

# PRACTICE EXAM 13: RACM RED SEAL SIMULATION (125 QUESTIONS)

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1. Under WHMIS 2015, a refrigerant cylinder containing R-410A must display a supplier label. Which pictogram is required for a compressed liquefied gas under pressure?
  - A. The flame pictogram indicating flammable gas content
  - B. The skull and crossbones pictogram for acute toxicity
  - C. The gas cylinder pictogram indicating gas under pressure
  - D. The exploding bomb pictogram for self-reactive substances
  
2. CSA B52 requires that a mechanical refrigeration machinery room be equipped with a refrigerant detector. At what condition must the detector activate the alarm and mechanical ventilation?
  - A. At a concentration set at or below the refrigerant's TLV-TWA or its corresponding action level
  - B. Only when the oxygen level in the room falls below nineteen point five percent
  - C. When room temperature exceeds the refrigerant's critical temperature value
  - D. At any detectable trace concentration regardless of the refrigerant type used
  
3. A worker must enter a walk-in cooler that has had a suspected ammonia leak. According to confined-space and refrigerant-safety practice, what is the first required action?
  - A. Enter quickly while holding the breath to locate the leak source
  - B. Test the atmosphere for oxygen and contaminant levels before entry
  - C. Open the door and wait five minutes for the space to clear itself
  - D. Apply soap solution to all joints inside before any atmosphere check
  
4. WHMIS 2015 requires a Safety Data Sheet to be organized into a standardized number of sections. How many sections does a compliant SDS contain?

- A. Eight sections arranged in no particular required order
- B. Twelve sections with the last four being optional content
- C. Ten sections covering only physical hazard information
- D. Sixteen sections in a standardized internationally aligned order

5. When lifting a condensing unit with a sling, the rated capacity of rigging hardware must be respected. What does the "working load limit" stamped on a shackle represent?

- A. The load at which the shackle is guaranteed to fail under testing
- B. The maximum load the shackle may carry in service under normal use
- C. The combined weight of the shackle and the attached lifting sling
- D. The load used only during proof testing at the manufacturer plant

6. A refrigeration technician is exposed to a refrigerant with an assigned ASHRAE safety classification of A1. What does the A1 designation indicate?

- A. Lower toxicity and no flame propagation under test conditions
- B. Higher toxicity with no flame propagation under test conditions
- C. Lower toxicity with high flammability under test conditions
- D. Higher toxicity with high flammability under test conditions

7. Personal protective equipment for brazing must protect against the specific hazards of the task. Which combination is required when brazing copper refrigerant lines?

- A. Hearing protection and a dust mask rated for fine particulate
- B. Cut-resistant gloves and a chemical splash apron only
- C. Eye protection with appropriate shade lenses and heat-resistant gloves
- D. A full body harness and a self-contained breathing apparatus

8. Environment Canada regulations restrict the intentional release of refrigerant. A technician servicing a system must do which of the following with the refrigerant charge?

- A. Vent it slowly to atmosphere when the concentration is below the TLV
- B. Release it only outdoors and only on days with adequate wind dispersal
- C. Discharge it into a floor drain connected to the sanitary sewer system
- D. Recover it into an approved recovery cylinder for reuse or reclaim

9. A data plate on a recovery cylinder shows a "TW" stamp. What does this value represent?

- A. The total working pressure rating of the cylinder in service
- B. The tare weight, the empty weight of the cylinder itself
- C. The test weight applied during the last hydrostatic test
- D. The total weight including a full charge of recovered refrigerant

10. Lockout/tagout procedures on a refrigeration system require verification of the de-energized state. After applying the lock, what is the next required step?

- A. Attempt to start the equipment to confirm the energy is isolated
- B. Begin the repair immediately since the lock confirms isolation
- C. Remove the lock briefly to test whether the breaker truly tripped
- D. Notify dispatch that the equipment is now ready for return to service

11. A compressed gas cylinder must be secured and stored correctly. According to safe-handling practice, how must a cylinder be stored when not in use?

- A. Lying horizontally on a padded surface with the valve facing down
- B. Standing upright but with the protective valve cap removed for access
- C. In direct sunlight to keep the contents at ambient working pressure

D. Upright and secured with the protective valve cap installed

12. Under CSA B52, who is authorized to operate and maintain a refrigeration plant exceeding the regulated power threshold?

A. Any worker on site who has read the equipment operating manual

B. The building owner regardless of trade qualification held

C. A certified operator or technician holding the required credential

D. An apprentice working entirely without any direct supervision

13. A technician finds a damaged manometer with a cracked sight glass during a tool inspection. What is the correct action under tool-safety practice?

A. Remove it from service and tag it until repaired or replaced

B. Continue using it carefully while avoiding the cracked portion

C. Tape over the crack and return the tool to normal service use

D. Use it only for low-pressure readings where cracking is acceptable

14. A brazed joint on a refrigerant line must be made with the correct filler metal. For a copper-to-copper joint, which filler is commonly used without requiring flux?

A. A tin-lead solder alloy applied with an acid-core flux paste

B. A phosphorus-bearing copper alloy such as a BCuP filler rod

C. A pure aluminum filler rod with a corrosive cleaning flux

D. A high-silver brazing alloy that always requires a white flux

15. When charging nitrogen for a pressure test, CSA B52 requires a specific safety device on the nitrogen supply. What device is mandatory?

A. A flow meter to record the exact volume of nitrogen introduced

- B. A check valve to prevent refrigerant migration into the cylinder
- C. A heating element to warm the nitrogen before it enters the line
- D. A pressure regulator with a relief valve to limit downstream pressure

16. During a pressure test on a newly brazed line set, leaks are checked. Which method is appropriate for locating a leak under nitrogen holding pressure?

- A. Apply an open flame near each joint and watch for color change
- B. Listen only, since pressurized nitrogen leaks are always audible
- C. Apply a bubble-forming leak solution to joints and watch for bubbles
- D. Spray water on the joints and observe the surface for any frosting

17. A technician must flow nitrogen through tubing while brazing. What is the primary purpose of this practice?

- A. To prevent the formation of copper oxide scale inside the tubing
- B. To cool the joint rapidly so the filler metal sets more quickly
- C. To increase the internal pressure so the joint seals more tightly
- D. To add moisture to the line that improves the filler metal flow

18. Tubing must be cut and prepared before joining. After cutting copper tube with a tube cutter, what is the required next step?

- A. Braze immediately to avoid any oxidation of the cut surface
- B. Ream the tube end to remove the burr created by the cutter
- C. Flare the tube end regardless of the joint type being used
- D. Apply flux to the outside of the tube along its full length

19. A flare connection is being made on soft copper tubing. What is the correct flare angle specified for refrigeration flare fittings?

- A. A thirty-degree included flare angle measured across the cone
- B. A sixty-degree included flare angle for high-pressure service
- C. A ninety-degree included flare angle for standard fittings
- D. A forty-five-degree included flare angle, the SAE standard

20. When a refrigerant line passes through a building wall, the installation must address the penetration. What does code generally require at the penetration?

- A. The line must be left loose so it can move freely with vibration
- B. The penetration must be sealed and the line protected from abrasion
- C. The line must be cut and rejoined on the far side of the wall
- D. The opening must be left open to allow refrigerant leak ventilation

21. A technician is required to evacuate a system to a specified vacuum level. What does pulling a deep vacuum primarily accomplish?

- A. It charges the system with the correct mass of refrigerant
- B. It increases the system's internal pressure for leak testing
- C. It removes moisture and non-condensables from the system
- D. It adds lubricating oil evenly throughout the refrigerant circuit

22. A micron gauge is used during evacuation. To confirm a system is properly evacuated and tight, what behavior should the micron reading show after the pump is valved off?

- A. The reading should hold stable at or below the target micron level
- B. The reading should climb steadily back toward atmospheric pressure
- C. The reading should drop to zero indicating a perfect vacuum
- D. The reading should oscillate rapidly between high and low values

23. A pipe support must be selected for a horizontal refrigerant line. What is the primary consideration in spacing and selecting supports?

- A. Supports should be spaced as far apart as the tubing will allow
- B. Supports are only needed where the line changes direction sharply
- C. Support spacing is irrelevant for lines smaller than one inch
- D. Supports must carry the weight and prevent sag and stress on joints

24. When isolating dissimilar metals in a piping run, a technician must prevent a specific problem. What problem arises from direct contact of dissimilar metals?

