



Tertiary and Vocational Education Commission
Knowledge Assessment – April 2022
Refrigeration and Air Conditioning Technician
National Vocational Qualification Level 04



Time: 03 Hours

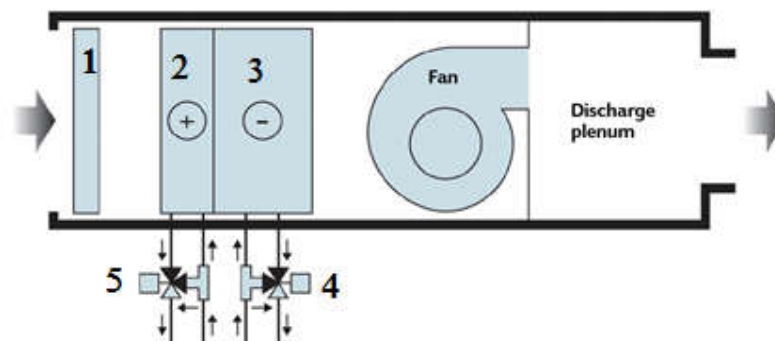
Instructions for the Candidates

- Answer all questions
 - In each of the questions from 1 to 50, pick the one of the alternatives (a), (b), (c), (d) which you consider is correct or most appropriate.
 - Mark a cross (x) on the number corresponding to your choice in the answer sheet provided.
 - This question paper consists of 08 pages
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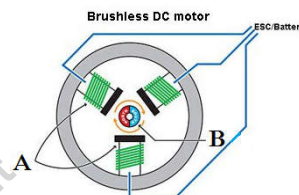
Part 1

1. Chilled water temperature in a central air conditioning system is 6 degrees Celsius (6°C). What is it in degrees Fahrenheit ($^{\circ}\text{F}$)?
 - a) 35.3
 - b) 38.0
 - c) 42.8
 - d) 50
2. What is the chemical formula of R-22 refrigerant used in the field of air conditioning?
 - a) CCL_2F_2
 - b) CHCLF_2
 - c) CCLF_3
 - d) CHCL_3
3. If the pressure on the low pressure side of a central air conditioning system is obtained from the pressure gauge, if it is 30 PSI, what is the absolute pressure of that pressure in PSI?
 - a) 15.3
 - b) 14.7
 - c) 47
 - d) 44.7
4. The year in which the R-22 refrigerant used for central air conditioning systems is to be phased out is,
 - a) 2016
 - b) 2020
 - c) 2030
 - d) 2035
5. The R-410A refrigerant used in air conditioners is made of which refrigerant mixture?
 - a) R-12 / R-22
 - b) R-134a / R-600a
 - c) R-32 / R-125
 - d) R-125 / R-143a

6. Below is a picture of the Air Handling Unit (AHU). What is the device referred to here as number 4?



- a) Chilled water 3 way Motorized valve
b) Hot water 3 way Motorized valve
c) Chilled water Hand operated valve
d) Hot water Hand operated Motorized valve
7. This diagram shows an insert inside a Brushless DC electric motor used in Inverter / VRF air conditioning systems. What is shown as **B** here?



- a) A permanent magnet
b) An electromagnet
c) Armature
d) Squirrel cage Rotor
8. The metal used in the refrigeration pipes of central air conditioning systems using ammonia refrigerant is,
- a) Iron
b) Copper
c) Aluminum
d) Brass

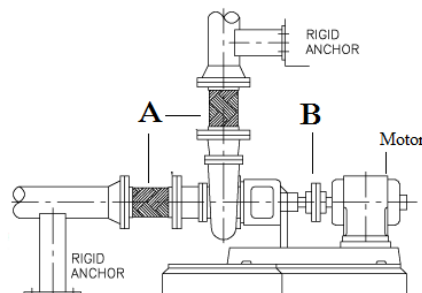
9. Which of the following condensers is an air cool condenser?
- a) Shell and tube
b) Shell and coil
c) Tubing tube
d) Fin and tube

10. When the pressure in a central air conditioning system is 2Bar, what is it in kilo Pascal?
- a) 2
b) 29.4
c) 101.325
d) 202.65

11. In an Air conditioning system, Mercury column was vacuumed up to 30mmHg. The Value in Tor is;
- a) 30 Tor
b) 45 Tor
c) 273 Tor
d) 460 Tor

