higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

ELECTRICAL PRINCIPLES AND PRACTICE
NQF LEVEL 2

8 December 2020

This marking guideline consists of 7 pages.

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QUESTION 1

1.1 1.1.1 Measurement of dimension or distance

1.1.2 Flow of electric charge or rate of movement of charge passing through conductor

1.1.3 The degree of heat present in substance or object

1.1.4 Amount of object matter

(4 × 1) (4)

1.2
- Part of unit symbol
- Compound prefixes not allowed
- Symbols of prefixes larger than 10^3 (kilo) in uppercase. (Any 2 × 1) (2)

1.3 $speed = \frac{d}{t}$

$= \frac{20 \times 1000\ m✓}{1 \times 60 \times 60✓}$

$= 5{,}556✓ m/s✓$ (4)

[10]

QUESTION 2

2.1 2.1.1 Atom with a gain or surplus of electrons

2.1.2 Tiny particles from which elements are made

2.1.3 Electrons in an outer most shell of an atom that are ready to be shared with other atoms to form a chemical bond

(3 × 1) (3)

2.2 $A = \frac{\pi d^2}{4}$

$A = \frac{\pi(10\ x\ 10^{-3})^2}{4}$ ✓

A $= 78{,}54 \times 10^{-6}\ m^2$✓

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

$l = \frac{(78{,}54 \times 10^{-6})(1{,}75)}{0{,}026 \times 10^{-6}}$ ✓

$= 5,286\ km$✓

(4)

2.3 2.3.1 $P = V.I$

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

$= \frac{1000}{220}$ ✓

$= 4,545\ A$ ✓ (2)

2.3.2

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

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

$R = \frac{(220\ )^2}{1000}$ ✓

$= 48{,}4\ \Omega$ ✓

Alternative 1

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

$= \frac{220\ V}{4{,}545\ A}$

$= 48{,}4\ \Omega$

Alternative 2

$P = I^2R$

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

$= \frac{1000}{(4{,}545)^2}$

$= 48{,}4\ \Omega$ (2)

2.3.3 $E = P\ \times t$

$E = 1000\ \times (30\ \times 60)$ ✓✓

$= 1\ 800\ 000\ J$

$= 1,8\ M\ J$ ✓ (3)

2.4 Joule's law states that the heat produced by current flow through a conductor is directly proportional ✓to the square of the current, the resistance and time. ✓ (2)

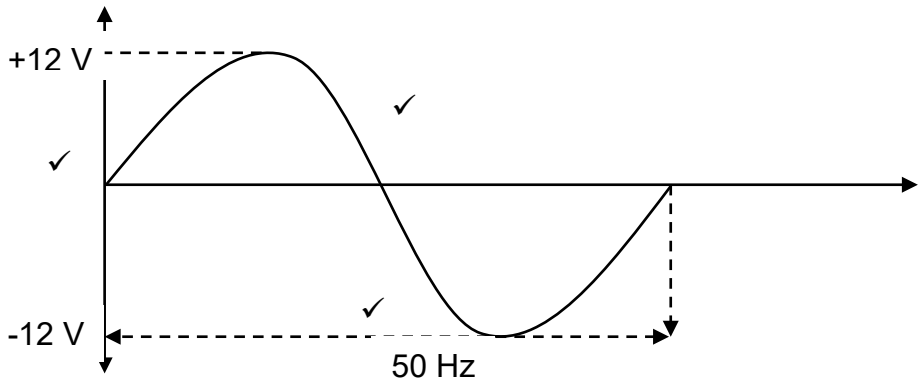
2.5 2.5.1 Electron flow is the current that flows✓ from negative terminal to a positive terminal of the supply. ✓ OR

Movement of electrons from negative terminal to the positive terminal of the supply.

2.5.2 Magnetic flux density is a measure of the strength✓ of a magnetic field at a particular point. ✓

(2 × 2) (4)

2.6



(3)

2.7
- Lines of force always travel from the north pole to the south pole outside the magnet, and from the south pole to the north pole inside the magnet.
- Each line of the magnetic flux forms a closed loop.
- Magnetic lines never intersect.
- Magnetic lines are like stretched elastic cords always trying to shorten themselves.
- Lines of magnetic flux are parallel and in the same direction. (Any 2 × 1) (2)

[25]

QUESTION 3

3.1 3.1.1 The potential difference will be the same as the voltage measured across the terminal of the battery. (2)

3.1.2 If bulb 1 is replaced with a working bulb the total current will increase since the two bulbs are connected in parallel (total resistance will be lower). (2)

3.2 3.2.1 $emf_T = 2{,}5\ V\ \times 3 = 7{,}5\ V$✓

$r_T = 0{,}3\ \Omega \times 3 = 0{,}9\ \Omega$✓

$I = \frac{emf_T}{R+r_T}$0

$= \frac{7{,}5\ V}{18\Omega + 0{,}9\Omega}$✓

$= 0,397\ A$ ✓ (4)

3.2.2 $Pd\ (V) = I \times R$

$= (0,397\ \times 18\ )$✓

$= 7,146\ V$✓ (2)

