higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

RENEWABLE ENERGY TECHNOLOGIES
NQF LEVEL 4

17 November 2022

This marking guideline consists of 5 pages.

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QUESTION 1

1.1.1
- Eastern Cape✓
- Western Cape✓
- KwaZulu Natal ✓
- Northern Cape✓ (4)

1.1.2 The red and orange colour on the map indicates the presence of high wind speeds. ✓ (1)

1.2 Turbine
Grid connection
Wind-turbine foundation
Land rent
Electrical installation (5 × 1) (5)

1.3 1.3.1 South Africa could participate in the fuel-cell industry as a major platinum-group metal (PGM) producer.✓ PGMs are the key catalytic materials used in most fuel cells, and with over 75% of the world's known PGM reserves found in South Africa,✓ the country could position itself as a fuel-cell deployment hub.✓ (3)

1.3.2
- Efficiency
- Reduced emissions
- Reliability
- Low maintenance
- Quietness
- Sustainability
- Compactness
- Modularity and flexibility (Any suitable 5 × 1) (5)

1.4
- Visual Impact
- Noise Impact
- Land Use
- Impacts on biodiversity
- Electromagnetic interference
- Air safety
- Impacts on cultural heritage
- Habitat fragmentation

(Any suitable 7 x 1) (7)
[25]

QUESTION 2

2.1 2.1.1 False
2.1.2 True
2.1.3 True
2.1.4 False
2.1.5 False
(5 × 1) (5)

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2.2 2.2.1 The energy conversion process, i.e., the kinetic energy✓ from the wind converted to mechanical and subsequently electrical energy,✓ can be described by three major conversion steps: aerodynamic, mechanical and electrical conversion.✓ (3)

2.2.2
- Lift
- Drag (2)

2.3
- FCEVs use an electric-only motor similar to a BEV.
- However, instead of recharging a battery via an outlet or a charging station, FCEVs store and use hydrogen gas as fuel.
- The fuel cell stacks in FCEVs provide electric power to the electric motor, which powers the vehicle just like a BEV. And like BEVs, there is no emission forming from FCEV tailpipes - the only by-product is water.
- Refilling with hydrogen can take as little as 5 minutes at a fi lling station.
- The FCEV is fuelled with hydrogen and obtains the electrical energy for the electric motor from a fuel cell module stack.
- There is no combustion engine.
- The high-voltage battery can also be charged externally via a special battery charger.

(ANY RELEVANT 7 X 1) (7)

2.4 2.4.1
- (+) terminal = anode
- (-) terminal = cathode (2)

2.4.2 When a power source (DC voltage) is applied, water molecules at the anode✓ are oxidised to oxygen.✓ At the cathode,✓ protons (H+ ions)✓ are reduced to hydrogen gas✓ by incorporating the electrons released from the oxygen at the anode.✓ (6)

[25]

QUESTION 3

3.1
3.1.1 F
3.1.2 A
3.1.3 D
3.1.4 E
3.1.5 C
3.1.6 B

(6 × 1) (6)

3.2
- Eliminating or reducing the necessity of working at heights.
- Use work equipment or other methods to prevent a fall from occurring.
- Ensure that all structures are designed and built to the appropriate standards.
- Wherever possible, suitable exclusion zones should be established and maintained underneath any activities that are carried out at heights to protect workers from falling objects.
- Ensure that all employees working at heights are trained and competent.
- When working at heights, all tools and equipment should be fitted with a lanyard where possible, and capture netting should be used if practicable.
- Avoid conducting tower/pole installation or maintenance work during poor weather conditions, especially if there is a risk of lightning strikes.
- An emergency rescue plan should be in place detailing the methods to be used to rescue workers. (Any 6 × 1) (6)

3.3
- Have discussions how to take reasonable care for the health and safety of themselves
- How to also not jeopardize the health and safety of other employees.
- Commit to wear Personal Protective Equipment and clothing provided at all times where necessary e.g. safety glasses, masks, gloves, hair nets, etc.

(Any RELEVANT 3 × 1) (3)
[15]

QUESTION 4

4.1 4.1.1 During charge, the lead sulphate of the positive plate✓ becomes lead dioxide.✓ As the battery reaches full charge, the positive plate begins generating dioxide causing a sudden rise in voltage✓ due to decreasing internal resistance.✓ (4)

4.1.2
- Battery boxes or containers are vented enclosures.
- They are made from aluminium, fiberglass, steel or other materials.
- These enclosures keep your batteries safe from theft.
- It protects unauthorised people against possible electrical or chemical hazards.
- Batteries in a battery bank should always be clean.
- Cable connections should be secure and tightened.
- Many battery problems are caused by dirty and loose connections.
- Serviceable lead-acid batteries need to have their fluid levels checked regularly and only at a full charge.
- Use only distilled water for refill as domestic water carries dissolved chemicals and minerals that are harmful to lead-acid batteries.
- To prevent corrosion of cables and connectors, use a small amount of high-temperature grease or petroleum jelly (Vaseline). (Any 7 × 1) (7)

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4.2 4.2.1 1.8 ✓V x 0.1 ✓A x 480 s = 86.4✓J (6)

4.2.2 (46.8✓/86.4✓) x 100 = 54.17✓%

4.3 4.3.1 (a) Lamp
(b) PV solar cells
(c) (voltmeters)
(d) Electrolysers

(4 × 1) (4)

4.3.2

Anode	$2\ H_2O \rightarrow 4\ H^+ + 4\ e^- + O_2$
Cathode	$4\ H^+ + 4\ e^- \rightarrow 2\ H_2$

[Source: RET Level 4 Textbook] (4)

4.4 4.4.1 A) Wind machine ✓
B) Wind turbine model ✓
C) Multimeter
D) Accumulator ✓ (4)

4.4.2 A typical multimeter can measure voltage✓, current✓, and resistance✓. (3)

4.4.3 A ✓ (1)

4.4.4
- Poor multimeter/load connections.✓
- Multimeter setting ✓
- Multimeter readings are sufficient but loads do not function.

(Any relevant x 3) (3)

[35]

TOTAL=100

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