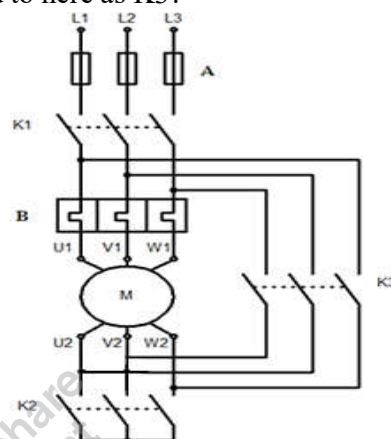
12. Below is a water pump used in a central air conditioning system? A is referred as;

- a) Check Valve
- b) Flexible joint
- c) Reducer joint
- d) Flexible coupling



13. The diagram below shows an electrical circuit that operates an electrical appliance in a central air conditioning system. What is referred to here as K3?

- a) Delta Contactor
- b) Star contactor
- c) Thermal over load
- d) Main contactor



14. Check the noise generated during the manufacture of air conditioners and specify in its specifications. The unit of measurement of sound is;

- a) Calories
- b) Decibels
- c) Coulomb
- d) Hertz

15. Which refrigerant has called $\text{CF}_3\text{CH}_2\text{F}$;

- a) R-12
- b) R-22
- c) R-134a
- d) R-410a

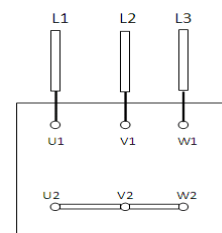
16. A three-phase electric motor used in an air conditioning system installed in Sri Lanka has 04 poles. What is the rotational speed (RPM) of this motor?

- a) 750
- b) 1500
- c) 3000
- d) 6000

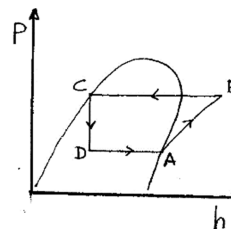
17. When capacitors of micro farad 35 and Micro farad 15 are connected in series. What is the equivalent capacity?

- a) Micro farad 35
- b) Micro farad 15
- c) Micro farad 50
- d) Micro farad 10.5

18. The Refrigerant that contributes the most to global warming is,
- R-134a
 - R-717
 - R-600a
 - R-290
19. The most comfortable temperature and humidity zone for air conditioning for human comfort is;
- Temperature 18°C - 22°C and relative humidity 90% - 100%
 - Temperature 30°C - 32°C and relative humidity 50% - 60%
 - Temperature 28°C - 32°C and relative humidity 90% - 100%
 - Temperature 24°C - 26°C and relative humidity 50% - 60%.
20. The ozone depletion potential (ODP) value of the R-12 refrigerant is;
- 1
 - 0.95
 - 0.55
 - 0
21. Which of the following is the most suitable air conditioning system for a server room?
- Split type AC
 - Package AC
 - VRF AC
 - Precision AC
22. Below are the connection terminals of a three-phase electric motor and how they are connected and supplied. When the three-phase power supply L1, L2 and L3 are connected to the three terminals U1, V1 and W1, the motor operates as follows.
- Star mode.
 - Delta mode.
 - The first is Star and the second is Delta.
 - The first is Delta and the second is Star mode.



23. The figure below shows how a cooling system at saturation is located on a pressure-thermal chart. Here the activity of the compressor is shown;
- AB
 - BC
 - CD
 - DA



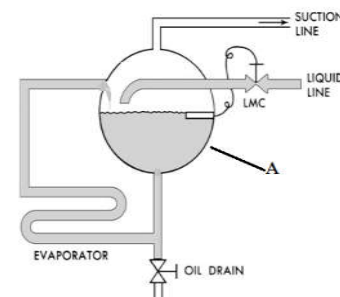
24. When an air conditioner is turned on, the trip switch off the power as soon as the compressor starts operating. The reason may be;
- The starting coil of the compressor is burnt out.
 - No refrigeration in the system.
 - The running coil of the compressor is burnt.
 - The coil of the compressor is underground.

