



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

ENGINEERING SCIENCE N2

31 July 2026

This marking guideline consists of 7 pages.

QUESTION 1

1.1	1.1.1	m/s^2 ✓	(5 × 1)	(5)
	1.1.2	A✓		
	1.1.3	J✓		
	1.1.4	W✓		
	1.1.5	Ω ✓		
1.2	1.2.1	1 500 kPa✓	(3 × 1)	(3)
	1.2.2	84,6 km/h✓		
	1.2.3	0,125 cm✓		
1.3	$v = u + at$ $= 50 + (30 \times 5)$ ✓ $= 290 \text{ m/s}$ ✓			(2)
1.4	1.4.1	$v = u + at$ $0 = 33,33 + (-10)t$ ✓ $3,33 \text{ seconds} = t$ ✓		(2)
	1.4.2	$s = u.t + \frac{1}{2}.a.t^2$ $s = (33,33 \times 3,33) + (-5)(3,33)^2$ ✓ $s = 111,11 - 55,44$ ✓ $s = 55,66 \text{ m}$ ✓		(3)
				[15]

QUESTION 2

2.1	2.1.1	False✓	(4 × 1)	(4)
	2.1.2	True✓		
	2.1.3	True✓		
	2.1.4	False✓		

$$\begin{aligned}
 2.2 \quad 2.2.1 \quad \Sigma \downarrow M &= \Sigma \uparrow M \text{ about L} \\
 (35 \times 1) + (95 \times 4) &= (70 \times 3) + (R \times 7) \checkmark \\
 35 + 380 &= 210 + 7R \\
 \frac{205}{7} &= R \checkmark \\
 29,286 \text{ N} &= R \checkmark \\
 \Sigma \downarrow M &= \Sigma \uparrow M \text{ about R} \\
 (L \times 7) &= (95 \times 3) + (35 \times 6) + (70 \times 10) \checkmark \\
 7L &= 1\,195 \\
 L &= \frac{1\,195}{7} \checkmark \\
 L &= 170,714 \text{ N} \checkmark \quad (6) \\
 2.2.2 \quad \Sigma F_{up} &= 29,286 \text{ N} + 170,714 \text{ N} \\
 &= 200 \text{ N} \\
 \Sigma F_{down} &= 70 \text{ N} + 35 \text{ N} + 95 \text{ N} \\
 &= 200 \text{ N} \\
 \therefore \Sigma F_{up} &= \Sigma F_{down} \checkmark \quad (1) \\
 2.3 \quad F_{vert} &= W \sin \theta \\
 &= 700 \text{ N} \sin 50^\circ \checkmark \\
 &= 536,231 \text{ N} \checkmark \\
 F_{horizontal} &= W \cos \theta \\
 &= 700 \text{ N} \cos 50^\circ \checkmark \\
 &= 449,951 \text{ N} \checkmark \quad (4) \\
 &\quad [15]
 \end{aligned}$$

QUESTION 3

$$\begin{aligned}
 3.1 \quad &\text{The energy of a body due to its motion.} \checkmark \checkmark \quad (2) \\
 3.2 \quad 3.2.1 \quad E_p &= mgh \\
 &= (3)(9,8)(12) \checkmark \\
 &= 352,8 \text{ J} \checkmark \quad (2) \\
 3.2.2 \quad v &= u + gt \\
 v &= 0 + (9,8)(1,5) \checkmark \\
 &= 14,7 \text{ m/s} \checkmark \\
 E_k &= \frac{1}{2} mv^2 \\
 &= \frac{1}{2} (3)(14,7)^2 \checkmark \\
 &= 324,135 \text{ J} \checkmark
 \end{aligned}$$

3.2.3 $E_k = 352,8$

$$\frac{1}{2} (3)(v)^2 = 352,8 \checkmark$$

$$v = \sqrt{235,2}$$

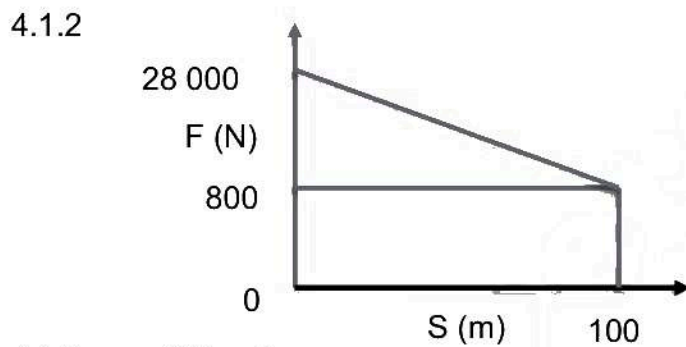
$$v = 15,336 \text{ m/s} \checkmark$$

(2)
[10]

QUESTION 4

4.1 4.1.1 Cable $W = 20 \times 100$
 $= 2\,000 \text{ N} \checkmark$

(1)



(4)

4.1.3 $WD = F \times s$
 $= 2\,800 \times 100 \checkmark$
 $= 280\,000 \text{ J or } 280 \text{ kJ} \checkmark$

(2)

4.2 $P = \frac{W}{t}$

$$W = Pt$$

$$= (2\,500) \times (2 \times 60) \checkmark$$

$$= 300 \text{ kN} \checkmark$$

(2)
[9]

