

071305T4RAC

Refrigeration and Air Conditioning Craftsperson – Level 5

ENG/OS/RAC/CR/01/5/A

Install, Service and Repair Refrigeration Units

July/August 2023



**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION COUNCIL  
(TVET CDACC)**

**WRITTEN ASSESSMENT**

**Time: 3 hours**

**INSTRUCTIONS TO CANDIDATE**

1. This paper has two sections **A, B** and **C**.
2. Attempt questions in each section as per instructions given in the section.
3. You are provided with a separate answer booklet.
4. Answer all questions in the answer booklet.
5. Marks for each question are as indicated in the brackets.
6. Do not write on the question paper

**This paper consists of SEVEN (7) printed pages**

**Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing**

**SECTION A: (20 marks)**

*Attempt ALL the questions from this section*

1. In case of leakage of Freon refrigerant, halide touch will change from \_\_\_\_\_ to \_\_\_\_\_ color.
  - A. green to purple
  - B. green to pink
  - C. blue to bright green
  - D. bright green to blue
  
2. \_\_\_\_\_ is the simplest capacity control for a compressor.
  - A. On/Off control.
  - B. Hot gas by pass.
  - C. Speed modulation.
  - D. Cylinder by-pass control
  
3. The function of an accumulator in a refrigeration system is to \_\_\_\_\_.
  - A. storing of liquid refrigerant
  - B. exchange of heat
  - C. storing of unvaporized liquid
  - D. condensing gas
  
4. Pumping down refrigeration system is done \_\_\_\_\_.
  - A. for more cooling effect
  - B. to check compressor efficiency
  - C. for refrigerant charging
  - D. to attend maintenance in low side
  
5. \_\_\_\_\_ valve is used in a reciprocating refrigeration compressor.
  - A. Rotary
  - B. Poppet
  - C. Ring plate
  - D. Globe

6. The purpose of connecting and standing a drainage pan on the compressor surface is \_\_\_\_\_.
- A. because the compressor needs water to function
  - B. because it is a safe place to keep the pan
  - C. so that the water should warm
  - D. to cool the compressor.
7. In most refrigeration systems, thermostats use a \_\_\_\_\_.
- A. Fuse
  - B. Sensing bulb
  - C. Thermistor
  - D. Valve
8. \_\_\_\_\_ is a preventive step taken to reduce fouling in condenser water tubes.
- A. Water treatment
  - B. Replace condenser
  - C. Decrease water flow
  - D. Replace cooling tower
9. The following are desirable property of a refrigerant except \_\_\_\_\_.
- A. high immiscibility with oil
  - B. low boiling point
  - C. good electrical conductivity
  - D. large latent heat
10. A leakage in a refrigeration system using ammonia is detected by \_\_\_\_\_.
- A. Halide torch
  - B. Sulphur sticks
  - C. Soap and water
  - D. Ultra violet light
11. Cooling towers are employed in high capacity refrigeration system to cool the condenser cooling water. Induced draught is considered better than the forced draught in the cooling towers because \_\_\_\_\_.
- A. power requirement is high for forced draught
  - B. maintenance of induced draught fan is costlier
  - C. forced draught is less efficient

- D. forced draught produces less amount of speed of air
12. A good charging of a refrigeration system is indicated when \_\_\_\_\_.
- A. the whole condenser is hot
  - B. half part of the condenser is hotter than the other
  - C. the suction line is hot
  - D. the condenser line is cold
13. One of the purposes of sub-cooling the liquid refrigerant is to \_\_\_\_\_.
- A. reduce compressor overheating
  - B. reduce compressor discharge temperature
  - C. increase cooling effect
  - D. ensure that only liquid and not the vapour enters the expansion (throttling) valve
14. In vapour compression cycle using ammonia refrigerant, the initial charge filled in the \_\_\_\_\_.
- A. suction of compressor
  - B. delivery of compressor
  - C. high pressure side close to receiver
  - D. low pressure side near receiver
15. High side float valve is fitted in the condensing unit just after the \_\_\_\_\_.
- A. receiver
  - B. compressor
  - C. condenser
  - D. evaporator
16. Moisture in Freon refrigeration system cause \_\_\_\_\_.
- A. Ineffective refrigeration
  - B. High power consumption
  - C. Freezing of regulating/expansion valve
  - D. Corrosion of the system
17. A system retrofitted with R-134a, uses \_\_\_\_\_ oil.
- A. Alkylbenzene (AB)
  - B. Polyolester (POE)
  - C. Mineral Oil (MO)



