higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

BUILDING SCIENCE N3

26 JULY 2018

This marking guideline consists of 7 pages.

✓ = mark
√ = ½ mark

QUESTION 1

1.1
- Clogging of water pipes
- Scaling of water-heating elements
- Increased energy consumption
- Discolouration of water
- Not easy to clean when compared to soft water (5)

1.2
- Forms a protective layer around the material e.g. protects wood and steel against decay and rust
- Aesthetic purposes (decorative/beautiful)
- Easier to clean surface (Any relevant answer) (3 × 1) (3)

[8]

QUESTION 2

2.1 2.1.1 $+\uparrow\Sigma F = -\downarrow\Sigma F$

$RL = (4 \times 0,5) + 10 + (6 \times 0,6)$✓

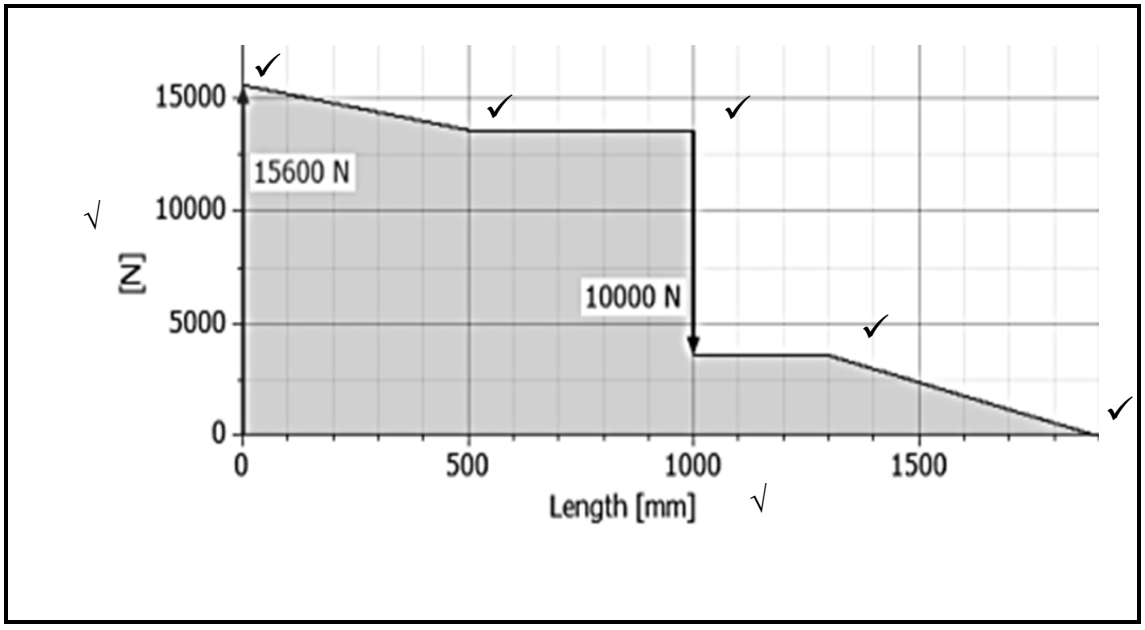
$= 15,6$ kN✓ (2)

2.1.2 $+\uparrow\Sigma M_{RL} = -\downarrow\Sigma M_{RL}$✓

$M_{RL} = (4 \times 0,5 \times 0,25) + (10 \times 1) + (6 \times 0,6 \times 1,6)$✓

