



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

**NATIONAL CERTIFICATE
NOVEMBER EXAMINATION
ENGINEERING SCIENCE N1**

24 NOVEMBER 2016

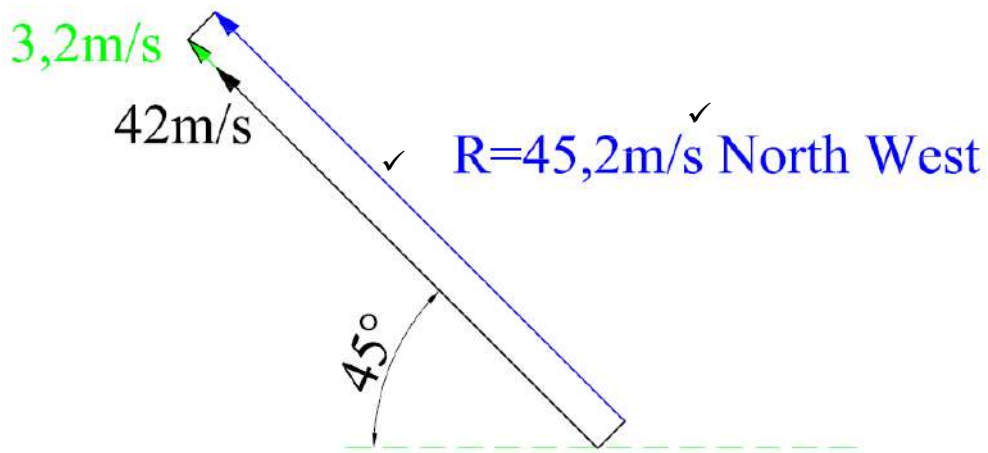
This marking guideline consists of 11 pages.

QUESTION 1

- 1.1 1.1.1 True
- 1.1 1.1.2 False
- 1.1 1.1.3 False
- 1.1 1.1.4 False
- 1.1 1.1.5 True

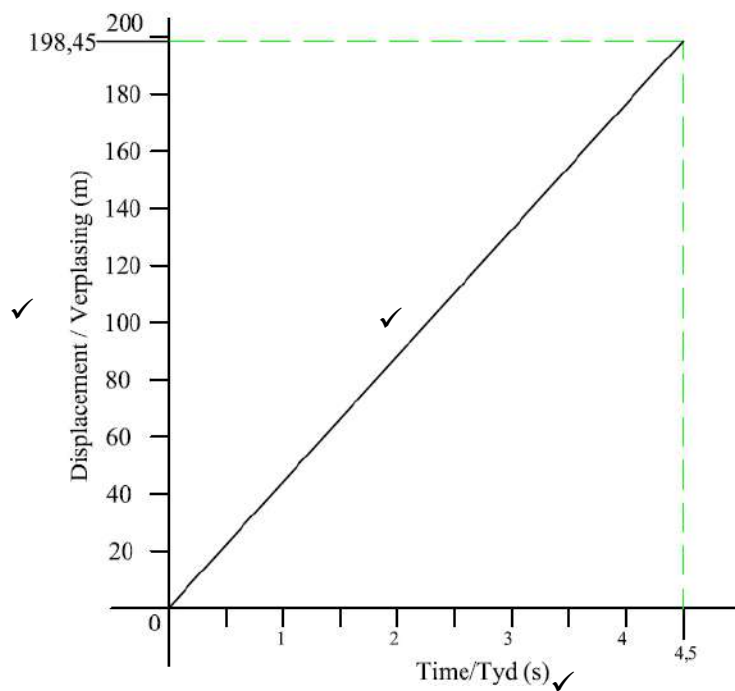
(5 × 1) (5)

- 1.2 $Velocity = 42 + 3,2 \checkmark$
 $Velocity = 45,2 \text{ m/s}; \text{North west}$



(Analytical or graphical method can be taken as correct) (2)

- 1.3 1.3.1



(3)

$$1.3.2 \quad \text{Slope} = \frac{\text{Displacement}}{\text{Time}}$$

$$\text{Slope} = \frac{198,45}{4,5}$$

$$\underline{\text{Slope} = 44,1\text{m} / \text{s}} \quad \checkmark \quad (1)$$

