higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

ELECTRICAL PRINCIPLES AND PRACTICE
NQF LEVEL 2

21 November 2023

This marking guideline consists of 7 pages.

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QUESTION 1

1.1 1.1.1 mole
1.1.2 kelvin
1.1.3 metre
1.1.4 second
1.1.5 kilogram

(5 × 1) (5)

1.2 Steradian is the solid angle subtended at the centre of a sphere by an area of its surface✓ equal to the square of the radius of the sphere.✓ (2)

1.3 1.3.1 micro
1.3.2 nano
1.3.3 tera

(3 × 1) (3)
[10]

QUESTION 2

2.1 2.1.1 False
2.1.2 True
2.1.3 False
2.1.4 False
2.1.5 False

(5 × 1) (5)

2.2 $R_t = R_0(1 + \alpha T)$

$R_t = 15\ [1 + (0{,}0038)(50^0)]$✓

$R_t = 15\ [1{,}19]$✓

$R_t = 17{,}85\ \Omega$✓ (3)

2.3 The current flowing in a circuit is directly proportional to the applied voltage across the circuit✓ and inversely proportional to the resistance of the circuit,✓ provided that the temperature remains constant.✓ (3)

2.4 2.4.1 $P = VI$

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

$= \frac{3\ 000}{220}$✓

$= 13{,}66\ A$✓

2.4.2 $R = \frac{V}{I}$

$= \frac{220}{13{,}66}$ ✓

$= 16{,}11\ \Omega$ ✓

2.4.3 $E = Pt$

$= (3\ 000)(60 \times 60)$ ✓

$= 1\ 0800\ 000\ J \quad or\ 10{,}8\ kJ$ ✓

(3 × 2) (6)

2.5
- Solid conductors
- Stranded conductors (2)

2.6 Alternating current changes direction and amplitude at regular intervals.✓ Direct current flows in one direction in a circuit and does not change polarities.✓ (2)

2.7 Hold the first three fingers of your left hand at right angles to each other.✓ Point the index finger in the direction of the main magnetic flux✓ and the middle finger in the direction of the current.✓ Your thumb then points in the direction of the force exerted on the conductor.✓ (4)

[25]

QUESTION 3

3.1 3.1.1 $r_T = r_1 + r_2$

$= 1{,}2 + 1{,}2$

$= 2{,}4\ \Omega$ ✓ (1)

3.1.2 $R_T = R + r_T$

$= 15 + 2{,}4$

$= 17{,}4\ \Omega$ ✓ (1)

3.1.3 $E_T = e_1 + e_2$

$= 2{,}4 + 2{,}4$

$= 4{,}8\ \Omega$ ✓ (1)

3.1.4 $I_T = \frac{E_T}{R + r_T}$

$= \frac{4{,}8}{17{,}4}$ ✓✓

$= 0{,}28\ A$ ✓ (3)

3.1.5 $V = IR$

$= (0{,}28)(15)$✓

$= 4{,}2\ V$ ✓ (2)

3.2 Each phase conductor carries the same current value.
The neutral conductor carries a small current or, if possible, no current at all.
Smaller cables are required. (3)

3.3 3.3.1 $9\ heaters = 9 \times 1050\ W \quad = 9\ 450\ W$✓

$3\ floodlights = 3 \times 200\ W \quad = 600\ W$✓

$15\ light\ fittings = 15 \times 60\ W = 900\ W$✓

$Total = 10\ 950\ W$✓

$Possible\ load\ per\ phase\ = \frac{10\ 950}{3}$ ✓

$= 4\ 650\ W$✓ (6)

3.3.2

Red	**White**	**Blue**
3 × H 1 × FL ✓ 5 × LF	3 × H 1 × FL ✓ 5 × LF	3 × H 1 × FL ✓ 5 × LF
4 650 W	4 650 W	4 650 W

(3)

3.4 When an alternating voltage is applied to the primary winding while the secondary winding is open,✓ a small current will flow.✓ This current is called the magnetising current.✓ An alternating magnetic field is set up in the core, which is linked with the turns of the secondary winding.✓ This magnetic field induces an emf in the secondary winding.✓ (5)
[25]

