



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

30 April 2024

This marking guideline consists of 8 pages.

QUESTION 1

- 1.1 The law of moments states that if a system of forces is in equilibrium✓ then some of the clockwise moments around any turning point✓ will be equal to the sum of the anti-clockwise moments around the same turning point.✓
- 1.2 Archimedes' principle of floatation states that the apparent loss of weight✓ of an object when immersed in water✓ is equal to the weight of the water displaced by the object.✓
- 1.3 The resultant force of two or more forces is the single force✓ that can replace the two or more forces✓ and yet have the same effect.✓
- 1.4 The centroid of an object is the point✓ about which the weight✓ of the object is said to act.✓
- 1.5 A cantilever is a beam anchored at only one end.✓ The beam carries a load to the support✓ where it is forced against by a moment and shear stress.✓

(5 × 3) [15]

QUESTION 2

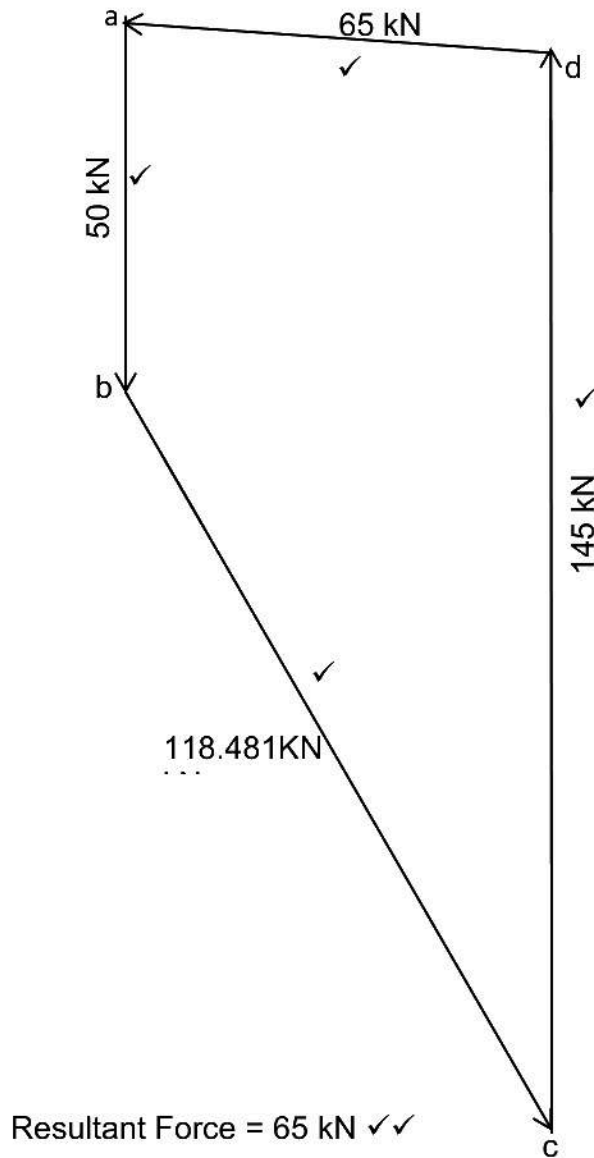
- 2.1 Take moments about R_R to calculate the magnitude of R_L
 $\sum \text{CW Moments} = \sum \text{ACW Moments}✓$
 $(R_L \times 6,5) + (20 \times 3) = (32,5 \times 3,25) + (15 \times 10)✓$
 $(R_L \times 6,5) = 105,625 + 150 - 60✓$
 $R_L = \frac{195,625}{6,5}✓$
 $R_L = 30,096 \text{ kN}✓$ (5)
- 2.2 Take moments about R_L to calculate the magnitude of R_R
 $\sum \text{ACW Moments} = \sum \text{CW Moments}✓$
 $(R_R \times 6,5) + (15 \times 3,5) = (32,5 \times 3,25) + (20 \times 9,5)✓$
 $(R_R \times 6,5) = 151,25 + 160 - 70✓$
 $R_R = \frac{243,125}{6,5}✓$
 $R_R = 37,5 \text{ kN}✓$ (5)
- 2.3 Test the answer to prove equilibrium:
 $\sum \text{Upwards Forces} = \sum \text{Downwards Forces}$
 $(30,096 \text{ kN} + 37,5 \text{ kN})✓ = (32,5 \text{ kN} + 15 \text{ kN} + 20 \text{ kN})✓$
 $67,5 \text{ kN} = 67,5 \text{ kN}✓$ (3)
[13]

QUESTION 3

3.1 3.1.1 $\sum 'R' = 0$
 $(55 \times 2) + (145 \times 3,5) = (R \cdot \sin 60^\circ \times 6) \checkmark$
 $110 + 507,5 = R \cdot 5,196$
 $\frac{617,5 \text{ kN}}{5,196} = R \checkmark$
 $R = 118,481 \text{ kN} \checkmark \checkmark$

(4)

3.1.2



(6)

