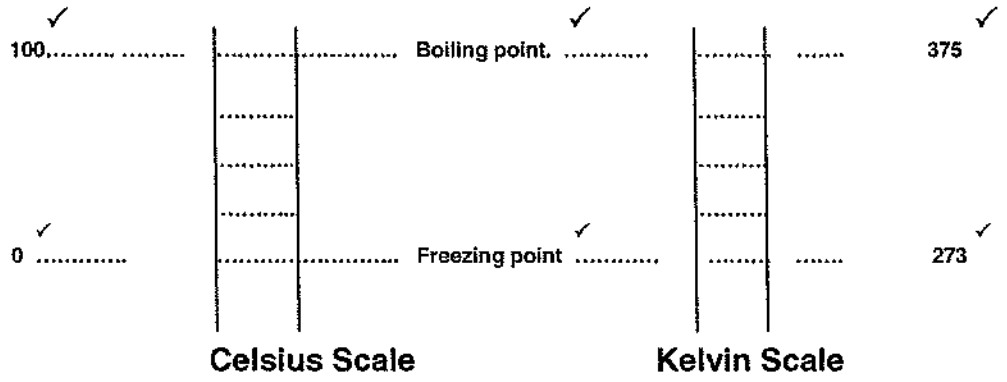
This marking guideline consists of 8 pages.

QUESTION 1

1.1 1.1.1 $T = t + 273$
$T = (273 + 30)K$✓
$T = 303\ K$✓ (2)

1.1.2 $T = t + 273$
$t = T - 273$
$t = 293 - 273$✓
$t = 20\ °C$✓ (2)

1.2



(6)

1.3 s.h.c. (1)

1.4 Given: Q = 267,3 kJ
$T1 = 283\ K$
$T_2 = 338\ K$
Specific heat capacity = 0,486 kJ/kg.K
M = ?

267,3 kJ = m × 0,486 kJ/kg.K × (338 – 283) ✓
267,3 kJ = m × 26,73 kJ/kg✓
m = (267,3/26,73) kg✓
m = 10 kg✓ (4)
[15]

QUESTION 2

2.1 A burnt clay brick has many pores or voids✓ which are interconnected.✓ The rising of water into these pores✓ or voids is called capillarity.✓ (4)

2.2 The more pores there are✓ in a material, the less compressive strength it has✓ because the pores are filled with air.✓ If the density of the material increases✓, that is if there are less pores✓, then the compressive strength increases. ✓ (6)

2.3 Volume of pores = Volume of water absorbed✓ ÷ saturated coefficient✓
Volume of pores = 0,036 cm^3 ÷ 0, 90✓
Volume of pores = 0,040 cm^3✓ (4)
[14]

QUESTION 3

3.1
- The water displaced will be equal✓ to the volume of the body immersed in water.✓
- An object in a fluid is buoyed up✓ by a force equal to the weight of the displaced fluid. ✓
- If a body is immersed partially or wholly in a fluid✓ it apparently loses weight equal to that of the displaced liquid. ✓ (6)

3.2 Buoyed = pushed up✓, keep up or bring to the surface✓ (2)

3.3
- Use a measuring cylinder and fill it up to the 100 cm^3 mark.✓
- Lower a piece of metal, 5 cm × 5 cm × 3 cm, attached to a string✓ into the cylinder, shake gently to remove all air bubbles.✓
- Write down the new reading and subtract the 100 cm^3.✓
- The end result should be 75 cm^3✓ which is the volume of the piece of metal.✓
- Therefore: The volume of liquid displaced is equal to the volume of the object immersed in the liquid.✓ (7)

[15]

QUESTION 4

4.1
- Durable✓
- Low tensile strength✓
- High coefficient of expansion and contraction✓
- Soft and easy to work with✓
- Very expensive✓
- Very malleable✓
- Tough and flexible✓ (Any 5 x 1) (5)

4.2 It tends to become greenish in colour ✓ (1)

[6]

QUESTION 5

5.1 If three forces acting on a point✓ are in equilibrium✓ then the forces can be represented in magnitude and direction✓ by the sides of a triangle when taken in order.✓ (4)