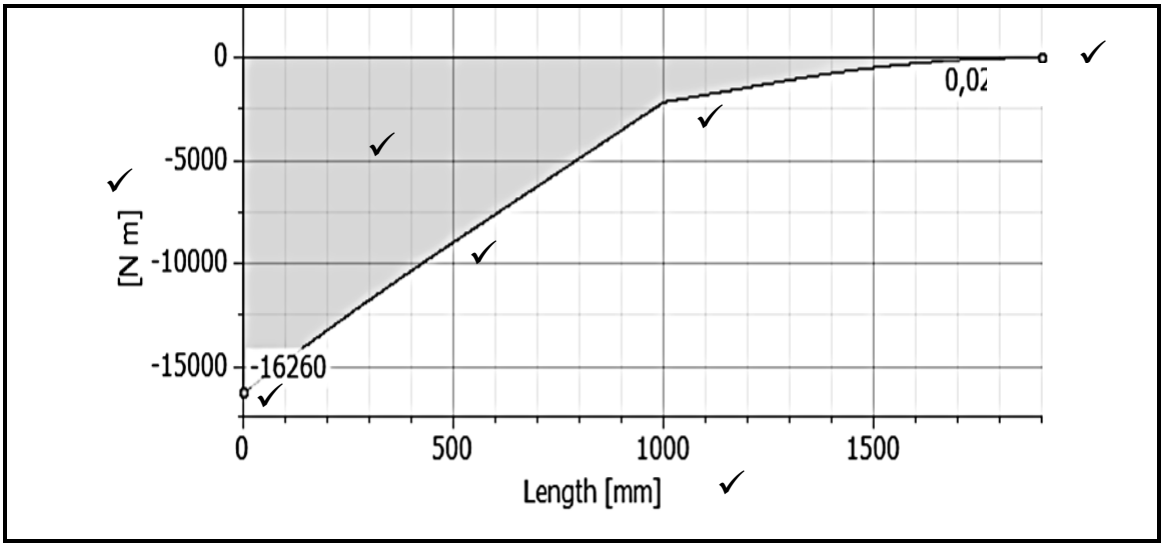
$=$ **16,26 kNm**✓ (3)

2.2 Linear scale: 1 cm : 0,2 m√ Shear force scale: 1 cm : 5 kN√



SHEAR FORCE DIAGRAM (7)

2.3 Linear scale: 1 cm : 0,2 m √ Bending moment scale: 1 cm : 1 kNm√



BENDING MOMENT DIAGRAM (8)

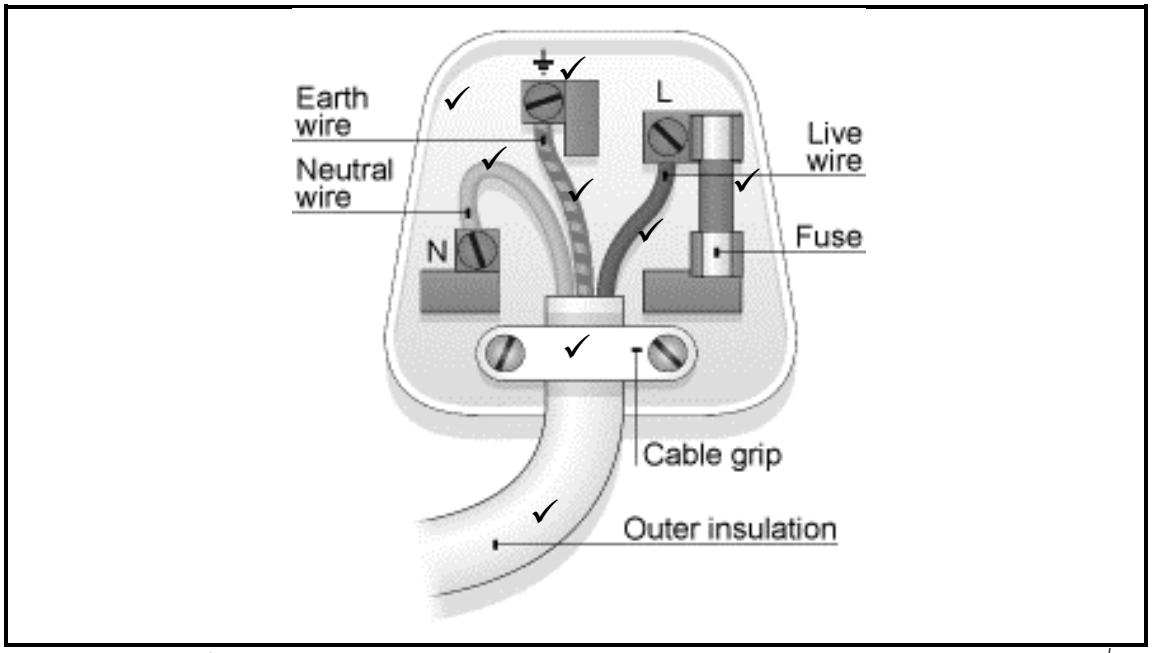
[20]

QUESTION 3

3.1 Alternating current changes direction of flow. ✓
Alternating current varies in magnitude over time. ✓

Direct current flows in one direction in a circuit. ✓
Direct current is constant in magnitude over time. ✓ (2 × 2) (4)