1.3.3 Average velocity (1)

$$1.4 \quad t_1 = \frac{s}{v} = \frac{2}{6} = 0,333h$$

$$t_2 = \frac{s}{v} = \frac{2}{16} = 0,125h \quad v_{ave} = \frac{s}{t_{ave}}$$

$$t_3 = \frac{s}{v} = \frac{1}{32} = 0,0313h \quad v_{ave} = \frac{5}{0,4893}$$

$$t_{ave} = t_1 + t_2 + t_3 \quad v_{ave} = \underline{10,219\text{m} / \text{s}} \quad \checkmark$$

$$t_{ave} = 0,333 + 0,125 + 0,0313$$

$$\underline{t_{ave} = 0,4893h} \quad \checkmark \quad (2)$$

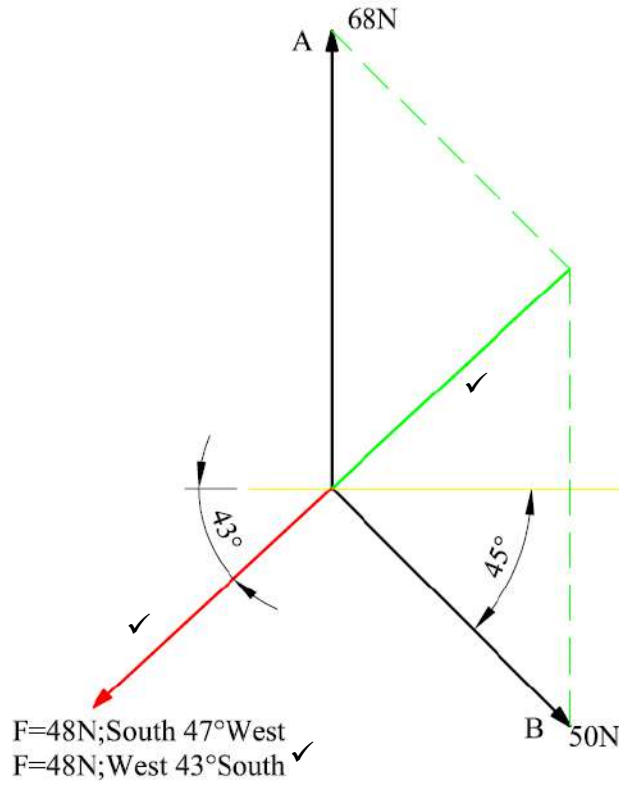
[14]

QUESTION 2

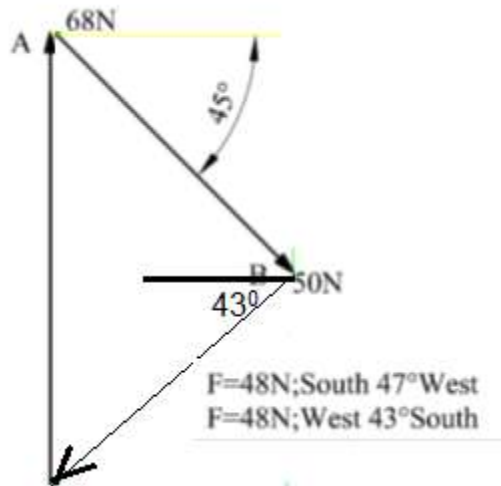
2.1	2.1.1	C
	2.1.2	D
	2.1.3	A
	2.1.4	D
	2.1.5	C

(5 × 1) (5)

2.2 2.2.1



OR



OR

Plane mirror reflection of this (3)

2.2.2 Equilibrant (1)

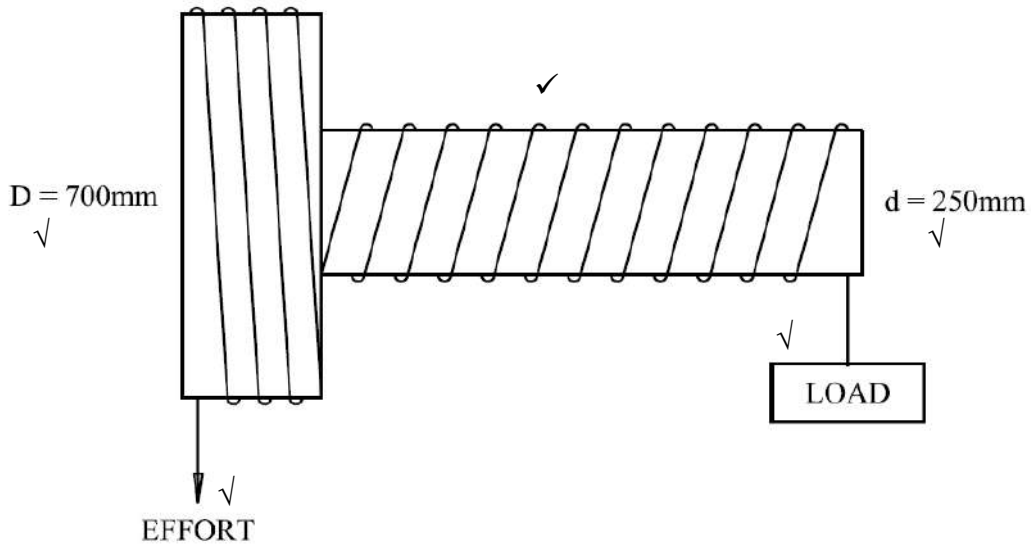
2.3 2.3.1 $MA = \frac{L}{E}$
 $MA = \frac{320 \times 9,8}{500}$
 $MA = 6,272 \quad \checkmark$

