higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

RENEWABLE ENERGY TECHNOLOGIES
NQF LEVEL 4

22 November 2024

This marking guideline consists of 7 pages.

Copyright reserved

QUESTION 1

1.1 1.1.1 The first windmills were developed to ease the tasks of grain grinding✓ and water pumping.✓ (2)

1.1.2 The earliest-known design of a windmill was developed in Persia and Afghanistan✓ around 500-900 A.D. ✓ (2)

1.2
- China ✓
- U.S. ✓
- Germany✓
- India✓
- Spain
- UK
- Canada, and
- France.

(Any 4 × 1) (4)

1.3
- Albeit wind is abundant and inexhaustible, wind power can have a drawback similar to photo-voltaic systems because wind is not always a constant energy source (wind is not always blowing). ✓
- The installation of large-scale wind turbines is considered expensive. ✓
- Wind turbines pose a threat to wildlife, primarily birds and bats, and are contributing to high mortality rates. ✓
- Noise pollution✓
- Visual pollution✓

(5)

1.4 The purpose of an environmental impact assessment is to ensure that the impacts of projects are identified✓ and assessed✓ before authorization is considered.✓ (3)

1.5 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, with opportunities for manufacturing, systems integration, and ancillary services. ✓ (2)

1.6
- Submarines✓
- Buses✓
- Space shuttles
- Delivery trucks
- Passenger cars

(Any 2 × 1) (2)

1.7
- Efficiency✓
- Reduced Emissions✓
- Reliability, Low Maintenance, and Quietness✓
- Sustainability✓
- Compactness✓
- Modularity and Flexibility✓

(Any 5 × 1) (5)
[25]

QUESTION 2

2.1
- Wind is caused by solar radiation that is absorbed differentially by the earth's surfaces✓
- and is converted through convective processes due to temperature✓
- and air pressure differences.✓ (3)

2.2
- Low-voltage systems✓ with nominal voltage <1 kV ✓
- Medium-voltage systems✓ with a nominal voltage above 1 kV up to 35 kV✓
- High-voltage systems✓ with a nominal voltage above 35 kV✓ (3 × 2) (6)

2.3 Proton Exchange Membrane Fuel Cell✓

It is a type of proton exchange fuel cells that take their name from the special polymer membrane used as the electrolyte✓ (2)

2.4

	Anode✓	Cathode✓
Half-reaction	$2H^+ + 2e$✓ $= H_{(g)}$✓	$O_2\,(g) + 4H^+ + 4e$✓ $= 2H_2O$✓

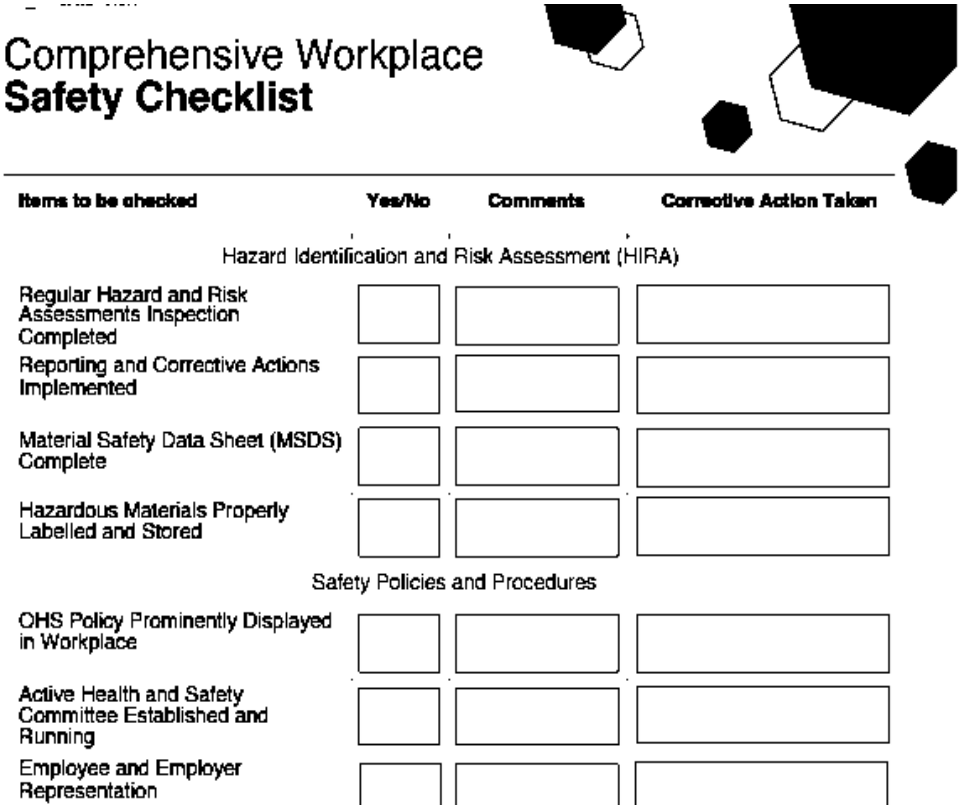
(6)

