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ANSWER BANK

ELEMENT ONE
Demonstrate knowledge of the principles of refrigeration.

1. Explain the following terms

Radiation **–** The transfer of heat through space.

Convection **-** The transfer of heat by movement of a warmed liquid or gas.

Conduction - The transfer of heat through direct contact.

2. Explain the purpose of the following components

Evaporator **-** The coils within the evaporator remove the heat and humidity that is being circulated by the heater fan motor from the surrounding air.

Compressor - The compressor draws in low pressure vapour through a system of valves, and pumps out a high pressure vapour to the condenser.

Expansion Valve - The thermostatic expansion valve is a restricting device that converts high pressure liquid refrigerant into low pressure vapour that is directed to the evaporator.

Condenser- The condensers main function is to dissipate heat from the refrigerant into the surrounding air.

3. Complete the following sentences.

Latent heat or **Hidden Heat** refers to the amount of **Heat Joules** (BTU) that a liquid will **absorb** without getting Warmer when changing state from a liquid to a gas.

Latent heat of **Evaporation** is the amount of heat energy a liquid will absorb from the time it reaches its boiling point until it changes state to a gas.

Latent heat of **Condensation** is heat energy released when water vapour condenses to form liquid droplets.

4. What is the function of the Receiver/Drier?

Absorbs moisture and filter particles and store excess refrigerant.

5. What are the main points of 'The Ozone Layer protection Act '?

This act regulates the proposed phase out of all ozone depleting substances. This act also controls the manufacture, import and export of all ozone depleting substances in New Zealand.

6. What are the dangers of handling refrigerant and what pre-cautions should be taken if skin contact is made?

Eye protection such as safety glasses must be worn and leather gloves.
Do not allow skin contact and also be careful not to inhale fumes.
If refrigerant comes into direct contact with skin treat for cold burns. To treat cold burn injuries hold the injured area under tepid water for at least 10 minutes. Allow the injury to dry before applying burn cream. Bandage the wound to avoid infection. Advise the patient to exercise the injured area until normal body temperature returns. If severe, seek medical assistance

ELEMENT TWO
Demonstrate knowledge of refrigerants used for automotive air conditioners.

1. What type of refrigerant is in use today?

R134A

2. What type of refrigerant has been used in the past and why has it been discontinued?

R12 it is chlorine based

3. What type of oil is used in the R-134a system?

Polyalkene Glycol (PAG) Oil

4. Which system runs higher pressures?

R134A

5. What precautions must be observed when transporting and storing refrigerants?

Store containers in a cool dry area.
Do not store or use containers in or near a welding or steam cleaning area.
Always store the cylinder securely in an vertical position.
When transporting cylinders ensure that they remain upright, they cannot slide and cannot come into contact with sharp edges.

6. What are the differences in the charging ports of the new and old systems?

R12 charging ports are a screw on type and R134A are a clip on type**.**

7. Name the components that require checking or replacing when completing a refrigerant conversion?

Compressor
Condenser
Receiver/drier
Charging ports
Hoses

8. What label must be fitted to a vehicle following a service/repair on an air/conditioning system and what information must be recorded?

Name of service agent
Date of service
Quantity of refrigerant
Type of refrigerant
Type of oil
Odometer reading

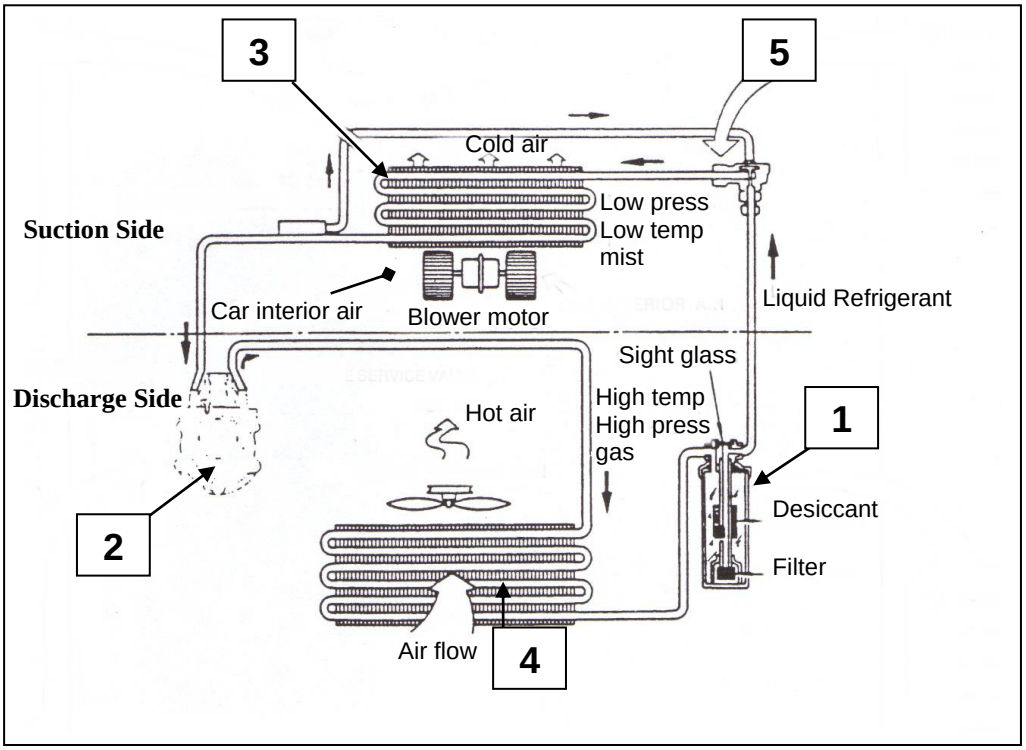
9. What would happen if the wrong oil is used in a system?