25. What is the medium used in Evaporative cool condenser,
- Water
 - Air
 - Water and Air
 - Naturally
26. The boiling point of the R-410a refrigerant is;
- 10 °C
 - 20 °C
 - 30 °C
 - 51 °C
27. A suitable Metering device for a system with a Flooded Type evaporator is;
- Thermostatic expansion valve
 - Capillary tube
 - Lower side Plot valve
 - Thermal electric expansion valve
28. The correct order in which a central air conditioning system (Chiller) start to function can be;
- Compressor - Cooling Tower – Condenser Pump - Chilled Water Pump
 - Compressor - Condenser pump - Chilled water pump - Cooling Tower
 - Condenser pump - Chilled water pump - compressor - cooling Tower
 - Cooling Tower - Condenser Pump - Chilled Water Pump – Compressor
29. What is the category to which the R-134a refrigerant belongs to?
- CFC
 - HFC
 - HCFC
 - HC
30. Below is a nameplate of an electric motor. The power factor of that motor is,
- 5.90/3.40
 - 0.85 -0.79
 - 220-240D/280-415Y
 - 2860-2890

3~MOT MG 90SA2-24FF165-C2			
50 Hz	P ₂ 1,50 kW	No 85807906	
	U 220-240D/380-415Y	V	
Eff. %	I _{1/1} 5.90/3.40	A	
82	I _{max} 6.50/3.75	A	
n 2860-2890	min	cos φ 0.85-0.79	
CL F	IP 55		0346
DE 6305.2Z.C4	NDE 6205.2Z.C3		
EFF 2			
CE GRUNDFOS Made in Hungary			

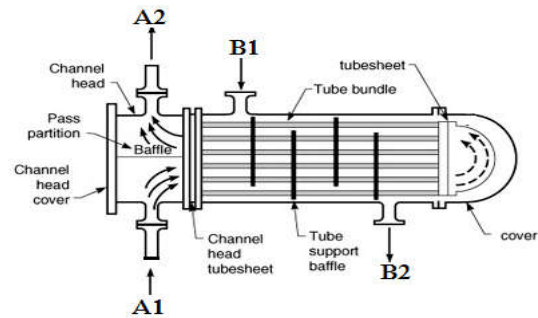
31. The most important factor to be considered when choosing a water pump is;
- Head
 - Ampere
 - Power
 - Voltage

32. The correct way to find the efficiency value of a central air conditioning system is,
- Condenser effect / Refrigeration effect
 - Refrigeration effect / Condenser effect
 - Refrigeration effect / compression effect
 - Condenser effect / compression effect
33. The moment when the large quantity of refrigerant passes through a thermostatic expansion valve;
- When the superheat value of the evaporator decreases.
 - When the sub cooling of the Condenser is decreases.
 - When the superheat value of the evaporator increases.
 - When the sub cooling of the Condenser is increase.
34. The ideal way to fill a refrigerant in a central air conditioning system;
- According to the refrigerant pressure
 - According to the running current
 - By experience
 - According to the refrigerant weight
35. What category does the R-22 refrigerant belongs to;
- CFC
 - HCFC
 - HFC
 - HC
36. The best place to fix an oil separator is;
- Liquid line
 - Suction line
 - Discharge line
 - Capillary line
37. The figure below shows part of a refrigeration cycle. Here the device A is;
- Accumulator
 - Oil separator
 - Surge Dram
 - Receiver
38. The refrigerant called R-717 is;
- Propane
 - Ammonia
 - Water
 - Butane
39. What is the function of Muffler in a refrigeration system?
- Stop vibration
 - Oil filtration
 - Stop Liquid Travel
 - Noise Reduction



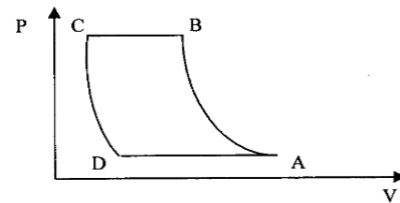
40. The type of condenser shown below is;

- a) Shell and coil
- b) Tube in tube
- c) Shell and tube
- d) Evaporative condenser



41. The following is a diagram of the pressure (P) and volume (V) at the operating stage of a piston type compressor. Part AB here shows;

- a) Gas expansion
- b) Gas Suction
- c) Gas pressure
- d) Gas Exhaust



42. The function of a step-down transformer used in electrical circuits is;

- a) Reduce potential.
- b) Increasing the potential.
- c) Increasing the current while keeping the potential constant.
- d) Reduce the current while keeping the potential constant.

43. Sprinkler head rotates;

- a) With the aid of an electric motor
- b) With the help of wind
- c) With the help of water pressure
- d) By high temperature

44. What is a secondary refrigerant?

- a) Water
- b) Ammonia
- c) R - 134a
- d) Butane

45. The correct type of chilled water pump that can be used when having a two way motorized valve in a central air conditioning system is;

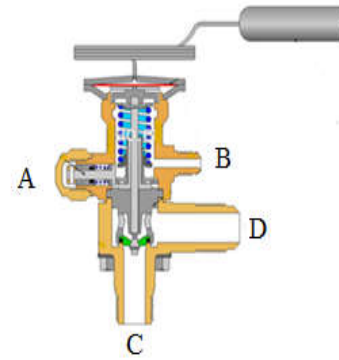
- a) Variable Speed Drive pump
- b) Constant speed pump.
- c) Single stage pump.
- d) Multi stage pump.

46. The functionality of a PTC sensor is;

- a) Resistance Increase as temperature Increase.
- b) Resistance decreases as temperature Increase.
- c) Resistance Increase as temperature decreases.
- d) Resistance constant as temperature Increase.

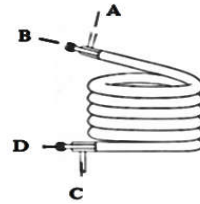
47. The figure below shows a device found in a central refrigeration system. The correct name of the device is;

- a) Electronic expansion valve.
- b) Hand operated expansion valve.
- c) Thermostatic expansion valve with internal equalizer.
- d) Thermostatic expansion valve with external equalizer.



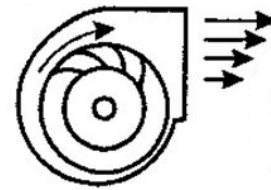
48. The following is a picture of a water cool condenser. Its correct name is;

- a) Shell and coil
- b) Tube in tube
- c) Shell and tube
- d) Evaporative condenser



49. The following type of fan (Blower Wheel) is;

- a) Radial Blade
- b) Backward Inclined
- c) Backward Curved
- d) Forward Curved



50. What is a device that measures the rotational speed of a motor;

- a) Ammeter
- b) Nanometer
- c) Tachometer
- d) Barometer

(01 x 50 = 50 Marks)



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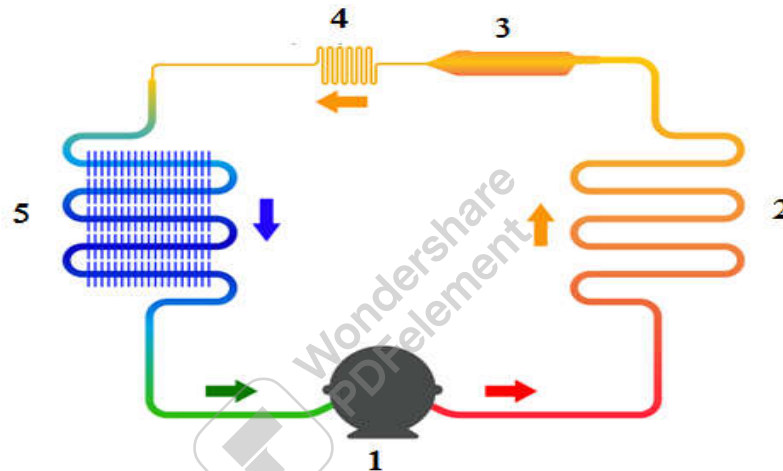
Instructions for the Candidates

- Answer for any five (05) questions.
- Answer the questions in the spaces provided in the same question paper
- This question paper consists of 08 pages.

Part 2

Answer for any five (05) questions

1. The following shows a diagram of a vapor compressor refrigeration cycle.
- i). Name the sections 1 to 5 and briefly list the functions performed by those sections in the table below. (05 Marks)



No	Name	The work done in brief
1		
2		
3		
4		
5		

- ii). Draw a line between the low pressure zone and the high pressure zone of this refrigeration cycle.

(02 Marks)

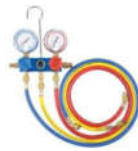
- iii). In the absence of a refrigerant leak in this refrigeration cycle, ice forms at the end of the capillary tube, what is the reason? (03 Marks)

2.

