higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

RENEWABLE ENERGY TECHNOLOGIES
NQF LEVEL 3

(12041043)

21 November 2019 (X-Paper)
09:00–12:00

This question paper consists of 7 pages.

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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. The following formula can be used:

   $\Delta = V \times C \times \Delta T$

   $Q = C \times m \times \Delta T$

5. Write neatly and legibly.

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QUESTION 1

1.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1.1–1.1.4) in the ANSWER BOOK.

1.1.1 Why is South Africa a contributor to greenhouse gas (GHG) emissions?

A South Africa is not a contributor to greenhouse gas emissions.
B South Africa has an energy-intensive economy.
C South Africa is overly reliant on coal to generate electrical energy.
D Both B and C are correct.

1.1.2 South Africa has committed itself to reduce greenhouse gas emissions. To achieve this, various national programmes are currently implemented. These programmes aim to:

A Lower the energy demands of buildings.
B Replace energy-inefficient traffic and street lights with energy-efficient ones.
C Support the installation of solar water heating systems.
D All of the above are correct.

1.1.3 Solar water heating systems can save households, companies and municipalities money for the following reason(s):

A SWH systems use non-electrical technology and have the ability to reduce the use of electrical energy to heat water.
B Solar energy is a renewable, free and abundant form of energy. It is considered to be the least expensive way of heating water for domestic use.
C Both A and B are correct
D None of the above are correct

1.1.4 The main targets of the National Solar Water Heating Programme (NSWHP 2015–2019) are the following:

A The installation of 1,75 million solar heating systems by 2019.
B A reduction in energy consumption by about 55 gigawatt hours (GWh) per month and a reduction in the use of diesel by 12% per month.
C None of the above are correct.
D Both A and B are correct.

(4 × 1) (4)

1.2 The NSWHP (2010–2014) had various shortcomings. As a result, less than 50% of the Department of Energy's target of one million solar water heating systems were installed.

State the main challenges of the NSWHP (2010–2014). (5)

1.3 Describe the following Acts:

1.3.1 Water Services Act

1.3.2 National Building Regulations and Building Standards Act

(2 × 2) (4)

1.4 Choose a/an item/word from COLUMN B that matches the SANS description in COLUMN A. Write only the letter (A–E) next to the question number (1.4.1–1.4.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.4.1	Sets the standard for energy usage in buildings	A	SANS 10400
1.4.2	When you cannot buy any product off the shelf. The materials used for SWH must comply with this standard	B	SANS 10252-2
1.4.3	SWH systems must be installed according to this standard	C	SANS 10400 XA
1.4.4	This standard focusses on the drainage system	D	SANS 10106
1.4.5	Detailed rules stipulated in the NBR and Building standards Act forms part of this standard	E	SANS 10252-1

(5 × 1) (5)

1.5 From a municipal perspective, state the benefits of Solar Water Heaters in residential areas and townships. (2)

[20]

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QUESTION 2

2.1 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (2.1.1–2.1.10) in the ANSWER BOOK.

2.1.1 Conduction occurs when two substances with different temperatures are in direct contact with each other.

2.1.2 The situation when an object emits heat energy by releasing it into its surrounding medium is called emittance.

2.1.3 When radiation is received on a surface of an object and passes through the material. This situation is called reflectance.

2.1.4 Convection is when energy is emitted in the form of light.

2.1.5 Water quality affects the efficiency of a solar water heating system.

2.1.6 One of the steps in the scientific method of experiment design is to analyse data and draw a conclusion.

2.1.7 Shading decreases a collector's efficiency and should be avoided.

2.1.8 A collector must always face south in the southern hemisphere.

2.1.9 Absorptance is when radiation is converted into sensible heat in the material.

2.1.10 Frost does not affect the efficiency of a solar water heating system.

(10 × 1) (10)

2.2 Rafters should be able to support a solar water heating system and must therefore be strengthened.

List TWO ways of strengthening rafters. (2)

2.3 Define the function of the two parts of a flat plate collector listed below.

2.3.1 Absorber plate

2.3.2 Glazing

(2 × 2) (4)

2.4 Name any FIVE factors that have be considered before installing a solar water heating system. (5)

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2.5 Define the following principles of energy conversion:

2.5.1 Transmittance

2.5.2 Emittance

2.5.3 Reflectance

(6)

2.6 Name THREE ways to deal effectively with the effects of shading. (3)

[30]

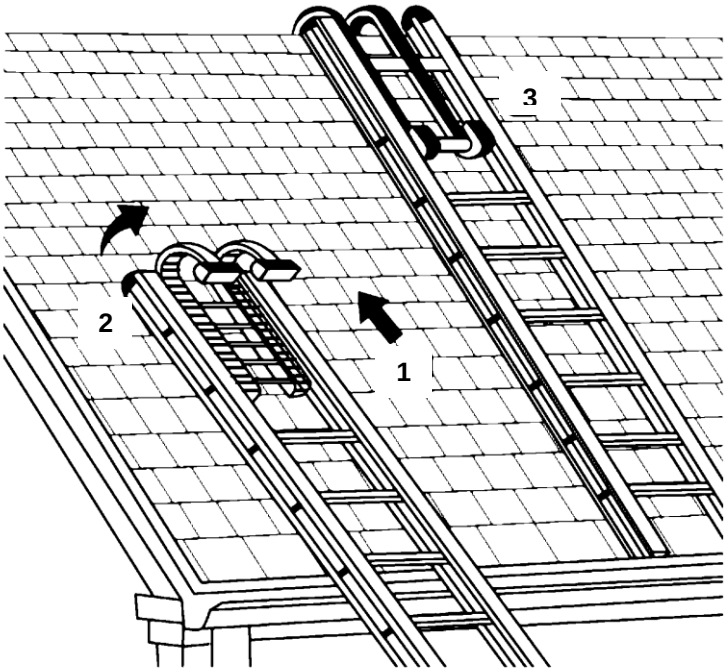
QUESTION 3

3.1 Name any TWO types of potential risks associated with working with SWH systems. (4)

3.2 When working on a SWH system, there are a few ways to protect workers from falling from a height.

List THREE factors that might cause a worker to fall and then specify THREE ways to prevent it from happening. (3 × 2) (6)

3.3 Below a numbered illustration shows how to set up a roof ladder. Explain the steps (1–3) in the ANSWER BOOK.



(3)

3.4 Explain in your own words what a work positioning system is. (2)

[15]

QUESTION 4

4.1	List THREE plumbing tools commonly used when working on a SWH system.	(3)
4.2	Which THREE classes of copper tube are generally used for the installation of SWH systems? 	(3)
4.3	In your own words, define the working principle and basic construction of a flat plate collector.	(4)
4.4	Explain the recommended installation of a TP relief valve.	(4)
4.5	With a diagram, illustrate how a SWH system is split in TWO: an active (forced) and a passive (thermosiphon) system.	(4)
4.6	Draw a neat, detailed freehand front view of a low-pressure close-coupled thermo-siphon system.	(6)
4.7	What will happen if there is a scale build-up inside a pipe? 	(1)
4.8	Explain step-by-step how you will attach a collector to a tile roof.	(10)
		[35]

TOTAL: 100

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