higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

APRIL EXAMINATION

ENGINEERING SCIENCE N1

9 APRIL 2013

This marking guideline consists of 10 pages.

✔ **= 1 mark**
√ **= ½ mark**

QUESTION 1

1.1 A vector is a quantity that has **magnitude**√ and **direction**√. (1)

1.2 A scalar is a quantity that has only **magnitude**✓. (1)

1.3 1.3.1 5 N + 3 N = 8 N west ✓ (1)
1.3.2 6 N - 4 N = 2 N north ✓ (1)

1.4 1.4.1 $6 + 1{,}2 = 7{,}2\ km$ ✓✓ (2)

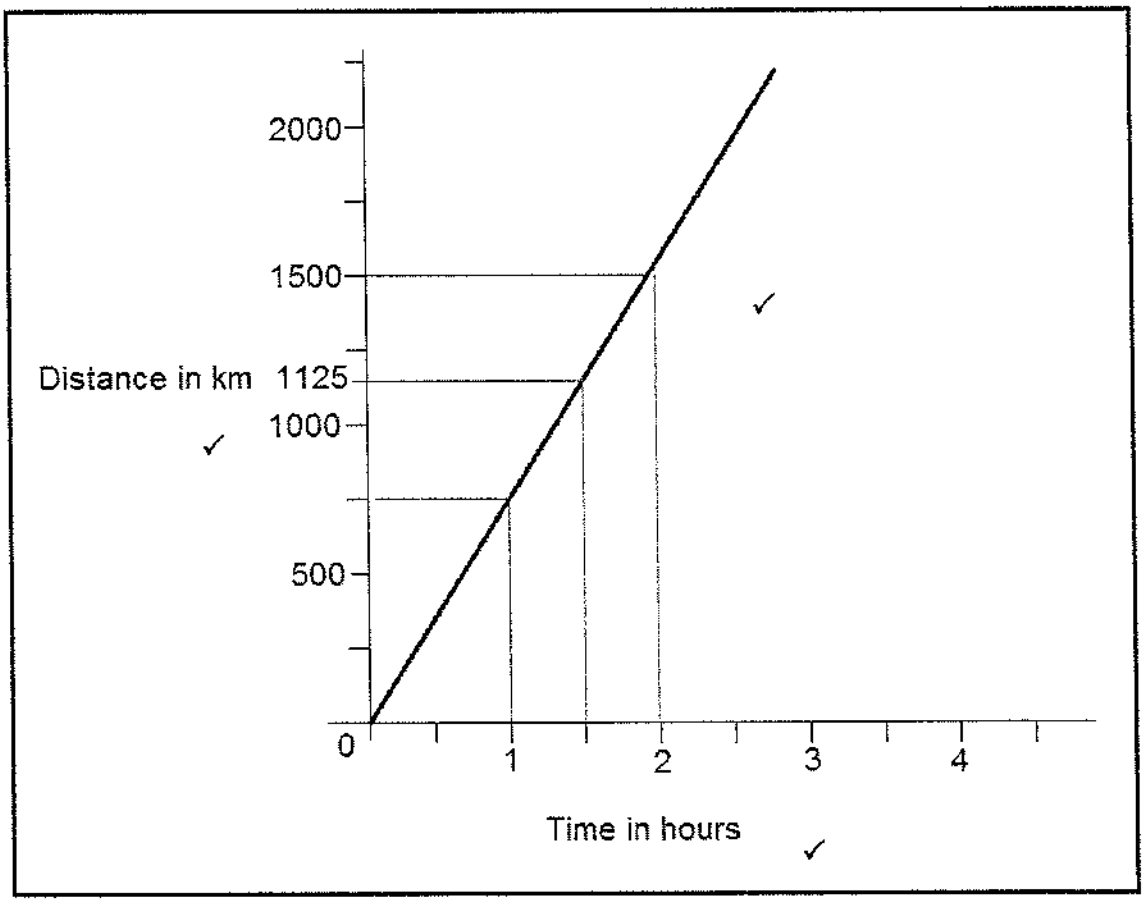
1.4.2

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

$6 + 1.2 = 7.2km$ $= \frac{7{,}2}{0{,}75}$ ✓

$= 9{,}6\ km/h$ ✓$v = \frac{7.2}{0.75}$ (2)

1.5



DISTANCE-TIME GRAPH (3)

1.5.1 2 hours ✓ (1)

1.5.2 1 125 km✓ (1)

