higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

RENEWABLE ENERGY TECHNOLOGIES
NQF LEVEL 2

(12041042)

22 November 2019 (Y-Paper)
13:00–16:00

This question paper consists of 7 pages.

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TIME: 3 HOURS
MARKS: 150

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. Write neatly and legibly.

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QUESTION 1

1.1 Changes to the climate impact vulnerable groups and communities in South Africa. Although it is difficult to predict the exact impact of climate change, it is clear that the climate we are accustomed to is no longer a reliable guide for predicting climate in future.

With respect to the above paragraph, answer the following questions:

1.1.1 In your own words, clearly describe the difference between 'Climate' and 'Weather'. (3)

1.1.2 Give TWO examples of the climate in specific regions of South Africa. (4)

1.1.2 Name TWO causes of climate change. (2)

1.1.3 List FIVE results of climate change on the environment. (4)

1.2 Reliable energy supply is essential in all economies for lighting, heating, communication, industrial processes, transport, et cetera. Electrical energy is generated from a variety of energy resources. Some of these sources are non-renewable whilst others are renewable energy sources.

With respect to the above paragraph, answer the following questions:

1.2.1 Describe the terms 'renewable energy' and 'non-renewable energy'. (2)

1.2.2 Compare the differences between renewable energy and non-renewable energy. (6)

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1.3 A sun-path diagram, also known as a sun or solar chart, plots the position of the sun throughout the year.

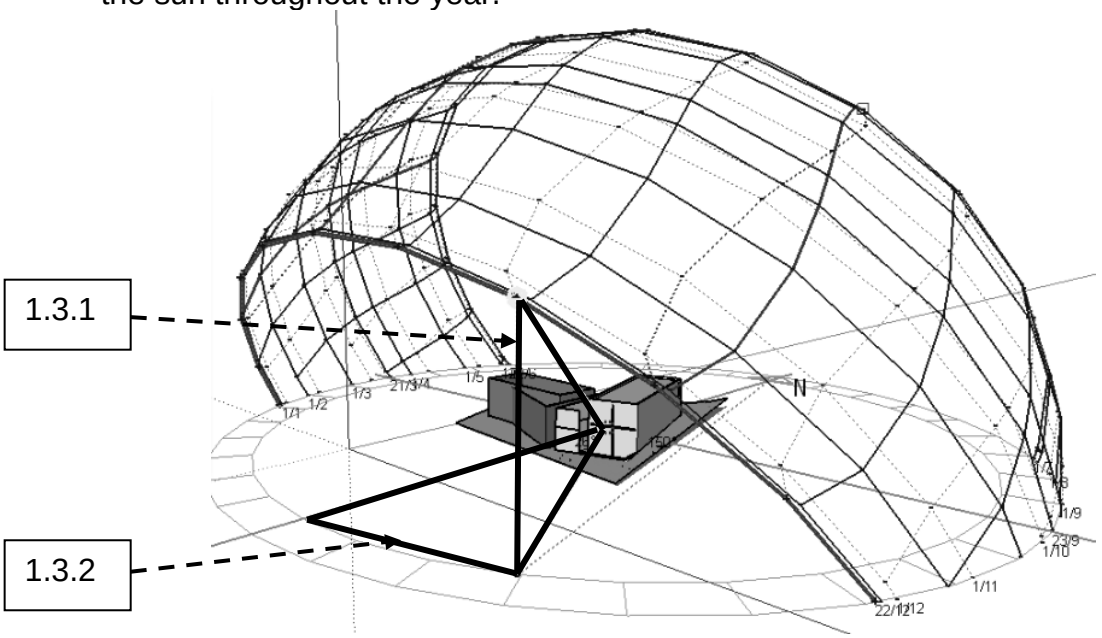

FIGURE 1 [*https://extensions.sketchup.com/pt-BR/content/curic-sun*]

Study the sun-path diagram in FIGURE 1 and identify the angles indicated as 1.3.1 and 1.3.2. Write down the answers in your answer book. (4)

[25]

QUESTION 2

2.1 An LED bulb has a power rating (P_{input}) of 8 watt. The bulb was activated for 300 seconds (t) and produced thermal energy (heat) with a value of 2000 joules (J) during this period.

Determine the power efficiency (η_p) of the bulb as a percentage (%). (8)

2.2 The concept of electric charge is the underlying principle used to explain all electric phenomena.

2.2.1 Describe the 'behaviour' of electric charges. (5)

2.2.2 Support your answer in 2.2.1 with a diagram(s) depicting the behaviour of electric charge. (4)

2.3 Draw a DC circuit that contains the following components: a battery (two 6 V cells), a single switch and two 3 W filament light bulbs connected in series. (5)

2.3.1 Determine the circuit current in ampere (A). (3)

[25]

QUESTION 3

3.1 Give ONE word or term for each of the following descriptions. Write only the word or term next to the question number (3.1.1–3.1.6) in the ANSWER BOOK.