QUESTION 4

4.1
4.1.1 F
4.1.2 E
4.1.3 A
4.1.4 B
4.1.5 D

(5 × 1) (5)

4.2
- All exposed conductive parts of the installation.
- All earthing cables, sheaths, armouring, wire ways, and catenary wires.
- The earthing terminal of a socket outlet.
- The secondary winding of a transformer if it is not a safety transformer.
- Earthing terminal of all permanently connected electrical equipment and appliances.
- Conductive parts of discharge luminaries and equipment that need special earthing arrangements.
- All Class-1 equipment. (Any 5 × 1) (5)

4.3
- Trench earth
- Earth rod
- Foundation earth (Any 2 × 1) (2)

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

[15]

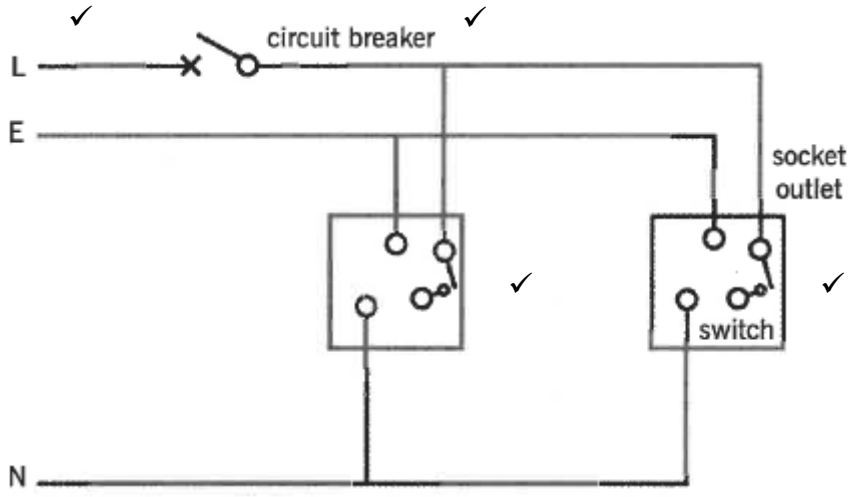
QUESTION 5

5.1
- Light bulb
- Lamp holder
- 1,5 mm^2 Red conductor
- 1,5 mm^2 Black conductor
- 1,5 mm^2 Green conductor
- 10-A circuit breaker
- Neutral bar
- 2 × two-way switches (Any 5 × 1) (5)

5.2
- In circuit diagrams✓ symbols represent circuit components and show how they are connected in a circuit.✓
- Wiring diagrams✓ show how components are wired and where connections must be made.✓
- In block diagrams✓ square or rectangular blocks represent plant or equipment.✓ (3 × 2) (6)

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5.3



(4)
[15]

QUESTION 6

6.1
- Metal
- Soft and flexible
- Ductile and malleable
- Weatherproof
- Can be soldered easily (Any 3 × 1) (3)

6.2
- Circuit breakers
- Isolators
- Surge protection devices
- Lightning arrestors
- Earth leakage relays (Any 4 × 1) (4)

6.3
- Do not discharge a battery beyond the minimum value.
- The level of the electrolyte should always be above the plates.
- Check and note the specific gravity of the electrolyte before and after charging.
- Always keep battery terminals clean.
- Always keep the charging room well ventilated.
- Spilling of electrolyte over a battery causes corrosion and should be cleaned with soda water.
- Keep the vent plugs open while a battery is charging.
- When a battery is charging, make sure that the positive terminal of the charger is connected to its positive side and the negative terminal of the charger to its negative side.
- High temperatures decrease the charging rate and shorten the life of a battery.
- Give a battery a periodic overcharge at half the normal rate to remove white sulphate.

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- If a battery's temperature exceeds 45 °C, the plates are damaged.
- Do not short a battery's terminals to check whether it is charged or not.
- Always keep the surface of a battery container dry. (Any 3 × 1) (3)

[10]

TOTAL: 100

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