



**higher education  
& training**

Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

# **MARKING GUIDELINE**

**NATIONAL CERTIFICATE  
APRIL EXAMINATION  
ENGINEERING SCIENCE N1**

**6 APRIL 2016**

**This marking guideline consists of 12 pages.**

✓ = 1 mark.

✓ = ½ mark.

Calculations:

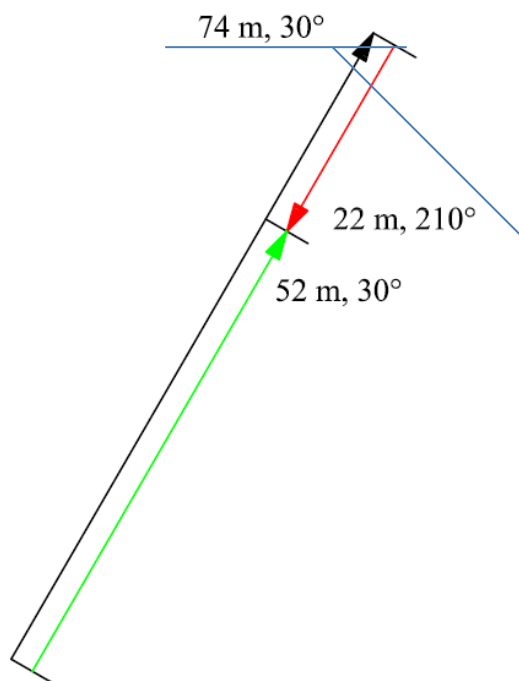
- 1 mark for substitution and conversion of values.
- 1 mark for answer and unit.
- -½ mark for using the incorrect unit.

**QUESTION 1**

1.1	1.1.1	C
	1.1.2	D
	1.1.3	B
	1.1.4	A

(4 x 1) (4)

1.2



✓✓ Resultant = 52 m, 30° ✓ (2)

1.3

1.3.1

$$v = \frac{s}{t}$$

$$s = v \cdot t$$

$$s = 375 \times \left(\frac{15}{60}\right)$$

$$s = 93,75 \text{ km}$$

✓✓

1.3.2

$$v = \frac{s}{t}$$

$$t = \frac{s}{v}$$

$$t = \frac{93,75}{375 \times 25\%} \checkmark \checkmark$$

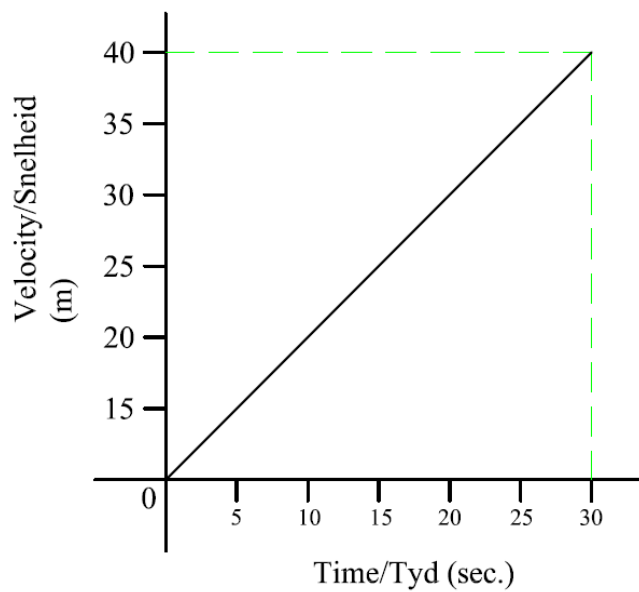
$$t = \frac{93,75}{468,75}$$

$$t = 0,2 \text{ hours}$$

$$t = 12 \text{ min}$$

(2 x 2) (4)

1.4 1.4.1

 $\checkmark \checkmark \checkmark$ 

(3)

1.4.2

$$a = \frac{\Delta v}{t}$$

$$a = \frac{40}{30} \checkmark \checkmark$$

$$a = 1,333 \text{ m.s}^{-2}$$

(2)  
[15]

**QUESTION 2**

2.1	2.1.1	False
	2.1.2	False
	2.1.3	True
	2.1.4	True
	2.1.5	False

(5 x 1) (5)