5.2

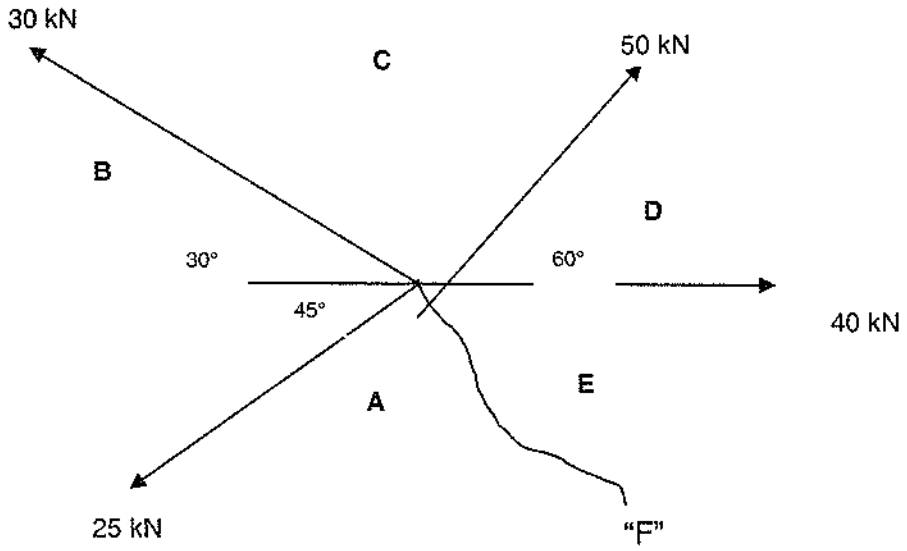


FIGURE 1

FORCE	VERTICAL COMPONENT		HORIZONTAL COMPONENT	
AB	25 × Sin 45°✓	-17,678✓	25 × Cos 45°✓	- 17,678✓
BC	30 × Sin 30 °✓	+ 15,0✓	30 × Cos 30°✓	- 25,981✓
CD	50 × Sin 60° ✓	+ 43,301✓	50 × Cos 60°✓	+ 25,0✓
DE	40 × Sin 0° ✓	0✓	40 × Cos 0°✓	+ 40,0✓

$\sum$ VC = 40,623 kN north ✓ $\sum$ HC = 21,341 kN east✓

$F = VC^2 + HC^2$
$= 40{,}623^2 + 21{,}341^2$✓
$= 45{,}888$ kN✓

$\text{Tan } \alpha = \sum VC \div \sum HC$
$= 40{,}623 \div 21{,}341$✓
$= 1{,}9035 \div \text{Tan}$✓
$= 62{,}285°$✓
45,888 kN @ 62,285° south of east✓

(24 x ½) (12)
[16]

QUESTION 6

6.1 6.1.1 Take moments about Rb to calculate Ra

$\sum$ O right moments = $\sum$ O left moments

$(20 \times 20) + (Ra \times 5) = (25 \times 2) + (30 \times 4) + (50 \times 6) + (10 \times 6 \times 1)$ ✓

$40 + 5\,Ra = 50 + 120 + 300 + 60$

$5\,Ra = 530 - 40$✓

$Ra = 490/5$✓

$Ra = 98$ kN✓ (4)

6.1.2 Take moments about Ra to calculate Rb

$\sum$ O left moments = $\sum$ O right moments

$(50 \times 1) + (Rb \times 5) = (30 \times 1) + (25 \times 3) + (20 \times 7) + (10 \times 6 \times 4)$ ✓

$50 + 5\,Rb = 30 + 75 + 140 + 240$

$5\,Rb = 485 - 50$✓

$Rb = 435 / 5$✓

$Rb = 87$ kN✓ (4)