2.3.2 $VR = \frac{L}{l}$
 $VR = \frac{1,12}{0,521}$
 $VR = 2,150 \quad \checkmark$

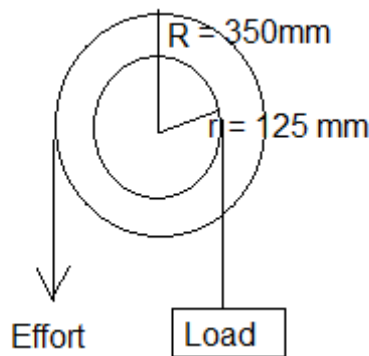
$VR = \frac{\delta E}{\delta L}$

(2 × 1) (2)

2.4



OR



(3)

2.5 $LM = RM$
 $350 \times 3 = 225 \times L$
 $L = \frac{350 \times 3}{225} \quad \checkmark \quad \Sigma ACWM = \Sigma CWM$
 $L = 4,667m \quad \checkmark$

(2)

2.6 $\Gamma(\text{torque}) = F \cdot r$
 $\Gamma(\text{torque}) = 450 \times 0,32 \checkmark$
 $\Gamma(\text{torque}) = 144 \text{ N.m} \checkmark$

(2)
[18]

QUESTION 3

- 3.1 3.1.1 Kinetic energy
 3.1.2 Atomic/chemical energy
 3.1.3 Heat energy
 3.1.4 Electric energy
 3.1.5 Potential energy
- (5 × 1) (5)

- 3.2 3.2.1 Chemical energy to electrical energy
 3.2.2 Kinetic energy to electrical energy
- (2 × 1) (2)

3.3 3.3.1 $t = 25 \times 60 = 1500 \text{ s}$

$$v = \frac{100}{3,6} = 27,78 \text{ m/s}$$

$$s = vt$$

$$= 27,78 \times 1500$$

$$= 41670 \text{ m} \quad \checkmark$$

$$W = Fs$$

$$= 920 \times 41670$$

$$= 38336400 \text{ J}$$

$$= 38,34 \times 10^6 \text{ J} = 38,34 \text{ MJ} \quad \checkmark$$

(2)