1.6 $F = m \times g$

$F = 75 \times 1{,}8$ ✓

$\underline{F = 135\,\text{N}}$ ✓

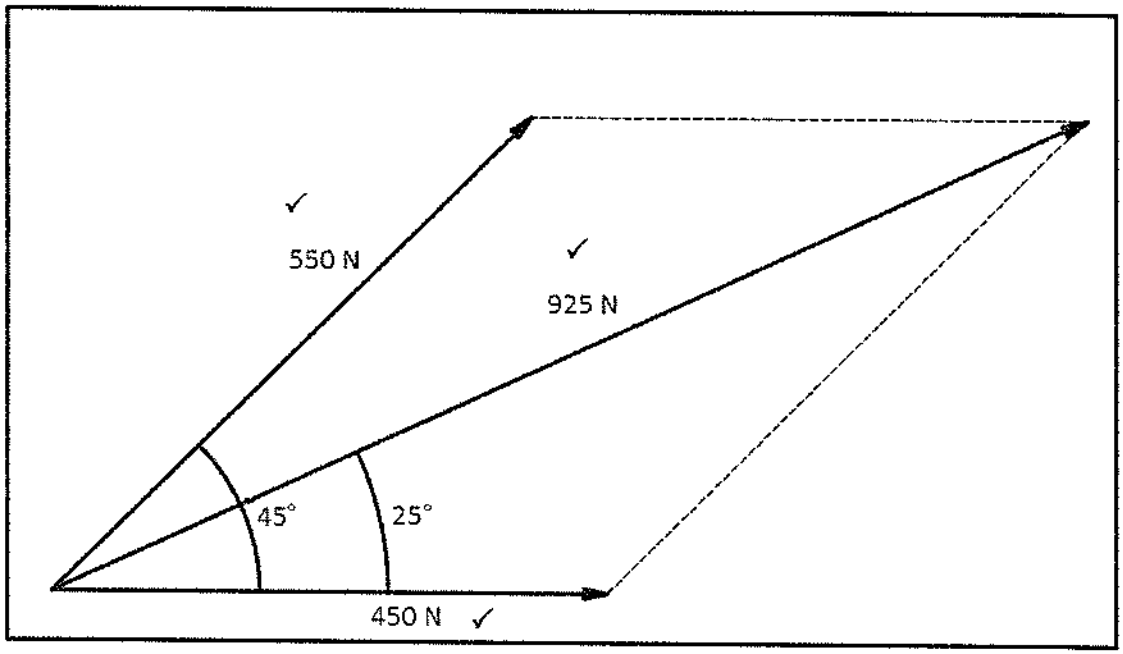
(2)
[15]

QUESTION 2

2.1
- Can move or tend to move a body ✓
- Can stop a moving body ✓
- Can change direction of a moving body
- Can change the shape of a body
- Can rotate a body

(Any 2 × 1) (2)

2.2 Because no direction is given, the student can draw it in any direction.



MAGNITUDE AND DIRECTION (3)

2.3 2.3.1

$$VR = \frac{D}{d}$$

$$VR = \frac{80}{16}$$ ✓

$\underline{VR = 5}$ ✓

(2)

2.3.2 $$MA = \frac{load}{effort}$$

$$MA = \frac{65 \times 9.8}{145} \quad \checkmark$$

$$\underline{MA = 4{,}393} \quad \checkmark$$

(2)

