higher education & training

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REPUBLIC OF SOUTH AFRICA

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REFRIGERATION TRADE THEORY N3

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
REFRIGERATION TRADE THEORY N3
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 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 (1.1.1–1.1.5) in the ANSWER BOOK. Also indicate how you arrived at each solution.

1.1.1 If the absolute pressure is 1 000 kPa, what is the ordinary pressure gauge reading?

A 1101.4 kPa
B -1101,4 kPa
C 898,6 kPa
D -898,6 kPa

1.1.2 If the reading on an ordinary pressure gauge is 700 kPa, what is the ordinary absolute pressure?

A -801,4 kPa
B 598,6 kPa
C 801,4 kPa
D -598,6 kPa

1.1.3 If a temperature reading is 25 °C, what is the temperature reading in Kelvin?

A 273 K
B -298 K
C -273 K
D 298 K

1.1.4 A volume of 40 litres of gas at 3°C is raised to 35°C at a constant pressure. What is the new volume if formula Vo/To=Vn/Tn is used?

A 56,46 litres
B 24,46 litres
C 44,46 litres
D 36,46 litres

1.1.5 F a temperature reading is 322 K, what is the temperature reading in °C?

A 59 5 °C
B -49 °C
C 49 °C
D 371 °C

(5 × 2) (10)

1.2 Define the following terms:

1.2.1 Saturated vapour (2)

1.2.2 Specific heat capacity (2)

1.3 Draw a neat, labelled sketch of a four-way reversing valve that changes the refrigerant flow for heating. Show the following components: compressor, indoor coil, outdoor coil, capillary tube and four-way reversing valve. Indicate the flow of the refrigerant by means of arrows. (6)
[20]

QUESTION 2

2.1 FIGURE 1 below shows a picture of a thermostatic expansion valve.

Study the picture and answer the questions.



FIGURE 1

2.1.1 State THREE advantages of the thermostatic expansion valve in FIGURE 1. (6)

2.1.2 What is the purpose of thermostatic expansion valve and state two components where it is connected in the refrigeration system? (4)

2.2 Explain the difference between an *automatic expansion valve* and a *thermostatic expansion valve*. (4)

2.3 Explain the term *miscellaneous heat load.* (2)

2.4 State FOUR sources of miscellaneous heat load. (4)
[20]

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QUESTION 3

3.1 Choose a description from COLUMN B that matches a term in COLUMN A. Write only the letter (A–E) next to the question number (3.1.1–3.1.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1.1	Evaporative condenser	A	designed to have a constant level of liquid refrigerant within the evaporator
3.1.2	Liquid over-feed evaporator	B	the amount of liquid refrigerant supplied is that amount which is actually demanded by the load
3.1.3	Flooded evaporator	C	the amount of refrigerant supplied to the coil is the amount required to remove the heat
3.1.4	Water-cooled condenser	D	rejects heat whilst using minimum quantities of water
3.1.5	Direct expansion evaporator	E	the heat is transferred to water

(5 × 1) (5)

3.2 Tabulate THREE advantages and the THREE disadvantages of the evaporative condenser. (6)

3.3 Briefly describe the operating principle of evaporative condenser in QUESTION 3.2 (3)

3.4 Explain THREE purposes of the pressure regulating valve used on absorption units. (6)

[20]

QUESTION 4

4.1 State the likely corrective actions of the following malfunctions on a condensing unit if the compressor starts and runs, but only in short cycles:

4.1.1 Evaporator fan not running

4.1.2 Low refrigerant charge

4.1.3 Low evaporator load

4.1.4 Blocked refrigerant filter

(4 × 1) (4)

4.2 Draw a neat, labelled sketch of a halide torch leak detector. (6)

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4.3 A two-cylinder compressor has a running speed of 1 000 r/min and a delivery of 0,1356 m³/min at a volumetric efficiency of 75%.

Calculate the bore and stroke of the compressor in millimetres.
HINT: ration of L:D is 1:1
Formula: $V = \frac{\pi \times D^2 \times L \times N \times n}{4} \times \eta_v$ (8)

4.4 State TWO advantages of a mechanical shaft seal. (2)
[20]

QUESTION 5

5.1 Name FOUR factors that influences heat leakage. (4)

5.2 FIGURE 2 below shows a combination refrigerator/freezer.

Identify the labelled parts and components by writing only the answer next to the letter (A–J) in the ANSWER BOOK.

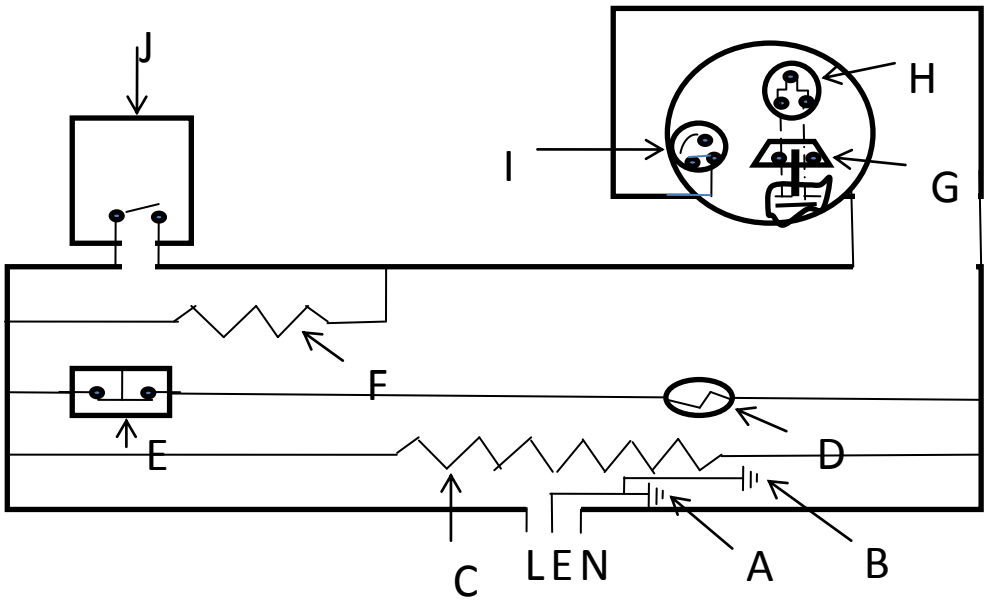

FIGURE 2 (9)

5.3 The thermostat in FIGURE 2 above is normally a double-pole switch.

Explain the operation of the system when the circuit is energised. (4)

5.4 Does the component labelled F have a resistive or an inductive load? (1)

5.5 Give a reason for your answer in QUESTION 5.4. (2)
[20]

TOTAL: 100

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