



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

ENGINEERING SCIENCE N1

11 August 2025

This marking guideline consists of 7 pages.

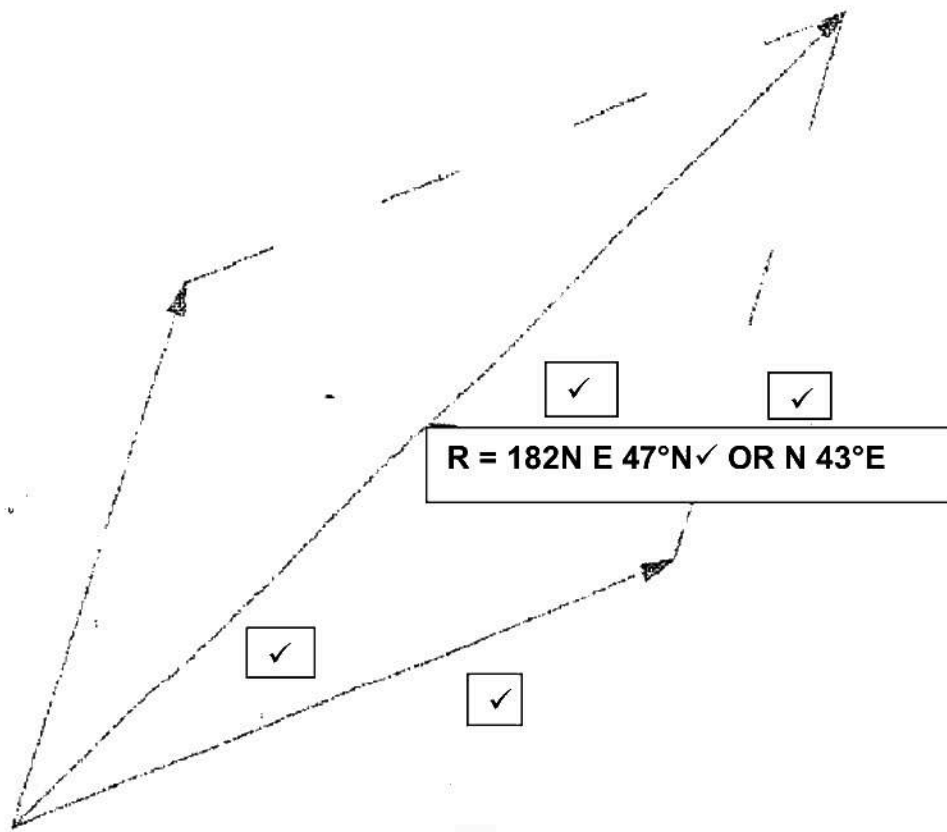
QUESTION 1: DYNAMICS

- 1.1 1.1.1 True✓✓
120 km/h / 3,6 = 33,333 m/s (2)
- 1.1.2 False✓✓
W = m.g
W = 2 × 1,6
W = 3,2 N (2)
- 1.1.3 True (1)
- 1.1.4 True (1)
- 1.1.5 True✓✓ (2)
- 1.2 1.2.1 Taken from the graph after 5 seconds, V = 49 m/s
Therefor V = 49 m/s × 3,6✓
V = 176,4 km/h✓
- 1.2.2 a = v / t
a = 49 / 5✓
a = 9,8 m/s² ✓
- 1.2.3 $\bar{V} = \frac{V_1 + V_2}{2}$
 $\bar{V} = \frac{0 + 49}{2}$ ✓
 $\bar{V} = 24,5$ m/s✓
- 1.2.4 $\bar{V} = s / t$
S = $\bar{v} \times t$
S = 24,5 × 5✓
S = 1225,5 m✓
- (4 × 2) (8)
[16]

QUESTION 2: STATICS

- 2.1
- An object in a state of rest begins to move.
 - A moving object comes to a standstill.
 - The direction of a moving object changes its direction.
 - The shape of an object changes.
- (4)
- 2.2 A force causes or tends to cause an object which is in rest✓ to move.✓
OR
A force also causes or tends to cause that an object which is in motion changes its velocity and/or direction and/or shape. (Any 1 × 2) ✓

2.3



Have a tolerance of +/- 3

(5)

2.4 If THREE forces acting in on a point are in equilibrium, ✓ then the three forces can be represented, in magnitude and direction, ✓ by the three sides of a triangle, taken in sequence. ✓

(1 × 3)

(3)

2.5 The law of moments state that a system of forces are in equilibrium, if the sum of the anti-clockwise moments about the same fulcrum ✓ is equal to the sum of the clockwise moments. ✓

(1 × 2)

(2)

2.6 Clockwise moment = anti-clockwise moment

$$F \times 5 = 300 \times 4$$

$$5F = 1200 \checkmark$$

$$5F / 5 = 1200 / 5 \checkmark$$

$$F = 240 \text{ N} \checkmark \checkmark$$

(4)

[20]

QUESTION 3: WORK, ENERGY AND POWER

- 3.1 Energy cannot be created nor destroyed,✓ but it can transform from one form of energy to another form of energy,✓ so that the sum total energy in the universe remains constant. (2)
- 3.2 3.2.1 $F = mg$
 $F = 1\,000 \times 9,8$
 $F = 9800\text{ N}$ ✓

 $W = F \times S$
 $W = 9800 \times (5 \times 1\,000)$ ✓
 $W = 49\text{ MJ}$ ✓ (3)
- 3.2.2 $P = W / t$
 $P = 49\,000\,000 / (2 \times 60)$ ✓
 $P = 408,333\text{ Kw}$ ✓ (2)
- 3.3
- A balance weight in a hydraulic accumulator
 - A jack hammer with the weight lifted
 - A heavy hammer that is lifted up
 - A river at the top end of a waterfall
 - A water tank on a high stand
 - A car at the top of a steep downhill
 - An aeroplane above the ground
- (Any other relevant answer) (Any 3 × 1) (3)
- 3.4 $W = F.s$
 $W = 2700 \times 60$ ✓
 $W = 162000\text{J}$ ✓