2.2      2.2.1

$$VR = \frac{E_{Dist}}{L_{Dist}}$$

$$E_{Dist} = VR \times L_{Dist} \quad \checkmark \checkmark$$

$$E_{Dist} = 3 \times 3,5$$

$$E_{Dist} = 10,5 \, m$$

2.2.2

$$MA = \frac{L}{E}$$

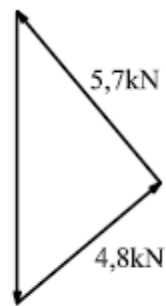
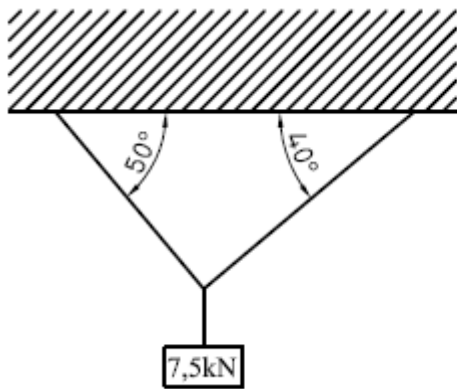
$$E = \frac{L}{MA} \quad \checkmark \checkmark$$

$$E = \frac{550}{2,5}$$

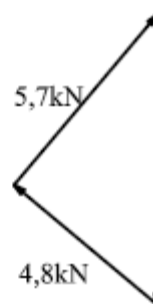
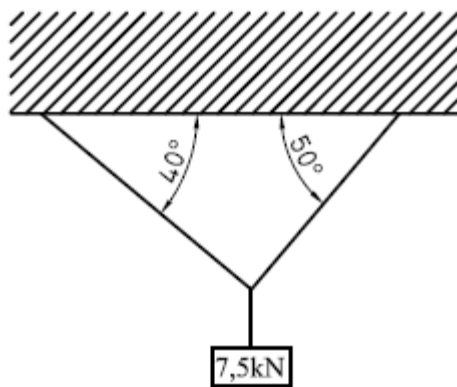
$$E = 220 \, N$$

(2 x 2) (4)

2.3



✓✓✓



OR

By calculations

Consider both A and B up

	A	B	125N
x	$-A \cos 40^\circ = -0,766A$	$B \cos 50^\circ = 0,643B$	0
Y	$A \sin 40^\circ = 0,643$	$B \sin 50^\circ = 0,766B$	-125

$$\sum x = 0$$

$$-0,766A + 0,643B = 0$$

$$B = 1,191A$$

1

$$\sum y = 0$$

$$0,643A + 0,766B = 7,5$$

2

1 in 2

$$0,643A + 0,766 \times 1,191A = 7,5$$

$$A = 4,823N$$

Therefore

$$B = 1,191 \times 4,823 = 5,744 \text{ kN}$$

✓✓✓

(3)