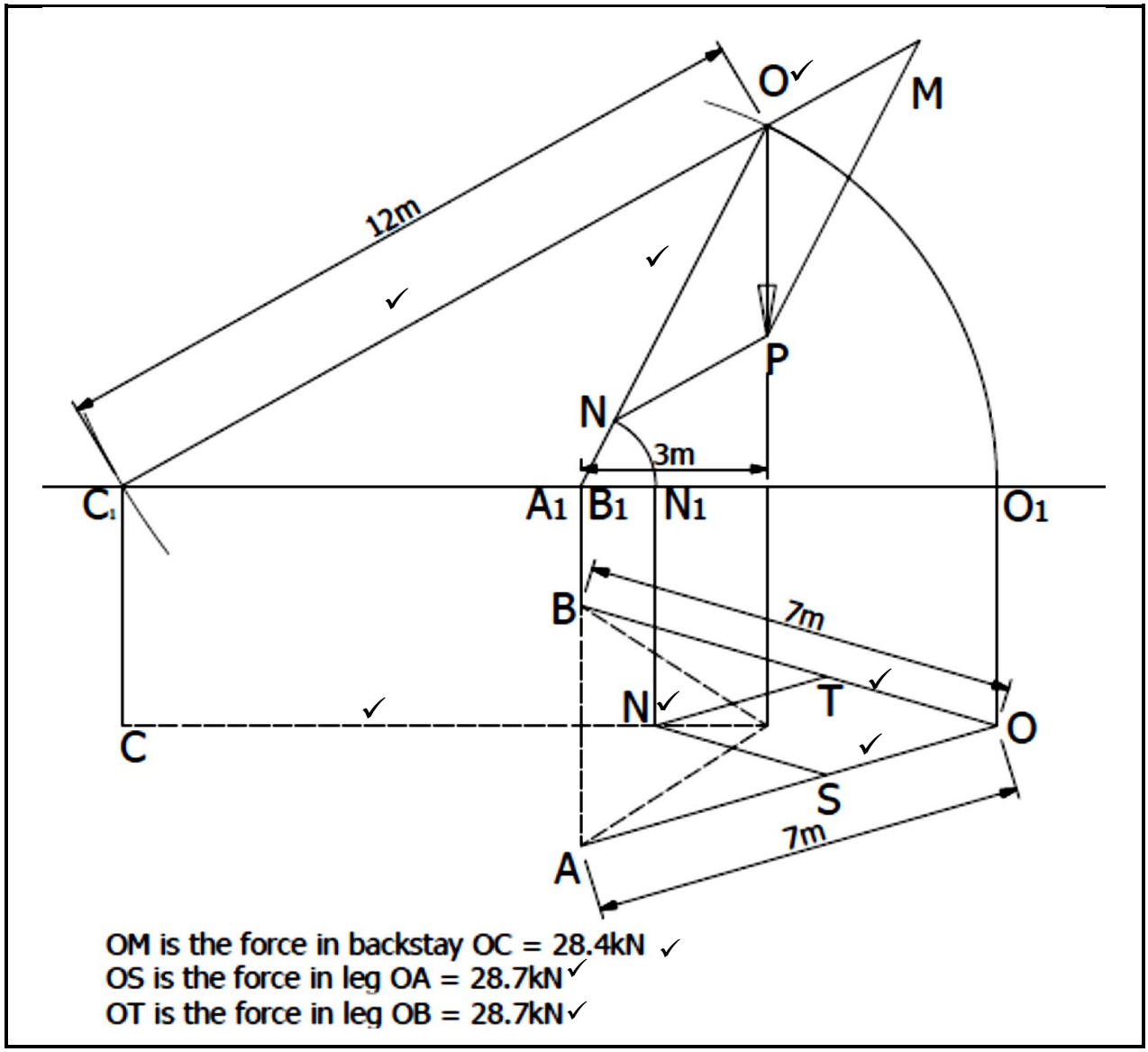
3.2



(1 mark (✓) if a part is correctly drawn and labelled, otherwise half mark (√)) (8)

[12]

QUESTION 4



[10]