3.3 3.3.1

$$R_P = \frac{R_1 \times R_2}{R_1 + R_2}$$

$$= \frac{15 \times 22}{15 + 22} \checkmark$$

$$= 8,919\ \Omega \checkmark$$

Alternative:

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R_P} = \frac{1}{15} + \frac{1}{22}$$

$$\frac{1}{R_P} = \frac{22 + 15}{330}$$

$$\frac{1}{R_P} = \frac{37}{330}$$

$$\frac{R_P}{1} = \frac{330}{37}$$

$$= 8,919\ \Omega$$

$$R_T = R_P + R_3$$

$$= 8,919 + 33$$

$$= 41,919\ \Omega \checkmark$$

(3)

3.3.2

$$I_T = \frac{V_T}{R_T}$$

$$= \frac{12}{41,919} \checkmark$$

$$= 0,286\ A \checkmark$$

(2)

3.3.3

$$V_P = I_T \times R_P$$

$$= 0,289\ \times 8,919 \checkmark$$

$$= 2,578\ V \checkmark$$

(2)

3.4

3.4.1 True
3.4.2 False
3.4.3 False
3.4.4 True
3.4.5 True

(5 × 1) (5)

3.5

$$\frac{N_1}{N_2} = \frac{I_2}{I_1}$$

$$I_2 = \frac{N_1 \times I_1}{N_2} \checkmark$$

$$= \frac{(5\ \times\ 3)}{12} \checkmark$$

$$= 1,25\ A \checkmark$$

(3)

[25]

QUESTION 4

4.1 Process by which all electric circuits and metal parts in a building are linked to the ground (earth)✓ to prevent any metal part in the building from becoming live✓ as a result of an electrical fault✓ (3)

4.2
- Never use an insulation tester on a live circuit.
- Always rotate the cranking handle clockwise when using an analogue insulation tester.
- Do not touch the points of the insulation tester while performing the test.

(Any 2 × 1) (2)

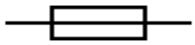
4.3 When the current flows in the solenoid✓ the soft iron bar is attracted towards the solenoid ✓and the movement results in a deflection of a pointer. ✓ (3)

4.4
- Set your multimeter's range selector to DC milliamp (range)
- Insert the red probe in to the Amps or mA connecting socket
- The black probe must be connected to the common connecting socket
- Remove the jumper(wire) from the one leg of the resistor (load) and place it out of the circuit.
- Insert one probe where you took out the jumper
- Insert another probe where the resistor leg is to complete the circuit
- Measure current and record the reading as displayed on the meter.

(7)
[15]

QUESTION 5

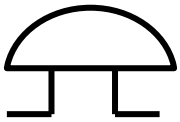
5.1 5.1.1



5.1.2

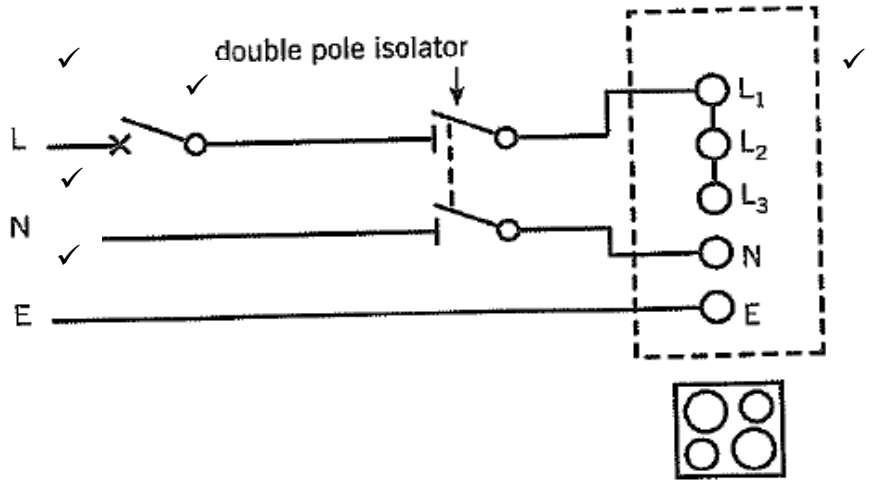


5.1.3



(3 x 1) (3)

5.2



(1 mark for isolator) (6)

5.3 5.3.1 4 mm^2
5.3.2 20 A
5.3.3 6 mm^2
5.3.4 35 A
5.3.5 2.5 mm^2
5.3.6 20 A

(6 × 1) (6)
[15]

QUESTION 6

6.1 Lightning arrestor consists of an assembly of small gaps and a non-linear resistor. ✓ It is contained in cylindrical porcelain enclosure. ✓ The non-linear resistance offers a low resistance to heavy surge currents, ✓therefore limiting the voltage across the resistor to low value. ✓ (4)

6.2 6.2.1 Earth leakage relay
6.2.2 Earth terminal bar
6.2.3 Circuit breaker

(3 × 1) (3)

6.3 During discharge the lead peroxide (positive plate) and the spongy lead (negative plate) are converted into lead sulphate.✓ The oxygen in the lead peroxide combines with hydrogen in the electrolyte to form water.✓ The electrolyte becomes weaker and its relative density decreases.✓ (3)
[10]

TOTAL 100

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