3.2 Absorbent materials

- Bricks $\checkmark$
- Wood $\checkmark$
- Sand $\checkmark$
- Concrete $\checkmark$
- Limestone $\checkmark$

(Any 2 $\times$ 1)

Non-absorbent materials

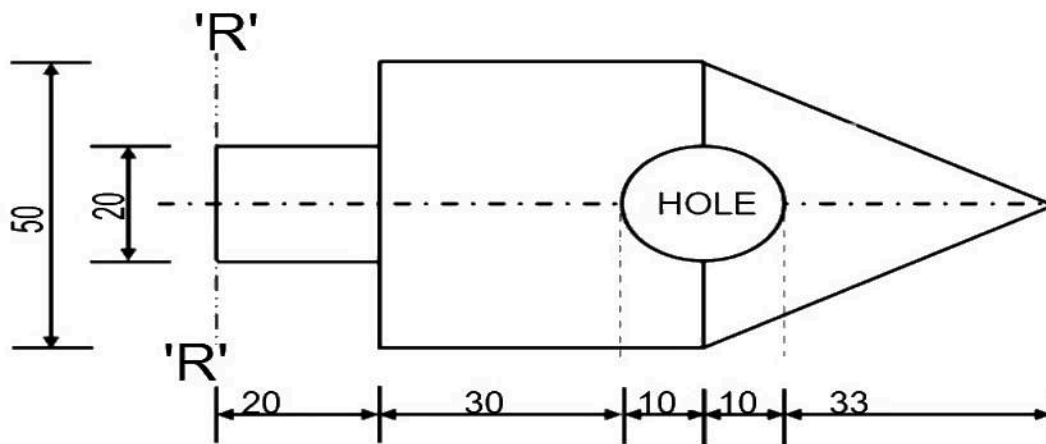
- Dense bricks ✓
- Polythene ✓
- Steel ✓
- Copper ✓
- Slate ✓

(Any 2 x 1)
(2 x 2)

(4)
[14]

QUESTION 4

4.1



(4)

4.2-4.4

MEMBER	4.2 AREA	4.3 Y-DISTANCE FROM RR	4.4 AREA x DISTANCE
1	$20 \times 20 = 400 \text{ mm}^2 \checkmark$	10 mm ✓	$400 \text{ mm}^2 \times 10 \text{ mm} = 4\,000 \text{ mm}^3 \checkmark$
2	$40 \times 50 = 2\,000 \text{ mm}^2 \checkmark$	40 mm ✓	$2\,000 \text{ mm}^2 \times 40 \text{ mm} = 80\,000 \text{ mm}^3 \checkmark$
3	$\pi \times (10)^2 = -314.159 \text{ mm}^2 \checkmark$	60 mm ✓	$-314.159 \text{ mm}^2 \times 60 \text{ mm} = 18\,849.54 \text{ mm}^3 \checkmark$
4	$\frac{1}{2} \times 50 \times 43 = 1075 \text{ mm}^2 \checkmark$	74,33 mm ✓	$1075 \text{ mm}^2 \times 74.33 \text{ mm} = 17062.5 \text{ mm}^3 \checkmark$
TOTALS	= 3160,841 mm² ✓		= 145 055.21 mm³ ✓ ✓
marks	(5)	(4)	(6)

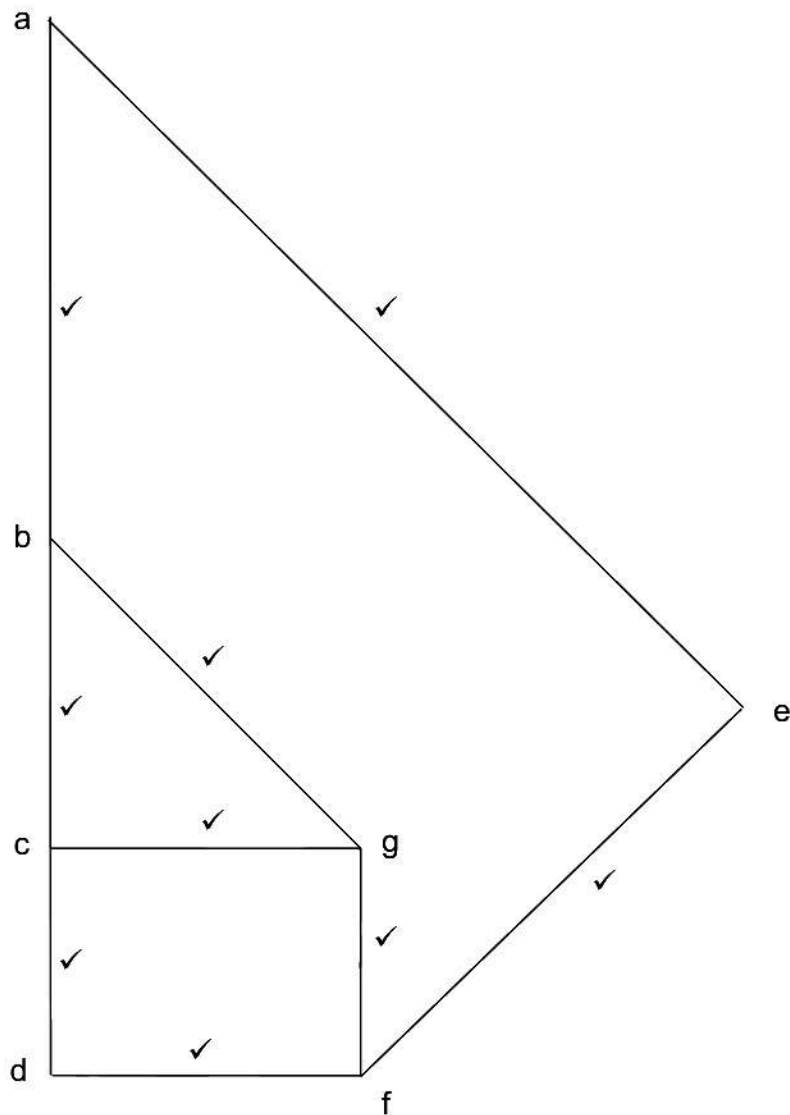
4.5 $\bar{y} = \frac{(\text{TOTAL AREA} \times \text{DISTANCE})}{\text{TOTAL AREA}}$