6.2 $\sum$ upward forces = $\sum$ downward forces

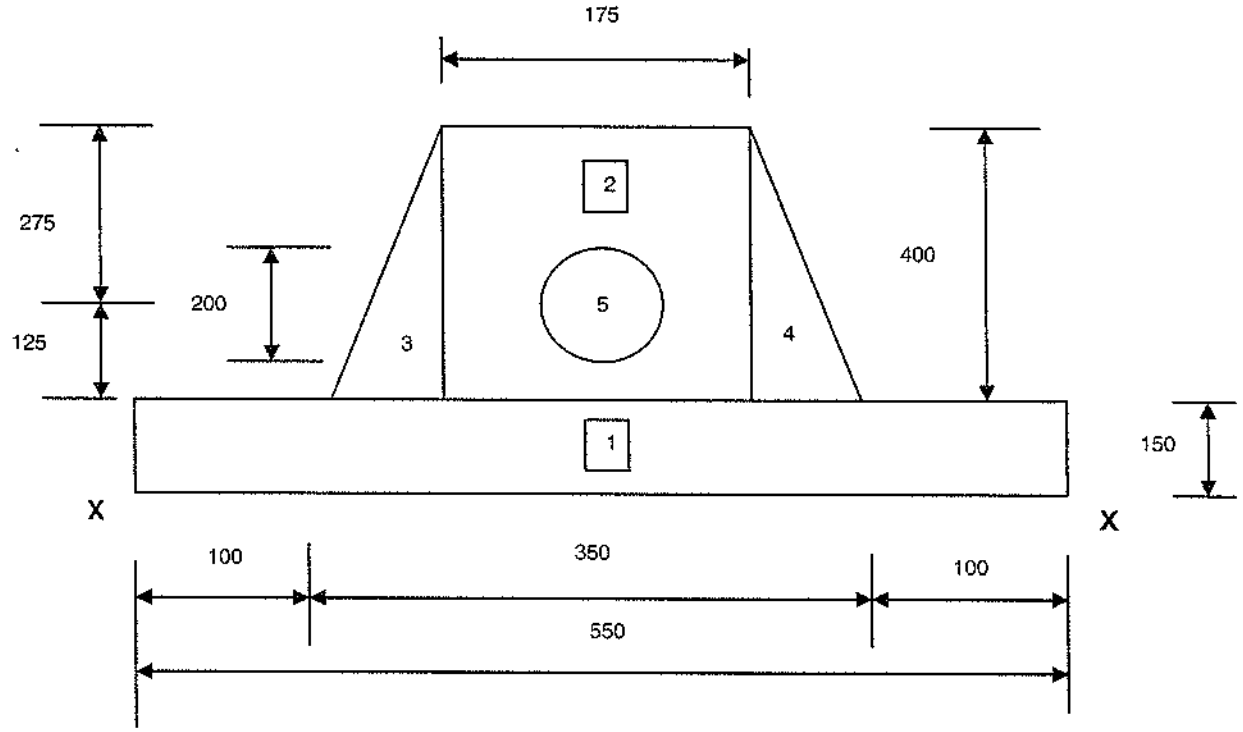
$Ra + Rb = 50 + 30 + 25 + 20 + (10 \times 6)$✓

$(98 + 87) = 50 + 30 + 25 + 20 + 60$ ✓

185 kN = 185 kN (2)

[10]