- A. The metals fuse together permanently and cannot be separated
- B. The joint becomes magnetized and attracts metal filings nearby
- C. Galvanic corrosion occurs at the junction of the two metals
- D. The thermal conductivity of both metals drops to near zero

25. A technician selects refrigerant tubing for an installation. Why is ACR-grade copper tubing specified rather than standard plumbing tube?

- A. ACR tube is thinner-walled and therefore cheaper to install
- B. ACR tube is cleaned, dehydrated, and sealed for refrigerant use
- C. ACR tube is colored green to identify it as a water-only line
- D. ACR tube contains an internal coating of soldering flux paste

26. When sizing a suction line, the technician must balance two competing factors. What are these two factors?

- A. Adequate refrigerant velocity for oil return versus pressure drop
- B. The color of the insulation versus the ambient room temperature
- C. The cost of the copper versus the appearance of the finished run

D. The length of the wire versus the gauge of the control cabling

27. A vibration eliminator is installed in a refrigerant line near a compressor. What is its primary function?

- A. To increase the refrigerant flow rate through the suction line
- B. To act as a secondary metering device controlling superheat
- C. To store excess refrigerant during low-load operating periods
- D. To absorb compressor vibration and protect joints from fatigue

28. During system piping, a P-trap is installed at the base of a suction riser. What is the purpose of this trap?

- A. To collect and drain condensate water from the suction line
- B. To ensure oil is carried up the riser back to the compressor
- C. To create a pressure drop that lowers the evaporator temperature
- D. To provide a sampling point for refrigerant purity testing

29. A technician must select an insulation thickness for a suction line. What is the primary purpose of insulating the suction line?

- A. To increase the structural strength of the copper tubing wall
- B. To raise the refrigerant temperature before it reaches the coil
- C. To prevent heat gain and condensation forming on the cold line
- D. To reduce the noise produced by refrigerant flowing in the line

30. When a filter drier is installed in the liquid line, orientation matters. How is a directional filter drier installed?

- A. With the flow arrow pointing in the direction of refrigerant flow

- B. With the flow arrow pointing against the direction of liquid flow
- C. In any orientation since the drier functions in both directions
- D. Vertically only, with the inlet positioned at the bottom port

31. A sight glass with a moisture indicator is used in the liquid line. What does a color change in the indicator typically signal?

- A. That the system refrigerant charge has become fully depleted
- B. That the compressor discharge temperature is above its limit
- C. That the condenser fan motor has failed and stopped turning
- D. That excess moisture is present in the refrigerant circuit

32. A technician torques a flare nut during assembly. Why is using a torque wrench preferred over hand-tightening for flare connections?

- A. To ensure a proper seal without over-stressing and cracking the flare
- B. To make the connection permanent so it can never be opened again
- C. To heat the flare nut enough to form a brazed metallurgical bond
- D. To allow the connection to be tightened without any backup wrench

33. When planning a refrigerant piping layout, the designer consults the manufacturer's line-set length limits. Why are maximum line lengths specified?

- A. Excessive length causes pressure drop and oil-return problems
- B. Longer lines always improve the system's overall efficiency rating
- C. Line length has no effect on a properly charged refrigeration system
- D. Shorter lines require more refrigerant to fill the same circuit

34. A load calculation must be performed before selecting equipment. What is the primary purpose of a cooling load calculation?

- A. To determine the color and finish of the ductwork to be installed
- B. To set the selling price of the completed installation for the client
- C. To size the equipment to match the building's actual heat gain
- D. To decide the number of workers needed to complete the job

35. A technician reviews drawings for a refrigeration installation. On a mechanical drawing, what does a centerline symbol typically indicate?

- A. The boundary edge of the property where work may be performed
- B. The location of an electrical panel feeding the equipment
- C. The required insulation thickness for the adjacent piping run
- D. The axis of symmetry of a component or the center of a pipe run

36. Planning includes selecting the correct refrigerant for an application. Why has R-410A largely replaced R-22 in new equipment?

- A. R-410A operates at much lower pressures than R-22 systems do
- B. R-22 is being phased out due to its ozone-depletion potential
- C. R-410A is a natural refrigerant with zero global-warming impact
- D. R-22 cannot be used in any temperature below the freezing point

37. During planning, a technician determines the required electrical service for a unit. Where is the minimum circuit ampacity found?

- A. On the equipment data plate or nameplate provided by the maker
- B. Estimated by doubling the horsepower rating of the compressor
- C. Determined only after the unit has run for twenty-four hours
- D. Taken from the refrigerant pressure-temperature relationship chart

38. A technician plans the location of a condensing unit outdoors. What is a key clearance consideration for the placement?

- A. The unit must be placed as close to the wall as physically possible
- B. Clearance is unnecessary as long as the unit fits in the space
- C. Adequate clearance is required for airflow and service access
- D. The unit must be enclosed on all sides to protect it from weather

39. When planning a system using a zeotropic refrigerant blend, a key property must be considered. What characteristic distinguishes a zeotropic blend?

- A. It behaves exactly like a single-component pure refrigerant
- B. It exhibits a temperature glide during phase change processes
- C. It cannot be used in any vapor-compression refrigeration system
- D. It must always be charged as a vapor from the cylinder

40. A planner specifies that a zeotropic blend must be charged in a particular phase. How must a zeotropic blend be removed from the cylinder for charging?

- A. As a vapor drawn from the top of the cylinder during operation
- B. By heating the cylinder until the entire contents flash to gas
- C. By inverting the cylinder and venting a portion to atmosphere first
- D. As a liquid to maintain the correct proportion of each component

41. A planning document references the design suction pressure for a medium-temperature application. Why must the technician know the design conditions?

- A. To select the paint color for the exterior cabinet of the unit
- B. To determine the warranty period offered by the equipment maker
- C. To verify components and refrigerant suit the operating range

D. To calculate the property taxes owed on the installed equipment

42. A technician plans the routing of a condensate drain line. What slope is generally required for a gravity condensate drain?

A. A continuous downward slope toward the drain termination point

B. A continuous upward slope away from the evaporator coil pan

C. A perfectly level run with no slope in either direction at all

D. A series of alternating up and down sections along the run

43. When planning to install equipment in a machinery room, CSA B52 sets requirements based on refrigerant quantity. What does the refrigerant charge size primarily determine?

A. The color the machinery room walls must be painted for safety

B. The brand of refrigerant the technician is permitted to use

C. The number of apprentices who must be present during startup

D. The ventilation and safety requirements applied to the room

44. A planner must account for the refrigerant concentration limit in an occupied space. What does the RCL protect against?

A. The risk of the refrigerant freezing inside the evaporator coil

B. Exposure to a hazardous refrigerant concentration if a leak occurs

C. The possibility of the compressor exceeding its discharge pressure

D. The chance that the refrigerant will degrade the copper tubing

45. A technician reviews a wiring diagram during planning. What is the difference between a ladder diagram and a pictorial wiring diagram?

A. A ladder diagram shows actual physical component appearance

- B. A pictorial diagram shows only the control circuit logic flow
- C. A ladder diagram shows the control logic in sequential rungs
- D. There is no functional difference between the two diagram types

46. A planner selects a thermostatic expansion valve for a new coil. What is the primary function the TXV must perform?

- A. To meter refrigerant flow to maintain a constant evaporator superheat
- B. To compress the refrigerant vapor before it enters the condenser
- C. To store excess liquid refrigerant during periods of low load
- D. To remove moisture from the refrigerant as it enters the coil

47. When planning a multi-evaporator system, the designer addresses oil return. Why is oil return a particular concern in such systems?

- A. Oil improves the heat transfer rate and must be maximized in coils
- B. Oil has no effect on system operation and can be ignored entirely
- C. Oil increases the refrigerant's ozone-depletion potential value
- D. Oil can become trapped in evaporators and starve the compressor

48. A planning specification calls for a specific copper tube type by wall thickness. Which designation indicates a heavier wall than Type L?

- A. Type M, which has the thinnest wall of the common types
- B. Type K, which has a heavier wall than Type L copper tube
- C. Type DWV, which is rated only for drain and vent service
- D. Type ACR, which is identical in wall thickness to Type M

49. A technician plans for thermal expansion of long copper runs. What feature accommodates the expansion and contraction of piping?

- A. An expansion loop or offset built into the piping run layout
- B. A rigid clamp at every joint to prevent any movement at all
- C. A reduction in the tube diameter at regular intervals along the run
- D. A complete elimination of all bends and direction changes

50. When planning, a technician must determine the equivalent length of a piping run. Why are fittings converted to equivalent length?