Should the incorrect type of oil be used, the O-rings will perish and refrigerant leakage will occur.

10. A large amount of bubbles or oil streaks on the inside if the receiver drier sight glass is an indication of what?

Low or a complete loss of refrigerant.

ELEMENT THREE
Demonstrate knowledge of an automotive air conditioning system.



1. **The above diagram is an illustration of an air/conditioning system. Insert the numbers of the following components in the boxes provided and explain their function**.

1. Receiver Drier
The primary function of the receiver-drier is to separate gas and store liquid refrigerant. The secondary purpose is to trap water vapour and filter out dirt.

2. Compressor
The compressor draws in low pressure vapour through a system of valves, and pumps out a high pressure vapour to the condenser.

3. Evaporator
The coils within the evaporator remove the heat and humidity that is being circulated by the heater fan motor from the surrounding air.

4. Condenser
The condenser's main function is to dissipate heat from the refrigerant into the surrounding air.

5. Expansion Valve (TX Valve)
The thermostatic expansion valve is a restricting device that converts high pressure liquid refrigerant into low pressure vapour that is directed to the evaporator.

2. Give two methods of detecting leaks?

Electronic leak detector
UV light 7 coloured glasses
Manifold gauge hand set

3. How should you store PAG (Polyalkene Glycol) oil?

Polyalkene glycol (PAG) oil must always be stored in an air-tight container.

4. Before a system can be re-gassed it must be evacuated and any old refrigerant must be recovered. Then the system must be filled with refrigerant. Explain the procedure involved?

Connect the manifold gauges. Stabilise the air conditioning system. Open the hand valves. Operate the vacuum pump. Check for vacuum leakage in system. Add additional lubricant to the system to replace any oil that was drawn out by the vacuum pump. Monitor the amount of refrigerant entering the system is no more or less than manufacturer's specifications. During the process, periodically inspect hand gauges. When correct amount of refrigerant has entered the system, close off hand gauges and remove. Check for leaks, run vehicle and check operation.

6. Why might it be necessary to flush the air conditioning system?

To remove any foreign particles, moisture or sludge caused by a component failure and to flush the old oil from the system when retrofitting from R12 to R134A.

7. After an air/conditioning failure certain components may need to be replaced. Name three of these?

Compressor, Receiver dryer or accumulator, Thermal expansion valve or orifice tube.

8. If the low side gauge reading is 40psi and high side reading is 250psi what could be the possible cause?

Possible overcharging of refrigerant, blocked condenser

9. What colours are the low and high pressure hoses on a recovery recycling station?

High Pressure – Red
Low Pressure - Blue

10. Is it possible to connect hoses from the old R12 system onto the newer R134a system?

No

ELEMENT FOUR
Demonstrate knowledge of safe working practices when working on an air conditioning system.

1. When handling refrigerants what protective safety gear would be needed?

Safety gloves, coveralls.
To prevent refrigerant from splashing onto skin.

Safety glasses:
To prevent refrigerant from splashing into eyes

Respirator:
To prevent refrigerant from been inhaled.

2. If refrigerant is splashed into your eyes what steps must be taken?

If refrigerant should contact eyes, seek medical attention immediately. Do not rub eyes. Splash tepid water or saline solution on the eyes to bring the temperature above freezing.

3. Explain why it is important to ensure that there is adequate ventilation when handling refrigerant.

Breathing in high levels of refrigerant will cause the nervous system to slow down and if exposure continues heart failure will occur. Breathing in small amounts will not have any lasting damaging effects. In the event of this type of emergency remove the patient to fresh air and assess their condition. Treat as necessary and send for medical help.

4. What first aid action should be taken if refrigerant is splashed onto skin?

Do not allow refrigerant to come in contact with skin as cold burns will result. To treat cold burn injuries hold the injured area under tepid water for at least 10 minutes. Allow the injury to dry before applying burn cream. Bandage the wound to avoid infection. Advise the patient to exercise the injured area until normal body temperature returns.

5. In the event of a refrigerant spill what action should be taken?

If a small amount of refrigerant is spilt, close the cylinder valve and thoroughly ventilate the area. If the spill is significant, evacuate the area and close the cylinder if possible. Do not return to the area until the area has been fully ventilated.

6. Provide a safety precaution when working on high pressure systems?

Ensure that high pressure hose fittings are secured to specifications as refrigerant may leak

7. What dangers are present when working on a running engine and rotating components?

Ensure adequate ventilation to avoid build-up of carbon monoxide.
Care has to be taken to avoid clothing, jewellery or hair becoming caught in the rotating component.

8. When recovering and storing refrigerant what safety precautions should be taken?

Ensure adequate ventilation. Ensure that no leaks occur. Store recovered refrigerant in a cool area.

9. When testing and repairing a high voltage electrical system on a motor vehicle what precautions should be taken?

Avoid short circuiting any electrical components.

10. What poisonous gas will be produced if refrigerant is exposed to an open flame?

Phosgene

11. What component of refrigerant can lead to ozone depletion?

CFC's