3.1.1 Measures designed to eliminate or reduce hazards or hazardous exposures

3.1.2 Incidents where no injury or damage to property occurred, but could potentially have happened

3.1.3 Areas or locations where the probability of health risks or injuries is high

3.1.4 A technique used to identify, evaluate and control health and safety hazards linked to particular tasks

3.1.5 An unplanned and uncontrolled event caused by unsafe acts or unsafe conditions, resulting in physical harm to a person or damage to property

3.1.6 The occurrence of an undesirable event that causes or could cause injury, illness or disease to a person and/or damage to plant equipment, and as a consequence, interruption of business operations

(6 × 1) (6)

3.2 Explain the 'Prove-Test-Prove' method used in testing for isolation during the Lock-out/Tag-out. (6)

[12]

QUESTION 4

4.1 Refer to EXTRACT 1 (below) and answer the questions.

Feeding-in to the Municipal Grid

Many municipalities across the Western Cape already have the rules and tariffs in place for feeding into the grid when installing a PV system. The remaining municipalities across the province are being supported by the Western Cape Government and GreenCape to design and implement appropriate feed-in tariffs and approve the necessary regulations. The below table indicates the status of the municipalities which allow SSEG. Please note this is a live table and is constantly changing.

EXTRACT 1 [https://www.westerncape.gov.za/energy-security-game-changer/upgrade-grid-tied-solar-pv-system]

4.1.1 Create a simplified schematic labelled illustration representing the essential components of a grid-connected PV system. (6)

4.1.2 How do grid-connected PV systems operate? (4)

4.1.3 Certain municipalities encourage the use of SSEGs (small-scale embedded generators).

What are the benefits of these generators? (4)

4.2 A potential client wishes to install PV panels on his roof. However, you have identified a large tree house located directly in front of the north-facing roof. The client refuses to remove the tree house as he does not fully understand how the presence of the tree house could affect the way in which the PV panels function.

4.2.1 Explain to the potential client what effect the shading caused by the tree house will have on the PV system. (4)

4.2.2 Explain to the client how the shading could potentially result in fire. (7)

4.2.3 Many modern PV module manufacturers have integrated the use of an electrical component to avoid the effect of shading on the complete PV system. Identify this component and explain how it will help to avoid the effect of shading. (4)

4.3 Study the IKS Experiment kit in FIGURE 1 and answer the questions below:

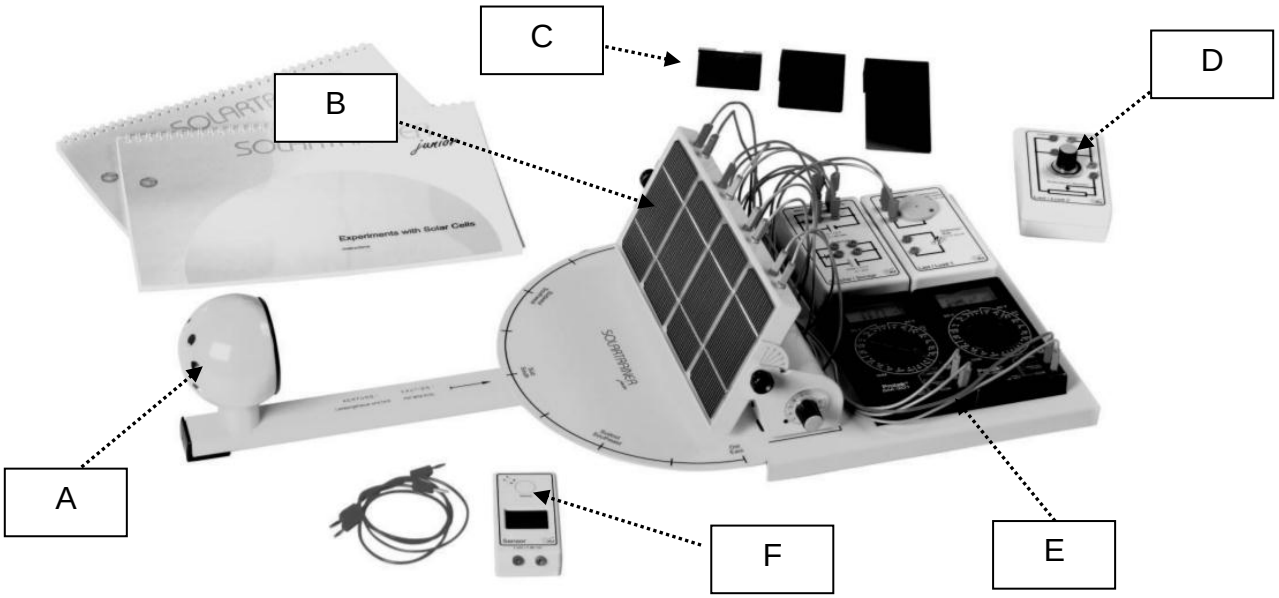

FIGURE 2 [http://www.iks-photovoltaik.de/fileadmin/iks/pdf/STJ_EN.pdf]

4.3.1 What instrument will be used to measure the amount of irradiance emitted by the halogen spotlight (sun simulator). Write only the letter of the device. (1)

4.3.2 The solar cells labelled as 'B' is rated 0,5 V and 2 mA.

Calculate:

(a) The voltage output if TWO solar cells are connected in parallel. (2)

(b) The current output if TWO solar cells are connected in parallel. (2)

4.3.3 The TWO solar-path angles mentioned in QUESTION 1.3 can be emulated using this experiment kit.

Explain how these angles can be emulated. (4)

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