



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

**NATIONAL CERTIFICATE
BUILDING SCIENCE N3**

3 February 2022

This marking guideline consists of 7 pages.

QUESTION 1

- 1.1
- Crushing strength test ✓
 - Impact test ✓
 - Abrasive value test ✓
 - Flakiness index test ✓
- (4)

- 1.2 **ADVANTAGES OF SOFT WATER**
- No deposits of chemicals or residue in pipes ✓
 - Cuts down the cost of replacing water and boiler pipes ✓
 - It lathers easily with soap ✓
 - Saves amount of soap usage ✓
 - Improves the conditions in which food is prepared ✓
- (Any correct 3)

DIS ADVANTAGES OF HARD WATER

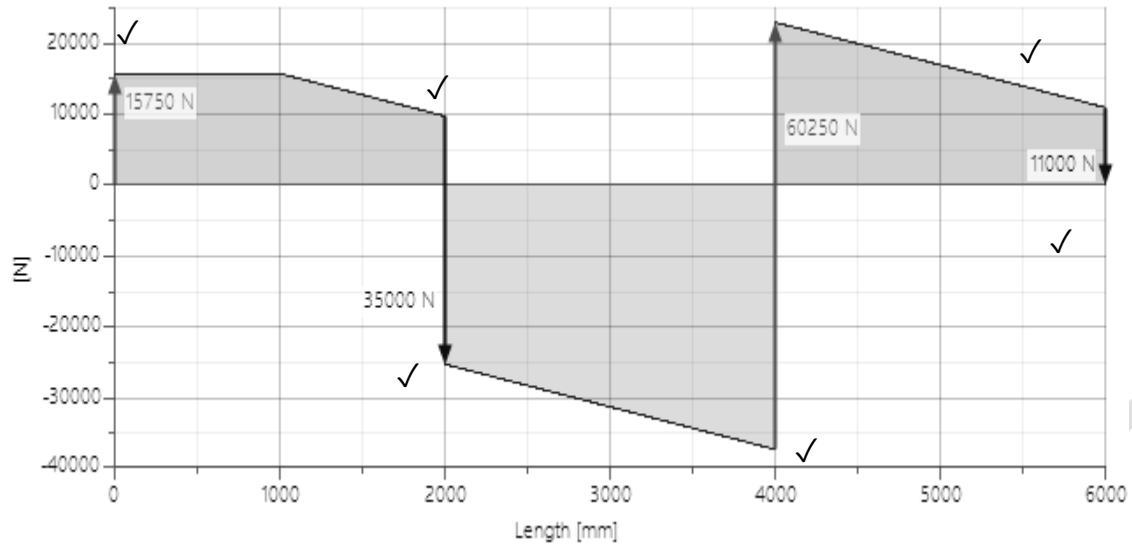
- Causes lime scale to build up in pipes and boiler resulting in blockages of long periods of time ✓
- May contain acidic elements which corrode the pipes ✓
- It may be plumbo-solvent ✓
- If stored for a long time may discolour to brownish ✓
- May dissolves lead or copper ✓

(Any correct 3) (3 × 2) (6)
[10]

QUESTION 2

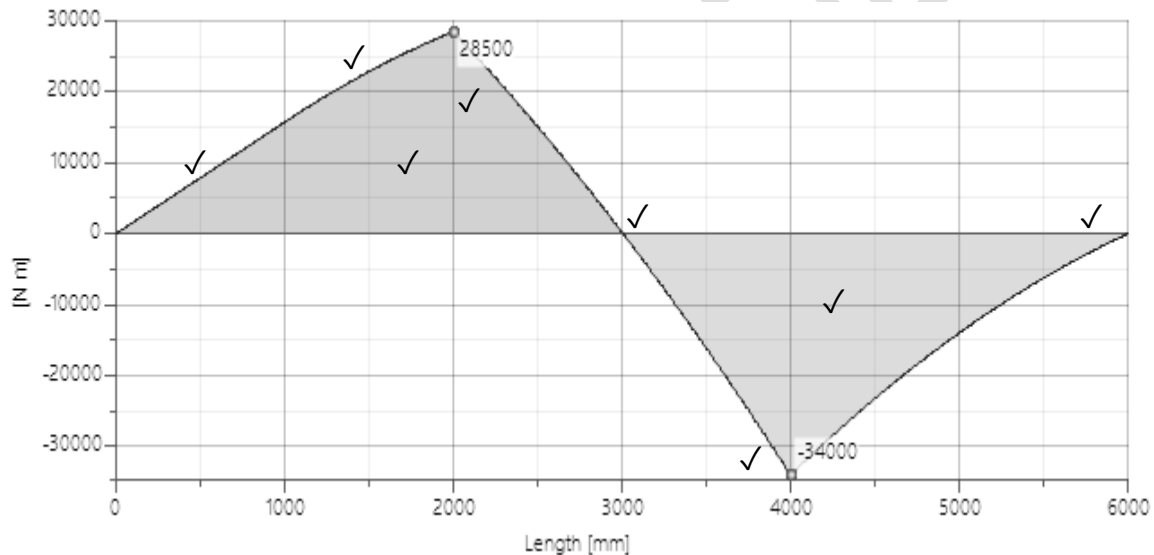
- 2.1 2.1.1 Taking moments about the right-hand support
 $(35 \times 2) - (11 \times 2) + (6 \times 5 \times 0,5) = 4R_L$ ✓
 $R_L = 15,75 \text{ kN}$ ✓
- 2.1.2 Taking moments about the left-hand support
 $(35 \times 2) + (11 \times 6) + (6 \times 5 \times 3,5) = 4R_R$ ✓
 $R_R = 60,25 \text{ kN}$ ✓
- (2 × 2) (4)

2.2



(8)

2.3



(8)
[20]

QUESTION 3

3.1

3.1.1

Taking Moment About Right-hand reaction

$$(30 \times 9) + (40 \times 6) + (60 \times 3) = 12 R_L \checkmark$$

$$\therefore R_L = 57,5 \text{ kN} \checkmark$$

3.1.2

Taking Moment About Left-hand reaction

$$(30 \times 3) + (40 \times 6) + (60 \times 9) = 12 R_R \checkmark$$

$$\therefore R_R = 72,5 \text{ kN} \checkmark$$

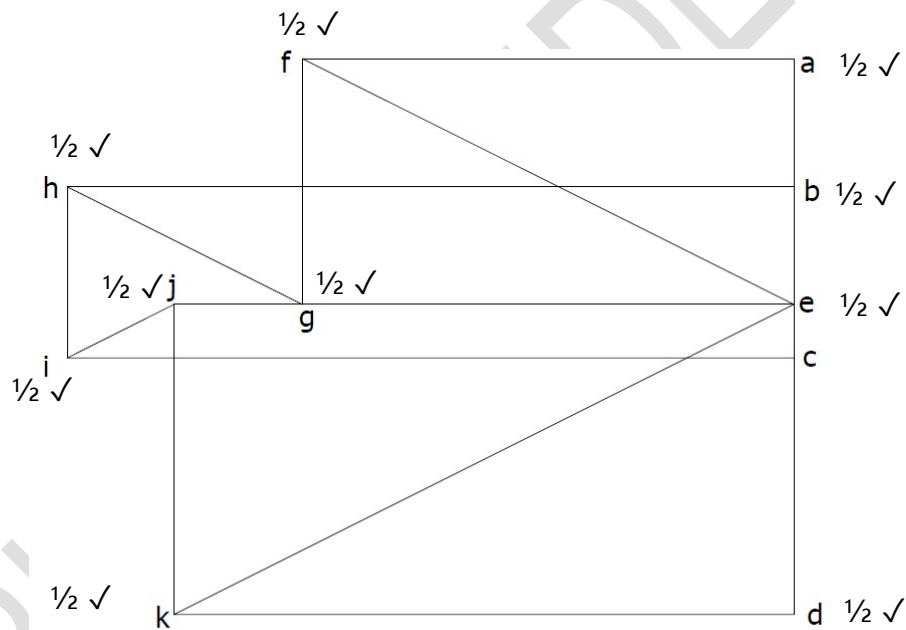
(2 × 1)

(2)

3.2

MEMBER	MAGNITUDE	NATURE
AF	9.6 KN $\frac{1}{2}$ ✓	Strut $\frac{1}{2}$ ✓
BH	14.7 KN $\frac{1}{2}$ ✓	Strut $\frac{1}{2}$ ✓
CI	14.7 KN $\frac{1}{2}$ ✓	Strut $\frac{1}{2}$ ✓
DK	12.3 KN $\frac{1}{2}$ ✓	Strut $\frac{1}{2}$ ✓
EK	14.3 KN $\frac{1}{2}$ ✓	Tie $\frac{1}{2}$ ✓
EJ	12.3 KN $\frac{1}{2}$ ✓	Tie $\frac{1}{2}$ ✓
EG	9.6 KN $\frac{1}{2}$ ✓	Tie $\frac{1}{2}$ ✓
EF	11.1 KN $\frac{1}{2}$ ✓	Tie $\frac{1}{2}$ ✓
FG	70 KN $\frac{1}{2}$ ✓	Strut $\frac{1}{2}$ ✓
GH	60 KN $\frac{1}{2}$ ✓	Tie $\frac{1}{2}$ ✓
HI	40 KN $\frac{1}{2}$ ✓	Strut $\frac{1}{2}$ ✓
IJ	26 KN $\frac{1}{2}$ ✓	Tie $\frac{1}{2}$ ✓
JK	72.5 KN $\frac{1}{2}$ ✓	Strut $\frac{1}{2}$ ✓

