higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

RENEWABLE ENERGY TECHNOLOGIES
NQF LEVEL 4

(12041044)

22 November 2024 (X-paper)
09:00–12:00

This question paper consists of 5 pages.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
RENEWABLE ENERGY TECHNOLOGIES
NQF LEVEL 4
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Start each section on a new page.
5. Use only blue or black ink.
6. Write neatly and legibly.

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QUESTION 1

1.1 Since antiquity, man has used wind energy. It is thus not a new idea. For centuries, windmills and watermills were the only source of motive power for several mechanical applications, some of which are even still used today. Humans have used wind energy in their daily work for 4000 years.

1.1.1 Explain the purposes for developing the first windmills. (2)

1.1.2 Where and when was the earliest-known design of a windmill developed? (2)

1.2 List FOUR countries that had over 10 GW of installed wind power capacity by the end of 2015. (4)

1.3 List FIVE disadvantages of wind power systems. (5)

1.4 According to the National Environmental Management Act (NEMA, Act 107 of 1998), what is the purpose of an environmental impact assessment? (3)

1.5 Give a short description of South Africa's competitive advantage of fuel cell production. (2)

1.6 State TWO applications of fuel cell technologies. (2)

1.7 List FIVE advantages of hydrogen and fuel cell technology. (5)

[25]

QUESTION 2

2.1 What causes wind? (3)

2.2 List THREE categories of power supply systems based on nominal voltage. (3 × 2) (6)

2.3 What does the acronym PEMFC stand for? (2)

2.4 Tabulate the two electrochemical reactions occurring at the anode and cathode of a fuel cell. (6)

2.5 To reduce CO_2 emissions, the automotive industry has pursued alternative fuel options.

Name FOUR alternatives to the traditional internal combustion engine (ICE). Add their respective acronyms. (8)

[25]

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QUESTION 3

3.1 Design a health and safety checklist that can be used at your place of work. (5)

3.2 List FOUR specific methods to prevent incidents when working at height. (4)

3.3 When working on wind turbines there are various safety hazards that you could face.

List and explain TWO types of safety hazards. (2 × 3) (6)

[15]

QUESTION 4

4.1 Study FIGURE 1 below and answer the questions that follow.

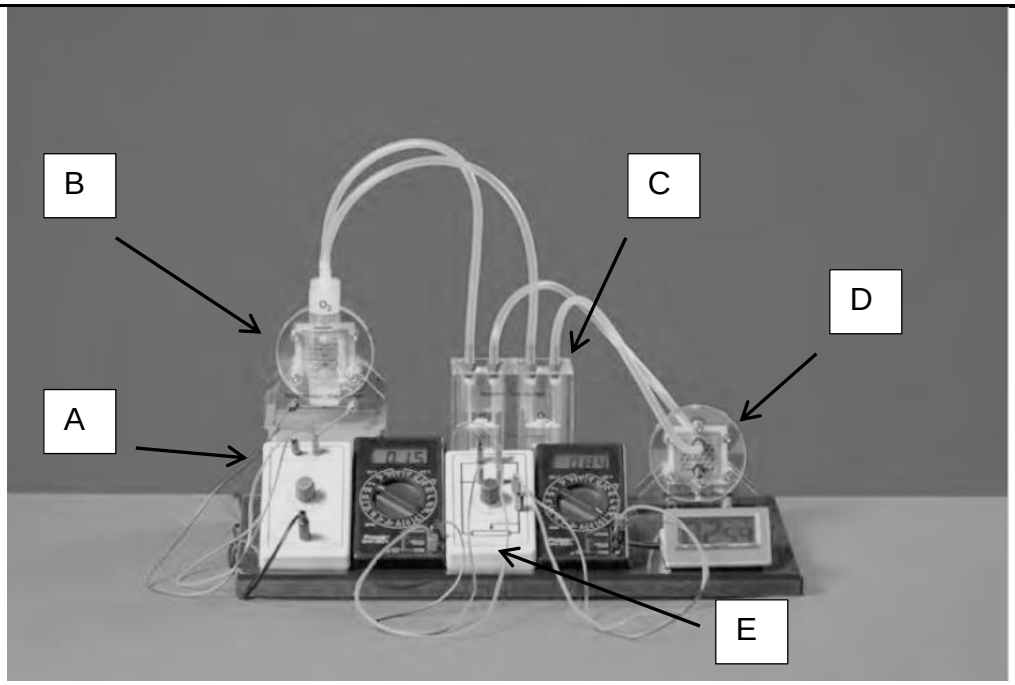

FIGURE 1

[Source: GIZ/S4GJ]

4.1.1 What should you do before starting the experiments with the training kit? (2)

4.1.2 List the components indicated in FIGURE 1 above write only the answer next to the letter (A - E) in the ANSWER BOOK. (5)

4.2 You have recorded the results from a wind power experiment you performed in your workshop. When the wind speed increased, what was the effect on the:

1. current
2. voltage
3. power (3)

4.3 Calculate the energy efficiency factor of an electrolyser if the chemical energy produced is 36,6 J and the electrical energy used is 105,3 J. (4)

4.4 You have performed an experiment to determine the electrical properties of an electrolyser.

Plot the I/V characteristics on a graph using the results in the table below:

I(mA)	V(V)
0	1.44
20	1.50
40	1.53
60	1.57
100	1.60
200	1.69
300	1.75
400	1.80
500	1.89

(7)

4.5 State SIX precautions to follow when handling and maintaining batteries. (6)

4.6 Describe the basic setup required for a battery to conduct an electrical current through a circuit and include reference to the charge. (4)

4.7 List FOUR common causes of battery failure. (4)

[35]

TOTAL: 100

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