2.4

$$LM = RM$$

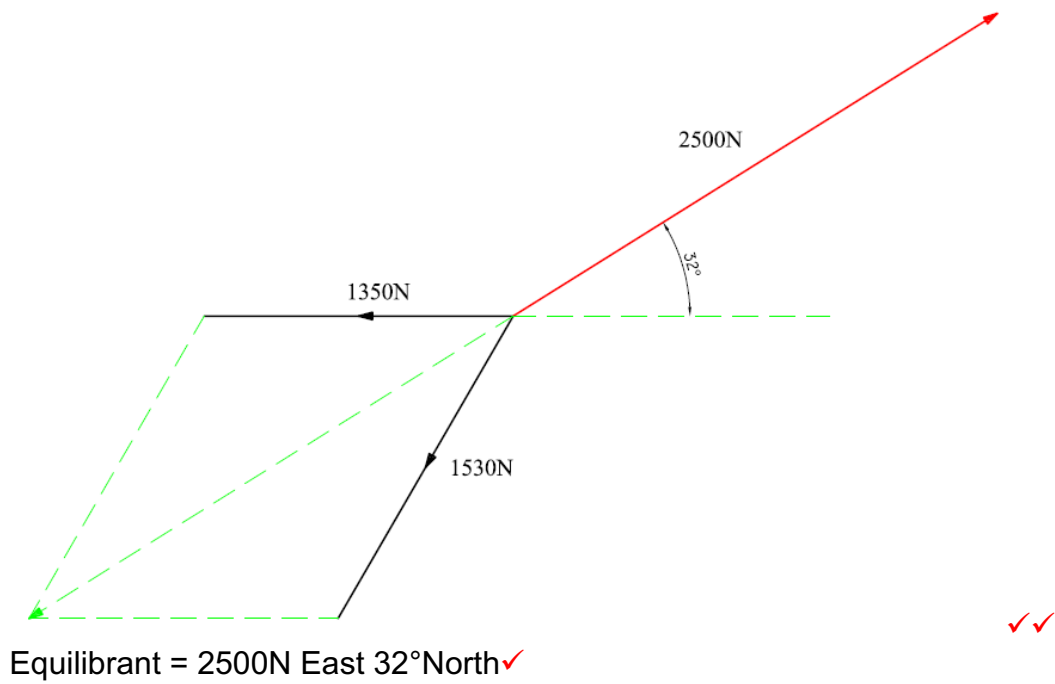
$$P \times 3 = 125 \times 2$$

$$P = \frac{125 \times 2}{3} \quad \checkmark \checkmark$$

$$P = 83,333 \text{ N}$$

(2)

2.5



OR

By calculations

(3)  
[17]**QUESTION 3**

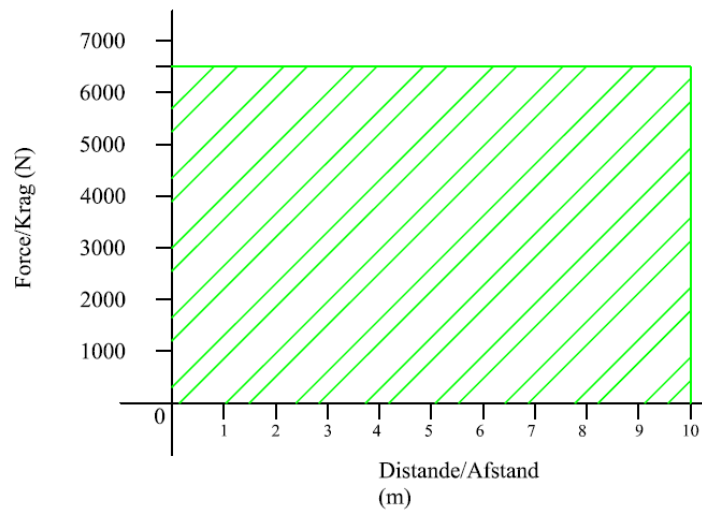
- |     |       |   |
|-----|-------|---|
| 3.1 | 3.1.1 | B |
|     | 3.1.2 | A |
|     | 3.1.3 | B |
|     | 3.1.4 | A |
|     | 3.1.5 | B |

(5 x 1) (5)

- 3.2      $W = F \times s$   
           $W = 525 \times 200$   
           $W = 105\,000$  ✓✓  
           $W = 105\text{ kJ}$

(2)

3.3 3.3.1



✓✓✓

(3)

3.3.2  $W = F \times s$ 

$$W = 6\,500 \times 10$$

$$W = 650\,00\,J$$

$$W = 65\,kJ$$

✓✓

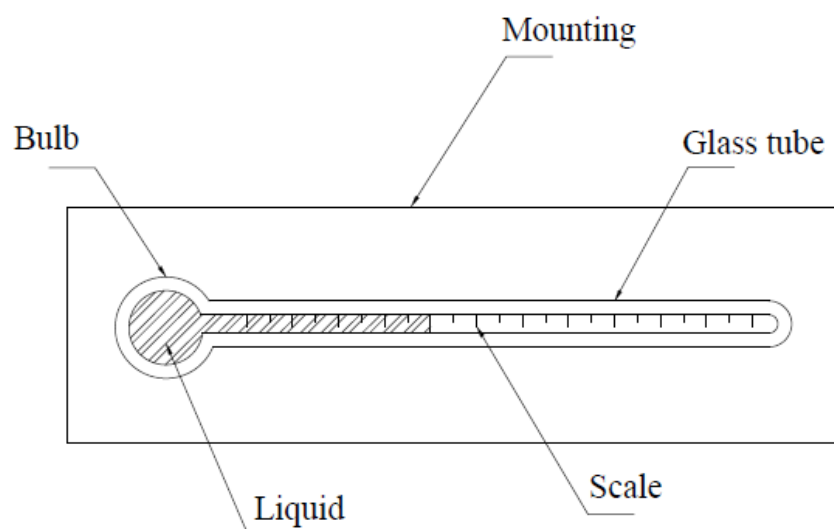
(2)  
[12]**QUESTION 4**

- 4.1 4.1.1 Higher  
 4.1.2 Lower  
 4.1.3 Removed  
 4.1.4 Radiation pyrometer  
 4.1.5 Joule