$$\bar{y} = \frac{145\,055.21 \text{ mm}^3 \checkmark}{3\,160.841 \text{ mm}^2 \checkmark}$$

$$\bar{y} = 45.891 \text{ mm 'R-R' } \checkmark \checkmark$$

(4)
[23]

5.2



(9)

5.3

MEMBER	MAGNITUDE	NATURE
AE	96 kN ✓	Tie✓
BG	41 kN ✓	Tie✓
CG	28 kN ✓	Strut✓
DF	28 kN ✓	Strut✓
FE	59 kN ✓	Strut✓
FG	20 kN ✓	Tie✓

(12 × ½)

(6)

[18]

QUESTION 6

6.1 Heat is the transfer of energy✓ from one substance to another✓ which results in a change in temperature.✓ (3)

6.2 Convection,✓ conduction✓ and radiation.✓ (3)

6.3

- The sun
- Chemical reaction
- Friction
- Fuels
- Change in the state of matter.
- Electricity
- Internal heat of the earth

(Any 4 × 1) (4)

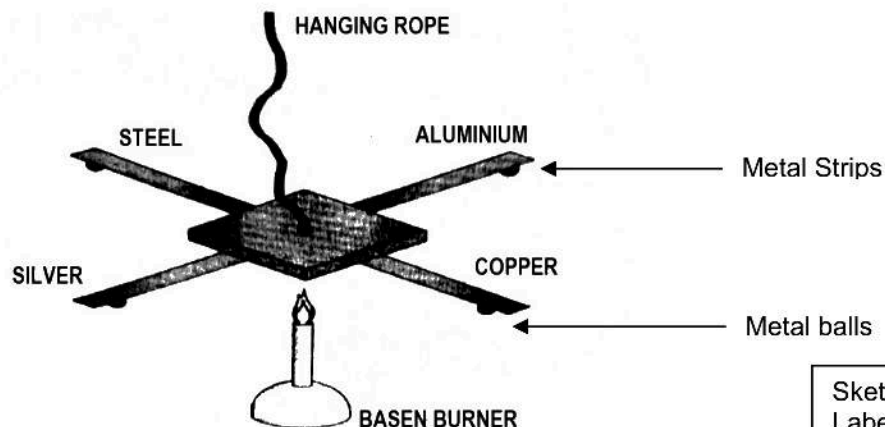
6.4 $\Delta L = L_o \times \Delta T \times \alpha$

$$L_o = \frac{\Delta L}{\alpha \times (t_2 - t_1)} \checkmark$$

$$= \frac{0.011}{1.7 \times 10^{-5} \times 68} \checkmark$$

$$= 8.296 \text{ m} \checkmark \checkmark (4)$$

6.5



EXPERIMENT

Comparing the heat conducting properties of different metals.

APPARATUS:

A special apparatus consisting of four strips of different metals (i.e. aluminium, copper, brass, and iron) of the same cross-section and length are riveted to a central disc of metal. Each metal strip has a small hollow drilled at the same distance from the centre.

Bunsen burner, wax and ball bearings, retort stand.

METHOD:

The special apparatus is turned over with the hollows pointing upwards, and a small drop of molten wax is deposited into each of the hollows. A small ball bearing, about 3mm in diameter, is placed in the hollow so that it will stick when the wax sets, and this is repeated until each of the four hollows has a ball bearing stuck to it. The apparatus is then suspended from the retort stand and heated at the centre of the apparatus by means of a Bunsen burner. Each ball bearing will drop off when sufficient wax has been melted. The first ball to drop off will indicate the metal that is the best conductor of heat.

While all metals are good conductors of heat, some are better than others.

(6)

[17]

TOTAL: 100