QUESTION 5

5.1 Work done is defined as the product of a force and the distance✓moved in the direction of the force applied.✓ (2)

5.2
- Friction depends on the nature of the surfaces in contact (materials and finish).
- For any two surfaces, friction is proportional to the normal pressure between the surfaces.
- Friction is independent of the sizes of the area in contact.
- Friction is independent of the sliding speed between the surfaces in contact. (Any 2 × 1) (2)

5.3 5.3.1 Velocity ratio = distance moved by effort/distance moved by load
= 25/3✓
= 8,33✓

5.3.2 Mechanical advantage (MA) = Load/Effort
= 1 000 N/300 N✓
= 3,33✓

5.3.3 Efficiency = MA/VR Where MA – Mechanical advantage
= 3,33/8,33√ VR – Velocity ratio
= 0,399√
= 40%✓

(3 × 2) (6)
[10]

QUESTION 6

SHAPE	AREA [mm²]	OY [mm]	OX [mm]	Aoy [mm³]	Aox [mm³]	Mark
A	33 × 50√ = 1 650	√ 180,50	√ 75,00	√ 297 825	√ 123 750,00	(2½)
B	-½ × 20 × 59√ = -590	√ 141,67	√ 55,33	√ -83 585,30	√ -32 644,70	(2½)
C	-22 × 59√ = -1 298	√ 124,00	√ 45,50	√ -160 952,00	√ -59 059,00	(2½)
D	67 × 100√ = 6 700	√ 130,50	√ 50,00	√ 874 350,00	√ 335 000,00	(2½)
E	97 × 50√ = 4 850	√ 48,50	√ 75,00	√ 235 225,00	√ 363 750,00	(2½)
F	-π × 25²/4√ = -490,87	√ 45,00	√ 75,00	√ -22 089,15	√ -36 815,25	(2½)
SUM	10 821,13			√ 1 140 773,55	√ 693 981,05	(1)

(16)

$\bar{X}$ **= ΣAX/ ΣA**
= 1 140 773,55/10 821,13✓
= 105,42 mm✓

$\bar{Y}$ **= ΣAY/ ΣA**
= 693 981,05/10 821,13✓
= 64,13 mm✓ (4)
[20]

QUESTION 7

7.1 $+\uparrow \Sigma M_{RR} = -\downarrow \Sigma M_{RR}$

$5RL = (6{,}4 \times 5) + (8{,}4 \times 4) + (8 \times 3) + (6{,}4 \times 2) + (12 \times 1)\surd$

$RL = 114{,}4/5\surd$

$= \underline{\mathbf{22.88\ kN}}\checkmark$ (2)