2.4 $$T = F \times r$$

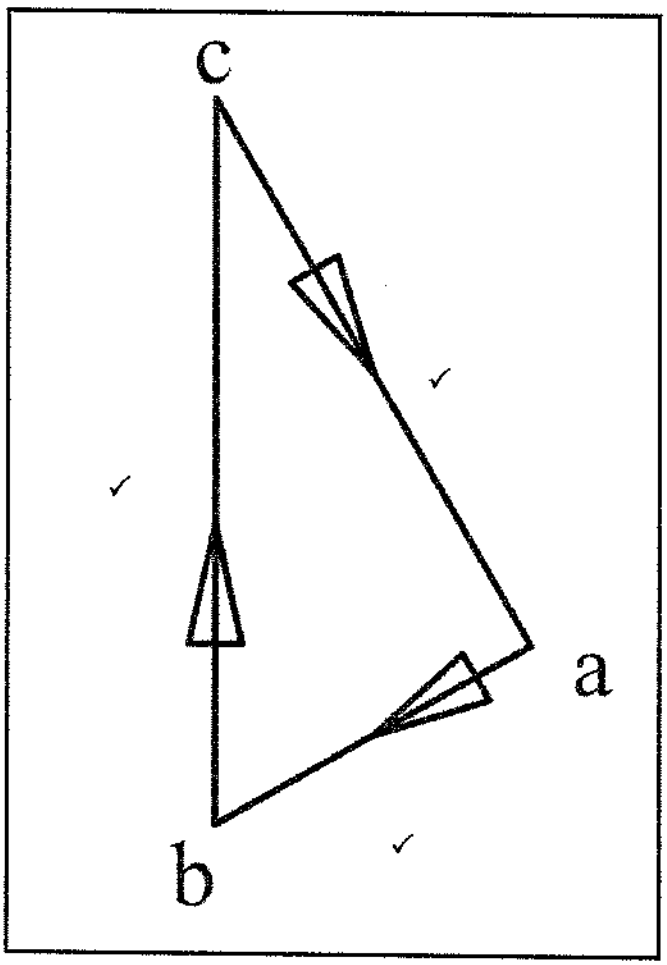
$$F = \frac{T}{r}$$

$$F = \frac{100}{0.4} \quad \checkmark$$

$$F = 250\ N \quad \checkmark$$

(2)

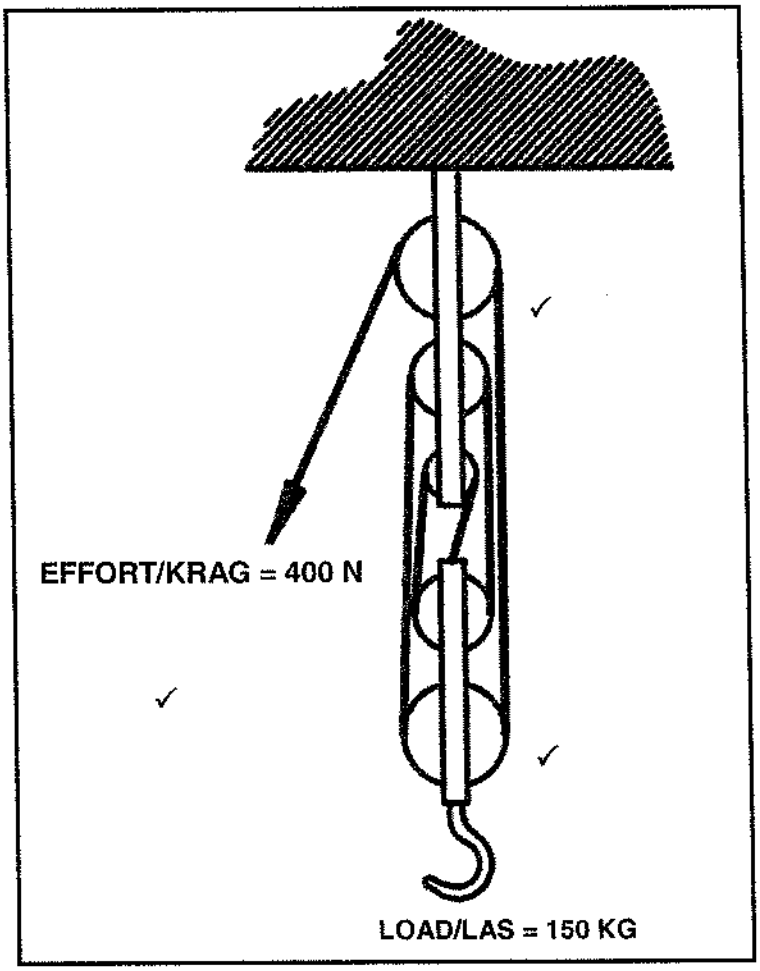
2.5



TRIANGLE OF FORCES

(3)

2.6 2.6.1



PULLEY SYSTEM (3)

2.6.2

$$MA = \frac{load}{effort}$$

$$MA = \frac{150 \times 9.8}{400} \quad \checkmark$$

$$MA = 3{,}675$$

(1)
[18]