- D. None of these. Retrofitting does not require oil use.
18. Formation of frost on evaporator in a refrigeration unit \_\_\_\_\_.
- A. results in loss of heat due to poor heat transfer
  - B. increases heat transfer rate
  - C. is immaterial
  - D. can be avoided by proper design
19. The oil pressure switch is installed in the \_\_\_\_\_ of the system.
- A. suction line
  - B. discharge line
  - C. expansion line
  - D. oil line
20. A compressor knock is caused by loose of \_\_\_\_\_.
- A. discharge lines
  - B. internal components
  - C. suction lines
  - D. vapour lines

**SECTION B: (40 Marks)**

*Attempt ALL the questions from this section*

21. What is the meaning of retrofitting in refrigeration and air conditioning? (2 marks)
22. One of the most difficult areas of sealed system servicing can be trying to find a refrigerant leak. Highlight FOUR methods of detecting refrigerant leak in a system. (4 marks)
23. Which THREE types of refrigerant oils are used in refrigeration systems and which refrigerants are applicable for each? (6 marks)
24. Since the evaporator in refrigeration system operate at temperatures below  $0^{\circ}\text{C}$ , it is subjected to the accumulation of frost or ice which have to be thawed for proper operation of the system. Name any FOUR methods of defrosting evaporator of refrigeration unit. (4 marks)

25. Give FOUR reasons why Rotary compressors are currently preferred in refrigeration systems from reciprocating compressors. (4 marks)
26. Explain the 3Rs in refrigeration and air conditioning. (6 marks)
27. Compressor is usually regarded as the heart of the refrigeration system. Which are any THREE most common contributors to compressor failure? (3 marks)
28. The functions of the metering devices are to regulate the flow of high-pressure liquid refrigerant from the liquid line into the evaporator and to maintain a pressure differential between the high and low pressure sides of the system in order to permit the refrigerant to vaporize under the desired low pressure in the evaporator and at the same time to be condensed at a high pressure in the condenser. Name any FOUR types of metering devices. (4 marks)
29. Which are any THREE types of capacity controls used in refrigeration system using reciprocating compressor? (3 marks)
30. Most industrial and commercial refrigeration compressors that have positive oil pumps also have a control that senses oil pressure and acts as a safety device whenever the oil pressure falls below a certain threshold level. Which are the TWO types of oil safety control devices and what is the mode of operation of each? (4 marks)

**SECTION C: (40 marks)**

*Attempt any THREE questions from this section*

31. In spite of keeping full preventive maintenance as per the set maintenance schedule, some problems may come at any time during the operation of refrigeration plant. The operator of refrigeration plant should know about the cause and remedies of the routine problems in plant.
- (a) What are THREE possible causes and remedies of the following problems of a refrigeration plant?
- (i) Suction pressure too low
  - (ii) Suction pressure too high
  - (iii) Condensing pressure too high
  - (iv) Suction line temperature too high.

(12 marks)

- (b) As a RAC technician, which FOUR equipment would you require to diagnose a refrigeration system? (8 marks)
32. A refrigerant is the working fluid in the refrigeration system through which heat transfer is achieved in a refrigeration system.
- a) Which are the two groups of refrigerants? (2 marks)
- b) What are FIVE desirable chemical properties of refrigerant? (5 marks)
- c) Recycling is defined as the cleaning of refrigerant for reuse. Which are any FOUR contaminants of refrigerant in a refrigeration system? (4 marks)
- d) It is recommended that refrigerant be recovered before performing any repair on a refrigeration unit. Why is recovering of refrigerant from a unit important? Give THREE reasons. (3 marks)
- e) What are any SIX factors to be considered to when charging a domestic refrigeration system? (6 marks)
33. Whereas the function of the evaporator is to absorb heat from the refrigerated space, the condenser must reject that heat outside the refrigerated space. In addition to evaporator heat and suction line superheat, the condenser must also reject the heat of compression and motor heat picked up by the suction vapor on its way through the compressor. This additional heat can be as much as one-third more than that absorbed by the evaporator. Two types of condenser suffice; air-cooled and water-cooled condensers. The latter is used in large refrigeration installations.
- (a) Give FOUR reasons why water-cooled most preferred in large capacity refrigeration systems? (4 marks)
- (b) Explain the THREE phases in which the refrigerant undergoes while passing through the condenser. (6 marks)
- (c) Give FOUR advantages of evaporative condensers. (10 marks)