higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

ELECTRICAL PRINCIPLES AND PRACTICE
NQF LEVEL 2

18 NOVEMBER 2019

This marking guideline consists of 8 pages.

QUESTION 1

1.1 $w = mg$

$= 100 \times 9{,}81$ ✓

$= 981\ N$ ✓ (2)

1.2 $60\ km/h = \frac{60 \times 1\ 000}{3\ 600}$ ✓ $= 16{,}667\ m/s$ ✓ (2)

1.3 $w = Fs$

$= 500 \times 20$ ✓

$= 10\ 000\ J\ OR\ 10\ kJ$ ✓ (2)

1.4 $3{,}409 \times 10^6 = 3\ 409\ 000$ (1)

1.5 1.5.1 J

1.5.2 Temperature

1.5.3 N

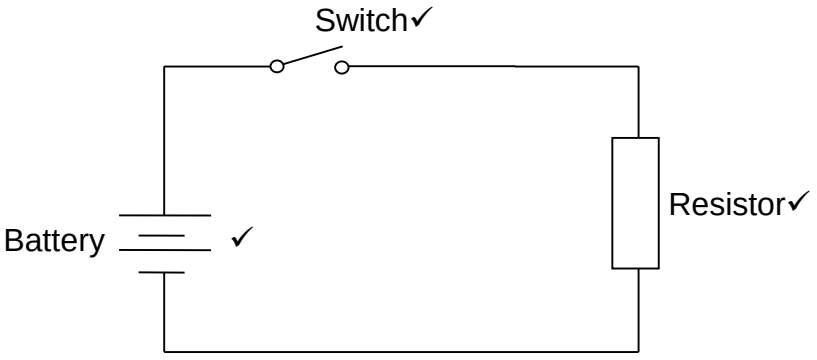
(3 × 1) (3)

[10]

QUESTION 2

2.1 An ionised atom is an atom that lost or gained one or more free electrons.✓✓ (2)

2.2



(3)

2.3 2.3.1 Joule's law states that the heat produced by the current flow through the conductor is directly proportional to the square of the current, the resistance and time.✓✓✓ (3)

2.3.2 $E = I^2Rt$ (1)

2.4 2.4.1 $P = VI$

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

$$= \frac{100}{220} \checkmark$$

$$= 0{,}455\ A \checkmark$$ (2)

2.4.2 $P = \frac{V^2}{R}$ OR $R = \frac{V}{I}$

$R = \frac{V^2}{P}$ $= \frac{220}{0{,}455}$

$= \frac{220^2}{100} \checkmark$ $= 483{,}5\ \Omega$

$= 484\ \Omega \checkmark$ (2)

2.5 Copper✓ and aluminium✓ (2)

2.6 2.6.1 The larger the cross-sectional area of a conductor, the lower the resistance; OR The smaller the cross-sectional area of a conductor, the higher the resistance.✓✓

2.6.2 The longer the conductor, the higher the resistance; OR The shorter the conductor, the lower the resistance.✓✓

(2 × 2) (4)

2.7 $R = \frac{\rho l}{A}$

$= \frac{1{,}2 \times 10^{-6} \times 0{,}716}{0{,}043 \times 10^{-6}}$ ✓✓

$= 19{,}981\ \Omega \checkmark$ (3)

2.8
- Battery
- Solar cell
- Thermocouple
- DC generator

(Any 3 × 1) (3)

[25]

QUESTION 3

3.1 3.1.1

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$= \frac{1}{2} + \frac{1}{4} + \frac{1}{6} \checkmark$$

$$= \frac{11}{12}$$

$$R_T = \frac{12}{11} \checkmark$$

$$R_T = 1{,}091\ \Omega \checkmark \quad (3)$$

3.1.2

$$I_1 = \frac{V_T}{R_1}$$

$$= \frac{12}{2}$$

$$= 6\ A \checkmark$$

$$I_2 = \frac{V_T}{R_2}$$

$$= \frac{12}{4}$$

$$= 3\ A \checkmark$$

$$I_3 = \frac{V_T}{R_3}$$

$$= \frac{12}{6}$$

$$= 2\ A \checkmark \quad (3)$$

3.1.3

$$I_T = I_1 + I_2 \qquad OR \qquad I_T = \frac{V_T}{R_T}$$

$$= 6 + 3 + 2 \checkmark \qquad = \frac{12}{1{,}091}$$

$$= 11\ A \checkmark \qquad = 11\ A \quad (2)$$

3.2 The current flowing through resistors R_2 and R_3 will be very high.✓✓ (2)

3.3 3.3.1 Electric cell is a device that converts chemical energy into electrical energy.✓✓