(5 x 1)

(5)

4.2



✓✓✓

(3)



4.3	4.3.1	Conduction		
	4.3.2	Convection		
	4.3.3	Convection/radiation		
			(3 x 1)	(3)
4.4		$Q = m \times c \times \Delta t$		
		$Q = 250 \times 4187 \times (55 - 15)$ ✓✓		
		$Q = 418\,700\,00\,J$		
		$Q = 41,87\,MJ$		(2)
4.5	4.5.1	$\Delta l = l_o - l_f$		
		$\Delta l = 36 - 35,105$ ✓		
		$\Delta l = 0,895m$		
		$\Delta l = 895\,mm$		
	4.5.2	$\Delta t = t_o - t_f$		
		$\Delta t = 85 - 25$ ✓		
		$\Delta t = 60\,^{\circ}C$		
			(2 x 1)	(2)
4.6	4.6.1	Heat is transferred between the lead and water.		
	4.6.2	The law of conservation of energy.		
	4.6.3	The temperature of both materials is the same.		
			(3 x 1)	(3)
				[18]

**QUESTION 5**

5.1	5.1.1	Atom		
	5.1.2	Matter		
	5.1.3	Molecule		
	5.1.4	Melting		
	5.1.5	Condensation		
			(5 x 1)	(5)
5.2		Gas: particles far from each other		
		Liquid: particles not far from each other		
		Solid: particles close to each other		(3)
5.3		Electron – negative		
		Neutrons – neutral		
		Proton – positive		(3)

5.4 When an atom has gained or lost an electron. ✓

(1)  
[12]**QUESTION 6**

- 6.1      6.1.1      C  
             6.1.2      D  
             6.1.3      A  
             6.1.4      E  
             6.1.5      B

(5 x 1)      (5)

6.2      6.2.1      Insulator – is a material that prevents the flow of electrical current.

6.2.2      Resistance – is a material that resists the flow of electrical current.

6.2.3      Potential difference – is the electrical pressure required to overcome the resistance in order for a current to flow.

6.2.4      Joule's Law – the quantity of heat generated by an electrical current is directly proportional to ????. Is something not missing here?

(4 x 1)      (4)

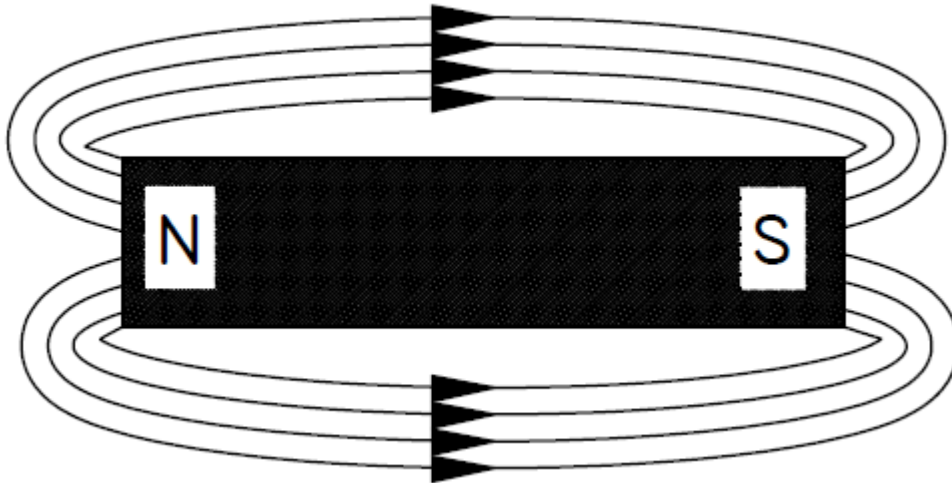
6.3      6.3.1       $\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2}$   
 $\frac{1}{R_t} = \frac{1}{125} + \frac{1}{230}$  ✓✓  
 $\underline{\underline{R_t = 80,986\Omega}}$