3.3.2

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

$$= \frac{38336400}{1560}$$

$$= 25557,6 \text{ W} = 25,56 \text{ KW}$$

OR

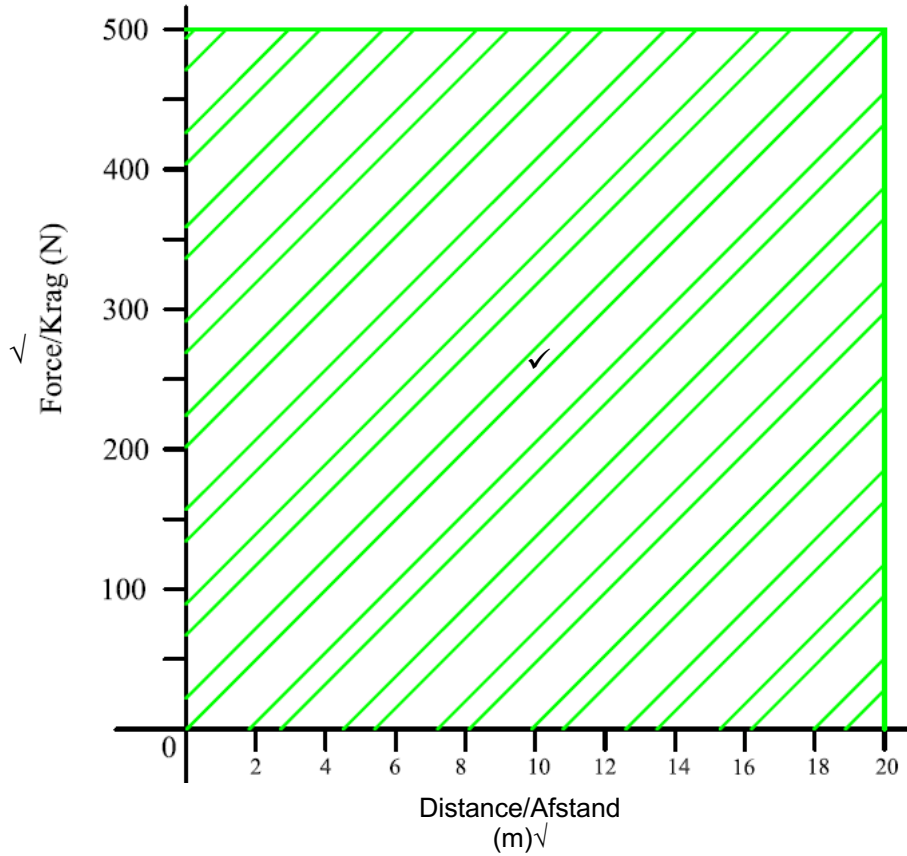
$$P = Fv$$

$$= 920 \times 27,78$$

$$= 25557,6 \text{ W} = 25,56 \text{ KW}$$

(1)

3.4



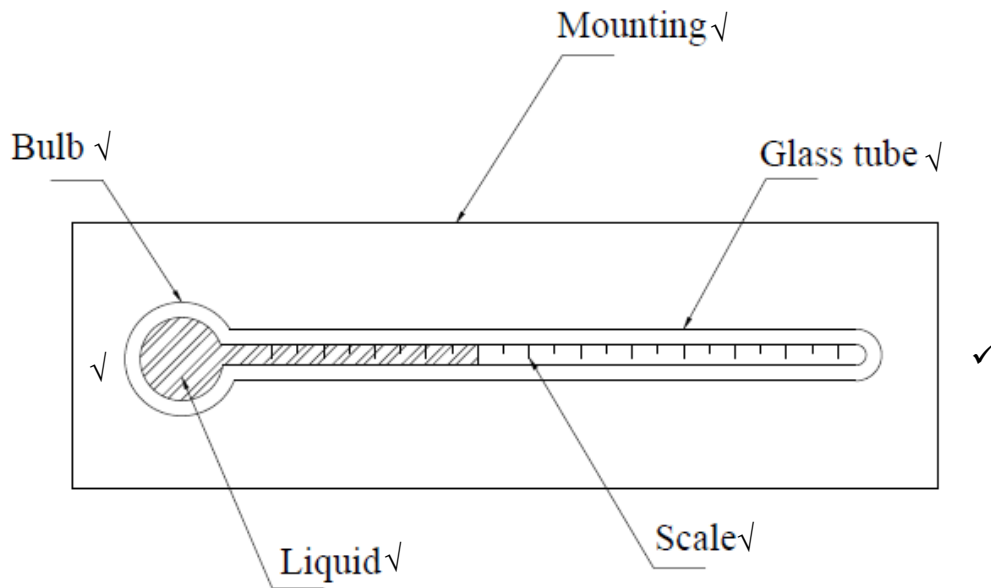
(2)
[12]

QUESTION 4

- 4.1 4.1.1 Temperature
- 4.1.2 Heat capacity
- 4.1.3 Thermometer
- 4.1.4 Conduction
- 4.1.5 Vacuum

(5 × 1) (5)

4.2



(3)

4.3 A thermocouple consists of two different types of metals joined at one end and the other end joined electrically (galvanometer). ✓ When the joined end is heated a voltage drop is created between the open ends and can be measured with a galvanometer. ✓ (2)

4.4 $Q = m.c.(t_f - t_o)$
 $t_f = \frac{Q}{m.c} + t_o$ ✓
 $t_f = \frac{1,5 \times 10^6}{(23 \times 3470)} + 15$ ✓
 $t_f = 33,795 \text{ } ^\circ\text{C}$ ✓ (3)

4.5 4.5.1 $\Delta t = t_f - t_o$
 $\Delta t = 350 - 20$
 $\Delta t = 330 \text{ } ^\circ\text{C}$ ✓

4.5.2 $\Delta l = l_f - l_o$
 $\Delta l = 1,3608 - 1,36$
 $\Delta l = 0,0008 \text{ m}$ ✓ (2 × 1) (2)

4.6 Because the linear expansion ✓ of copper is faster than that of steel, the bi-metallic strip will bend in the direction of the steel. ✓ (2)

4.7 Pyrometer (1)

[18]