2.5
- Hybrid Electric Vehicle ✓ (HEV) ✓
- Plug-n Hybrid Electric Vehicle ✓ (PHEV) ✓
- Fuel Cell Electric Vehicle ✓ (FCEV) ✓
- Battery Electric Vehicle✓ (BEV) ✓ (8)

[25]

QUESTION 3

3.1 **NB: THIS IS AN EXAMPLE**



Comprehensive Workplace
Safety Checklist

Items to be checked	Yes/No	Comments	Corrective Action Taken
Hazard Identification and Risk Assessment (HIRA)			
Regular Hazard and Risk Assessments Inspection Completed			
Reporting and Corrective Actions Implemented			
Material Safety Data Sheet (MSDS) Complete			
Hazardous Materials Properly Labelled and Stored			
Safety Policies and Procedures			
OHS Policy Prominently Displayed in Workplace			
Active Health and Safety Committee Established and Running			
Employee and Employer Representation			

Except from Workplace-Safety-Checklist
PDF (absolutehealth.co.za)

Check at least FIVE criteria ✓✓✓✓✓

(5)

3.2
- Ensuring structures are designed and built to appropriate standards. ✓
- Establishing exclusion zones underneath activities carried out at height. ✓
- Training and ensuring competence of employees working at height. ✓
- Fitting tools and equipment with lanyards and using capture netting where practicable. ✓
- Avoiding work during poor weather conditions, especially with lightning risks.
- Having an emergency rescue plan in place

(Any 4 × 1) (4)

3.3
- Electrical hazards: ✓Workers in the wind power industry are exposed to a variety of potentially serious electrical hazards. These often include an electrical shock and severe burns from arc flashes.✓✓
- Falling hazard: ✓Workers who erect and maintain wind turbines, work at heights and are thus exposed to falls with potentially dangerous consequences (serious injuries or death). ✓✓ (2 × 3) (6)

[15]

QUESTION 4

4.1 4.1.1 Familiarize yourself with the training kit components✓ and consult the student manual for more information and descriptions of the components. ✓ (ANY RELAVANT ANSWER) (2)