- A. To calculate the painting surface area of the installed piping
- B. To determine the total weight the supports must be rated to carry
- C. To account for the pressure drop that fittings add to the run
- D. To establish the resale value of the copper used in the project

51. A technician installs a condensing unit on a rooftop curb. Before setting the unit, what must be verified about the supporting structure?

- A. That the curb has been painted to match the building exterior
- B. That the curb is taller than the unit it is intended to support
- C. That the roof drain is located directly beneath the curb opening
- D. That the structure can bear the operating weight of the unit

52. During installation, copper lines are brazed with nitrogen flowing through them. If nitrogen is omitted, what defect results inside the tubing?

- A. The tubing wall becomes thicker due to the heat of brazing
- B. A flaky copper-oxide scale forms that can foul system components
- C. The copper changes permanently to a softer annealed condition
- D. The internal diameter of the tube increases beyond specification

53. A technician makes the final electrical connections to a unit. What must be confirmed about the supply voltage before energizing?

- A. That the supply voltage matches the unit's nameplate rating
- B. That the supply voltage is exactly double the nameplate value
- C. That the supply is direct current rather than alternating current
- D. That the voltage is irrelevant as long as the breaker is sized right

54. When installing a TXV, the sensing bulb location is critical. Where is the bulb correctly mounted?

- A. On the liquid line just downstream of the filter drier outlet
- B. On the discharge line between compressor and condenser inlet
- C. On the suction line near the evaporator outlet, clamped tightly
- D. Inside the evaporator coil submerged in the refrigerant flow

55. A technician installs a liquid-line filter drier on a new system. Why is a drier installed during the initial installation?

- A. To meter the refrigerant flow into the evaporator coil precisely
- B. To capture moisture and debris remaining in the system after work
- C. To increase the refrigerant charge required to fill the circuit
- D. To act as a muffler reducing the noise of the compressor running

56. During installation, a technician must support a vertical refrigerant riser. What problem does proper support of a riser prevent?

- A. It prevents the refrigerant from changing state inside the line
- B. It prevents the line from becoming too cold during operation
- C. It prevents heat from transferring into the conditioned space

D. It prevents stress and strain being transferred to brazed joints

57. A technician connects the condensate drain to a trapped fitting at the unit. Why is a trap required on a draw-through unit's drain?

A. To prevent air from being drawn in or out through the drain line

B. To increase the velocity of the condensate leaving the coil pan

C. To filter debris from the condensate before it reaches the drain

D. To raise the temperature of the condensate as it leaves the unit

58. During installation of refrigerant piping, a technician must avoid trapping oil. On a long horizontal suction line, what slope is recommended?

A. A steep upward slope back toward the evaporator coil outlet

B. No slope at all since horizontal lines do not affect oil return

C. A slight slope downward in the direction of refrigerant flow

D. A series of traps installed every few feet along the run length

59. A technician installs an accumulator in the suction line. What does a suction-line accumulator protect against?

A. Excessive subcooling of the liquid before it reaches the valve

B. Liquid refrigerant slugging returning to the compressor inlet

C. Loss of refrigerant charge through a leaking service valve

D. Overheating of the discharge gas leaving the compressor

60. When installing a system, the technician must purge the lines. What gas is used to purge and pressure-test refrigerant lines?

A. Compressed shop air drawn through an oil-removal coalescing filter

- B. Oxygen, because it dries the inside of the tube most effectively
- C. Carbon dioxide drawn from a beverage-grade supply cylinder
- D. Dry nitrogen, which is inert and contains no moisture

61. A technician installs a receiver in a system with a TXV. What is the function of the liquid receiver?

- A. To store liquid refrigerant and accommodate charge variations
- B. To superheat the suction vapor before it enters the compressor
- C. To meter refrigerant precisely into the evaporator distributor
- D. To remove all traces of oil from the circulating refrigerant

62. During installation, a technician routes the suction line and liquid line together. Why are these two lines sometimes taped together?

- A. To make the installation appear neater for the customer's benefit
- B. To prevent the liquid line from vibrating against the building
- C. To subcool the liquid line and superheat the suction line slightly
- D. To reduce the total amount of insulation material required overall

63. A technician installs a service valve on a system. What is the primary purpose of the service valve?

- A. To meter the refrigerant flow rate into the evaporator coil
- B. To automatically regulate the system's high-side pressure
- C. To filter contaminants out of the circulating refrigerant
- D. To allow isolation, gauge connection, and service access

64. When installing electrical controls, a technician wires a contactor. What does the contactor do in a typical condensing unit?

- A. It steps the supply voltage down to a lower control voltage
- B. It switches power to the compressor and fan when energized
- C. It senses refrigerant pressure and displays it on a gauge
- D. It converts the alternating current supply into direct current

65. A technician installs a crankcase heater on a compressor. What is its purpose?

- A. It drives refrigerant out of the oil during the off cycle
- B. It preheats the suction vapor before compression begins
- C. It melts frost that forms on the outdoor condenser coil
- D. It warms the discharge line to prevent condensation forming

66. During installation, refrigerant charging is performed by weight. Why is charging by weight preferred for critically charged systems?

- A. Because weight is easier to estimate than pressure in the field
- B. Because it eliminates any need to evacuate the system first
- C. Because it delivers the exact manufacturer-specified charge mass
- D. Because weight charging works only with flammable refrigerants

67. A technician installs a low-ambient control on an outdoor unit. What problem does this control address?

- A. Excessive head pressure during very hot summer conditions
- B. Compressor overheating caused by high indoor return air temperature
- C. Frost forming on the evaporator coil during high-humidity operation
- D. Low head pressure in cold weather that starves the metering device

68. When installing a heat pump, a reversing valve is wired. What does the reversing valve do?

- A. It reverses the rotation of the compressor motor for defrost
- B. It redirects refrigerant flow to switch between heating and cooling
- C. It reverses the direction of the condenser fan during defrost
- D. It alternates the electrical supply phase to balance the load

69. A technician installs ductwork and must seal the joints. Why is duct sealing important to system performance?

- A. Air leakage reduces delivered airflow and wastes system capacity
- B. Sealing increases the static pressure the fan must overcome
- C. Unsealed ducts improve air mixing and raise comfort levels
- D. Sealing is only required on the return side of the duct system

70. During installation, a technician must set the airflow across an evaporator coil. What happens if airflow across the coil is too low?

- A. The coil capacity increases beyond the rated design value
- B. The compressor discharge pressure drops below normal limits
- C. The coil can frost or freeze and reduce system performance
- D. The refrigerant subcooling increases far above the design point

71. A technician installs a thermostat for a cooling system. Where should the thermostat be mounted for accurate operation?

- A. On an exterior wall directly exposed to outdoor temperature swings
- B. On an interior wall away from drafts, sunlight, and heat sources
- C. Directly above a supply register so it senses conditioned air first
- D. Inside a closet where temperature remains most consistently stable

72. When installing refrigerant lines, a technician must protect them from physical damage. What is required where a line passes through a metal stud?

- A. The line must be left bare so any leak can be detected quickly
- B. The line must be cut and a coupling installed at the stud location
- C. The line must be brazed directly to the stud for secure support
- D. A grommet or sleeve must protect the line from chafing on the metal

73. A technician installs a high-pressure cutout switch. What does this safety control do?

- A. It increases the compressor speed when head pressure rises high
- B. It opens the supply water valve when discharge pressure climbs
- C. It stops the compressor if discharge pressure exceeds a safe limit
- D. It bypasses hot gas to the evaporator to lower the head pressure

74. During installation, the technician installs a sight glass in the liquid line. Where is the sight glass positioned for an accurate charge indication?

- A. In the liquid line, downstream of the receiver and filter drier
- B. In the suction line just ahead of the compressor inlet port
- C. In the discharge line between the compressor and the condenser
- D. In the hot-gas bypass line feeding back to the evaporator coil

75. A technician sets up the defrost controls on a low-temperature evaporator. What is the purpose of a defrost cycle?

- A. To increase the cooling capacity during peak load periods
- B. To circulate oil back to the compressor from the evaporator
- C. To raise the suction pressure during the morning startup

D. To remove frost or ice buildup that insulates the evaporator coil

76. When installing a condensate pump, a technician wires a safety switch. What does the float safety switch do?

A. It shuts off the cooling system if the condensate level rises too high

B. It increases the pump speed when the reservoir is nearly empty

C. It heats the condensate to prevent the drain line from freezing

D. It opens a bypass that drains condensate to the building exterior

77. During commissioning, a technician verifies the evaporator superheat. How is superheat calculated?

A. By subtracting the saturation temperature from the discharge temperature

B. By adding the suction pressure to the discharge pressure value

C. By dividing the condenser temperature by the evaporator temperature

D. By subtracting the saturation temperature from the actual suction line temperature

78. A technician measures subcooling at commissioning. What does adequate subcooling confirm?

A. That liquid refrigerant, not vapor, is reaching the metering device

B. That the suction line is fully insulated along its entire length

C. That the compressor oil level is within the manufacturer range

D. That the condenser fan is rotating in the correct direction

79. When commissioning a system, the technician records operating pressures. Why are pressures converted to saturation temperatures during analysis?

A. Because pressure gauges cannot display values above one hundred psi

B. Because temperature is the only value that the code requires logged

- C. Because comparing saturation temperatures reveals system performance
- D. Because pressure readings are unrelated to the refrigerant condition

80. A technician commissions a system and checks the compressor amperage. What does drawing amperage above the rated load indicate?

- A. That the system is operating at peak efficiency as designed
- B. That the refrigerant charge has been completely lost from the system
- C. That the supply voltage is higher than the nameplate rating allows
- D. That the compressor may be overloaded or experiencing a fault

81. During commissioning, the technician verifies airflow across the indoor coil. What instrument measures the temperature difference across the coil?

- A. A clamp-on ammeter placed around the supply conductor
- B. A pair of thermometers reading the entering and leaving air
- C. A megohmmeter testing the insulation resistance of the motor
- D. A manometer reading the refrigerant pressure at the coil inlet

82. A technician commissions a system using a zeotropic blend and must interpret pressures. Why must the technician account for temperature glide?

- A. Because the saturation temperature differs at the same pressure across the coil
- B. Because the blend behaves as a single pure substance at all points
- C. Because glide eliminates the need to measure superheat at all
- D. Because glide only matters when the system is completely shut off

83. When commissioning, the technician confirms the condensate drain functions. What test verifies proper drainage?

- A. Measuring the electrical resistance of the drain pan heater element
- B. Checking that the refrigerant charge weight matches the data plate
- C. Reading the suction pressure while the drain valve is held closed
- D. Pouring water into the pan and confirming it flows to the drain

84. A technician commissions a heat pump and tests the defrost cycle. What initiates a demand-defrost cycle?

- A. A fixed time clock that energizes defrost every thirty minutes
- B. The indoor thermostat calling for additional heating capacity
- C. Sensors detecting frost conditions based on coil temperature and time
- D. The homeowner manually pressing a defrost button on the wall

85. During commissioning, the technician sets the TXV superheat. What happens if the superheat setting is too low?

- A. Liquid refrigerant may return to the compressor causing damage
- B. The evaporator will operate far above its design temperature
- C. The condenser will reject far less heat than it was designed to
- D. The system will draw substantially less current than rated

86. A technician commissions a system and logs the data. Why is a complete commissioning record important?

- A. It replaces the need for any future maintenance on the system
- B. It documents baseline performance for warranty and future service
- C. It determines the resale price of the building where it is installed
- D. It is required only for systems using natural refrigerants by code

87. When commissioning, a technician checks rotation on a three-phase compressor. What can incorrect rotation cause on a scroll compressor?

- A. Improved efficiency due to the reversed refrigerant flow direction
- B. A slight increase in the cooling capacity beyond the rated value
- C. No effect at all since scroll compressors run in either direction
- D. Reverse rotation that fails to pump and can damage the compressor

88. A technician verifies the operation of a low-pressure control during commissioning. What function does the low-pressure control serve?

- A. It increases the refrigerant charge automatically when pressure drops
- B. It raises the condenser fan speed when suction pressure falls low
- C. It stops the compressor when suction pressure falls below a setpoint
- D. It opens a bypass valve to add hot gas into the suction line

89. During commissioning, the technician must verify proper refrigerant charge. On a TXV system, which method best confirms correct charge?

- A. Measuring liquid-line subcooling against the manufacturer's target
- B. Adding refrigerant until the sight glass is completely full of vapor
- C. Charging until the suction line frosts back to the compressor body
- D. Weighing the technician before and after the charging process

90. A technician commissions a walk-in freezer evaporator. Why must the space be pulled down in stages?

- A. To allow the refrigerant to gradually change to a solid state
- B. To avoid overloading the compressor and to manage moisture removal
- C. To give the customer time to stock the freezer with product

D. To allow the oil in the compressor to reach its boiling point

91. When commissioning, the technician confirms the safety controls reset properly. What type of reset requires manual intervention after a trip?

A. An automatic reset that closes again once conditions normalize

B. A timed reset that re-closes after a fixed delay has elapsed

C. A pressure-actuated reset that responds to system pressure only

D. A manual reset that must be physically pressed to restore operation

92. A technician commissions a system and verifies the metering device feeds evenly. On a multi-circuit coil, what component distributes refrigerant evenly?

A. The accumulator mounted in the suction line near the compressor

B. The receiver positioned in the liquid line after the condenser

C. The refrigerant distributor with equal-length feeder tubes to circuits

D. The crankcase heater wrapped around the compressor shell base

93. During commissioning, a technician records the discharge temperature. Why is monitoring discharge temperature important?

A. Excessively high discharge temperature can break down oil and damage valves

B. Discharge temperature has no relationship to compressor health at all

C. Low discharge temperature always indicates an overcharged system

D. Discharge temperature is measured only on water-cooled systems

94. A technician commissions a system with an electronic expansion valve. How does an EEV differ from a thermostatic expansion valve?

A. An EEV can only be used on ammonia refrigeration systems by code

- B. An EEV requires no superheat control and floods the coil deliberately
- C. An EEV operates purely mechanically with no electrical connection
- D. An EEV uses a controller and stepper motor to meter refrigerant flow

95. When commissioning, the technician confirms head pressure control. Why might a system need head pressure control in cold weather?

- A. To raise suction pressure so the evaporator runs colder than designed
- B. To maintain adequate liquid pressure to feed the metering device properly
- C. To lower the compressor amperage below the nameplate rating value
- D. To increase the temperature glide of the zeotropic refrigerant blend

96. A technician commissions a system and checks for non-condensables. How do non-condensables affect system operation?

- A. They raise the condensing pressure above the value for the refrigerant alone
- B. They improve the heat transfer in the condenser by adding turbulence
- C. They have no measurable effect on the operation of the system
- D. They lower the discharge temperature well below the normal range

97. During commissioning, the technician verifies the thermostat heat anticipator. What does proper anticipator setting prevent?

- A. The refrigerant from freezing solid inside the evaporator coil
- B. The compressor from drawing excessive current at every startup
- C. Wide temperature swings caused by short cycling of the equipment
- D. The condenser fan from operating during the heating season

98. A technician services a system and finds the liquid-line sight glass shows bubbles. What does this most likely indicate?

- A. The system contains far too much oil in the refrigerant circuit
- B. The condenser is rejecting far more heat than its rated capacity
- C. The compressor discharge valve has failed in the open position
- D. The system may be low on charge or have a liquid-line restriction

99. During maintenance, a technician measures high superheat and low suction pressure. What does this symptom combination commonly indicate?

- A. The system is significantly overcharged with refrigerant
- B. The system is undercharged or the metering device is starved
- C. The condenser fan motor is running in the wrong direction
- D. The evaporator airflow is far above the design specification

100. A technician finds high head pressure and high subcooling during service. What is a likely cause?

- A. The metering device is stuck wide open and flooding the coil
- B. The suction line insulation has fallen off in several places
- C. The system is overcharged or the condenser is not rejecting heat
- D. The thermostat heat anticipator is set far too high for the system

101. During service, a technician must recover refrigerant from a system. What rate consideration applies to liquid recovery?

- A. Liquid recovery is faster than vapor recovery for large charges
- B. Liquid recovery is prohibited and only vapor may be recovered
- C. Recovery rate has no effect on the time the job will take

D. Recovery must always be done at a temperature below freezing

102. A technician services a compressor that has burned out. After a burnout, what additional service step is essential?

- A. Replacing only the refrigerant while reusing the original oil charge
- B. Running the system for an hour before changing any components
- C. Installing a suction-line filter drier to clean acidic contaminants
- D. Adding extra oil to the new compressor beyond the nameplate value

103. During service, a technician tests refrigerant for acid. Why is an acid test performed after a compressor failure?

- A. To measure the exact refrigerant charge remaining in the system
- B. To determine the refrigerant's ozone-depletion potential value
- C. To check the color of the refrigerant for identification purposes
- D. To detect contamination that requires additional system cleanup

104. A technician finds an evaporator coil iced over during a service call. What is a common cause of evaporator icing?

- A. The condenser fan is spinning faster than its rated speed setting
- B. Low airflow or low charge dropping the coil below freezing
- C. The thermostat is set several degrees higher than the room needs
- D. The compressor is drawing far more current than its rated load

105. During maintenance, a technician cleans a condenser coil. Why is keeping the condenser coil clean important?

- A. A dirty coil reduces heat rejection and raises head pressure

- B. A dirty coil lowers the head pressure below the safe minimum
- C. A clean coil increases the refrigerant's ozone-depletion potential
- D. Coil cleanliness has no measurable effect on system operation

106. A technician services a system and must check the compressor oil. What does a low oil level in the crankcase indicate?

- A. The system has far too much refrigerant charge in the circuit
- B. The condenser is rejecting heat well above its rated capacity
- C. The evaporator superheat is set far below the design target
- D. Possible oil logging in the system or a refrigerant leak issue

107. During service, a technician replaces a failed run capacitor. What is the function of a run capacitor on a single-phase motor?

- A. It disconnects the motor automatically when it reaches full speed
- B. It steps the supply voltage up to start the motor under load
- C. It improves the motor's running efficiency and power factor
- D. It converts the alternating current into direct current for the motor

108. A technician services a contactor with pitted and burned contacts. What is the correct action?

- A. File the contacts smooth and return the contactor to service
- B. Replace the contactor since burned contacts cause poor connection
- C. Wrap the contacts in tape to prevent further arcing damage
- D. Increase the control voltage to overcome the contact resistance

109. During maintenance, a technician checks a TXV that appears to be hunting. What does hunting refer to?

- A. Continuous oscillation of superheat as the valve over-corrects
- B. The valve remaining permanently stuck in the closed position
- C. The complete loss of the refrigerant charge from the sensing bulb
- D. The valve admitting only vapor and never any liquid refrigerant

110. A technician services a heat pump that is not defrosting properly. What is a likely consequence of failed defrost?

- A. The compressor will run cooler and last much longer in service
- B. The system efficiency will increase during the heating season
- C. The indoor coil will overheat and trip the high-pressure switch
- D. Ice builds on the outdoor coil and heating capacity drops sharply

111. During service, a technician must leak-check a system suspected of losing charge. Which method gives the most precise leak location?

- A. Weighing the recovered refrigerant against the data-plate charge
- B. Observing the sight glass for bubbles during normal operation
- C. Using an electronic leak detector or bubble solution at joints
- D. Listening for the sound of escaping gas from across the room

112. A technician services a system and finds a clogged filter drier. What symptom would a restricted liquid-line drier produce?

- A. A temperature drop and possible frost across the drier body
- B. An increase in the suction pressure above the normal range
- C. A rise in the compressor crankcase oil level over time
- D. A complete loss of the refrigerant charge to the atmosphere

113. During maintenance, a technician measures motor winding resistance. What does an infinite resistance reading on a winding indicate?

- A. A short circuit between the winding and the motor frame ground
- B. An open winding, meaning the circuit is broken internally
- C. A perfectly healthy winding with ideal low resistance value
- D. A partial short between two adjacent turns of the same winding

114. A technician services a walk-in cooler with poor temperature control. The evaporator fans run but the box is warm. What should be checked first?

- A. The exterior paint condition of the condensing unit cabinet
- B. The brand label printed on the side of the compressor shell
- C. The resale value of the refrigerant currently in the system
- D. The refrigerant charge, airflow, and metering device operation

115. During service, a technician documents the work performed. Why is accurate service documentation important?

- A. It eliminates the need for the equipment to ever be serviced again
- B. It sets the property tax assessment for the building it serves
- C. It provides a service history for diagnosis and warranty claims
- D. It is required only for systems charged with natural refrigerants

116. A technician services a system and must adjust a pressure control setpoint. Why must setpoints be set to manufacturer specifications?

- A. To ensure safe operation within the equipment's design limits
- B. To increase the refrigerant's global-warming potential rating
- C. To reduce the number of service visits the warranty will cover

D. To raise the resale value of the installed refrigeration equipment

117. During maintenance, a technician finds short cycling on a compressor. What is a common cause of short cycling?

- A. The condenser coil being slightly cleaner than factory condition
- B. A faulty control, low charge, or an oversized system for the load
- C. The supply voltage being exactly equal to the nameplate value
- D. The refrigerant having a lower ozone-depletion potential rating

118. A technician services a system with a noisy compressor. What internal problem can cause a knocking noise?

- A. The refrigerant having too low a global-warming potential value
- B. The condenser coil being cleaner than the design specification
- C. The thermostat being mounted slightly higher than recommended
- D. Liquid slugging or worn internal compressor components

119. During service, a technician replaces a reversing valve solenoid coil. What does the solenoid coil control?

- A. The speed of the outdoor condenser fan during the defrost cycle
- B. The amount of subcooling produced in the liquid line section
- C. The pilot valve that shifts the reversing valve between modes
- D. The refrigerant charge level held within the liquid receiver

120. A technician must retrofit a system from R-22 to an alternative refrigerant. What must be considered about the existing oil?

- A. The mineral oil may be incompatible with the new refrigerant

- B. The existing oil never needs to be considered in any retrofit
- C. The oil must be removed and the system run completely dry
- D. The oil automatically converts to match the new refrigerant type

121. During maintenance, a technician checks the EEV operation. What component provides the input signal to the EEV controller?

- A. A high-pressure mechanical cutout switch on the discharge line
- B. A manual potentiometer that the technician turns by hand on site
- C. The building's main electrical service disconnect switch position
- D. Pressure and temperature sensors reporting to the controller

122. A technician services a system and finds the suction line frosting back to the compressor. What does this indicate?

- A. The system is operating exactly at its rated design condition
- B. Liquid floodback is occurring, often from low superheat or overcharge
- C. The condenser is rejecting far more heat than its rated value
- D. The discharge temperature has risen far above its safe limit

123. During service, a technician must purge a recovery machine after use. Why is purging the recovery machine important?

- A. To prevent cross-contamination between different refrigerant types
- B. To increase the recovery machine's pumping speed on the next job
- C. To convert the leftover refrigerant into a lower-GWP alternative
- D. To raise the temperature of the recovery cylinder for faster filling

124. A technician services a chilled-water system and checks the flow switch. What does the flow switch protect against?

- A. The chilled water exceeding its maximum allowable supply pressure
- B. The refrigerant charge dropping below the data-plate specification
- C. The evaporator freezing if water flow stops while the compressor runs
- D. The condenser fan running when the outdoor temperature is too low

125. A technician completes a service call and must verify the repair. What is the final step before returning the system to the customer?

- A. Removing all the refrigerant so the system can be recharged fresh
- B. Confirming the system operates within specification and is leak-free
- C. Disconnecting the thermostat so the customer cannot adjust settings
- D. Leaving the access panels off so the next technician saves time

## Practice Exam 13: Answer Key and Explanations

1. C — The gas cylinder pictogram indicates contents held under pressure. R-410A is a compressed liquefied gas, and WHMIS 2015 classifies gases under pressure with this specific pictogram. The flame and other pictograms apply only if the product also meets those hazard criteria, which an A1 refrigerant does not.

2. A — The detector must activate at or below the refrigerant's TLV-TWA or corresponding action level to warn workers before exposure becomes hazardous. CSA B52 ties machinery-room detection to occupational exposure thresholds rather than oxygen depletion alone. Early activation gives time to ventilate and evacuate before concentrations reach dangerous levels.

3. B — Testing the atmosphere for oxygen and contaminants before entry is the first required step in any potential confined-space or leak situation. Ammonia displaces oxygen and is toxic, so entering without verifying the atmosphere risks asphyxiation or poisoning. Atmospheric testing protects the worker before any leak-locating work begins.

4. D — A WHMIS 2015 / GHS-aligned SDS contains sixteen standardized sections in a fixed international order. This consistency lets workers quickly locate hazard, handling, and first-aid

information regardless of supplier. The standardized order is a core feature of the globally harmonized system.

5. B — The working load limit is the maximum load the hardware may safely carry in normal service. It is set well below the failure point by a designed safety factor, so it is not the breaking or proof-test load. Respecting the WLL keeps rigging within its rated safe margin.

6. A — An ASHRAE A1 classification means lower toxicity (Class A) and no flame propagation (Class 1). This combination makes A1 refrigerants the safest category for occupied spaces. The letter denotes toxicity and the numeral denotes flammability.