- i). Below are diagrams of some of the appliances used in the refrigeration and air conditioning industry. Write their name in front of them. (03 Marks)



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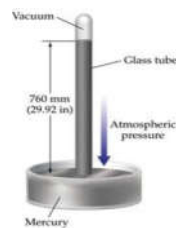
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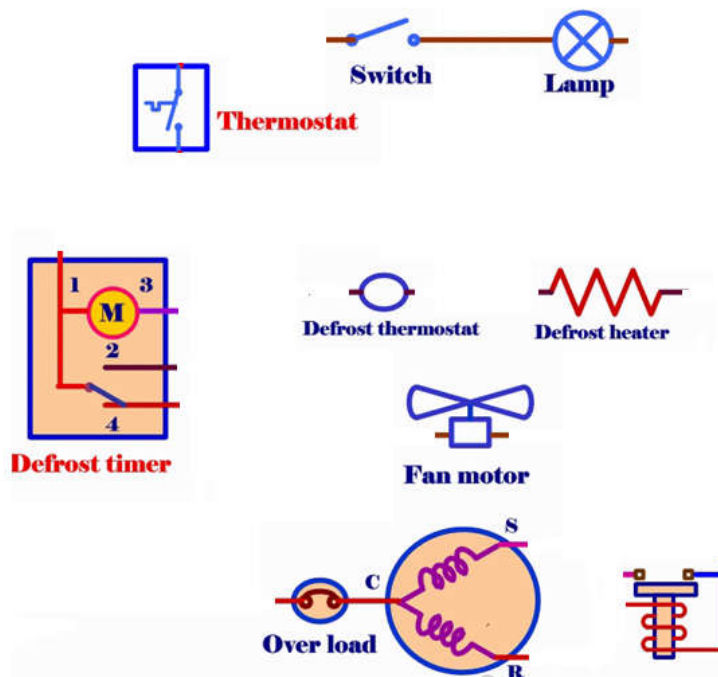


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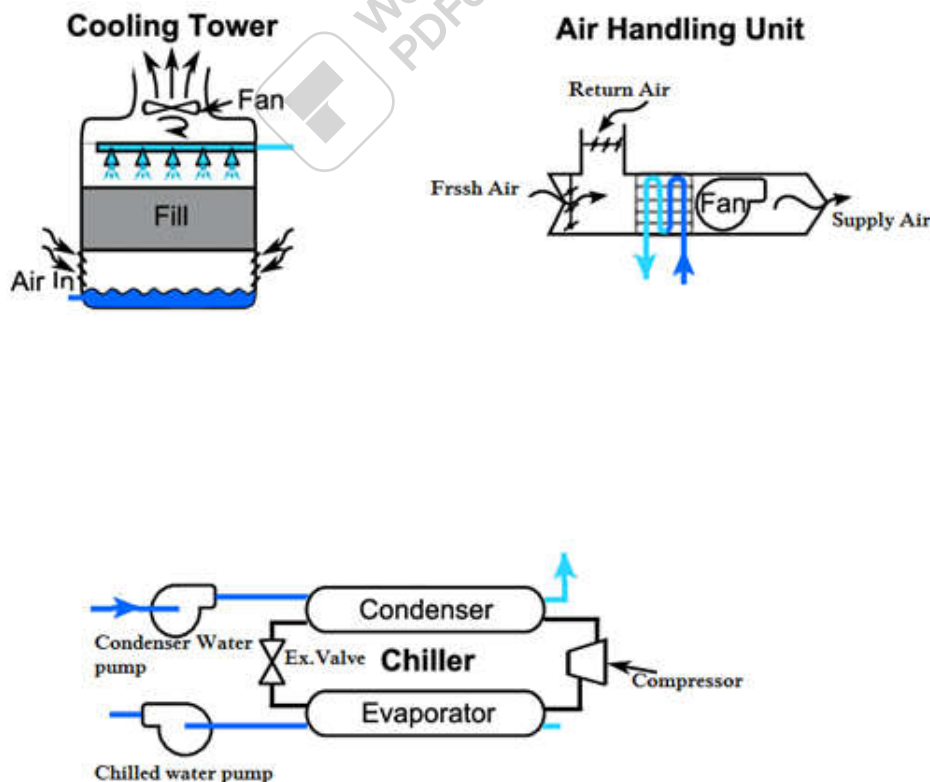


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- ii). The diagram below shows the No Frost two doors fitted to the refrigerator electrical devices. Draw exactly how these devices should be connected to each other by the conductor wires in this diagram. (04 Marks)