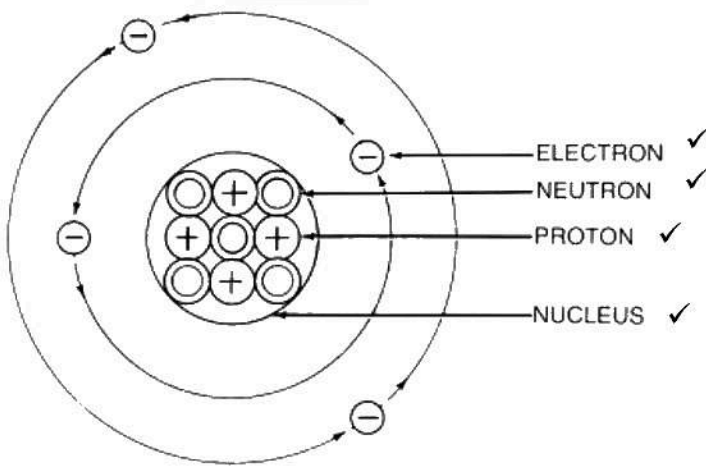
 $P = W / t$
 $P = 16200 \times (2 \times 60)$ ✓
 $P = 19440000\text{ W}$ ✓ OR 19440 kW OR 19,4 MW (4)
[14]

QUESTION 4: HEAT

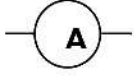
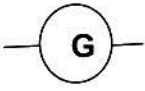
- 4.1
- Heat is a form of energy.
 - Temperature is the degree of heat that a body contains.
- (2 × 1) (2)
- 4.2
- Measuring temperatures in hard-to-reach places of machines
 - Used as hospital thermometers
 - In diagnostics testing of vehicle engines
 - In some gas appliances such as boilers, water heaters and on ovens they are use as a safety features
- (Any THREE correct answers) (Any 3 × 1)

- 4.3
- Change in temperature
 - Change in colour
 - Change of state
 - Change of composition
 - Change in resistance
- (Any THREE correct answers) (Any 3 × 1) (3)
- 4.4
- $Q = m.c. \Delta t$
 $Q = 5000 \times 1000 \times (50 - 20)✓$
 $Q = 150 \text{ MJ}✓$ (2)
- 4.5
- $8\,000 = 3 \times m \times (75^\circ - 35^\circ)$
 $8\,000 / 120 = 120 \text{ m} / 120✓$
 $m = 66,667 \text{ m}✓$ (2)
- 4.6
- 4.6.1
- $\Delta l = l_2 - l_1$
 $\Delta l = 500,895 - 500✓$
 $\Delta l = 895 \text{ mm}✓$ (2)
- 4.6.2
- $\Delta l = L_0 \alpha \Delta t$
 $\Delta t = 0,895 / (500 \times 11 \times 10^{-6})✓$
 $\Delta t = 162,727^\circ\text{C}✓$ (2)
- [16]

QUESTION 5: PARTICLE STRUCTURE OF MATTER

- 5.1
- Liquid
 - Solid
 - Gas
- (3)
- 5.2
- 
- The diagram shows a central nucleus composed of protons (marked with '+') and neutrons (marked with 'o'). Surrounding the nucleus are three concentric circles representing electron shells. Four electrons (marked with '-') are shown on these shells. Labels with arrows point to one electron, one neutron, one proton, and the nucleus. Each label has a checkmark next to it.
- (4)
- 5.3
- Matter is anything that occupies space and has mass. (1)
- 5.4
- 5.4.1 False
- 5.4.2 False
- (2 × 1) (2)

QUESTION 6: ELECTRICITY

- 6.1
- Conductor is the material that allows electrical current to flow through it.
 - Insulator is the material that does not allow electrical current to flow through it. (2 × 1) (2)
- 6.2
- 6.2.1  OR 
- 6.2.2 
- 6.2.3 
- 6.2.4 
- (4 × 1) (4)
- 6.3
- 6.3.1
$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_T} = (\frac{1}{5} + \frac{1}{11} + \frac{1}{23})\checkmark$$

$$\frac{1}{R_T} = \frac{423}{1265}$$

$$R_T = 2,991 \Omega\checkmark$$
- 6.3.2
$$I_T = V_T / R_T$$

$$I_T = 12 / 2,991\checkmark$$

$$I_T = 4,012 A\checkmark$$
- 6.3.3
$$P = VI$$
 OR
$$P = V^2/R$$
 OR
$$P = I^2R$$

$$P = 12 \times 4,012\checkmark$$

$$P = 12^2 / 2,991$$

$$P = 4,012^2 \times 2,991$$

$$P = 48,144 W\checkmark$$

$$P = 48,144 W$$

$$P = 48,144 W$$

(3 × 2) (6)
- 6.4
- The type of material used (resistivity)
 - Length of material
 - Cross-sectional area
 - Temperature (4)
- 6.5 Joule's law: The heat generated in a conductor is directly proportional to the square of the current,✓ the resistance of the conductor and the time that the current flows.✓ (1 × 2) (2)

6.6 6.6.1 $Q = I^2 R t$
 $Q = 20^2 \times 10 \times (15 \times 60) \checkmark$
 $Q = 360\,000 \text{ J} \checkmark$

6.6.2 $V_T = I \times R$
 $V_T = 20 \times 10 \checkmark$
 $V_T = 200 \text{ V} \checkmark$

(2 × 2) (4)

6.7



(2)
[24]

TOTAL: 100