QUESTION 5

- 5.1 5.1.1 C
 5.1.2 E
 5.1.3 A
 5.1.4 D
 5.1.5 B
(5 × 1) (5)
- 5.2 5.2.1 Melting/liquidation
 5.2.2 Evaporation/vaporisation
(2 × 1) (2)
- 5.3 • Liquid: Movement of molecules is fast.
 • Solid: Movement of molecules is slow.
(2)
- 5.4 • Electron✓ – Negative✓
 • Proton✓ – Positive✓
 • Neutron✓ – Neutral✓
(½ × 6) (3)
[12]

QUESTION 6

- 6.1 6.1.1 Conductor
 6.1.2 Resistor
 6.1.3 Ammeter
 6.1.4 Voltage
 6.1.5 Alternating
(5 × 1) (5)
- 6.2

CONDUCTORS	ISOLATORS
6.2.1 Copper✓	6.2.4 Mica✓
6.2.2 Zinc✓	6.2.5 PVC✓
6.2.3 Silver✓	6.2.6 Rubber✓

(6 × ½) (3)
- 6.3 6.3.1 Ammeter✓
 6.3.2 Battery✓
 6.3.3 Voltmeter✓
 6.3.4 Open Switch✓
(4 × ½) (2)

6.4

$$R = \frac{V}{I}$$

$$R = \frac{220}{15,3} \checkmark$$

$$R = \underline{14,379\Omega} \checkmark \quad (2)$$

6.5 Heating up of motors, ✓ generators ✓ and transformers. (Any 2 × 1) (2)

6.6

$$Q = I^2 \cdot R \cdot t$$

$$t = \frac{Q}{I^2 \cdot R}$$

$$t = \frac{485000}{3,75^2 \cdot 45} \checkmark$$

$$t = \underline{766,419s} \checkmark$$

$$t = \underline{12 \text{ min } 46,419s} \quad (2)$$

6.7

6.7.1

$$P = \frac{V^2}{R}$$

$$R = \frac{V^2}{P}$$

$$R = \frac{220^2}{1500} \checkmark$$

$$R = \underline{32,267 \Omega} \checkmark$$

6.7.2

$$P = VI$$

$$I = \frac{P}{V}$$

$$I = \frac{1500}{220} \checkmark$$

$$I = 6,818A \checkmark$$

OR

$$I = \frac{V}{R}$$

$$= \frac{220}{32,267}$$

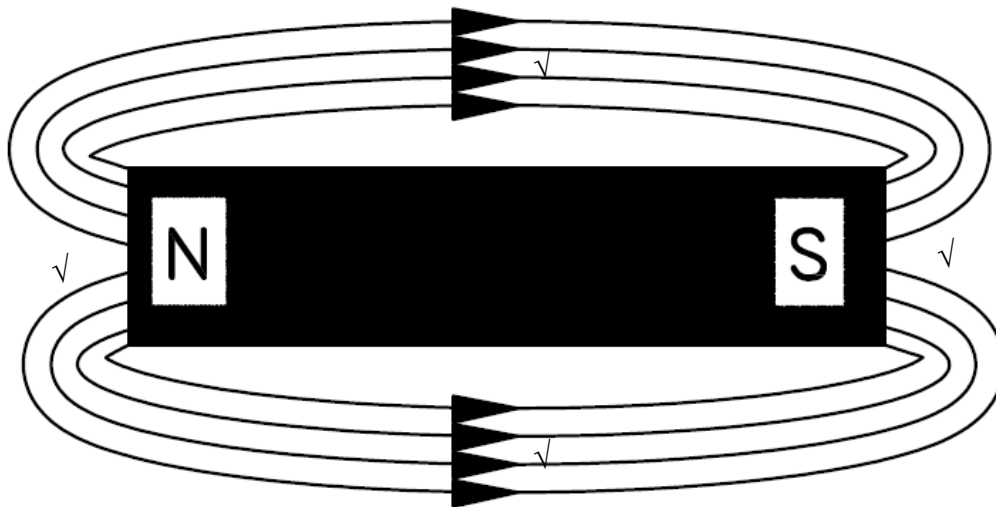
$$A = 6,818$$

(2 × 2) (4)

6.8 $R = R_1 + R_2 + R_3$
 $R = 23,5 + 63 + 12,4 \checkmark$
 $R = 98,9\Omega \checkmark$ (2)

- 6.9
- Temperature
 - Length
 - Diameter
 - Type (resistivity)
- (Any 2 × 1) (2)

6.10



(2)
[26]

TOTAL: 100