6.3.2       $I = \frac{V}{R}$   
 $I = \frac{24}{80,986}$  ✓✓  
 $I = 0,296A$   
 $\underline{\underline{I = 296mA}}$

6.3.3       $P = V \times I$        $P = I^2 R$        $P = \frac{V^2}{R}$   
 $P = 24 \times 0,296$  OR  $P = 0,296^2 \times 80,986$  OR  $P = \frac{24^2}{80,986}$  ✓✓  
 $\underline{\underline{P = 7,104W}}$        $\underline{\underline{P = 7,096W}}$        $\underline{\underline{P = 7,112W}}$

(3 x 2)      (6)

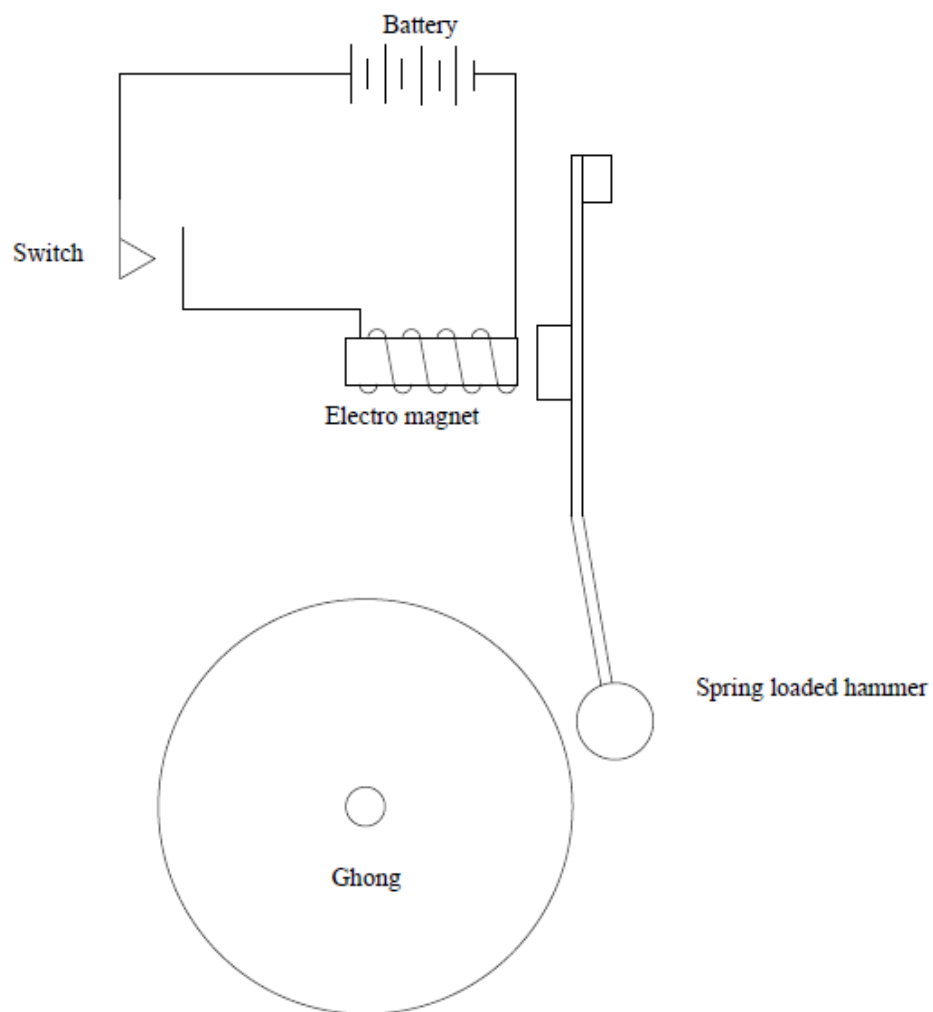
- 6.4      6.4.1      Resistivity – Different metals have different resistances.
- 6.4.2      Length – The longer the conductor, the higher the resistance. (2 x 1)      (2)
- 6.5      6.5.1      Alloys – no change in resistance.✓
- 6.5.2      Insulators – The resistance decreases with the rise in temperature.✓
- (2 x 1)      (2)
- 6.6



✓✓✓

(3)

6.7



✓✓✓✓

(4)  
[26]**TOTAL: 100**