QUESTION 3

3.1 A **force** ✓ must be applied over a **distance** ✓. (2)

3.2 3.2.1

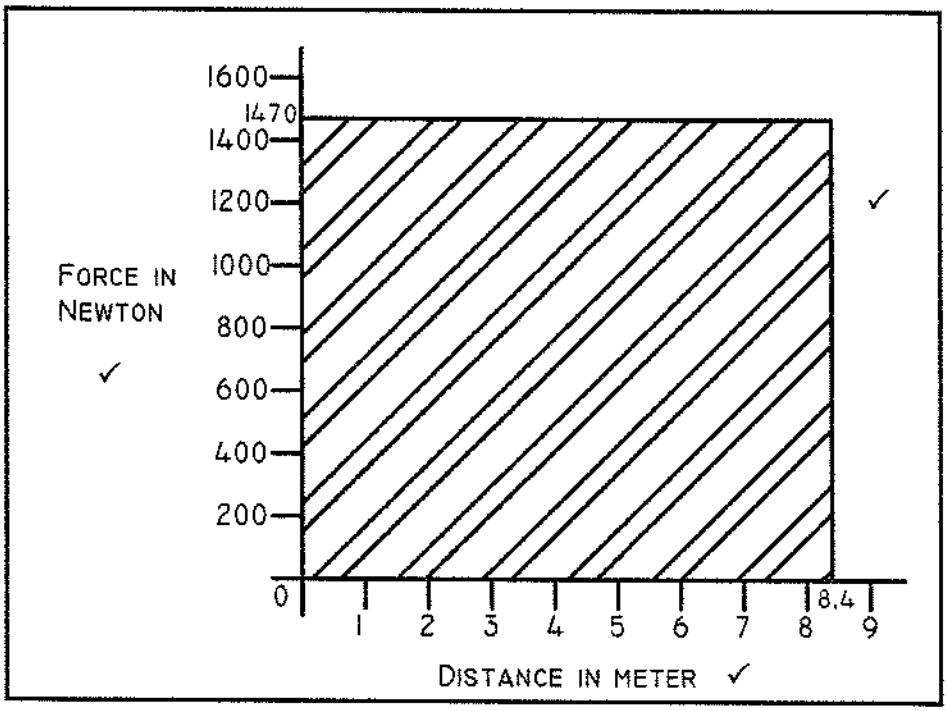
$$W = F \times s$$
$$W = (4\,000 \times 9{,}8) \times 200 \quad \checkmark$$
$$W = 784\,0000\ J$$
$$W = 7{,}84\ MJ \quad \checkmark$$

(2)

$$P = \frac{W}{t}$$
$$P = \frac{784\,000}{(5 \times 60)} \quad \checkmark$$
$$P = 26\,133\ W$$
$$P = 26{,}133\ kW \quad \checkmark$$

(2)

3.3 3.3.1



FORCE-DISTANCE GRAPH (3)

3.3.2

$$W = F \times s$$
$$W = 1\,470 \times 8.4 \quad \checkmark$$
$$W = 12\,348\ J$$
$$W = 12{,}348\ kJ \quad \checkmark$$

(2)

3.4 Power input ✓ (1)

[12]

QUESTION 4

4.1 Heat is a form of energy measured in Joule. ✓
Temperature is an indication of the degree of hotness or coldness of an object. ✓ (2)

4.2 $Q = m.c.\Delta t$

$$c = \frac{Q}{m.\Delta t}$$

$$c = \frac{2.25 \times 10^6}{15 \times 330}$$ ✓

$c = 454{,}545\ J/kg°C$ ✓ (2)

4.3 4.3.1 Conduction✓ (1)

4.3.2 When the water and the steel rod has the same temperature, transfer of heat is completed. ✓ (1)

4.4 4.4.1 $\Delta l = Lf - Lo$

$\Delta l = 50 - 49{,}875$

$\Delta l = 0{,}125\ mm$ ✓ (1)

4.4.2 $\Delta l = Tf - To$

$\Delta l = 48 - 20$

$\Delta l = 28\ °C$ ✓ (1)

4.5 4.5.1 pyrometer ✓

4.5.2 mercury thermometer ✓

4.5.3 thermo coupling ✓

4.5.4 alcohol thermometer ✓

(4 × 1) (4)

4.6 Bridges, railway lines, bi-metallic strip ✓ (Any applicable answer) (1)

4.7
- Temperature changes✓
- Colour changes✓
- Volume changes✓
- Change of phase✓
- Change in resistance

(Any 4 × 1) (4)
[17]

QUESTION 5

5.1 An atom ✓ (1)

5.2
- Proton – positive ✓
- Electron – negative ✓
- Neutron – neutral ✓ (3)

5.3 Solid – very slow movement. ✓
Liquid – fast movement. ✓
Gas – very fast movement. ✓ (3)

5.4 5.4.1 liquid ✓

5.4.2 melting ✓

5.4.3 condensation ✓ (3)

5.5 5.5.1 False, atoms. ✓ (1)

5.5.2 False, electron ✓ (1)
[12]

QUESTION 6:

