



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

**RENEWABLE ENERGY TECHNOLOGIES
NQF LEVEL 3**

(12041043)

**7 December 2020 (X-paper)
09:00–12:00**

This question paper consists of 6 pages.

381Q1N2007

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. Formulae available on page 6.
 5. Write neatly and legibly.
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QUESTION 1

- 1.1 State THREE ways in which CO₂ emissions should be handled by energy efficient and energy demand management national programmes in South Africa. ॐ (3)
- 1.2 State FOUR challenges of the NSWHP programme (2010–2014) which led to the agreement between the Department of Energy (DoE) and Eskom being terminated. (4)
- 1.3 Compare solar water heating technologies to the use of electric geysers in potentially reducing greenhouse gas emissions. (2)
- 1.4 State FIVE benefits of solar water heating systems to households and municipalities. (5)
- 1.5 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.5.1–1.5.6) in the ANSWER BOOK. ॐ
- 1.5.1 Globally, South Africa is not a major contributor to greenhouse gas (GHG) emissions.
- 1.5.2 The NSWHP (2010-2014) intended to introduce solar water heating technologies as a clean and renewable alternative for domestic hot-water generation.
- 1.5.3 One of the objectives of the NSWHP (2015 – 2019) is job creation.
- 1.5.4 Various stakeholders like TVET colleges introduced training interventions because solar water heating installations under the NSWHP (2010 – 2014) were of poor quality.
- 1.5.5 Standards are measurable criteria supporting the implementation of regulations. ॐ
- 1.5.6 The Occupational Health and Safety Act recognises that water is a natural resource belonging to all people.
- (6 × 1) (6)
[20]

QUESTION 2

2.1 Define each of the following principles of energy conversion:

2.1.1 Transmittance

2.1.2 Emittance



2.1.3 Reflectance

(3 × 2) (6)

2.2 Answer the questions below regarding the installation of a solar water heating system on a roof.

Information

- Pitched roof with a low roof slope
- 300 ℓ solar water heating system requiring two collectors
- Significant weight on roof area often more than 400 kg
- Tiled roof
- House surrounded by large trees



2.2.1 What general instructions regarding roof work must be followed before commencing with the installation?

(5)

2.2.2 An inspection of the roof envelope shows that some of the critical components such as tiles are damaged.

What would you recommend?

(2)

2.2.3 Adequate roof strengthening is required before installation.

Explain how this will be done.



(5)

2.2.4 How many hanger brackets does the system require?

(1)

2.2.5 Identify the type of assembly the roof requires.

(1)

2.2.6 State THREE ways to deal with shade caused by large trees surrounding the house.

(3)

2.2.7 Describe the mounting process of the solar water heating system on this type of roof structure.



(7)
[30]

QUESTION 3

- 3.1 Give TWO examples for each of the following when working with a solar water heating system:
- 3.1.1 Safety hazards ॐ
- 3.1.2 Ergonomic hazards (2 × 2) (4)
- 3.2 Name TWO systems which could be used to prevent workers falling down heights. (2)
- 3.3 Describe the setup of a straight ladder. (3)
- 3.4 Name FOUR hazards commonly associated with working at heights. ॐ (4)
- 3.5 Name TWO roof types relative to working on solar water heating systems. (2)
- [15]**

QUESTION 4

Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–F) next to the question number (4.1.1–4.1.4) in the ANSWER BOOK.

4.1	COLUMN A	COLUMN B
4.1.1	Valve using spherical closure element to open or shut off fluid, thus isolating system for maintenance	A drain cock
4.1.2	Located at lowest point of system with ribbed outlet enabling good grip for hosepipe connection	B pressure control valve ॐ
4.1.3	Maintains and regulates incoming water pressure supplied by the municipality (mains water) at pre-set limit of specific valve ॐ	C temperature and pressure relief valve
4.1.4	Combined control valve crucial for any hot-water system because every storage or heater tank is a potential pressurised tank	D stop cock/ball valve
		E reduced pressure-zone valve
		F vacuum breaker

(4 × 1) (4)

- | | | |
|---------------|---|---------------------|
| 4.2 | State THREE functional features to consider when purchasing an SWH storage tank.  | (3) |
| 4.3 | Describe the working of an indirect (closed-loop) thermosiphon. | (3) |
| 4.4 | Make a neat line drawing of a typical direct forced-circulation system and label any FIVE components. | (10) |
| 4.5 | What material is used to fabricate evacuated tubes for SWH systems?  | (2) |
| 4.6 | What happens in the event of excessive scale build-up in hot-water supply pipes? | (2) |
| 4.7 | Name THREE alternative types of assessment that should be done when planning work on an SWH system. | (3) |
| 4.8 | Give THREE minimum installation standards for an SWH system. | (3) |
| 4.9 | Make a neat drawing of a collector bracket mounted onto a rafter on a tiled roof.  | (5) |
| TOTAL: | | [35]
100 |

RENEWABLE ENERGY TECHNOLOGIES L3

FORMULAS

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

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