7. C — Brazing requires eye protection with appropriate shade lenses and heat-resistant gloves to guard against intense light, sparks, and high temperatures. The filler-rod and flux fumes plus radiant heat make these the task-specific hazards. Respiratory and other PPE may supplement but eye and hand protection are essential.

8. D — Environment Canada regulations prohibit venting and require refrigerant to be recovered into an approved cylinder for reuse or reclaim. Intentional release contributes to ozone depletion and climate impact and is illegal. Recovery is the only compliant means of removing a charge during service.

9. B — "TW" stamped on a recovery cylinder is the tare weight, the empty weight of the cylinder. Knowing the tare lets the technician calculate the net refrigerant recovered and avoid overfilling past the 80% safe-fill limit. It is distinct from the cylinder's pressure or test ratings.

10. A — After applying the lock, the next step is to attempt to start the equipment to verify the energy is truly isolated. This "try" step confirms the lockout actually de-energized the circuit before any work begins. Skipping verification risks working on a circuit that is still live.

11. D — Cylinders must be stored upright and secured with the protective valve cap installed. The cap protects the valve from impact damage that could cause sudden, dangerous gas release. Securing prevents the cylinder from falling and shearing the valve.

12. C — CSA B52 requires a certified operator or technician holding the required credential to operate and maintain a plant above the regulated power threshold. This ensures qualified personnel manage

systems with significant safety consequences. The requirement scales with plant size and refrigerant type per the standard and provincial regulation.

13. A — A tool with a cracked sight glass must be removed from service and tagged until repaired or replaced. A damaged pressure instrument can fail under load, giving false readings or injuring the user. Tagging prevents another worker from unknowingly using the defective tool.

14. B — A phosphorus-bearing copper alloy (BCuP) is self-fluxing on copper-to-copper joints because the phosphorus acts as a deoxidizer. No separate flux is needed for copper-to-copper, which simplifies the joint and avoids flux residue. Flux is required only when joining copper to dissimilar metals such as brass.

15. D — A pressure regulator with a relief valve is mandatory on the nitrogen supply to limit downstream pressure. Full cylinder pressure can exceed the tubing's burst rating and cause a violent rupture. The regulator and relief together cap the test pressure at a safe value.

16. C — Applying a bubble-forming leak solution and watching for bubbles reliably locates leaks under nitrogen holding pressure. The escaping gas forms visible bubbles at the leak point. Open flame is unsafe and water alone does not pinpoint leaks.

17. A — Flowing nitrogen during brazing prevents copper-oxide scale from forming inside the tubing. Without an inert purge, the heated copper oxidizes and sheds flakes that foul TXVs, driers, and valves. The nitrogen displaces oxygen so no scale forms.

18. B — After cutting copper tube, the end must be reamed to remove the burr left by the cutter. An unremoved burr restricts flow and can shed into the system. Reaming restores the full inside diameter before joining.

19. D — Refrigeration flare fittings use a forty-five-degree included flare angle, the SAE standard. Matching the flaring tool and fitting to this angle ensures a leak-tight metal-to-metal seal. A mismatched angle will leak under pressure.

20. B — Code requires the wall penetration to be sealed and the line protected from abrasion. Sealing maintains the building envelope and the protection prevents the tube from wearing through against the rough opening. Both vibration chafing and air or pest intrusion are addressed.

21. C — Pulling a deep vacuum removes moisture and non-condensable gases from the system. Moisture forms acids and ice at the metering device, while non-condensables raise head pressure. Evacuation is verified with a micron gauge before charging.

22. A — A properly evacuated and tight system holds the micron reading stable at or below the target after the pump is valved off. A steady rise indicates a leak or remaining moisture still boiling off. Holding the vacuum confirms the system is dry and sealed.

23. D — Pipe supports must carry the line's weight and prevent sag that places stress on brazed joints. Sagging concentrates load at the joints and can crack them over time. Proper spacing distributes the weight and keeps the run aligned.

24. C — Direct contact of dissimilar metals causes galvanic corrosion at the junction. The electrochemical difference drives metal loss at the more active metal in the presence of moisture. Isolation with a dielectric fitting prevents the reaction.

25. B — ACR-grade copper is cleaned, dehydrated, and sealed at the factory specifically for refrigerant service. Plumbing tube is not internally clean and would introduce contaminants and moisture. The sealed ends keep the inside dry until installation.

26. A — Suction-line sizing balances adequate refrigerant velocity for oil return against acceptable pressure drop. Too large and velocity falls so oil stalls; too small and pressure drop hurts capacity. The correct size satisfies both requirements.

27. D — A vibration eliminator absorbs compressor vibration and protects brazed joints from fatigue failure. Repeated vibration would otherwise work-harden and crack the copper at the joints. It isolates the rigid piping from the compressor's motion.

28. B — A P-trap at the base of a suction riser ensures oil is carried up the riser back to the compressor. The trap collects oil so refrigerant velocity can lift it up the vertical run in slugs. Without it, oil can pool and starve the compressor.

29. C — Suction-line insulation prevents heat gain into the cold refrigerant and stops condensation forming on the line surface. Heat gain raises suction superheat and reduces capacity, and dripping condensate can damage surroundings. Insulation maintains performance and prevents water problems.

30. A — A directional filter drier is installed with the flow arrow pointing in the direction of refrigerant flow. This orients the internal filtration and desiccant correctly so contaminants are captured. Reversed installation defeats the drier's function.

31. D — A color change in the moisture indicator signals excess moisture in the refrigerant circuit. The indicator chemistry shifts color when water content exceeds a safe level. This warns the technician to replace the drier and address the moisture source.

32. A — A torque wrench ensures a proper seal without over-stressing and cracking the flare. Over-tightening splits the soft copper flare while under-tightening leaks. Torquing to spec achieves a reliable, serviceable connection.

33. A — Maximum line-set lengths are specified because excessive length causes pressure drop and oil-return problems. Long runs increase friction losses and make it harder to return oil to the compressor. Staying within limits preserves capacity and lubrication.

34. C — A cooling load calculation sizes the equipment to match the building's actual heat gain. Oversized equipment short cycles and dehumidifies poorly; undersized equipment cannot maintain conditions. The load calculation is the basis for correct selection.

35. D — A centerline symbol indicates the axis of symmetry of a component or the center of a pipe run. It is a reference line for dimensioning and alignment on mechanical drawings. It does not denote property lines or electrical features.

36. B — R-22 is being phased out because of its ozone-depletion potential under international agreements. R-410A, with no chlorine, replaced it in new equipment despite operating at higher pressures. Regulation, not pressure or temperature limits, drove the change.

37. A — The minimum circuit ampacity is found on the equipment data plate or nameplate. The manufacturer calculates it from the connected loads and lists it for proper conductor and breaker sizing. It is not estimated from horsepower or pressure data.

38. C — Adequate clearance is required around an outdoor condensing unit for airflow and service access. Restricted airflow recirculates hot discharge air and raises head pressure, and tight quarters prevent service. Manufacturer clearance specs must be met.

39. B — A zeotropic blend exhibits temperature glide during phase change. Its components evaporate and condense over a range of temperatures at a constant pressure rather than a single point. This glide must be accounted for when calculating superheat and subcooling.

40. D — A zeotropic blend must be removed from the cylinder as a liquid to maintain the correct proportion of each component. Drawing vapor would preferentially remove the more volatile component and fractionate the charge. Liquid charging keeps the blend composition correct.

41. C — Knowing the design conditions lets the technician verify components and refrigerant suit the operating range. Matching the equipment to the intended suction and head pressures ensures reliable operation. Mismatched components fail prematurely or perform poorly.

42. A — A gravity condensate drain requires a continuous downward slope toward the termination. The slope lets condensate flow out by gravity without pooling in the line. Level or back-sloped runs trap water and overflow the pan.

43. D — The refrigerant charge size primarily determines the ventilation and safety requirements applied to the machinery room under CSA B52. Larger charges raise the potential leak concentration, triggering stricter ventilation, detection, and egress rules. The standard scales requirements to the quantity present.

44. B — The refrigerant concentration limit (RCL) protects against exposure to a hazardous concentration if a leak occurs in an occupied space. It caps the allowable charge relative to room volume so a full release stays below dangerous levels. It is a life-safety, not a mechanical, limit.

45. C — A ladder diagram shows control logic in sequential rungs, while a pictorial diagram shows physical component appearance and layout. The ladder format clarifies the sequence of operation for troubleshooting. The two serve different purposes and are not interchangeable.

