higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

# NATIONAL CERTIFICATE (VOCATIONAL)

## REFRIGERATION PRINCIPLES
## NQF LEVEL 2

(6030055)

**17 November 2022 (Y-paper)**
**13:00–16:00**

**This question paper consists of 7 pages.**

509Q1N2217

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**TIME: 3 HOURS**
**MARKS: 100**

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**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 a blue or black pen.
6. Write neatly and legibly.

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## QUESTION 1

1.1 Explain the operation of the following in a refrigeration system:

1.1.1 Compressor (2)

1.1.2 Condenser (1)

1.1.3 Thermostatic expansion valve (1)

1.1.4 Evaporator (2)

1.2 Indicate the correct directions of flow of the refrigerant below:

A Evaporator to thermostatic expansion valve.
B Compressor to condenser.
C Thermostatic expansion valve to condenser.
D Evaporator to compressor. (2)

1.3 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.3.1–1.3.10) in the ANSWER BOOK.

1.3.1 The purpose of a vibration eliminator is to reduce the vibrations of the pipes, thereby reducing the risk of broken pipes.

1.3.2 A crankcase heater prevents the off-cycle migration of refrigerant back to the compressor.

1.3.3 It is called a sight glass because it indicates the liquid level of a receiver.

1.3.4 Vapour bubbles in a sight glass is an indication of good sub-cooling or a good refrigerant charge in the system.

1.3.5 A suction line heat exchanger decreases the refrigeration capacity of an evaporator.

1.3.6 The only purpose of an oil separator is to separate the oil in the discharge gas.

1.3.7 Safety valves are mounted to also protect a compressor.

1.3.8 The condensate pipe and the suction pipe are two different pipes used for the interconnection.

1.3.9 Charging a refrigerant can also be done through the Schrader valves.

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1.3.10 A suction accumulator offers considerable protection against refrigerant flood-back, both at start-up and during operation or after a defrost cycle.

(10 × 1) (10)
**[18]**

## QUESTION 2

2.1 SI units and symbols are often used in electrical measurements. Redraw and complete the table below in the ANSWER BOOK.

| No | Component | SI Unit | Symbol |
|---|---|---|---|
| 2.1.1 | Frequency | | |
| 2.1.2 | Electromotive force | | |
| 2.1.3 | Power | | |
| 2.1.4 | Current | | |

(4 × 1) (4)

2.2 Define the following terms:

2.2.1 Electron

2.2.2 Electrocution

(2 × 2) (4)

2.3 Three resistors of 10 Ω, 13 Ω and 20 Ω are connected in parallel. The current drawn from the supply is 2,3 A.

Calculate the following:

2.3.1 The total resistance of the parallel circuit.

2.3.2 The power consumed by a parallel circuit.

(3 × 2) (6)

2.4 State ONE reason for the proper earthing of electrical equipment. (1)
**[15]**

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## QUESTION 3

3.1 Technicians in the refrigeration industry often use the hand tool below. Study **FIGURE 1** and answer the questions.