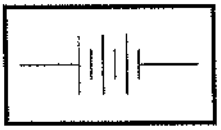
6.1 6.1.1 The difference in electrical pressure between two points in a circuit that causes electrical current to flow ✓ (1)

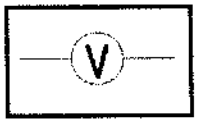
6.1.2 The opposition offered to the flow of electrical current ✓ (1)

6.2 An ammeter has a low resistance that will not influence the circuit. ✓
A voltmeter has a high resistance and will influence the circuit. ✓ (2)

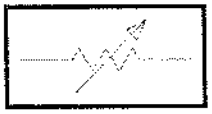
6.3 6.3.1
$$Rt = R_1 + R_2 + R_3$$
$$Rt = 14 + 29 + 35 \quad ✓$$
$$Rt = 78\,\Omega \quad ✓$$ (2)

6.3.2
$$\frac{1}{Rt} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$
$$\frac{1}{Rt} = \frac{1}{68} + \frac{1}{39} + \frac{1}{124} \quad ✓$$
$$Rt = 20{,}656\,\Omega \quad ✓$$ (2)

6.4 6.4.1  ✓ (1)

6.4.2 

✓ (1)

6.4.3  ✓ (1)

6.5 $I = \frac{V}{R}$

$I = \frac{12}{3}$

$I = 4\ A$ (2)

6.6 $P = .V \times I$

$P = 220 \times 12$

$P = 2\,640\ W$

$P = 2.64\ kW$ (2)

6.7
- Type of material ✓
- Length ✓
- Cross-sectional area
- Temperature

(Any 2 × 1) (2)

6.8
- Heater ✓
- Stove ✓
- Geyser
- Kettle

(Any 2 × 1) (2)

6.9 6.9.1 $P = V \times I$ (2)

6.9.2 $P = V \times I$

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

$I = \frac{60}{220}$ ✓

$I = 0{,}273\ A$ ✓

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

$R = \frac{220}{0{,}2727272}$

$R = 806{,}667\ \Omega$

OR

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

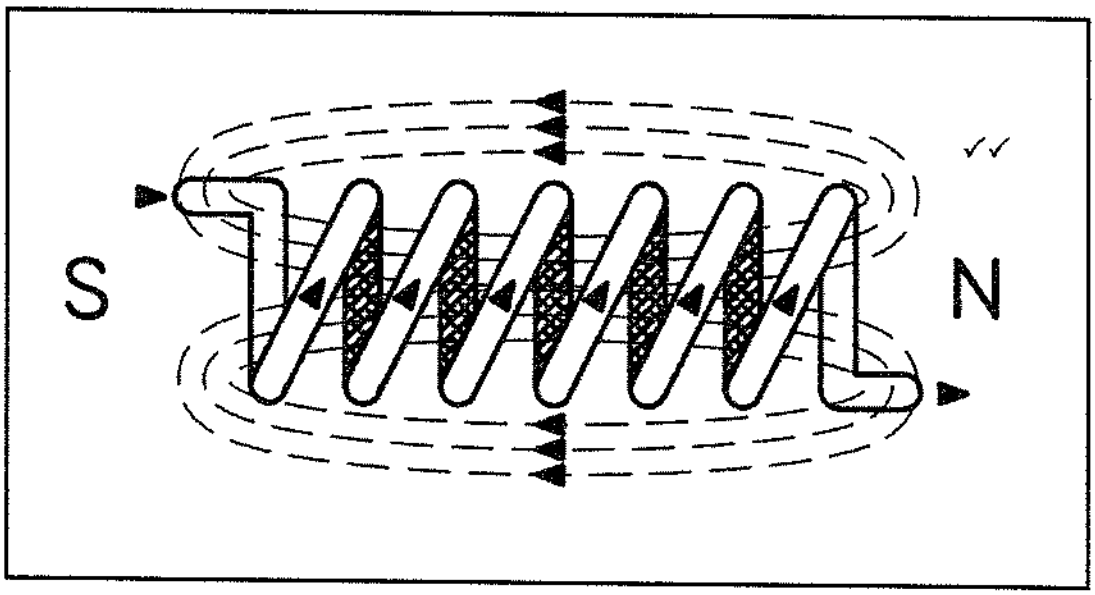
$R = \frac{V^2}{P}$

$R = \frac{220^2}{60}$ ✓

$R = 806.667\ \Omega$ ✓ (2)

6.10 The resistance will stay the same.✓ (1)

6.11



SOLENOID MAGNETIC FIELD (2)

[26]

TOTAL: 100