46. A — A TXV meters refrigerant flow to maintain a constant evaporator superheat. It modulates flow in response to the sensing bulb so the coil is fed correctly across load changes. It does not compress, store, or dry refrigerant.

47. D — Oil return is a concern in multi-evaporator systems because oil can become trapped in evaporators and starve the compressor. Proper line design and velocity are needed to carry oil back from each coil. Lost oil leads to compressor lubrication failure.

48. B — Type K copper has a heavier wall than Type L. The common types from thickest to thinnest wall are K, L, then M. Heavier wall types suit higher-pressure or more demanding service.

49. A — An expansion loop or offset built into the run accommodates thermal expansion and contraction of long copper piping. The loop flexes to absorb length changes without stressing joints or supports. Rigid clamping everywhere would instead concentrate that stress.

50. C — Fittings are converted to equivalent length to account for the pressure drop they add to the run. Each elbow or valve resists flow like an added length of straight pipe. Including equivalent length gives an accurate total pressure-drop calculation for sizing.

51. D — Before setting a rooftop unit, the supporting structure must be verified to bear the operating weight of the unit. Operating weight includes the charge, water, and dynamic loads, which can exceed the dry weight. Structural confirmation prevents curb or roof failure.

52. B — Omitting the nitrogen purge during brazing lets a flaky copper-oxide scale form inside the tubing. The scale breaks loose and fouls metering devices, driers, and valves downstream. Flowing nitrogen displaces oxygen so no scale forms.

53. A — Before energizing, the supply voltage must be confirmed to match the unit's nameplate rating. Operating on the wrong voltage damages motors and controls and voids warranty. The nameplate states the required supply for safe operation.

54. C — The TXV sensing bulb is correctly mounted on the suction line near the evaporator outlet, clamped tightly for good thermal contact. This location lets the bulb sense the superheat of the leaving vapor and modulate the valve accordingly. Poor contact or wrong placement gives false superheat readings.

55. B — A liquid-line filter drier is installed to capture moisture and debris remaining in the system after installation work. Brazing and assembly leave particulate and the drier desiccant absorbs residual moisture. This protects the metering device and prevents acid formation.

56. D — Proper support of a vertical riser prevents stress and strain from being transferred to brazed joints. The weight of the standing line would otherwise load the joints and crack them over time. Support carries the load independently of the joints.

57. A — A trap on a draw-through unit's condensate drain prevents air from being drawn in or out through the drain. The negative pressure at the drain pan would otherwise hold water in the pan or pull air through. The trap allows condensate to drain while sealing against airflow.

58. C — A long horizontal suction line should slope slightly downward in the direction of refrigerant flow. This helps carry oil along with the refrigerant toward the compressor. A reverse slope would let oil pool away from the compressor.

59. B — A suction-line accumulator protects against liquid refrigerant slugging returning to the compressor inlet. It traps liquid and meters it back as vapor along with oil at a controlled rate. This prevents the damage that liquid slugs cause to compressor valves.

60. D — Dry nitrogen is used to purge and pressure-test refrigerant lines because it is inert and contains no moisture. Oxygen is dangerous with oil and shop air carries moisture. Nitrogen's dryness and inertness make it the correct choice.

61. A — A liquid receiver stores liquid refrigerant and accommodates charge variations between operating conditions. It provides a reservoir so the metering device always has a solid column of liquid. This is essential in TXV systems with changing load.

62. C — Taping the suction and liquid lines together subcools the liquid line while slightly superheating the suction line. The warm liquid line gives up heat to the cold suction line, improving liquid subcooling. This heat exchange improves system efficiency.

63. D — A service valve allows isolation, gauge connection, and service access to the system. It lets the technician read pressures, isolate sections, and charge or recover without opening the sealed circuit. It is a service point, not a metering or filtering device.

64. B — A contactor switches power to the compressor and fan when energized. The control circuit energizes the contactor coil, closing its contacts to feed line voltage to the loads. It is an electrically operated power switch, not a transformer.

65. A — A crankcase heater drives refrigerant out of the oil during the off cycle. It keeps the oil warm so refrigerant does not migrate and condense into the crankcase, which would cause foaming and poor lubrication at startup. This protects the compressor on start.

66. C — Charging by weight is preferred for critically charged systems because it delivers the exact manufacturer-specified charge mass. Small systems with TXVs and short line sets are sensitive to charge, and weight is the precise method. Pressure methods are less accurate for these systems.

67. D — A low-ambient control addresses low head pressure in cold weather that starves the metering device. When the condenser overcools, liquid pressure falls and the TXV cannot feed the coil properly. The control maintains head pressure by limiting condenser airflow.

68. B — A reversing valve redirects refrigerant flow to switch a heat pump between heating and cooling. It changes which coil acts as condenser and which as evaporator. The compressor and fans continue running in their normal directions.

69. A — Air leakage from unsealed ducts reduces delivered airflow and wastes system capacity. Conditioned air escaping into unconditioned spaces never reaches the rooms it should serve. Sealing keeps the designed airflow and capacity in the duct system.

70. C — If airflow across the evaporator coil is too low, the coil can frost or freeze and reduce system performance. Insufficient heat reaching the coil drops its temperature below freezing, building ice that blocks airflow further. The result is loss of capacity and possible floodback.

71. B — A thermostat should be mounted on an interior wall away from drafts, sunlight, and heat sources. These influences would give a false reading of the room temperature and cause poor control. A representative location lets it sense true space conditions.

72. D — Where a line passes through a metal stud, a grommet or sleeve must protect the line from chafing on the metal. Vibration would otherwise wear the tube against the sharp edge until it leaks. The protective sleeve prevents abrasion at the contact point.

73. C — A high-pressure cutout stops the compressor if discharge pressure exceeds a safe limit. Runaway head pressure from a blocked condenser or overcharge could rupture components, so the switch interrupts the circuit. It is a protective safety control.

74. A — A sight glass for charge indication is positioned in the liquid line, downstream of the receiver and filter drier. There it shows whether a solid column of liquid is reaching the metering device. Bubbles at that point indicate low charge or a restriction.

75. D — A defrost cycle removes frost or ice buildup that insulates the evaporator coil. Frost blocks airflow and heat transfer, reducing capacity, so periodic defrost restores the coil. It does not add capacity or return oil.

76. A — A float safety switch shuts off the cooling system if the condensate level rises too high. Detecting a blocked or failed drain prevents water overflow and property damage. It interrupts cooling until the condensate level is corrected.

77. D — Superheat is calculated by subtracting the saturation temperature from the actual suction-line temperature. The saturation temperature comes from converting the measured suction pressure, and the difference is the degrees of superheat. It confirms vapor leaving the coil is fully boiled off.

78. A — Adequate subcooling confirms that liquid refrigerant, not vapor, is reaching the metering device. Subcooling is the degrees the liquid is below its saturation temperature, proving a solid liquid column. This ensures the metering device feeds liquid as designed.

79. C — Pressures are converted to saturation temperatures because comparing saturation temperatures reveals system performance. Saturation temperatures relate directly to coil conditions and let the technician compute superheat and subcooling. This is more meaningful than raw pressure for diagnosis.

80. D — Amperage above the rated load indicates the compressor may be overloaded or experiencing a fault. High current can stem from high head pressure, mechanical binding, or voltage problems. It signals the technician to investigate before damage occurs.

81. B — A pair of thermometers reading entering and leaving air measures the temperature difference across the coil. This temperature split, with airflow, indicates coil performance. The other instruments measure electrical or pressure values, not air temperature.

82. A — Temperature glide must be accounted for because the saturation temperature differs at the same pressure across the coil with a zeotropic blend. Using the wrong dew or bubble point produces incorrect superheat and subcooling values. Glide-aware readings give accurate commissioning data.

83. D — Pouring water into the pan and confirming it flows to the drain verifies proper condensate drainage. This directly tests the slope, trap, and clear path of the drain line. A blocked or back-sloped drain reveals itself immediately.

84. C — A demand-defrost cycle is initiated by sensors detecting frost conditions from coil temperature and time. Unlike a fixed time clock, demand defrost runs only when frost actually accumulates, improving efficiency. It defrosts based on real conditions rather than a schedule.

85. A — If the TXV superheat setting is too low, liquid refrigerant may return to the compressor and cause damage. Low superheat means the coil is overfed and not all liquid boils off before the suction line. Liquid reaching the compressor leads to slugging and valve damage.