$+\uparrow \Sigma M_{RL} = -\downarrow \Sigma M_{RL}$

$5RR = (8{,}4 \times 1) + (8 \times 2) + (6{,}4 \times 3) + (12 \times 4)\surd$

$RR = 91{,}6/5\surd$

$= \underline{\mathbf{18{,}32\ kN}}\checkmark$

OR

$+\uparrow \Sigma F = -\downarrow \Sigma F$

$RR\ RL = 6{,}4 + 8{,}4 + 8 + 6{,}4 + 12\surd$

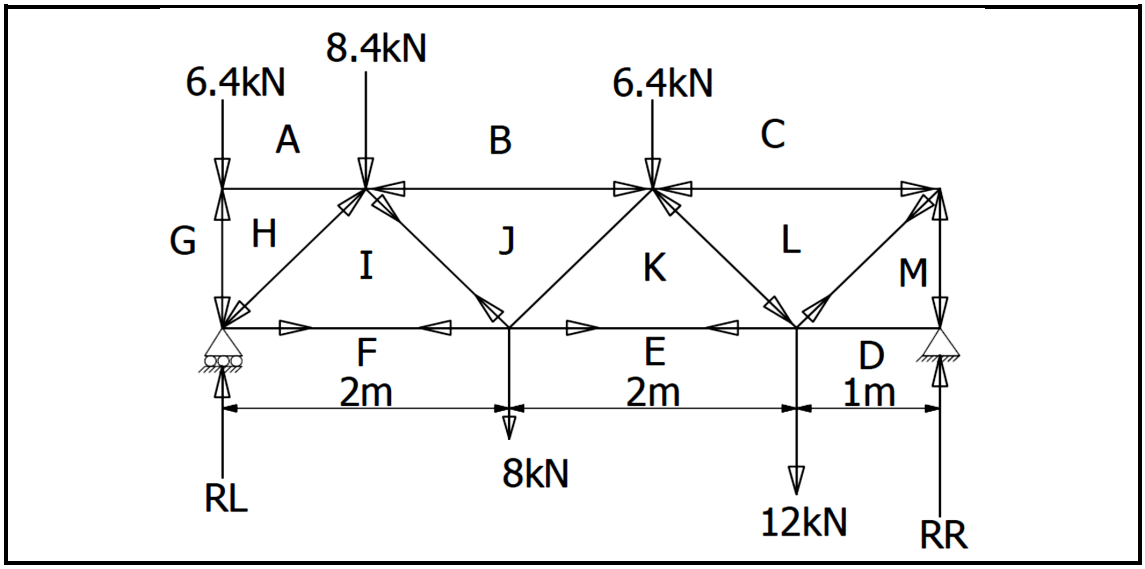
$RR = 42{,}2 - RL$

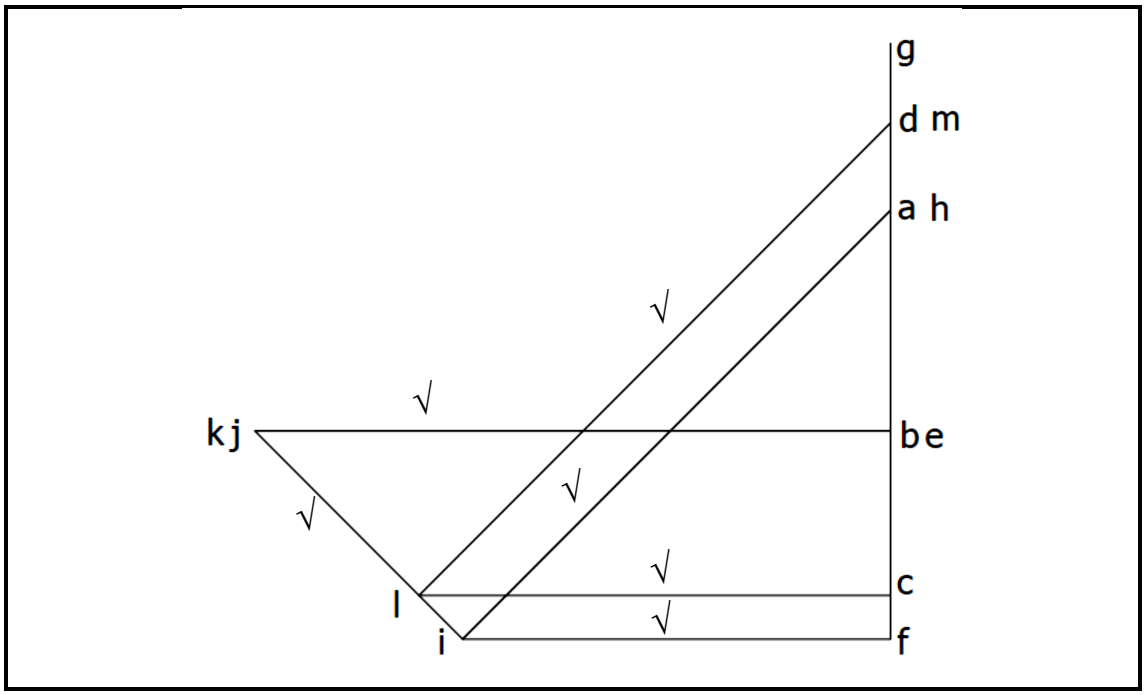
But $RI = 22{,}88$ kN$\surd$

$\therefore RR = 41{,}2 - 22{,}88$

$= \underline{\mathbf{18{,}32\ kN}}\checkmark$ (2)

7.2





(6 × ½) (3)

MEMBER	MAGNITUDE (kN)	NATURE
GH	6,4√	STRUT√
AH	0√	REDUNDANT√
HI	23,3√	STRUT√
FI	16,5√	TIE√
IJ	12,4√	TIE√
BJ	25,4√	STRUT√
JK	0√	REDUNDANT√
EK	25,4√	TIE√
KL	9,4√	STRUT√
CL	18,2√	STRUT√
LM	25,7√	TIE√
DM	0√	REDUNDANT√
CM	18,3√	STRUT√

(13)
[20]

TOTAL: 100