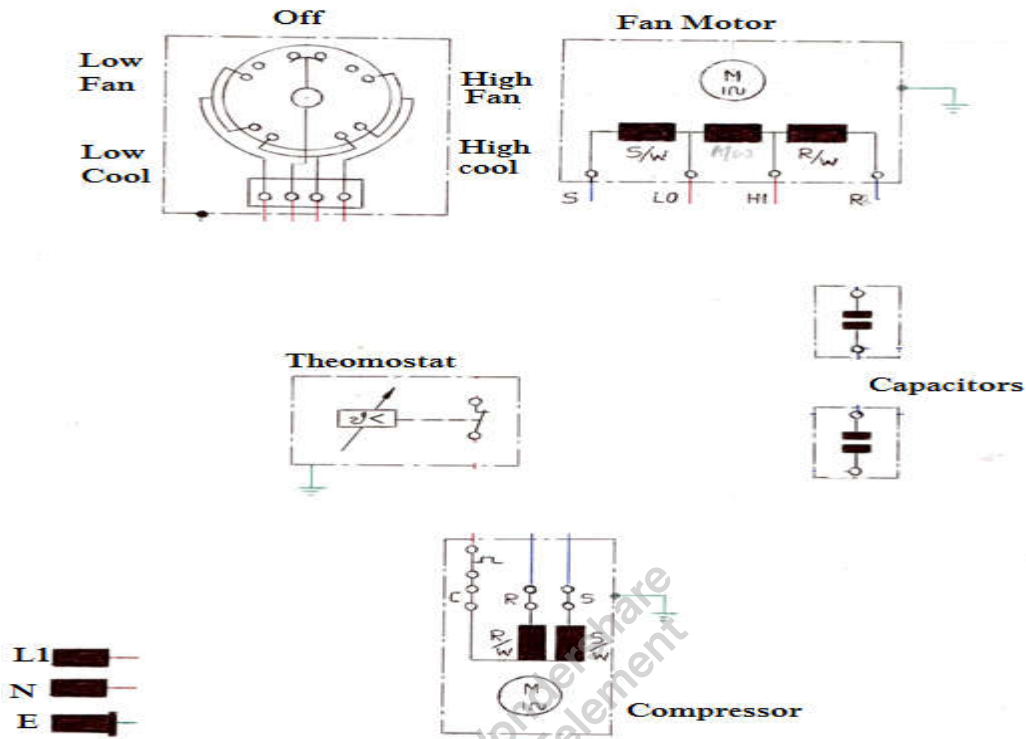


- iii). The diagram below shows some of the components of a central air conditioning system. In this diagram, show how the three devices should be connected to each other through pipelines. (03 Marks)

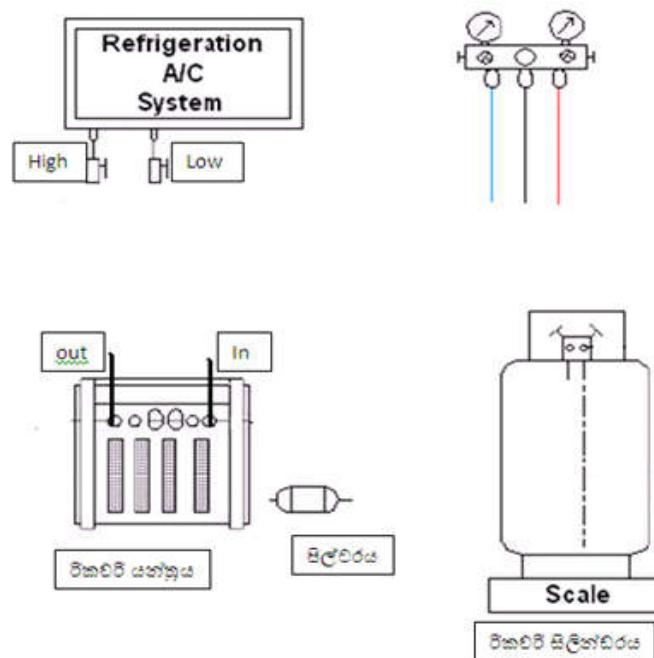


3.

- i). The diagram below shows the components required for the electrical circuit of a window type air conditioner. Draw exactly how these devices should be connected to each other by the conductor strings in this diagram. (07 Marks)