QUESTION 5

- 5.1 5.1.1 $MA = \frac{L}{E}$
 $= \frac{600}{80} \checkmark$
 $= 7,5 \checkmark$ (2)
- 5.1.2 $VR = \frac{2D}{d_1 - d_2}$
 $= \frac{500}{420 - 380} \checkmark$
 $= \frac{500}{40} \checkmark$
 $= 12,5 \checkmark$ (3)
- 5.1.3 $\eta = \frac{MA}{VR} \times 100\%$
 $= \frac{7,5}{12,5} \times 100\% \checkmark$
 $\eta = 60\% \checkmark$ (2)
- 5.2 5.2.1 $P = (T^1 - T^2) \frac{\pi DN}{60}$
 $= (170 - 20) \frac{\pi(0,225 \times 500)}{60} \checkmark \checkmark$
 $P = 883,573 \text{ W} \checkmark$ (3)
- 5.2.2 $TR = \frac{T^1}{T^2}$
 $= \frac{170}{20} \checkmark$
 $= 8,5:1 \checkmark$ (2)
- 5.2.3 $N^1, D^1 = N^2, D^2$
 $(1\ 100) D^1 = (500 \times 225) \checkmark$
 $D^1 = 102,28 \text{ mm} \checkmark$ (2)
- 5.2.4 $v = \frac{\pi DN}{60}$
 $= \frac{\pi(0,225 \times 500)}{60} \checkmark$
 $= 5,89 \text{ m/s} \checkmark$ (2)

QUESTION 6

- 6.1
- Unwanted noise✓
 - Heat generation✓
 - Excessive wear✓
- (Accept any other applicable correct answer) (3)
- 6.2
- 6.2.1
- $$\begin{aligned} L_{\text{comp}} &= w \cos 15^\circ \\ &= (300 \times 9,8) \cos 15^\circ \checkmark \\ &= 2\,839,822 \text{ N} \checkmark \end{aligned} \quad (2)$$
- 6.2.2
- $$\begin{aligned} l_{\text{comp}} &= w \sin 15^\circ \\ &= (300 \times 9,8) \sin 15^\circ \checkmark \\ &= 760,928 \text{ N} \checkmark \end{aligned} \quad (2)$$
- 6.2.3
- $$\begin{aligned} F_\mu &= w \cos 15^\circ \times \mu \\ &= 2\,839,822 \times 0,4 \checkmark \\ &= 1\,135,93 \text{ N} \checkmark \end{aligned} \quad (2)$$
- 6.2.4
- $$\begin{aligned} F_a &= w \sin 15^\circ + F_\mu \checkmark \\ &= 760,928 + 1\,135,93 \checkmark \\ &= 1\,896,86 \text{ N} \checkmark \end{aligned} \quad (3)$$
- 6.3
- $$\begin{aligned} P &= pgh \\ 180\,000 &= (1024)(9,8)h \checkmark \\ 17,937 \text{ m} &= h \checkmark \end{aligned} \quad (2)$$
- [14]

QUESTION 7

- 7.1
- When a hot substance is mixed with a cooler one, the heat is transferred from the hotter one to the cooler one,✓ until both substances reach the same temperature.✓ (2)
- 7.2
- $$t^1 = 600^\circ\text{C} ; t^2 = 20^\circ\text{C} : t^{\text{final}} = 30^\circ\text{C} ; m^1 = ? ; m^2 = 1,5 \text{ kg}$$
- $$c^1 (\text{steel}) = 494 \text{ J/kg} ; c^2 (\text{water}) = 4\,200 \text{ J/kg}$$
- heat lost = heat gained
- $$m^1 c^1 (t^1 - t^{\text{final}}) = m^2 c^2 (t^{\text{final}} - t^2) \checkmark$$
- $$m^1 (494)(600 - 30) = (1,5)(4200)(10) \checkmark$$
- $$m^1 = 0,224 \text{ kg} \checkmark \quad (3)$$

7.3 $l = 5 \text{ m}$; $t = 25^\circ$; $T = 200^\circ\text{C}$; $\alpha = 0,000017/^\circ\text{C}$; $\Delta l = ?$

$$\alpha = \frac{\Delta l}{l + \Delta t} \checkmark$$

$$0,000017 = \frac{\Delta l}{5(200 - 25)} \checkmark$$

$$\Delta l = 0,0148 \text{ m}$$

$$= 14,8 \text{ mm} \checkmark$$

(3)
[8]

QUESTION 8

- 8.1
- To strengthen the metal $\checkmark$ (Harden the outer layer)
 - To enhance its appearance $\checkmark$
 - To prevent corrosion $\checkmark$

(3)

- 8.2
- 8.2.1 $\text{NaCl} \checkmark$
- 8.2.2 $\text{HCl} \checkmark$

(2 × 1)

(2)
[5]

QUESTION 9

9.1 9.1.1 $\frac{1}{R} = \frac{1}{R^1} + \frac{1}{R^2}$

$$\frac{1}{R} = \frac{1}{6} + \frac{1}{9} \checkmark$$

$$R = \frac{5}{18}$$

$$R = 3,6 \Omega \checkmark$$

(2)

9.1.2 $R_T = R + R_3$
 $= 3,6 + 13$
 $= 16,6 \Omega \checkmark$

(1)

9.2 $l = ?$; $a = 7,07 \times 10^{-6} \text{ m}^2$; $R = 2 \Omega$; $\rho = 0,000\,000\,028 \Omega\text{m}$

$$R = \frac{\rho l}{a}$$

$$2 = \frac{0,000000028(L)}{7,07 \times 10^{-6}} \checkmark$$

$$L = 505 \text{ m} \checkmark$$

(2)

9.3 It is when an EMF is produced by relative motion $\checkmark$ between a magnetic flux $\checkmark$ and an electric circuit. $\checkmark$

(3)
[8]

TOTAL: