

PRACTICE EXAM 14: RACM RED SEAL SIMULATION (125 QUESTIONS)

1. A technician measures a suction pressure that corresponds to a saturation temperature of $-5\text{ }^{\circ}\text{C}$, but the suction line temperature at the compressor reads $7\text{ }^{\circ}\text{C}$. What does this $12\text{ }^{\circ}\text{C}$ difference represent?
 - A. Superheat in the suction line
 - B. Subcooling at the condenser outlet
 - C. The total system pressure drop
 - D. The compression ratio of the system

2. Under Canadian environmental regulations, which action is required before opening a refrigerant circuit for service on a comfort-cooling system?
 - A. Vent the charge slowly to atmosphere over several minutes
 - B. Top up the system with nitrogen and release it
 - C. Bleed the high side only into the room
 - D. Recover the refrigerant into an approved recovery cylinder

3. A scroll compressor draws locked-rotor amperage and trips on overload immediately at start-up. Which condition is the most likely cause?
 - A. A seized compressor or shorted motor winding
 - B. A slightly low refrigerant charge
 - C. A dirty condenser coil
 - D. An oversized liquid line filter-drier

4. When silver-brazing copper-to-copper refrigeration tubing, why is dry nitrogen purged through the line during the process?

- A. To increase the joint temperature faster
- B. To pressure-test the joint while brazing
- C. To prevent the formation of copper-oxide scale inside the tube
- D. To cool the joint immediately after heating

5. A TXV (thermostatic expansion valve) is hunting, causing erratic superheat. Which is the most probable cause?

- A. An improperly mounted or poorly insulated sensing bulb
- B. An oversized condenser
- C. A restricted discharge muffler
- D. Excessive subcooling in the liquid line

6. What is the primary purpose of an accumulator located in the suction line of a heat pump?

- A. To prevent liquid refrigerant slugging from reaching the compressor
- B. To increase refrigerant subcooling before the metering device
- C. To filter acid from the refrigerant during a burnout
- D. To meter refrigerant flow into the evaporator

7. A psychrometric chart is being used to find the dew point of supply air. Which two properties, when known, allow every other property to be located?

- A. Enthalpy and specific volume only
- B. Dry-bulb temperature and total pressure only
- C. Relative humidity and specific volume only
- D. Any two independent properties, such as dry-bulb and wet-bulb temperature

8. During an electrical check, a single-phase PSC motor runs but is noticeably weak and overheats. The run capacitor tests far below its rated microfarad value. What should the technician do?

- A. Replace the run capacitor with one of the correct rating
- B. Add refrigerant to reduce the load
- C. Increase the supply voltage to the motor
- D. Bypass the capacitor and run the motor on start winding alone

9. On an R-410A system, why must service gauges and hoses rated for that refrigerant be used?

- A. R-410A requires oxygen-compatible fittings
- B. R-410A operates at substantially higher pressures than R-22
- C. R-410A is flammable and needs sealed hoses
- D. R-410A reacts with standard brass fittings

10. A water-cooled condenser shows a rising condensing temperature and approach over several weeks. What is the most likely cause?

- A. Refrigerant overcharge
- B. Scale or fouling build-up on the water-side tubes
- C. A faulty high-pressure switch
- D. Air trapped in the cooling tower basin

11. Which control component senses temperature and directly modulates refrigerant flow to maintain a set evaporator superheat?

- A. Solenoid valve
- B. Evaporator pressure regulator
- C. Thermostatic expansion valve

D. Crankcase pressure regulator

12. A reciprocating compressor has a high volumetric-efficiency loss. Worn or leaking discharge valves would most directly cause which symptom?

- A. Low oil level only
- B. Excessive subcooling
- C. Reduced capacity with high discharge temperature
- D. Increased suction superheat at the evaporator inlet

13. What is the function of a hot-gas defrost system on a low-temperature commercial evaporator?

- A. To divert discharge gas to the evaporator to melt frost quickly
- B. To raise the suction pressure before shutdown
- C. To subcool the liquid line during defrost
- D. To bypass the compressor during off cycles

14. A technician finds an open circuit across a normally-closed klixon (bimetal overload) on a compressor that has cooled down. This indicates:

- A. The overload is functioning normally
- B. The supply voltage is too high
- C. The start relay has failed
- D. The overload has failed open and must be replaced

15. During leak detection on an HFC system, which method offers the highest sensitivity for pinpointing a small leak?

- A. An electronic halogen leak detector

- B. A soap-bubble solution alone
- C. Listening for a hiss
- D. Watching for oil staining only

16. The compression ratio of a system is defined as:

- A. Absolute discharge pressure divided by absolute suction pressure
- B. Gauge discharge pressure divided by gauge suction pressure
- C. Suction temperature divided by discharge temperature
- D. Condenser area divided by evaporator area

17. A pressure-temperature relationship holds true only when the refrigerant in a vessel is:

- A. Fully superheated vapour
- B. A saturated mixture of liquid and vapour
- C. Highly subcooled liquid
- D. Above its critical temperature

18. Which refrigerant property change indicates non-condensables (air) are present in the condenser?

- A. Lower-than-normal head pressure for the condensing temperature
- B. Higher-than-normal head pressure for the measured condensing temperature
- C. Reduced subcooling with normal head pressure
- D. Lower superheat at the evaporator

19. A technician must size a relief valve for a refrigerant pressure vessel. Which standard primarily governs this requirement in Canada?

- A. WHMIS 2015

- B. The National Building Code only
- C. CSA B52 Mechanical Refrigeration Code
- D. NFPA 70

20. When recovering refrigerant into a recovery cylinder, the cylinder must not be filled beyond what fraction of its capacity to allow for liquid expansion?

- A. 95%
- B. 90%
- C. 85%
- D. 80%

21. A capillary-tube system is critically charged. The most reliable method to verify the correct charge is:

- A. Charging to a fixed head pressure
- B. Weighing in the exact manufacturer-specified charge
- C. Adding refrigerant until frost clears the suction line
- D. Charging until the sight glass is clear

22. Which gas law explains why refrigerant vapour temperature rises as it is compressed at constant entropy?

- A. Compression work raises internal energy, increasing temperature
- B. Boyle's law alone at constant temperature
- C. Dalton's law of partial pressures
- D. The refrigerant absorbing heat from the evaporator

23. An air-cooled condenser fan motor fails on a hot day. What is the immediate effect on system operation?

- A. Suction pressure drops sharply
- B. Head pressure rises and may trip the high-pressure control
- C. The metering device freezes open
- D. The compressor oil pressure increases

24. A three-phase compressor motor runs backward after a service disconnect was replaced. The corrective action is to:

- A. Replace the compressor
- B. Add a start capacitor
- C. Increase the breaker size
- D. Swap any two of the three line conductors

25. What is the role of subcooling the liquid refrigerant before it reaches the metering device?

- A. It prevents flash gas in the liquid line and improves capacity
- B. It increases superheat at the compressor
- C. It reduces the condensing pressure directly
- D. It eliminates the need for a receiver

26. A duct system shows high static pressure and low airflow. Which is the most likely cause at the air-handler?

- A. An oversized blower wheel
- B. Too many open supply registers
- C. A clogged filter or dirty evaporator coil
- D. Excessive return-air openings

27. When charging an R-410A system, why is it charged as a liquid (from an inverted cylinder, throttled) rather than as a vapour?

- A. R-410A vapour is toxic
- B. R-410A is a near-azeotropic blend that fractionates if charged as vapour
- C. Liquid charging is faster only
- D. The cylinder pressure is too low for vapour charging

28. A technician measures 0 V across a closed contactor coil that should be energized. The thermostat is calling for cooling. The next logical check is:

- A. Replace the compressor
- B. Recover the refrigerant charge
- C. Trace the low-voltage control circuit for an open safety or transformer fault
- D. Replace the condenser fan motor

29. In a flooded chiller, the refrigerant level is maintained so that the:

- A. Compressor is fully submerged in refrigerant
- B. Condenser tubes are flooded with liquid
- C. Evaporator tubes are submerged in boiling refrigerant
- D. Receiver remains completely empty

30. Which lubricant is required for use with HFC refrigerants such as R-134a and R-410A?

- A. Mineral oil
- B. Alkylbenzene oil
- C. Naphthenic oil
- D. Polyolester (POE) synthetic oil

31. A low-pressure control is set to cut out at 50 kPa and cut in at 200 kPa. The difference between these settings is called the:

- A. Range
- B. Set point
- C. Differential
- D. Deadband offset

32. During a pump-down cycle, the compressor is used to:

- A. Add refrigerant to the evaporator before shutdown
- B. Evacuate refrigerant from the low side into the receiver/condenser
- C. Increase suction pressure before stopping
- D. Bypass the metering device

33. What does a high superheat combined with low suction pressure typically indicate?

- A. Compressor overcharge
- B. A flooded evaporator
- C. Excessive condenser airflow
- D. An underfeeding metering device or low charge/restriction

34. A brazed plate heat exchanger in a chiller is being selected. Its main advantage over a shell-and-tube design is:

- A. Lower cost of cleaning chemicals
- B. Tolerance of dirty fluids without filtration
- C. High heat-transfer efficiency in a compact footprint

D. No need for refrigerant charge control

35. Per safe practice, before working inside an electrical panel a technician must:

A. Lock out and tag out the disconnect, then verify zero energy

B. Wear cotton gloves only

C. Leave the panel energized to test components live

D. Disconnect the thermostat wires first

36. A TXV with an external equalizer is required when:

A. The evaporator has a significant pressure drop across its circuits

B. The condenser is air-cooled

C. The system uses a capillary tube

D. The compressor is hermetic

37. Which instrument directly measures the moisture content remaining in a system during evacuation?

A. A compound gauge

B. A clamp-on ammeter

C. An infrared thermometer

D. A micron (vacuum) gauge

38. A deep vacuum of 500 microns is achieved but rises and stabilizes at 5000 microns after isolating the pump. This rise-and-hold indicates:

A. A perfect vacuum with no issues

B. The vacuum pump is too large

C. Moisture or non-condensables still present in the system

D. The system is fully charged

39. The primary reason for installing a liquid-line filter-drier is to:

A. Remove moisture and trap particulate contaminants

B. Increase liquid-line pressure

C. Meter refrigerant to the evaporator

D. Subcool the liquid charge

40. A centrifugal compressor experiences surge. This condition is best described as:

A. Excessive oil foaming

B. Liquid floodback to the suction

C. Normal start-up behaviour

D. Flow reversal due to insufficient flow against high head

41. In a 208 V three-phase system, the line-to-line voltage between two phases is correct, but one phase reads near 0 V to the others. This indicates:

A. Correct balanced operation

B. A high-voltage condition

C. A single-phasing or open-phase condition

D. A grounded neutral only

42. What is the function of a crankcase pressure regulator (CPR)?

A. To raise evaporator pressure during defrost

B. To regulate condenser fan speed

C. To control head pressure in winter

D. To limit suction pressure to the compressor and protect the motor on start-up

43. A heat-pump reversing valve fails to shift from cooling to heating. With 24 V confirmed at the solenoid coil, the most likely remaining cause is:

A. A tripped high-pressure switch

B. An open thermostat

C. A blown low-voltage fuse

D. A stuck valve slide due to low pressure differential or debris

44. Refrigerant 134a has replaced R-12 largely because R-134a:

A. Has zero ozone-depletion potential

B. Operates at much lower pressures

C. Is compatible with mineral oil

D. Has a higher ozone-depletion potential

45. A clamp-on ammeter reads 18 A on a motor with an FLA (full-load amps) rating of 12 A and an SFA of 14 A. This indicates:

A. Normal operation within service factor

B. The motor is overloaded and drawing excessive current

C. The motor is lightly loaded

D. A faulty ammeter reading only

46. Which device prevents short-cycling of a compressor by enforcing a minimum off-time?

A. A liquid-line solenoid

B. A suction accumulator

- C. A discharge check valve
- D. An anti-short-cycle timer

47. When testing a hermetic compressor for a grounded winding, an ohmmeter is connected between:

- A. A motor terminal and the compressor shell/ground
- B. The two run capacitor terminals
- C. The high and low service ports
- D. The line and load of the contactor

48. The superheat method of charging is most appropriate for systems using:

- A. A flooded evaporator
- B. A receiver and king valve
- C. A pump-down circuit
- D. A fixed-orifice (piston or capillary) metering device

49. A cooling tower's approach is the difference between:

- A. Entering and leaving water temperatures
- B. Leaving water temperature and entering wet-bulb air temperature
- C. Wet-bulb and dry-bulb air temperatures
- D. Condensing and suction temperatures

50. Why is it important to slope horizontal suction lines slightly toward the compressor in some designs, or to install traps?

- A. To increase refrigerant velocity to dangerous levels
- B. To prevent any vapour return

- C. To ensure oil return to the compressor
- D. To reduce the refrigerant charge required

51. A digital manifold shows a discharge saturation temperature 20 °C above ambient on an air-cooled unit, when 10–15 °C is typical. This suggests:

- A. Low refrigerant charge
- B. An oversized evaporator
- C. Overcharge, dirty condenser, or non-condensables
- D. A faulty suction service valve

52. Which refrigerant-handling certification is legally required in Canada to purchase and handle controlled refrigerants?

- A. A provincial driver's licence
- B. WHMIS supplier label training only
- C. A municipal trade permit
- D. An ODS/refrigerant-handling (e.g., environmental) certification

53. A blower motor on an ECM (electronically commutated motor) air handler maintains constant airflow despite a dirtier filter by:

- A. Reducing speed to save energy
- B. Running only on high speed at all times
- C. Switching to a PSC mode automatically
- D. Increasing torque/RPM to hold the programmed CFM

54. The latent heat of vaporization of a refrigerant is the heat required to:

- A. Raise the temperature of the liquid by one degree
- B. Change saturated liquid to saturated vapour at constant temperature
- C. Superheat the vapour above saturation
- D. Subcool the liquid below saturation

55. A TXV-equipped system has correct superheat but very low subcooling and bubbles in the sight glass. The most probable cause is:

- A. A refrigerant undercharge
- B. An overcharge of refrigerant
- C. A restricted suction line
- D. An oversized condenser fan

56. When silver-brazing a copper-to-brass joint in a refrigeration system, why is flux required when it is not needed for copper-to-copper joints made with a BCuP alloy?

- A. Flux prevents oxidation on the dissimilar brass surface and promotes proper filler wetting
- B. Flux lowers the melting point of the copper tube so the joint forms at a cooler temperature
- C. Flux removes refrigerant oil residue left inside the brass fitting before any heat is applied
- D. Flux adds extra phosphorus to the joint so the brass can self-flux like plain copper does

57. What is the purpose of nitrogen pressure-testing a newly brazed system before evacuation?

- A. To charge the system with refrigerant
- B. To remove moisture from the lines
- C. To verify joint integrity and locate leaks safely
- D. To lubricate the compressor

58. A heat pump in heating mode shows frost building heavily on the outdoor coil and never defrosting. A likely cause is:

- A. The indoor blower is oversized
- B. The reversing valve is stuck in heating
- C. A failed defrost control or sensor
- D. An overcharge of refrigerant only

59. Sensible heat added to air will:

- A. Raise its dry-bulb temperature without changing its moisture content
- B. Increase its moisture content at constant temperature
- C. Lower its dew point directly
- D. Condense water out of the air

60. A solenoid valve installed backward (against the flow arrow) will most likely:

- A. Operate normally in both directions
- B. Increase system efficiency
- C. Act as a metering device
- D. Fail to seat properly or not open/close correctly

61. The most accurate way to confirm a compressor is pumping to capacity is to:

- A. Measure the shell temperature only
- B. Perform a closed-loop pump-down/blank-off test comparing achievable pressures
- C. Listen for noise
- D. Measure the line voltage

62. Which factor most directly increases a building's sensible cooling load?

- A. Number of occupants showering
- B. Latent moisture from cooking
- C. Solar gain through windows and conduction through walls
- D. Humidity infiltration only

63. An oil-pressure safety control on a compressor measures:

- A. Discharge pressure only
- B. The net oil pressure (oil pump output minus crankcase pressure)
- C. Suction pressure alone
- D. Condenser water pressure

64. When a system is contaminated after a hermetic motor burnout, the recommended cleanup includes:

- A. Installing a suction-line acid-removing filter-drier and monitoring acid levels
- B. Adding extra refrigerant only
- C. Leaving the old oil in place
- D. Running the system continuously to "burn off" the acid

65. Total heat (enthalpy) of air is the sum of:

- A. Sensible heat and latent heat
- B. Dry-bulb and wet-bulb temperature
- C. Static and velocity pressure
- D. Superheat and subcooling

66. A variable-frequency drive (VFD) controls a motor's speed by varying the:

- A. Resistance in the rotor circuit
- B. Frequency and voltage supplied to the motor
- C. Number of motor poles physically
- D. Capacitor value continuously

67. Which scenario would most likely cause TXV bulb charge loss and result in the valve closing/starving the evaporator?

- A. A slightly dirty air filter
- B. A cracked or leaking sensing-bulb capillary
- C. An oversized condenser
- D. High ambient temperature only

68. The "ton of refrigeration" is defined as the heat absorbed to melt:

- A. 1 kg of ice in 1 hour
- B. 1 tonne of ice in one day at any rate
- C. 2000 lb (1 short ton) of ice at 0 °C in 24 hours
- D. 1000 lb of water at 4 °C

69. When a compressor's discharge valve leaks, a service technician performing a blank-off (dead-head) test would observe:

- A. The compressor pulls a deep vacuum quickly and holds
- B. The compressor cannot pull down or hold the expected vacuum
- C. No effect on suction pressure
- D. An immediate rise in oil pressure

70. Which refrigerant line is normally the largest in diameter on a typical system?

- A. The liquid line
- B. The equalizer line
- C. The discharge line
- D. The suction line

71. A high condenser approach with normal water flow on a water-cooled unit most likely indicates:

- A. Low refrigerant charge
- B. An oversized compressor
- C. Excess subcooling
- D. Fouled condenser tubes reducing heat transfer

72. Static pressure in an air-distribution system is best described as:

- A. The outward pressure exerted against duct walls
- B. The pressure due to air velocity only
- C. The total of velocity pressure minus friction
- D. Atmospheric pressure at the register

73. When evacuating a system, a triple evacuation involves:

- A. Three separate vacuum pumps in series
- B. Evacuating, breaking the vacuum with dry nitrogen, and repeating to dilute moisture
- C. Charging three times the normal amount
- D. Running the compressor three times

74. What is the main reason for installing an inverted P-trap (riser loop) at the evaporator outlet on some installations?

- A. To prevent liquid refrigerant from draining back into the evaporator during the off cycle
- B. To increase the system charge
- C. To reduce noise from the metering device
- D. To act as a secondary metering device

75. An evaporator showing partial frosting (frost on inlet, dry/warm at outlet) with high superheat typically indicates:

- A. An overcharged system
- B. Excessive condenser fouling
- C. A flooded evaporator
- D. Insufficient refrigerant feed (low charge or restriction)

76. The purpose of a head-pressure control on a system operating in low ambient conditions is to:

- A. Lower the suction pressure intentionally
- B. Increase the evaporator airflow
- C. Reduce the compressor oil level
- D. Maintain adequate condensing pressure for proper TXV operation

77. A digital scale used for charging should be:

- A. Calibrated and zeroed with the empty hose weight accounted for
- B. Used only with vapour charging
- C. Replaced after every job
- D. Set to ounces only regardless of spec

78. Which of the following best describes a near-azeotropic refrigerant blend's temperature glide?

- A. It has no temperature change during phase change
- B. It boils at a single fixed temperature like a pure refrigerant
- C. It increases ozone depletion
- D. It changes saturation temperature slightly as it evaporates/condenses at constant pressure

79. A defrost termination thermostat on a heat pump's outdoor coil functions to:

- A. Start defrost based on time only
- B. End the defrost cycle when the coil reaches a set temperature
- C. Reverse the compressor rotation
- D. Open the high-pressure switch

80. When sizing copper tubing for a long liquid line with significant vertical lift, the technician must account for:

- A. Pressure drop and the static head that can cause flash gas
- B. Only the horizontal run length
- C. The colour of the insulation
- D. The discharge muffler size

81. A megohmmeter (insulation tester) applied to a compressor motor reads a very low resistance to ground. This indicates:

- A. A healthy motor with good insulation
- B. An open run winding
- C. A normal start capacitor
- D. Deteriorated winding insulation or a ground fault

82. The most effective control strategy to prevent humidity problems while cooling in a humid climate is to:

- A. Increase airflow across the coil dramatically
- B. Maintain an evaporator coil temperature low enough to dehumidify while not short-cycling
- C. Oversize the compressor significantly
- D. Disable the condensate drain

83. In a properly operating TXV system, increasing the spring tension on the valve (adjusting the superheat screw clockwise) will generally:

- A. Decrease superheat
- B. Increase superheat
- C. Have no effect on superheat
- D. Flood the compressor immediately

84. Which condition would cause a compressor to experience liquid floodback?

- A. A severe refrigerant undercharge
- B. Excessive superheat at the evaporator
- C. A failed/stuck-open TXV or very low evaporator load with overfeed
- D. A blocked liquid-line drier

85. The function of an oil separator installed in the discharge line is to:

- A. Filter refrigerant entering the evaporator
- B. Return oil carried by discharge gas back to the compressor crankcase
- C. Subcool the liquid refrigerant
- D. Meter refrigerant flow

86. When two pressure readings are taken on a blend with glide, the dew-point and bubble-point values are used to calculate:

- A. The compression ratio
- B. Superheat (from dew point) and subcooling (from bubble point)
- C. The condenser approach
- D. The static pressure

87. A capacitor-start, capacitor-run (CSCR) motor that hums and fails to start, then trips, most likely has:

- A. A normal run winding only
- B. An oversized condenser
- C. A failed start capacitor or start relay/potential relay
- D. Excess refrigerant charge

88. Which CSA standard specifically addresses the safe installation and operation of mechanical refrigeration systems in Canada?

- A. CSA C22.1 (Canadian Electrical Code)
- B. CSA B52 (Mechanical Refrigeration Code)
- C. CSA W47.1
- D. CSA Z462

89. A heat-recovery system on a refrigeration rack captures:

- A. Suction-line cooling for free air conditioning
- B. Reject heat from the discharge gas for water or space heating
- C. Latent heat from the evaporator only
- D. Subcooling from the receiver

90. A flat-rate diagnosis shows a TXV stuck open. The symptom set most consistent with this is:

- A. High superheat and low suction pressure
- B. Normal superheat and high subcooling
- C. Low superheat, high suction pressure, possible floodback
- D. High head pressure with high subcooling only

91. The wet-bulb temperature of air is always:

- A. Equal to or lower than the dry-bulb temperature
- B. Higher than the dry-bulb temperature
- C. Equal to the dew point at all conditions
- D. Independent of humidity

92. A condensate drain on a high-efficiency system is trapped to:

- A. Prevent air bypass and ensure proper drainage under negative pressure
- B. Increase the cooling capacity
- C. Filter the condensate water
- D. Raise the evaporator temperature

93. When a single-phase motor's centrifugal start switch fails to open at running speed, the result is:

- A. The motor will not start at all
- B. The start winding stays energized and may burn out
- C. The motor runs at double speed
- D. No effect on operation

94. The most accurate description of "false loading" a compressor during low-load testing is:

- A. Adding refrigerant to the crankcase
- B. Removing the discharge valve plate
- C. Introducing hot gas to maintain a minimum suction pressure/load
- D. Increasing condenser fan speed

95. A pressure-enthalpy (Mollier) diagram plots the refrigeration cycle to show:

- A. Only the electrical consumption
- B. Air properties at various states
- C. Heat content at each point of the cycle and component effects
- D. The duct static pressure profile

96. A water-source heat pump rejecting heat to a closed loop shows rising loop temperatures and high head pressure across all units. The likely system cause is:

- A. One unit's TXV failure
- B. A single dirty air filter
- C. A low refrigerant charge in one unit
- D. A loop fluid-cooler or circulation problem

97. What does a "subcooled" liquid line indicate at the condenser outlet?

- A. The refrigerant is a saturated mixture
- B. The refrigerant is superheated vapour
- C. The liquid is cooler than its saturation temperature for the measured pressure
- D. The refrigerant is above its critical point

98. When charging by superheat on a fixed-orifice system, the target superheat is determined using:

- A. The discharge pressure alone
- B. The liquid-line temperature only
- C. The outdoor dry-bulb and indoor wet-bulb (charging chart)
- D. The compressor amperage

99. A burned set of contactor contacts that are pitted and welded will most likely cause:

- A. The compressor to short-cycle off only
- B. Improved conductivity
- C. Reduced current draw
- D. The compressor to remain energized or chatter with voltage drop

100. The primary safety hazard when brazing near a charged or partially charged system is:

- A. Phosgene and toxic decomposition gases from refrigerant exposed to flame
- B. Excessive subcooling
- C. Loss of superheat
- D. Low oil pressure

101. A capacity-control unloader on a reciprocating compressor reduces capacity by:

- A. Holding suction valves open on selected cylinders
- B. Closing the discharge service valve
- C. Reducing condenser airflow
- D. Adding refrigerant to the crankcase

102. A psychrometric process moving up and to the left on the chart represents:

- A. Sensible heating only
- B. Cooling and dehumidification
- C. Humidification at constant temperature
- D. Sensible cooling without moisture change

103. Which is the correct sequence when commissioning a new split system?

- A. Charge first, then leak test, then evacuate
- B. Evacuate, then charge, then pressure test
- C. Pressure-test with nitrogen, evacuate to deep vacuum, then charge
- D. Charge with refrigerant during the vacuum

104. An expansion valve's maximum operating pressure (MOP) charge limits:

- A. The minimum suction pressure
- B. The condenser pressure directly
- C. The maximum evaporator pressure to protect the compressor motor on pull-down
- D. The liquid-line subcooling

105. A scroll compressor must never be operated:

- A. With a suction accumulator installed
- B. In a heat-pump application
- C. With POE oil
- D. In reverse rotation (which can occur on three-phase miswiring)

106. Air entrained in a chilled-water loop is best removed by:

- A. Increasing pump speed
- B. An automatic air vent at the system high point
- C. Lowering the loop temperature
- D. Adding glycol

107. Where should the TXV sensing bulb be mounted on a horizontal suction line to ensure accurate superheat control?

- A. Inside the evaporator coil header where the refrigerant first begins to fully vaporize
- B. On the bottom of the suction line so it reads the temperature of the returning oil film
- C. Downstream of the suction accumulator where the vapour temperature has fully stabilized
- D. On the top or side of the line, firmly clamped and insulated, away from any oil pooling

108. Which reading confirms a refrigerant restriction, such as a partially plugged filter-drier, in the liquid line of an operating system?

- A. A temperature drop and possible frost at the restriction, with high subcooling backing up upstream
- B. A uniform temperature across the drier body, with the system running at its normal design conditions
- C. A high suction pressure at the compressor, with the evaporator coil flooding and the line sweating
- D. A low head pressure at the condenser, with high suction pressure and the metering device wide open

109. The main reason POE oil must be kept sealed and handled quickly is that it:

- A. Is flammable at room temperature
- B. Reacts with copper tubing
- C. Evaporates rapidly
- D. Is highly hygroscopic and absorbs atmospheric moisture readily

110. An economizer on a rooftop unit improves efficiency by:

- A. Increasing compressor speed
- B. Using outdoor air for free cooling when conditions allow
- C. Lowering the refrigerant charge
- D. Bypassing the evaporator coil

111. A megohmmeter test should NOT be performed:

- A. On a de-energized motor
- B. With the motor isolated from the circuit
- C. After locking out the supply
- D. While the compressor is energized and running

112. Which best explains why a flooded evaporator gives better heat transfer than a dry-expansion coil?

- A. The entire tube surface is wetted with boiling liquid refrigerant
- B. It uses less refrigerant charge
- C. It operates without a compressor
- D. It superheats the vapour more

113. The function of a check valve in a heat-pump refrigerant circuit is to:

- A. Meter refrigerant to the evaporator
- B. Regulate crankcase pressure
- C. Separate oil from discharge gas
- D. Direct refrigerant flow through the appropriate metering device for each mode

114. During a brazing operation, signs of overheating a copper joint include:

- A. The filler metal flowing too slowly
- B. No colour change at all
- C. A bright shiny finish only
- D. A dull, blackened, or oxidized surface and scaling

115. When measuring three-phase voltage imbalance, the maximum acceptable percentage for safe motor operation is generally:

- A. 10%
- B. 5% with no concern
- C. 2% or less to avoid excessive winding heating
- D. Any imbalance is acceptable

116. The cut-in pressure of a low-pressure control should be set:

- A. Below the cut-out pressure
- B. Equal to the cut-out pressure
- C. Above the cut-out pressure by the differential amount
- D. At atmospheric pressure

117. A refrigerant with a high temperature glide should be charged and have its leaks repaired by:

- A. Topping off with vapour as needed
- B. Recovering, evacuating, and recharging with virgin blend to maintain composition
- C. Adding only the lightest component
- D. Mixing two different blends

118. A condensing unit located in direct sun with restricted airflow clearance will most likely experience:

- A. Reduced head pressure
- B. Improved efficiency
- C. Lower discharge temperature
- D. Elevated head pressure and reduced capacity

119. The purpose of a liquid-line sight glass with a moisture indicator is to:

- A. Measure superheat
- B. Indicate compressor oil level
- C. Show refrigerant flow condition and moisture presence (colour change)
- D. Regulate refrigerant flow

120. A properly designed suction line riser in a system with capacity control may require a double riser to:

- A. Maintain oil return at both full and reduced load conditions
- B. Reduce the refrigerant charge
- C. Increase head pressure
- D. Eliminate the need for an accumulator

121. When a TXV system has the correct charge but low capacity and the evaporator is starved despite adequate subcooling, suspect:

- A. An overcharge of refrigerant
- B. A flooded condenser
- C. A TXV restriction, plugged inlet screen, or undersized valve

D. Excessive condenser airflow

122. The latent heat of fusion relates to a substance changing between:

- A. Liquid and vapour states
- B. Solid and liquid states
- C. Vapour and superheated vapour
- D. Two gases mixing

123. A compressor that runs continuously and never satisfies the thermostat in a properly sized system most likely has:

- A. An oversized condenser
- B. Too much refrigerant charge only
- C. Low capacity from valve, charge, or load problems
- D. A faulty defrost timer only

124. Which action is correct when a refrigerant cylinder's pressure reads higher than the saturation pressure for its temperature?

- A. Continue charging normally
- B. Heat the cylinder to raise pressure
- C. Assume the gauge is faulty
- D. Suspect contamination/non-condensables and verify before use

125. A technician finds the indoor coil icing up with low airflow and low suction pressure. After confirming the charge is correct, the most likely remaining cause is:

- A. Overcharge of refrigerant

- B. Restricted airflow (dirty filter/coil or blower fault) lowering coil temperature
- C. A faulty high-pressure switch
- D. An oversized condenser fan

Practice Exam 14: Answer Key and Explanations

1. A — Superheat is sensible heat added to vapour above its saturation temperature. The $-5\text{ }^{\circ}\text{C}$ saturation versus $7\text{ }^{\circ}\text{C}$ actual line temperature gives $12\text{ }^{\circ}\text{C}$ of superheat, confirming the refrigerant is fully vaporized before the compressor. Adequate suction superheat protects the compressor from liquid floodback.
2. D — Canadian environmental regulations prohibit venting controlled refrigerants to atmosphere; they must be captured in an approved recovery cylinder. Refrigerants are potent greenhouse and ozone-depleting substances, so recovery is both a legal and environmental requirement before any circuit is opened.
3. A — Locked-rotor amps with immediate overload trip means the rotor cannot turn, pointing to a mechanically seized compressor or a shorted/grounded winding. A low charge or dirty coil affects capacity gradually, not instantaneous locked-rotor current. This distinguishes a mechanical/electrical failure from a performance issue.
4. C — Flowing dry nitrogen displaces oxygen so the heated copper cannot oxidize internally. Without it, cupric-oxide scale forms inside the tube, later breaking loose to plug metering devices and screens. Clean internal joints are essential to long-term system reliability.
5. A — A loosely mounted or uninsulated TXV bulb senses fluctuating, inaccurate temperatures, causing the valve to overcorrect and hunt. Proper bulb contact and insulation give a stable signal. Hunting wastes capacity and stresses the compressor with swinging superheat.
6. A — A suction accumulator traps liquid refrigerant and meters it back as vapour, protecting the compressor from slugging. Heat pumps reverse flow seasonally and are prone to floodback, making the accumulator critical for compressor longevity.
7. D — On a psychrometric chart, fixing any two independent properties locates the air's state point, from which all others are read. Dry-bulb and wet-bulb are the most common field pair. This lets a technician find dew point, humidity, and enthalpy from simple measurements.

8. A — A run capacitor that tests well below its rated microfarads cannot provide the proper phase shift, weakening torque and overheating the windings. Replacing it with the correct μF and voltage rating restores normal operation and prevents motor burnout.
9. B — R-410A operates at roughly 50–70% higher pressures than R-22, so only gauges, hoses, and fittings rated for those pressures are safe. Using underrated equipment risks rupture and injury. Pressure rating, not chemical reactivity, is the governing concern.
10. B — A gradual rise in condensing temperature and approach over weeks signals scale or fouling insulating the water-side tubes. Fouling reduces heat transfer, forcing higher head pressure. Regular tube cleaning or water treatment restores condenser performance.
11. C — The thermostatic expansion valve senses suction-line temperature via its bulb and modulates refrigerant flow to hold a target evaporator superheat. This active feedback distinguishes it from fixed devices and on/off solenoids, optimizing evaporator loading.
12. C — Leaking discharge valves let compressed gas re-expand into the cylinder, reducing pumped volume and raising discharge temperature as the same gas is recompressed. The result is lost capacity with abnormally high discharge heat.
13. A — Hot-gas defrost routes hot discharge gas directly into the frosted evaporator to melt ice quickly from the inside. It is faster and more energy-efficient than electric defrost for low-temperature commercial coils, minimizing case temperature rise.
14. D — A normally-closed bimetal overload should read continuity once cooled; an open reading means the contacts no longer close and the device has failed. It must be replaced because a failed-open overload prevents the compressor from running.
15. A — An electronic halogen leak detector offers the highest sensitivity for pinpointing small HFC leaks, detecting trace concentrations a bubble test or hiss would miss. It allows precise location of the leak before repair, reducing repeat callbacks.