QUESTION 7

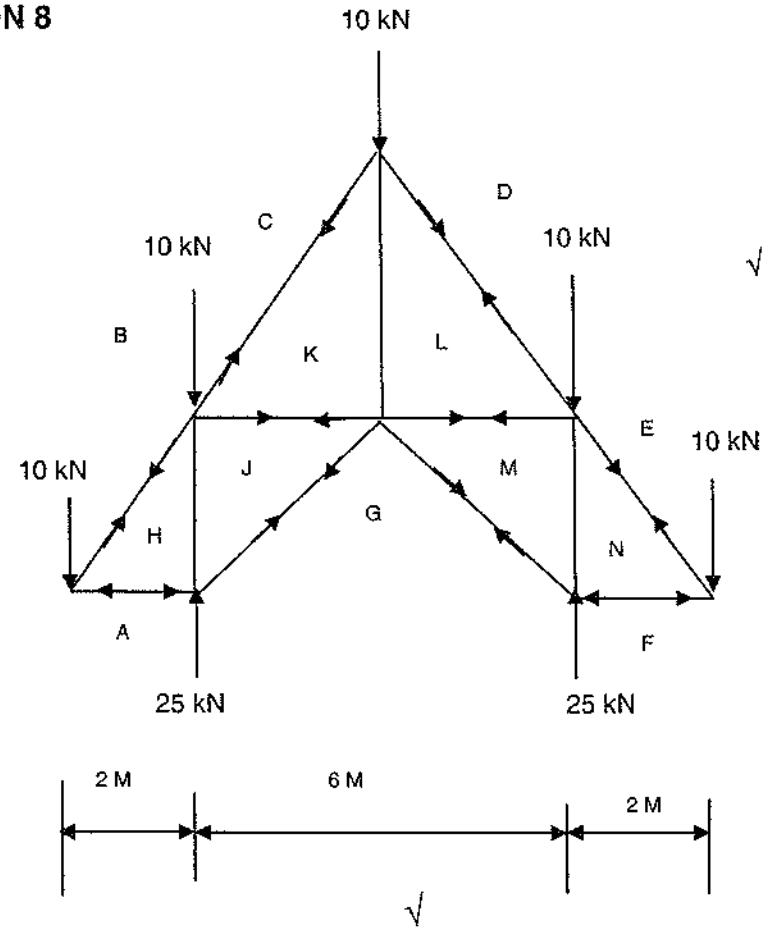


Member	Area	Distance	Area × Distance
1	L × b 550 × 150 = 82 500 mm²	150 ÷ 2 = 75 mm	6187500 mm³✓
2	L × b 400 × 175 = 70 000 mm²	200 + 150 = 350 mm	24500 000 mm³✓
3	½ × 87,5 (275 + 125) = 17 500 mm²	(400 × 1/3) + 150 = 283,333 mm	4958327,5 mm³✓
4	½ × 87,5 (275 + 125) = 17 500 mm	(400 × 1/3) + 150 = 283,333 mm	4958327,5 mm³✓
5	- πr² = - 3,14 × 100² = - 31 400 mm²	100 + 25 + 150 = 275 mm	- 8635000 mm³✓
	TOT: 156 100 mm²✓		TOT: 31969155 mm³✓

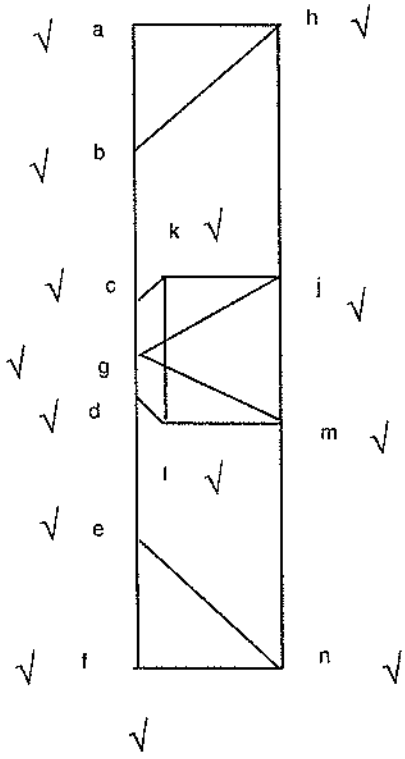
y = (TOT. Area × Distance) ÷ TOT. Area
= 31969155 mm³ ÷ 156100 mm²✓
= 204,799 mm from x-x✓

[9]

QUESTION 8



SPACE DIAGRAM SCALE 1 : 100 (2 x ½) = 1



(14 x ½) = 7

VECTOR DIAGRAM SCALE 2 mm = 1 kN

MEMBER	MAGNITUDE	TIE	STRUT
BH; EN	14 kN✓	✓	
CK; DL	22 kN✓	✓	
FN; AH	10 kN✓		✓
GM; GJ	17,5 kN✓		✓
HJ; MN	10 kN✓		✓
JK; LM	15 kN✓	✓	
KL	15 kN ✓		✓

(14 x ½) 7
[15]

TOTAL: 100