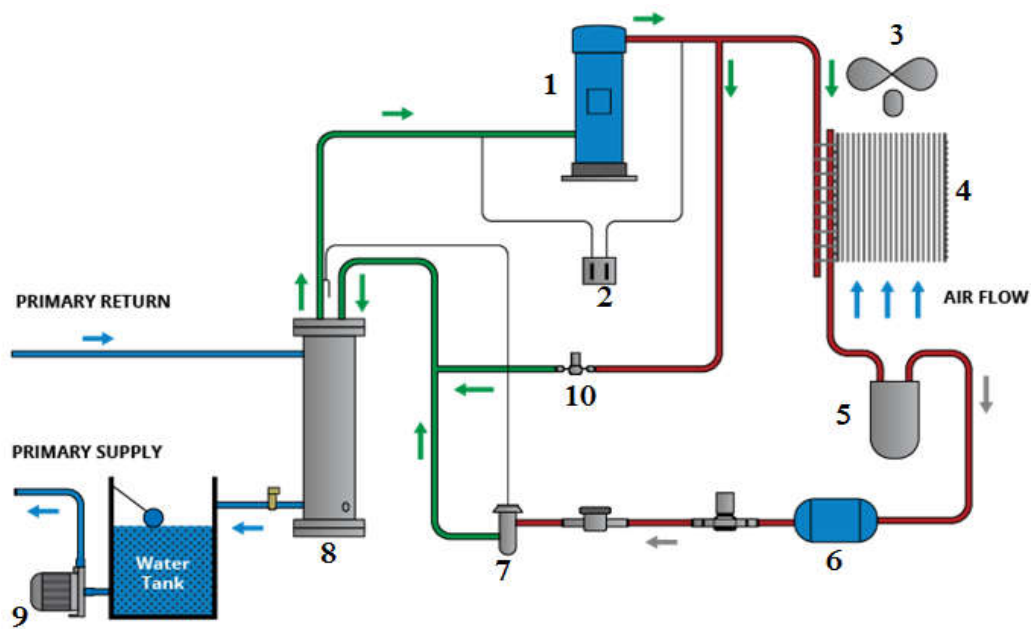
- ii). Below is a demonstration of how to recover refrigerant from the refrigeration system connected to the machine and other equipment. (03 Marks)



4. Below is a diagram of a central air conditioner (Chiller) system.

i). Write the names of the devices numbered 1 to 10 in it.

(05 Marks)



1	6
2	7
3	8
4	9
5	10

ii). What is the benefit to the system by the device number 02 here?

(03 Marks)

iii). In such a central air conditioning system (chiller) the compressor shuts off if the cold water flow stops. What's the name of that stop guard switch?

(02 Marks)

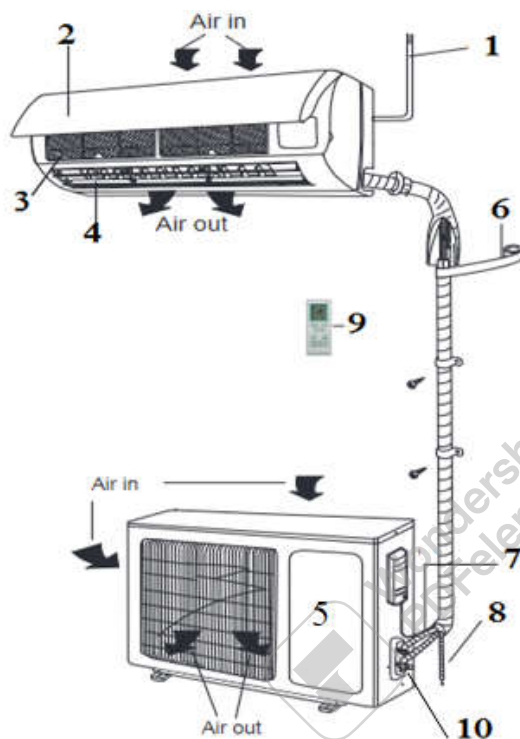
5.

i). What is the correct name of the air conditioner shown in the diagram below?

(03 Marks)

ii). Write the names in sections 1 to 10 of the diagram

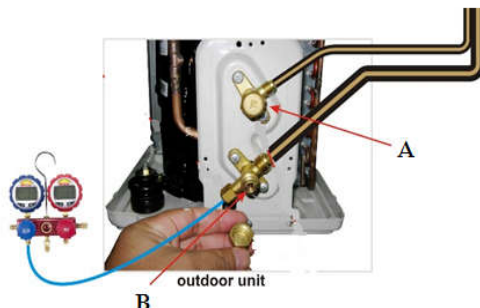
(05 Marks)