86. B — A complete commissioning record documents baseline performance for warranty and future service. Recorded pressures, temperatures, and amperages give a reference for diagnosing later changes. It is the system's performance benchmark, not a substitute for maintenance.

87. D — Incorrect rotation on a three-phase scroll compressor causes reverse rotation that fails to pump and can damage the compressor. Scrolls only compress in one direction, so reversed phasing produces no pumping and rising noise. Phase rotation must be corrected immediately.

88. C — A low-pressure control stops the compressor when suction pressure falls below a setpoint. This protects against running on a lost charge or a closed valve, which would risk overheating or freezing. It interrupts the circuit until pressure recovers.

89. A — On a TXV system, measuring liquid-line subcooling against the manufacturer's target best confirms correct charge. The TXV controls superheat, so subcooling becomes the reliable charge indicator. Matching the target subcooling confirms the proper liquid charge.

90. B — A walk-in freezer must be pulled down in stages to avoid overloading the compressor and to manage moisture removal. Rapid pulldown draws excessive current and can cause condensation and coil icing. Staged pulldown keeps the compressor within its limits.

91. D — A manual-reset control must be physically pressed to restore operation after a trip. This forces a technician to investigate the fault before the system can restart, unlike an automatic reset. It is used where repeated tripping signals a serious condition.

92. C — A refrigerant distributor with equal-length feeder tubes distributes refrigerant evenly to the circuits of a multi-circuit coil. Equal tube lengths balance the flow so each circuit receives the same charge. Uneven feeding would leave some circuits starved.

93. A — Monitoring discharge temperature matters because excessively high discharge temperature can break down oil and damage valves. Overheated oil loses lubricity and carbonizes, and hot valves fail. Discharge temperature is a key indicator of compressor health.

94. D — An EEV differs from a TXV in that it uses a controller and stepper motor to meter refrigerant flow. Electronic sensing and control give finer, faster superheat regulation than the mechanical TXV. It still controls superheat, just by electronic means.

95. B — Head pressure control is needed in cold weather to maintain adequate liquid pressure to feed the metering device properly. Cold condensing temperatures lower head pressure until the TXV can no longer feed the coil. The control holds pressure high enough for normal operation.

96. A — Non-condensables raise the condensing pressure above the value for the refrigerant alone. The trapped gases occupy condenser volume and add their partial pressure, elevating head pressure and discharge temperature. This reduces efficiency and signals the need for evacuation.

97. C — A properly set heat anticipator prevents wide temperature swings caused by short cycling of the equipment. It adds a small heat to the thermostat to open the contacts slightly early, smoothing the cycle. Correct setting matches the system current draw.

98. D — Bubbles in the liquid-line sight glass most likely indicate the system is low on charge or has a liquid-line restriction. Either condition produces flash gas where a solid liquid column should be. The bubbles signal the metering device is not receiving full liquid.

99. B — High superheat with low suction pressure commonly indicates the system is undercharged or the metering device is starved. Too little refrigerant reaching the coil leaves it underfed, raising superheat while suction pressure stays low. The coil is not getting the flow it needs.

100. C — High head pressure with high subcooling points to an overcharged system or a condenser not rejecting heat. Excess liquid backs up in the condenser, raising both subcooling and head pressure. A dirty coil or failed fan produces the same signature.

101. A — Liquid recovery is faster than vapor recovery for large charges. Pulling liquid moves far more mass per unit time than drawing slow vapor. Technicians use liquid recovery first, then switch to vapor to finish the system.

102. C — After a compressor burnout, installing a suction-line filter drier to clean acidic contaminants is essential. The burnout releases acid and debris into the system that would damage the replacement compressor. The suction drier captures these contaminants during cleanup.

103. D — An acid test after a compressor failure detects contamination that requires additional system cleanup. Acid from a burnout attacks windings and metal surfaces, so a positive test directs further drier changes and flushing. It guides the cleanup, not charge or identification.

104. B — Evaporator icing commonly results from low airflow or low charge dropping the coil below freezing. Either condition starves the coil of heat so its surface falls below 32°F and frost accumulates. The ice then further blocks airflow, worsening the problem.

105. A — A dirty condenser coil reduces heat rejection and raises head pressure. Insulating dirt blocks heat transfer, forcing the refrigerant to condense at a higher pressure and temperature. This lowers efficiency and stresses the compressor.

106. D — Low crankcase oil indicates possible oil logging in the system or a refrigerant leak issue. Oil can be trapped in the evaporator or lines instead of returning, or escape with a leak. Either way the compressor loses lubrication and must be addressed.

107. C — A run capacitor improves the running efficiency and power factor of a single-phase motor. It stays in the circuit during operation, shifting phase to the start winding to improve torque and current draw. It is not a start switch or rectifier.

108. B — A contactor with pitted and burned contacts should be replaced, since burned contacts cause poor electrical connection. The resistance and arcing at damaged contacts lead to voltage drop, heat, and eventual failure. Filing is a temporary fix that does not restore reliability.

109. A — TXV hunting refers to continuous oscillation of superheat as the valve over-corrects. The valve overshoots feeding and starving the coil repeatedly, swinging the superheat up and down. Bulb placement, charge, or valve sizing are common causes.

110. D — Failed defrost lets ice build on the outdoor coil so heating capacity drops sharply. The ice insulates the coil and blocks airflow, crippling heat absorption in heating mode. Restoring defrost is necessary to recover capacity.

111. C — Using an electronic leak detector or bubble solution at joints gives the most precise leak location. These methods pinpoint the exact leaking fitting, unlike charge weighing or sight-glass observation which only confirm a loss exists. Direct detection finds the source.

112. A — A restricted liquid-line filter drier produces a temperature drop and possible frost across the drier body. The restriction acts like a metering point, causing a pressure and temperature drop that can frost the outlet. This local cooling flags the clogged drier.

113. B — An infinite resistance reading on a motor winding indicates an open winding, meaning the internal circuit is broken. No current can pass through a broken conductor, giving an infinite ohm reading. This is distinct from a short, which reads low resistance.

114. D — When evaporator fans run but a walk-in cooler stays warm, the refrigerant charge, airflow, and metering device operation should be checked first. These directly affect the cooling delivered to the box. The non-technical options have no bearing on performance.

115. C — Accurate service documentation provides a service history for diagnosis and warranty claims. Recorded readings and work let the next technician trace changes and support warranty coverage. It is a diagnostic and contractual record.

116. A — Pressure-control setpoints must follow manufacturer specifications to ensure safe operation within the equipment's design limits. The factory sets protective cutouts to match the system's safe operating envelope. Altering them risks unsafe operation or nuisance trips.

117. B — Short cycling commonly results from a faulty control, low charge, or an oversized system for the load. Each causes the compressor to start and stop too frequently, whether from premature cutout, pressure swings, or rapid satisfaction of the load. Frequent cycling stresses the compressor.

118. D — A knocking noise from a compressor can be caused by liquid slugging or worn internal components. Liquid entering the cylinders cannot compress and hammers the valves, while worn bearings or rods knock mechanically. Both are serious internal conditions.

119. C — A reversing valve solenoid coil controls the pilot valve that shifts the reversing valve between modes. The coil moves a small pilot that uses system pressure to slide the main valve. It does not directly handle the full refrigerant flow.

120. A — In an R-22 retrofit, the mineral oil may be incompatible with the new refrigerant. Many alternatives require POE oil for proper miscibility and oil return, so the mineral oil must be changed out. Leaving incompatible oil causes lubrication and return failures.

121. D — Pressure and temperature sensors reporting to the controller provide the input signal to an EEV. The controller calculates superheat from these inputs and drives the stepper motor to position the valve. This replaces the mechanical bulb and spring of a TXV.

122. B — A suction line frosting back to the compressor indicates liquid floodback, often from low superheat or overcharge. Liquid carrying past the coil chills the suction line below freezing and threatens the compressor. The condition must be corrected to prevent slugging damage.

123. A — Purging the recovery machine after use prevents cross-contamination between different refrigerant types. Residual refrigerant left in the machine would mix with the next job's recovered charge, ruining its purity. Purging clears the machine for the next refrigerant.

124. C — A chilled-water flow switch protects against the evaporator freezing if water flow stops while the compressor runs. Without flow, the stagnant water in the cooler freezes and ruptures tubes. The switch stops the compressor when flow is lost.

125. B — The final step before returning a system to the customer is confirming it operates within specification and is leak-free. Verifying performance and integrity ensures the repair is complete and reliable. The other options would leave the system unsafe or unfinished.