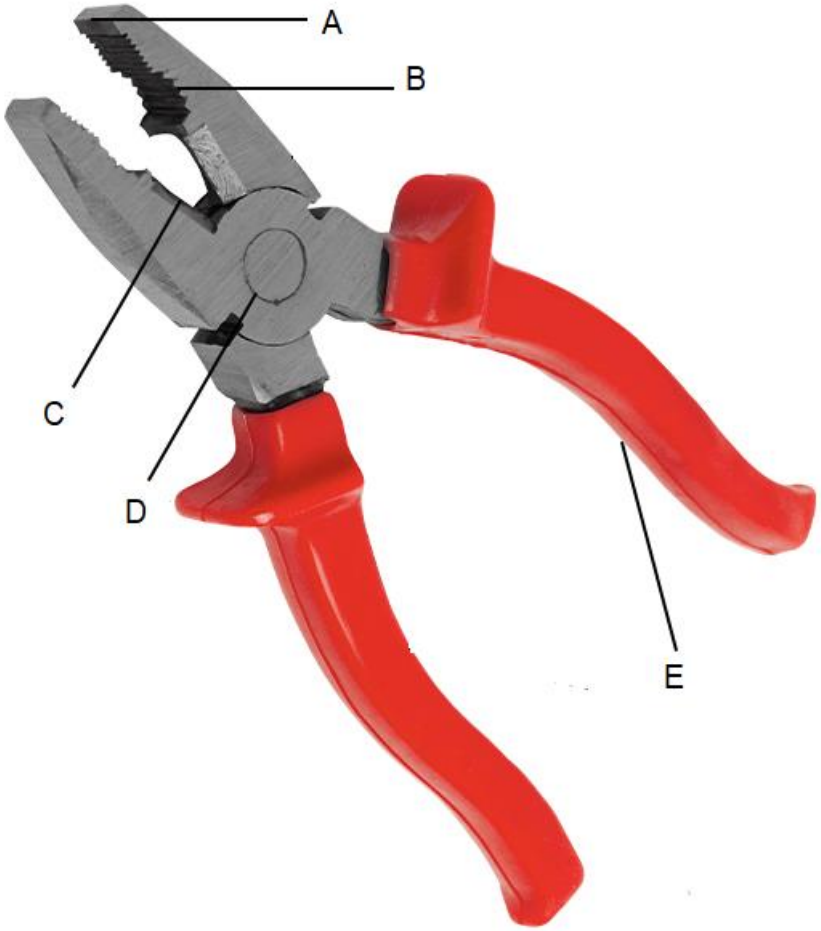


**FIGURE 1**

3.1.1 What is the name of the tool shown in **FIGURE 1**? (1)

3.1.2 Label the parts of the tool in FIGURE 1 by writing the correct answer next to the letters (A–E) in the ANSWER BOOK. (5)

3.2 State the reasons for the following faults in a flaring tool:

3.2.1 Too much pressure by cone on tube.

3.2.2 Wrongly seated tube in flaring tool.

3.2.3 Cone screwed too fast on tube.

(3 × 1) (3)

3.3 Name the THREE colour-coded refrigerant hoses and state where you would connect them. (2 × 3) (6)

**[15]**

## QUESTION 4

4.1 Choose a description from COLUMN B that matches the refrigerant commonly used in South Africa in COLUMN A. Write only the letter (A–E) next to the question number (4.1.1–4.1.5) in the ANSWER BOOK.

| COLUMN B | | COLUMN B | |
|---|---|---|---|
| 4.1.1 | R717 | A | traditional refrigerants |
| 4.1.2 | CFCs | B | chlorine-free long-term alternatives |
| 4.1.3 | HCs | C | natural refrigerants |
| 4.1.4 | HCFCs | D | halogen-free long-term alternatives |
| 4.1.5 | HFCs | E | transitional alternatives |

(5 × 1) (5)

4.2 What is the critical temperature of the refrigerant R134a? (1)

4.3 According to SABS 10147, the Monterol Protocol imposes certain restrictions on the use of refrigerants in South Africa.

Name FOUR of these restrictions. (2 × 4) (8)

**[14]**

## QUESTION 5

5.1 Name the THREE types of piping that are fast becoming popular in refrigeration industry. (3)

5.2 Choose a nominal bore pipe in inches in COLUMN B that matches the ISO pipe in COLUMN A. Write only the letter (A–E) next to the question number (5.2.1–5.2.5) in the ANSWER BOOK.

| COLUMN B | | COLUMN B | |
|---|---|---|---|
| 5.2.1 | 32 mm | A | 3 inches |
| 5.2.2 | 15 mm | B | ¾ inch |
| 5.2.3 | 80 mm | C | 2 inches |
| 5.2.4 | 20 mm | D | 1¼ inches |
| 5.2.5 | 50 mm | E | ½ inch |

(5 × 1) (5)

5.3 Name the FIVE methods of pipe fitting. (5)

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5.4 When the compressor operates, it pumps a certain amount of oil with the refrigerant vapour.

Draw a neat diagram of an oil trap and indicate the directions from the compressor to the evaporator as well as the trapped oil. (5)
**[18]**

## QUESTION 6

6.1 Name the SIX types of drive-head styles of screws. (6)

6.2 Give ONE word or term for each of the following descriptions. Write only the word or term next to the question number (6.2.1–6.2.4) in the ANSWER BOOK.

6.2.1 It completely covers the bolt thread and can be packed with grease to prevent corrosion.

6.2.2 Two small grips on either side, which can be turned by hand.

6.2.3 A nylon ring at the top that exerts pressure on the bolt, which causes extra friction on the bolt thread to prevent it from loosening.

6.2.4 A hole is pre-drilled in a given position on the threaded end of a bolt.

(4 × 1) (4)
**[10]**

## QUESTION 7

7.1 Explain the consequences of overcharging a system fitted with a thermostatic expansion valve. (2)

7.2 Name the FOUR types of leak testing methods applied in the refrigeration industry. (4)

7.3

| COLUMN B | | COLUMN B | |
|---|---|---|---|
| 7.3.1 | Food processing | A | Copper tubing |
| 7.3.2 | Cold water line | B | Stainless steel |
| 7.3.3 | Commercial refrigeration | C | Steel tubing |
| 7.3.4 | Ammonia refrigeration | D | Plastic tubing |

(4 × 1) (4)
**[10]**

**TOTAL: 100**

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