3.3.2 Internal resistance is the resistance of the cell or battery and is a result of the chemical activity inside the cell or battery.✓✓

(2 × 2) (4)

3.4 3.4.1 3 × flood lamps = 3 × 1 000 = 3 000 W✓
6 × motors = 6 × 2 000 = 12 000 W✓
9 × lamps = 9 × 500 = 4 500 W✓

Total load = 3 000 + 12 000 + 4 500 = 19 500 W or 19,5 kW✓ (4)

3.4.2 The possible load per phase = 19 500 / 3 = 6 500 W or 6,5 kW (1)

3.5 3.5.1 A turns-ratio of a transformer is the ratio of the number of turns on the primary to the number of turns on the secondary.

3.5.2
- Step-up transformer
- Step-down transformer

(2 × 2) (4)

3.6 $$voltage\ ratio = \frac{V_1}{V_2}$$

$$= \frac{240}{12}\ ✓$$

$$= 20:1\ ✓$$ (2)

[25]

QUESTION 4

4.1 4.1.1 Earthing refers to an electrical connection to the general mass of the earth. (1 × 2) (2)

4.1.2 To ensure correct operation at all times. (1)

4.2
- An analogue measuring instrument uses a pointer to indicate an electrical or physical quantity.
- A digital measuring instrument gives a numerical value of the measured quantity. (2 × 2) (4)

4.3
- There is no parallax error or estimation error.
- There are fewer range scales.
- It is faster and easier to take a digital reading.
- They are more accurate.
- They have a high input resistance. (Any 4 × 1) (4)

4.4 4.4.1 By connecting a resistor, usually of high value, in series with the voltmeter.

4.4.2 By connecting a suitable resistor in parallel with the ammeter.

(2 × 1) (2)

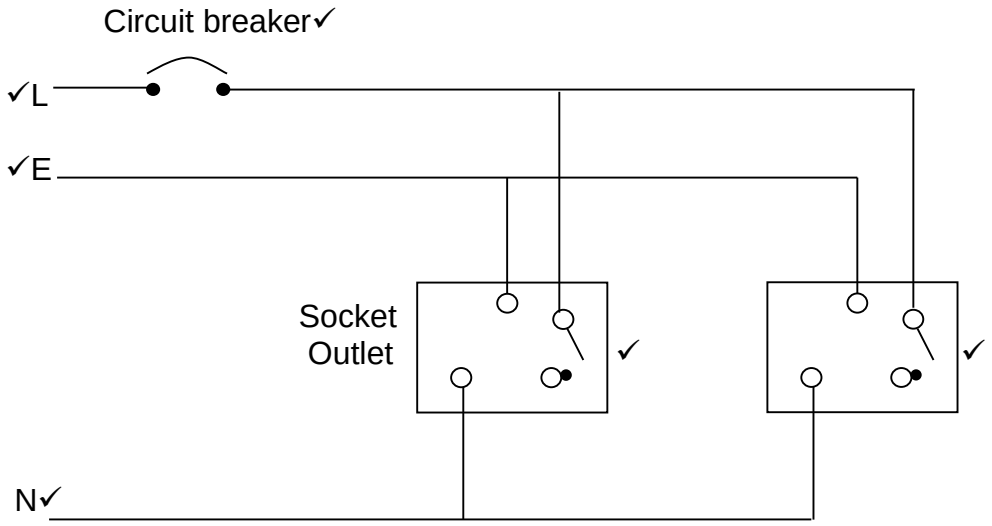
4.5
- Ohmmeter
- Bell tester
- Insulation resistance tester or Megger

(Any 2 × 1) (2)

[15]

QUESTION 5

5.1



(6)

5.2 5.2.1 1,5 mm^2

5.2.2 10 A

5.2.3 2,5 mm^2

5.2.4 20 A

5.2.5 Stove

(5 × 1) (5)

5.3 A = element
B = thermistor
C = double isolator
D = circuit breaker

(4 × 1) (4)

[15]

QUESTION 6

6.1 6.1.1 Fuse

6.1.2 Saddle

6.1.3 Compact fluorescent lamp

6.1.4 Incandescent lamp

(4 × 1) (4)

6.2
- The main circuit breaker or isolator
- A kilowatt-hour meter
- An earth connection (3)

6.3
- Calculators
- Watches
- Cameras
- Hearing aids
- Back-up power circuitry (Any THREE/Any other relevant answer) (3)

[10]

TOTAL: 100