4.1.2
A. Regulator✓
B. Electrolyser✓
C. Gas storage✓
D. Fuel cell✓
E. Load✓ (5)

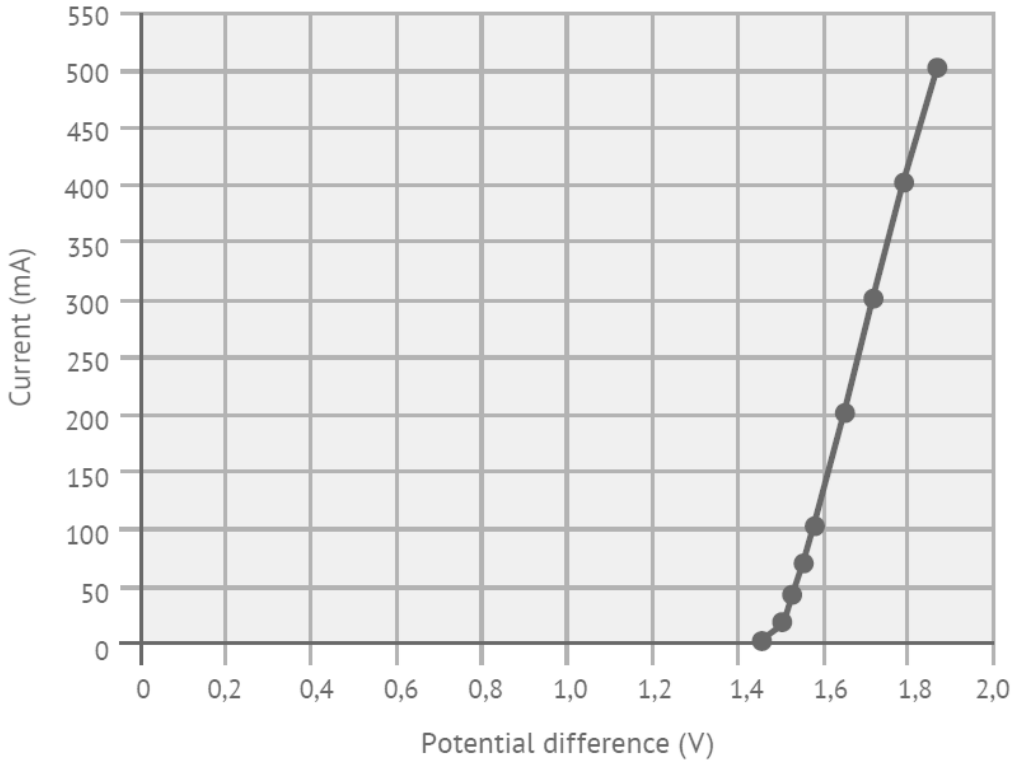
4.2
1. The current increased✓
2. The voltage increased✓
3. The power increased.✓ (3)

4.3 $\eta_E = \frac{E_{el}}{E_{ch}} \times 100$ ✓

$= \frac{36,6}{105,3} \times 100$ ✓✓

$= 34.8\ \%$ ✓ (4)

4.4



2 marks for axis✓✓

5 marks for graph✓✓✓✓✓ (7)

4.5

- Never work alone. Always have someone near you when working around batteries. ✓
- Wear appropriate PPE when working with batteries. ✓
- Use proper lifting techniques when working with batteries. ✓
- Never use old or untested batteries. Check each battery label for age, type and date to ensure all batteries are identical. ✓
- Batteries are sensitive to changes in temperature. Always install batteries in a stable environment. ✓
- Install batteries in a well-ventilated area. Batteries can produce explosive gases. For compartment or enclosure installations, always vent batteries to the outside. ✓
- Provide sufficient space between batteries in a battery bank to make provision for cooling.
- Use appropriate insulated tools at all times.
- Always verify proper polarity before connecting batteries. To reduce the chance of fire or explosion, do not short-circuit the batteries.
- In the event of accidental exposure to battery acid, wash thoroughly with water. In the event of exposure to the eyes, flood them for at least 15 minutes with running water and seek immediate medical attention.
- Last but not least, recycle old batteries.

(Any 6 × 1) (6)

4.6
- Two electrodes (negative anode✓and positive cathode✓)
- separated by an electrolyte,✓
- is the basic setup required for a battery to conduct an electrical current through a circuit ✓ (4)

4.7
- Loss of electrolyte due to heat or overcharging✓
- Lead sulfation✓
- Undercharging✓
- Age, i.e. positive plate shedding✓
- Freezing or high temperatures
- Use of domestic water, causing for example calcium sulfation
- Positive grid corrosion or growth due to high temperatures
- Fast recharging rates

(Any 4 × 1) (4)
[35]

TOTAL: 100

Copyright reserved