(13)



(5)
[20]

QUESTION 4

4.1

SHAPE	AREA (mm ²)	Y (mm)	AY (mm ³)	X (mm)	AX (mm ³)
a (140 × 15)	140 × 15 = 2100 ½ ✓	140/2 = 70 ½ ✓	147 000 ½ ✓	7.5 ½ ✓	15 750 ½ ✓
b (30 × 8)	30 × 8 = 240 ½ ✓	(140-25)/2 -15 = 42.5 ½ ✓	10 200 ½ ✓	15 + 4 = 19 ½ ✓	4 560 ½ ✓
c (25 × 60)	25 × 60 = 1500 ½ ✓	140/2 = 70 ½ ✓	105 000 ½ ✓	15 + 30 = 45 ½ ✓	67 500 ½ ✓
d (30 × 8)	30 × 8 = 240 ½ ✓	(140-25)/2 +25+15 = 97.5 ½ ✓	23 400 ½ ✓	15 + 4 = 19 ½ ✓	4 560 ½ ✓
e (22 × 8)	22 × 8 =176 ½ ✓	(140-25)/2 – 4 = 53.5 ½ ✓	9 416 ½ ✓	15+8+22/ 2 =34 ½ ✓	5 984 ½ ✓
f (22 × 8)	22 × 8 =176 ½ ✓	(140-25)/2 +25+ 4 = 86.5 ½ ✓	15 224 ½ ✓	15+8+22/ 2 =34 ½ ✓	5 984 ½ ✓
TOTAL	4 432 ✓		310 240 ✓		104 338 ✓

(18)

$$\begin{aligned}\bar{x} &= \Sigma Ax / \Sigma A \\ &= 104\,338 / 4432 \\ &= 23,54 \text{ mm} \times\end{aligned}$$

$$\begin{aligned}\bar{Y} &= \Sigma Ay / \Sigma A \\ &= 310\,240 / 4432 \\ &= 70,00 \text{ mm} \times\end{aligned}$$

(2)
[20]

QUESTION 5

- 5.1 Alternating current refers to current that reverses the direction of flow ✓ and is generated from sources like a generator while direct current refers to electric current that flows in one direction ✓ and is generated from sources like a battery (2)
- 5.2 5.2.1 MCB protects a circuit by tripping or switching off ✓ as soon as there is an overcurrent or earth leakage ✓
- 5.2.2 Fuses protect the circuit by blowing (melting the fuse) ✓ as soon as there is an over current thereby breaking the circuit, thus preventing the flow of electricity ✓ (2 × 2) (4)
- 5.3
- Must be situated in an easily accessible place ✓
 - Must not be installed in a bathing room ✓
 - There must be clear unobstructed space in front of it ✓
 - Maximum height above finished floor level should be 2,2 m ✓
 - A minimum height from finished floor level should be 1,2 m ✓ (Any 4 × 1) (4)
- [10]

QUESTION 6

- 6.1 Component Perpendicular = $W \cos \theta$
 $= 75 \times 9,81 \cos 20^\circ$
 $= 691,38 \text{ N}$ ✓
- 6.2 Component Parallel = $W \sin \theta$
 $= 75 \times 9,81 \sin 20^\circ$
 $= 251,64 \text{ N}$ ✓
- 6.3 Coefficient of friction of the plane, $\mu = \text{Parallel Component} / \text{Perp Component}$
 $= (251,64 / 691,38)$ ✓
 $= 0,36$ ✓
- 6.4 Frictional Force = $\mu W \cos \theta$
But $\mu = \text{Parallel Component} / \text{Perp Component}$
 $= (251,64 / 691,38) \times (75 \times 9,81 \cos 20^\circ)$ ✓
 $= 251,64 \text{ N}$ ✓
- 6.5 Force required to pull the body up the incline
 $F_1 = \mu W \cos \theta + W \sin \theta$
 $= 251,64 + 251,64$ ✓
 $= 503,28 \text{ N}$ ✓
- (5 × 2) [10]

QUESTION 7

- 7.1 Mechanical Advantage = Load / Effort ✓
= 2100/500 ✓
= 4,2 ✓ (2)
- 7.2 Work Done = Force × Distance Moved ✓
= 2.1 × 0,8 ✓
= 16,8 kJ ✓ (3)
- 7.3 Velocity Ratio = Total number of pulleys
= 3 + 2 ✓
= 5 ✓ (3)
- 7.4 Efficiency = Mechanical Advantage/Velocity Ratio
= (4,2/5) × 100% ✓
= 84% ✓ (2)

[10]

TOTAL: 100