16. A — Compression ratio is absolute discharge pressure divided by absolute suction pressure, using absolute (not gauge) values. Working in absolute pressure is essential because gauge values would distort the ratio, which indicates compressor loading and efficiency.

17. B — The pressure-temperature relationship is valid only for a saturated liquid-vapour mixture, where pressure fixes the saturation temperature. Once fully superheated or subcooled, pressure and temperature vary independently, so P-T charts no longer apply.

18. B — Non-condensable air occupies condenser volume and adds its partial pressure, raising head pressure above what the condensing temperature alone would produce. This excess head pressure for a given temperature is the classic indicator of air in the system.

19. C — CSA B52, the Mechanical Refrigeration Code, governs pressure-relief and safety requirements for refrigeration vessels in Canada. It defines relief-device sizing and placement to protect against overpressure, making it the controlling standard here.

20. D — Recovery cylinders must not be filled beyond 80% of capacity, leaving room for liquid expansion as temperature rises. Overfilling risks hydrostatic rupture, a serious safety hazard, so the 80% rule is strictly enforced.

21. B — A critically charged capillary-tube system has no receiver to buffer charge, so the only reliable method is weighing in the exact manufacturer charge. Sight-glass or frost methods are unreliable here because small charge errors greatly affect performance.

22. A — During isentropic compression, the work input raises the vapour's internal energy and therefore its temperature, with no heat added from outside. This is why discharge gas leaves the compressor hot, a direct consequence of compression work.

23. B — A failed condenser fan eliminates condenser heat rejection, so head pressure climbs rapidly and may trip the high-pressure control. On a hot day this happens quickly, protecting the system from dangerous overpressure.

24. D — A three-phase motor reverses rotation when phase sequence changes; swapping any two of the three line conductors restores correct direction. No component replacement is needed—only conductor sequence correction.

25. A — Subcooling ensures the liquid reaching the metering device is below saturation, preventing premature flash gas in the liquid line. Solid liquid feed improves evaporator capacity and metering-device performance, raising overall efficiency.

26. C — High static pressure with low airflow at the air-handler points to a restriction such as a clogged filter or dirty evaporator coil. The blower works against added resistance, reducing CFM. Cleaning the restriction restores design airflow.

27. B — R-410A is a near-azeotropic blend whose components can fractionate; charging vapour from the cylinder would draw off the lighter component and shift composition. Liquid charging (inverted, throttled) keeps the blend ratio correct.

28. C — Zero volts across a coil that should be energized means the control circuit is open upstream—a tripped safety, bad transformer, or broken low-voltage wire. Tracing the 24 V circuit isolates the fault before any component is condemned.

29. C — In a flooded chiller the evaporator tubes are submerged in boiling refrigerant, maximizing wetted surface and heat transfer. A controlled liquid level keeps tubes covered, which is the defining feature of the flooded design.

30. D — HFC refrigerants require polyolester (POE) synthetic oil because mineral oil is immiscible with HFCs and will not return to the compressor. POE circulates properly with R-134a and R-410A, ensuring lubrication.

31. C — The difference between cut-out and cut-in pressures is the differential. It sets how far pressure must recover before the control re-closes, preventing rapid short-cycling of the compressor.

32. B — During pump-down the compressor evacuates refrigerant from the low side and stores it in the receiver/condenser before shutdown. This isolates the charge, preventing migration and floodback at the next start.

33. D — High superheat with low suction pressure means the evaporator is being underfed—a low charge, restriction, or starving metering device. The refrigerant boils off too early, leaving excess superheat and depressed suction pressure.

34. C — Brazed plate heat exchangers offer very high heat-transfer efficiency in a compact, lightweight package compared with shell-and-tube units. Their tight passages demand clean fluids but deliver excellent performance per unit volume.

35. A — Lockout/tagout of the disconnect followed by verifying zero energy is the mandatory first step before opening an electrical panel. This confirmed de-energization protects the technician from electrocution and arc-flash hazards.

36. A — An external equalizer is required when evaporator pressure drop is significant, so the TXV senses true outlet pressure rather than inlet. Without it the valve over-feeds, distorting superheat control across the coil circuits.

37. D — A micron (vacuum) gauge measures the absolute pressure during evacuation, indirectly indicating remaining moisture and non-condensables. A compound gauge is far too coarse to confirm a deep, dry vacuum.

38. C — A vacuum that rises and holds at a higher level after isolating the pump indicates moisture boiling off or non-condensables outgassing inside the system. A continuous rise would mean a leak; rise-and-stabilize means trapped contaminants.

39. A — The liquid-line filter-drier removes moisture with desiccant and traps particulates with its filter media. This protects the metering device from plugging and prevents acid formation, safeguarding the whole system.

40. D — Centrifugal surge is a momentary flow reversal when insufficient gas flow cannot sustain the head the impeller develops. It causes noise, vibration, and damage, and is corrected by maintaining adequate load/flow.

41. C — One phase reading near zero while the others are correct indicates a single-phasing or open-phase condition. Running a three-phase motor single-phased overheats windings rapidly, so it must be corrected before operation.

42. D — A crankcase pressure regulator limits suction pressure entering the compressor, protecting the motor from overload during high-load pull-down after start-up. It throttles until suction drops to a safe level.

43. D — With 24 V confirmed at the coil, the electrical side is good, so a reversing valve that won't shift is mechanically stuck—often from low pressure differential or debris in the slide. The valve, not the control circuit, is at fault.

44. A — R-134a replaced R-12 mainly because it has zero ozone-depletion potential, satisfying environmental phase-out requirements. The chlorine-free molecule does not attack stratospheric ozone, unlike the CFC it replaced.

45. B — Drawing 18 A against a 12 A FLA and 14 A SFA means the motor exceeds even its service-factor limit and is overloaded. Sustained overcurrent overheats windings, so the cause of excess load must be found.

46. D — An anti-short-cycle timer enforces a minimum off-time, preventing the compressor from restarting against high head pressure too soon. This protects the motor and contacts from damaging rapid cycling.

47. A — A ground (insulation) test is made between a motor terminal and the compressor shell/ground; low resistance there reveals a winding-to-ground fault. This is distinct from a winding-continuity test between terminals.

48. D — The superheat charging method suits fixed-orifice systems (piston or capillary) because charge directly affects evaporator superheat. With no TXV to compensate, superheat is the reliable charging indicator using a charging chart.

49. B — Cooling-tower approach is the difference between leaving water temperature and the entering air wet-bulb temperature. It reflects how closely the tower performs to its theoretical limit; a rising approach signals reduced tower effectiveness.

50. C — Sloping suction lines and properly placed traps ensure oil entrained in the refrigerant returns to the compressor. Without adequate velocity and design, oil logs in the evaporator and the compressor loses lubrication.