1-	
2-	
3-	
4-	
5-	
6-	
7-	
8-	
9-	
10-	

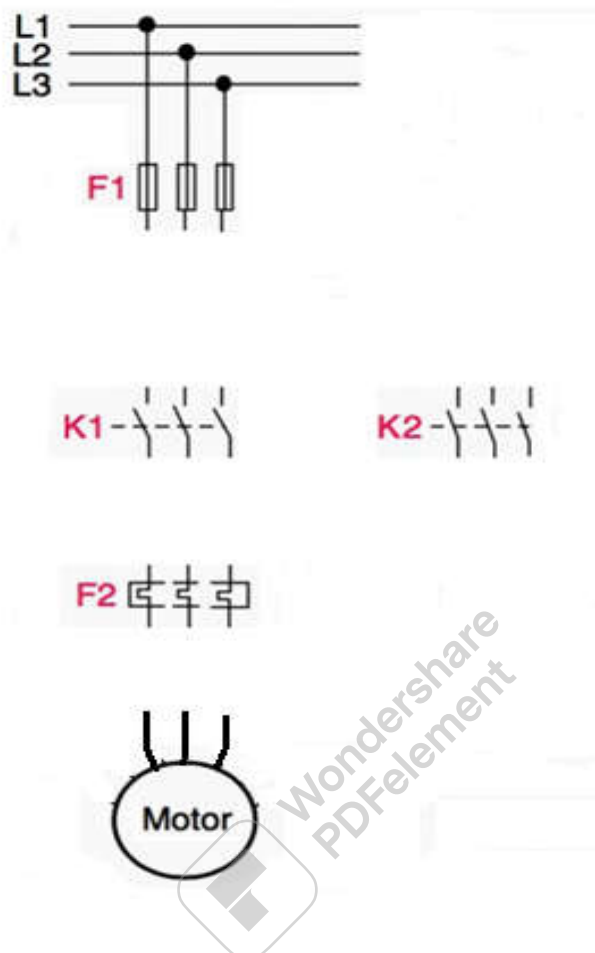
iii). The picture below shows how the pipes are located on the outdoor of a split type air conditioner. Which of the A and B valves must be closed first to pump-down this machine?

(02 Marks)



6. The following are the components required for an electrical circuit in a forward - reverse motor.

- i). In this diagram, show the three-phase circuit (Power Circuit) required by these devices to operate the motor correctly. (05 Marks)



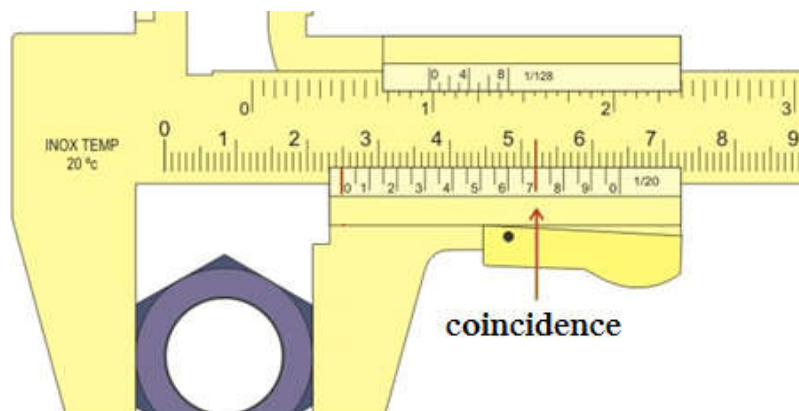
- ii). What is meant by the following letters in this circuit? (04 Marks)

F1 K1

K2 F2

- iii). What happens if the L1 Phase break down while the motor is running? (01 Mark)

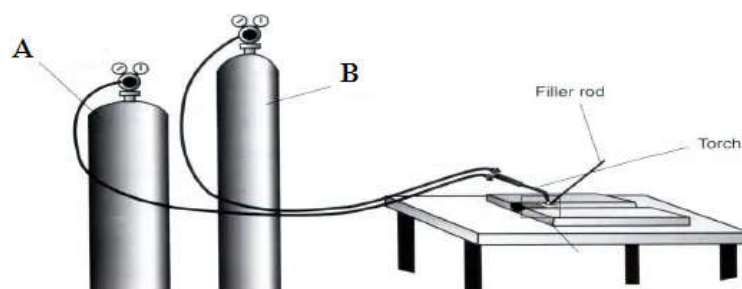
7. The picture below shows a measurement taken from a Vernier caliper with an accuracy of $\frac{1}{20}$.



- i).
- Specify the smallest (Vernier scale) measurement here in millimeters
(02 Marks)
 - What is the reading obtained here?
(03 Marks)
- ii). The picture below shows a set of tools used for gas welding. What gases are in cylinders A and B?
(02 Marks)

A-

B-



- iii). In gas welding, we set the flame of the lamp in three ways. What are those three types of flames?
(03 Marks)

1-.....

2-.....

3-.....