51. C — A discharge saturation 20 °C above ambient (versus the normal 10–15 °C split) signals excessive heat rejection load—overcharge, a dirty condenser, or non-condensables. Each raises head pressure above design.

52. D — Canadian law requires an environmental/ODS refrigerant-handling certification to purchase and handle controlled refrigerants. This ensures handlers are trained in recovery and containment, supporting environmental compliance.

53. D — An ECM holds programmed CFM by increasing torque and RPM as duct resistance rises, such as with a dirtier filter. This constant-airflow behaviour distinguishes ECMs from fixed-speed PSC motors.

54. B — Latent heat of vaporization is the heat absorbed to convert saturated liquid to saturated vapour at constant temperature. This phase-change heat absorption in the evaporator is the basis of the refrigeration effect.

55. A — Correct superheat but low subcooling with sight-glass bubbles indicates a refrigerant undercharge: not enough liquid to fill the condenser and feed solid liquid forward. Adding charge restores subcooling and clears the bubbles.

56. A — Silver-phosphorus (BCuP) alloys are self-fluxing on copper, but brass contains zinc and does not self-flux, so a separate flux is needed to prevent oxidation and ensure the filler wets the joint. Matching filler and flux to the base metals produces a sound, leak-free joint.

57. C — Nitrogen pressure-testing pressurizes the system with an inert gas to verify brazed-joint integrity and locate leaks before evacuation. Using nitrogen instead of refrigerant avoids venting and confirms a leak-free system safely.

58. C — Heavy coil frost that never clears, with the system otherwise running, points to a failed defrost control or sensor that never initiates or terminates defrost. The defrost circuit, not the charge, is the fault.

59. A — Sensible heat changes dry-bulb temperature without altering moisture content, moving horizontally on the psychrometric chart. Latent processes change moisture; sensible processes change only temperature.

60. D — A solenoid valve installed against its flow arrow will not seat or operate correctly, since its design depends on pressure assisting the intended flow direction. Correct orientation is essential for proper opening and closing.

61. B — A closed-loop pump-down/blank-off test, comparing the vacuum and pressures the compressor can achieve, is the most definitive capacity check. It directly reveals valve leakage and pumping ability beyond surface symptoms.

62. C — Solar gain through glazing and conduction through the envelope are sensible loads that directly raise dry-bulb temperature. Occupant moisture and cooking add latent load; the question targets the sensible component.

63. B — An oil-pressure safety measures net oil pressure—pump output minus crankcase (suction) pressure—because that difference is what actually circulates oil. It trips if net pressure falls too low, protecting bearings.

64. A — After a hermetic burnout, installing a suction-line acid-removing filter-drier and monitoring acid levels cleans the circuit of contaminants. This staged cleanup protects the replacement compressor from residual acid.

65. A — Total heat, or enthalpy, of air equals the sum of its sensible and latent heat. This combined value is what cooling equipment must remove, making enthalpy central to load calculations.

66. B — A VFD varies motor speed by changing the frequency and voltage supplied, maintaining the proper volts-per-hertz ratio. This electronic control gives efficient, stepless speed modulation without changing the motor itself.

67. B — A cracked or leaking sensing-bulb capillary loses its charge, so the TXV diaphragm sees no opening force and the valve closes, starving the evaporator. Loss of bulb charge is a classic cause of a starved coil.

68. C — One ton of refrigeration equals the heat needed to melt 2000 lb (one short ton) of ice at 0 °C in 24 hours, equal to 12,000 BTU/h. This defines cooling capacity in conventional units.

69. B — If discharge valves leak, a blank-off test shows the compressor cannot pull down or hold the expected vacuum, because gas leaks back across the valves. Inability to reach and hold vacuum confirms internal valve leakage.

70. D — The suction line carries low-pressure, low-density vapour, so it must be the largest diameter to keep velocity and pressure drop acceptable. Higher-pressure liquid and discharge lines are smaller for the same mass flow.

71. D — A high approach with normal water flow means heat transfer is impaired by fouled condenser tubes, not a flow problem. The insulating deposit raises condensing temperature relative to leaving water. Cleaning restores the approach.

72. A — Static pressure is the outward force air exerts against the duct walls, independent of air motion. It is what the blower must overcome to move air, distinct from velocity pressure created by airflow.

73. B — Triple evacuation means evacuating, breaking the vacuum with dry nitrogen, and repeating, which dilutes and carries away moisture more effectively than a single pull. Each cycle reduces residual water vapour in the system.

74. A — An inverted P-trap (riser loop) at the evaporator outlet prevents liquid refrigerant from draining back into the coil during the off cycle. This reduces floodback risk at the next compressor start.

75. D — Partial frosting with high superheat—frost at the inlet, warm dry outlet—indicates the coil is underfed by a low charge or restriction. Insufficient refrigerant boils off early, leaving the outlet starved and superheated.

76. D — Low-ambient head-pressure control maintains adequate condensing pressure so the TXV has enough pressure differential to feed the evaporator properly. Without it, cold weather collapses head pressure and starves the coil.

77. A — A charging scale must be calibrated and zeroed, accounting for hose weight, so the weighed-in charge is accurate. Precise weight charging is essential, especially on critically charged systems.

78. D — A near-azeotropic blend has a small temperature glide, meaning its saturation temperature shifts slightly as it changes phase at constant pressure. This glide must be considered when reading superheat and subcooling.

79. B — A defrost termination thermostat ends the defrost cycle once the outdoor coil reaches a set temperature, confirming the ice has melted. This prevents wasting energy and overheating once defrost is complete.

80. A — A long liquid line with vertical lift loses pressure to friction and static head, which can flash liquid into gas before the metering device. Proper sizing and possibly subcooling prevent flash gas and capacity loss.

81. D — A very low insulation resistance to ground on a megohmmeter test reveals deteriorated winding insulation or a ground fault. This warns of impending motor failure before a hard short occurs.

82. B — Effective dehumidification requires a coil cold enough to condense moisture while the compressor runs long enough to remove it—avoiding short-cycling. Oversizing or excessive airflow cools without dehumidifying, leaving the space clammy.

83. B — Turning the TXV superheat screw clockwise increases spring tension, which raises the superheat setting by requiring more superheat before the valve opens. This reduces refrigerant feed slightly to hold higher superheat.

84. C — Liquid floodback occurs when the evaporator is overfed—a stuck-open TXV or very low load—so liquid reaches the compressor. Inadequate boil-off lets liquid return, threatening the compressor with slugging.

85. B — A discharge-line oil separator captures oil entrained in hot gas and returns it to the crankcase, maintaining compressor lubrication. This is valuable on long-line or low-temperature systems where oil return is difficult.

86. B — On a glide blend, dew-point pressure is used to calculate superheat and bubble-point pressure to calculate subcooling. Using the correct reference temperature for each measurement keeps charging and diagnostics accurate.

87. C — A CSCR motor that hums, won't start, then trips has lost its starting torque—typically a failed start capacitor or start relay/potential relay. The run components alone cannot start the motor under load.

88. B — CSA B52 is the Mechanical Refrigeration Code governing safe installation and operation of refrigeration systems in Canada. It is distinct from the electrical code (C22.1) and addresses refrigeration-specific safety.

89. B — Heat recovery captures reject heat from the discharge gas and uses it for water or space heating, improving overall efficiency. It repurposes energy that would otherwise be wasted at the condenser.

90. C — A stuck-open TXV overfeeds the evaporator, producing low superheat, high suction pressure, and possible floodback. The unrestricted refrigerant flow is the signature of a valve failed in the open position.

91. A — Wet-bulb temperature is always equal to or lower than dry-bulb, since evaporative cooling of the wet wick lowers the reading except at saturation, where they are equal. This relationship underlies psychrometric measurement.

92. A — A trapped condensate drain prevents air from being pulled through the drain under the blower's negative pressure and lets water drain freely. Without the trap, air bypass blocks proper condensate flow.

93. B — If the centrifugal start switch fails to open at speed, the start winding stays energized continuously and overheats, eventually burning out. The switch must open to drop the start winding once running.

94. C — False loading introduces hot gas to maintain a minimum suction pressure and simulated load during low-load testing. This keeps the compressor within safe operating conditions while diagnostics are performed.

95. C — A pressure-enthalpy (Mollier) diagram plots heat content at each cycle point, showing refrigeration effect, work of compression, and heat rejection. It is the key tool for analyzing component performance.

96. D — Rising loop temperatures and high head across all water-source units point to a system-wide loop fluid-cooler or circulation problem, not a single unit. The common loop fault affects every connected heat pump.

97. C — A subcooled liquid line means the refrigerant is cooler than its saturation temperature for the measured pressure, confirming pure liquid free of vapour. Subcooling guarantees solid liquid feed to the metering device.

98. C — Superheat charging on a fixed-orifice system uses a charging chart based on outdoor dry-bulb and indoor wet-bulb to set the target superheat. These conditions determine the correct superheat for the operating environment.

99. D — Pitted or welded contactor contacts cause voltage drop, chatter, or a stuck-closed condition that keeps the compressor energized. The damaged contacts impede normal switching and can overheat the circuit.

100. A — Brazing near a charged system can expose refrigerant to flame, producing phosgene and other toxic decomposition gases. This is a serious inhalation hazard, so systems must be recovered and purged before applying heat.

101. A — An unloader reduces capacity by holding suction valves open on selected cylinders, so they pump no gas. This steps capacity down to match load without stopping the compressor.

102. B — Movement up and to the left on the psychrometric chart means lowering dry-bulb while removing moisture—cooling and dehumidification. This is the typical air-conditioning process across a cooling coil.

103. C — Correct commissioning sequence is nitrogen pressure-test, deep-vacuum evacuation, then charging. Testing first confirms integrity, evacuation removes moisture and air, and only a verified dry system is charged.

104. C — A MOP-charged expansion valve limits maximum evaporator (suction) pressure, protecting the compressor motor from overload during pull-down. Above the MOP the valve restricts, capping suction pressure.

105. D — A scroll compressor must never run in reverse rotation, which can occur with three-phase miswiring; reverse operation can quickly damage the scrolls. Correct phase rotation must be verified at start-up.

106. B — An automatic air vent at the system's high point removes air entrained in a chilled-water loop, where air naturally collects. Trapped air causes noise, poor circulation, and reduced heat transfer if not vented.

107. D — The bulb mounts at the 10–2 o'clock position on a horizontal suction line, firmly clamped and insulated, so it senses true vapour temperature rather than oil pooled at the bottom. Correct placement gives a stable signal and accurate superheat control.

108. A — A liquid-line restriction causes a localized pressure drop, so the refrigerant cools and may frost at that point, with liquid backing up and raising subcooling upstream. This temperature change at the drier pinpoints the restriction..

109. D — POE oil is highly hygroscopic, absorbing atmospheric moisture rapidly, so it must be kept sealed and handled quickly. Moisture in POE forms acids and degrades the system, making fast handling essential.

110. B — An economizer uses suitable outdoor air for free cooling when conditions allow, reducing compressor run time. This lowers energy use during mild weather by supplementing or replacing mechanical cooling.

111. D — A megohmmeter must never be applied while the compressor is energized and running; the test requires a de-energized, isolated motor. Testing live would endanger the technician and damage the meter.

112. A — A flooded evaporator wets the entire tube surface with boiling liquid refrigerant, giving superior heat transfer compared with a partly dry dry-expansion coil. Full wetting maximizes the heat-exchange area.

113. D — A check valve in a heat-pump circuit directs refrigerant through the correct metering device for each mode by blocking one path and opening another. This routing makes bidirectional heat-pump operation possible.

114. D — Overheating a copper joint produces a dull, blackened, oxidized surface and scaling, signalling excessive temperature. Proper brazing keeps a controlled colour; heavy oxidation indicates the joint was overheated.

115. C — Three-phase voltage imbalance should be 2% or less; greater imbalance causes disproportionate current imbalance and excessive winding heating. Keeping imbalance low protects motor life and efficiency.

116. C — The cut-in pressure of a low-pressure control is set above the cut-out by the differential amount, so pressure must rise before the control re-closes. This prevents the rapid cycling that equal settings would cause.

117. B — A high-glide blend must be recovered, evacuated, and recharged with virgin blend to preserve composition, since topping off after a leak shifts the mix. Maintaining the correct blend ratio keeps performance on spec.

118. D — A condensing unit in direct sun with restricted clearance cannot reject heat well, raising head pressure and lowering capacity. Adequate airflow clearance is required for proper condenser performance.

119. C — A liquid-line sight glass shows refrigerant flow condition (bubbles indicate vapour/undercharge) and, with a moisture indicator, changes colour to reveal moisture. It gives a quick visual check of charge and dryness.

120. A — A double suction riser maintains oil return at both full and reduced (unloaded) capacity, since a single riser sized for full load loses velocity at part load. The two risers keep velocity adequate across the range.

121. C — Correct charge and subcooling but a starved evaporator points to a TXV restriction, plugged inlet screen, or undersized valve limiting flow. The metering device, not the charge, is restricting refrigerant delivery.

122. B — Latent heat of fusion is the heat involved in changing between solid and liquid states at constant temperature, such as ice melting. This phase change differs from vaporization, which involves liquid and vapour.

123. C — A correctly sized system that runs nonstop without satisfying the thermostat has low capacity from a valve, charge, or excessive load problem. The compressor cannot meet demand, so the limiting fault must be identified.

124. D — Cylinder pressure higher than the saturation pressure for its temperature indicates non-condensables or contamination, so the refrigerant should be verified before use. Charging contaminated refrigerant would degrade system performance.

125. B — With charge confirmed correct, an icing indoor coil with low airflow and low suction pressure points to restricted airflow—dirty filter/coil or blower fault—lowering coil temperature below freezing. Restoring airflow clears the ice.