

PRACTICE EXAM 22: RACM RED SEAL SIMULATION (125 QUESTIONS)

1. A mechanic has applied a lock and opened the disconnect. Of the following, which is the single most important step before touching the conductors?

- A. Notifying the building occupants of the work
- B. Recording the refrigerant charge on the work order
- C. Closing the suction service valve
- D. Verifying zero voltage with a meter on the conductors

2. Both recovery and reclaim remove refrigerant from service. The key distinction is that reclaim, unlike recovery:

- A. Reprocesses refrigerant to a recognized purity standard for resale
- B. Simply removes refrigerant into a storage cylinder
- C. Is performed only on the roof
- D. Requires no certification at all

3. A worker can either ventilate a refrigerant-filled mechanical room or put on a dust mask and proceed. The correct choice and reason is:

- A. Wear the dust mask, since it filters refrigerant vapour
- B. Ventilate first, because the hazard is oxygen displacement a mask cannot fix
- C. Proceed without either, since refrigerant is harmless
- D. Wear the dust mask only if the smell is strong

4. Comparing a supplier label and a workplace label under WHMIS 2015, the workplace label is the one applied when:

- A. The product first leaves the manufacturer
- B. The product is sold to a distributor
- C. A product is decanted into a different container on site
- D. The product is exported internationally

5. A multimeter on ohms and a clamp ammeter are both available. To check a de-energized, locked-out winding for an open, the better instrument and why is:

- A. The multimeter on ohms, because an open reads infinite resistance
- B. The clamp ammeter, because it reads current without contact
- C. The multimeter on volts, because windings are voltage devices
- D. The clamp ammeter, because resistance is measured live

6. Of these capacitor-handling steps, which is the most critical for technician safety?

- A. Recording its microfarad rating
- B. Noting its voltage rating
- C. Checking its physical case for bulging
- D. Discharging it through a resistor before handling

7. When mentoring, explaining the reasoning behind a step is preferable to drilling the steps alone chiefly because it:

- A. Saves the journeyperson time on the job
- B. Reduces the documentation required
- C. Lets the apprentice adapt correctly to new situations
- D. Eliminates the need for supervision

8. A fire extinguisher and a hot-work permit are both arranged for a brazing task. Which statement best captures their combined purpose?

- A. They satisfy the refrigerant logging requirement
- B. They calibrate the brazing equipment
- C. They control the fire risk created by the open flame
- D. They replace the need for a fire watch

9. Recovery, recycling, and reclaim form an increasing scale of thoroughness. The correct ordering from least to most processing is:

- A. Reclaim, recycling, recovery
- B. Recycling, recovery, reclaim
- C. Reclaim, recovery, recycling
- D. Recovery, recycling, reclaim

10. Of the following, the action that most directly satisfies the legal refrigerant-handling record is:

- A. Photographing the equipment nameplate
- B. Logging the refrigerant type and quantity handled
- C. Recording the ambient temperature
- D. Noting the service-valve torque

11. Comparing PPE choices for breaking into a charged liquid line, the most relevant item is:

- A. Gloves and eye protection rated for refrigerant
- B. Hearing protection for the plant room
- C. A high-visibility vest
- D. A particulate dust mask

12. A clamp ammeter reading and an ohmmeter reading both relate to a motor. Which pairing of measurement-to-condition is correct?

- A. Clamp ammeter measures winding resistance
- B. Ohmmeter measures running current
- C. Clamp ammeter measures running current; ohmmeter measures resistance when dead
- D. Both must be taken on a live circuit

13. Of the lockout steps, the one most often skipped yet most likely to prevent injury is:

- A. Notifying affected workers
- B. Shutting down by the normal method
- C. Applying the personal lock
- D. Verifying the zero-energy state

14. During a standing vacuum test, a rise that levels off and a rise that never stops mean different things. The reading indicating remaining moisture is the one that:

- A. Falls below the starting micron level
- B. Stays perfectly flat at the deepest vacuum
- C. Rises continuously without stabilizing
- D. Rises and then holds steady

15. Comparing a flare joint and a brazed joint, the flare joint is preferred specifically where the connection:

- A. Will be permanently buried in a wall
- B. May need to be opened later for service
- C. Carries no refrigerant at all

D. Is larger than three inches

16. Soldering and brazing differ by filler melting point. The statement that correctly distinguishes brazing is that it uses filler melting:

A. Below 212 °F

B. Below 450 °F

C. At exactly 600 °F

D. Above 840 °F

17. Of cutting a tube with a tubing cutter versus a hacksaw, the tubing cutter is preferred chiefly because it:

A. Leaves a square end without internal filings

B. Anneals the tube end automatically

C. Is faster on large diameters only

D. Removes the need to deburr

18. A nitrogen purge during brazing and a nitrogen pressure test serve different purposes. The purge during brazing specifically:

A. Locates leaks in the finished joint

B. Cools the joint after brazing

C. Tests the system to its design pressure

D. Prevents internal copper-oxide scale

19. Comparing an oversized and an undersized suction line, the oversized line's characteristic failure is:

A. Excessive pressure drop and lost capacity

- B. Inability to be insulated
- C. Refrigerant velocity too low to return oil
- D. A raised condensing temperature

20. Of the following, which best distinguishes a cold brazed joint from a sound one?

- A. The sound joint shows oxide scale inside
- B. The cold joint has a smooth continuous fillet
- C. The sound joint melts the rod only in the flame
- D. The cold joint forms when the base metal never reached flow temperature

21. Comparing soft annealed and hard-drawn copper, soft copper is distinguished by being:

- A. Bendable and flareable by hand
- B. Joinable only by mechanical fittings
- C. Rated solely for water service
- D. Always larger in diameter

22. The correct finishing sequence after piping, compared to common wrong orders, is:

- A. Charge, then leak test, then evacuate
- B. Leak test, then evacuate, then charge
- C. Evacuate, then charge, then leak test
- D. Charge, then evacuate, then leak test

23. Reaming a cut tube with the end facing down, versus facing up, is preferred because facing down:

- A. Anneals the end faster

- B. Lets chips fall out instead of into the line
- C. Increases the tube diameter
- D. Speeds the nitrogen purge

24. A refrigeration flare and a hydraulic flare differ in angle. The refrigeration flare is:

- A. 30 degrees
- B. 37 degrees
- C. 60 degrees
- D. 45 degrees

25. Comparing swaging and flaring, swaging is the operation that:

- A. Expands a tube end into a socket for a brazed joint
- B. Forms a 45-degree cone for a mechanical joint
- C. Removes the internal burr
- D. Squares the cut end

26. Of a low and a high nitrogen flow during brazing, the low flow is correct because high flow would:

- A. Improve capillary action
- B. Blow molten filler out and overpressurize the heated line
- C. Prevent oxide scale more effectively
- D. Cool the joint too slowly

27. A pressure drop on a 24-hour temperature-corrected nitrogen test, versus a steady reading, indicates:

- A. A leak that must be located

- B. A perfectly tight system
- C. Condensation of the nitrogen
- D. An over-ranged gauge

28. Comparing ACR copper and plumbing copper, ACR copper is distinguished by being:

- A. Sized by nominal inside diameter
- B. Sized by actual outside diameter and supplied clean and capped
- C. Rated only for low pressure
- D. Available only in straight lengths

29. Of a level suction run and one sloped toward the compressor, the sloped run is preferred because it:

- A. Reduces the refrigerant charge
- B. Aids oil return to the compressor
- C. Raises the condensing pressure
- D. Increases subcooling

30. Comparing the consequence of skipping a deburr versus skipping insulation, skipping the deburr most directly causes:

- A. A flow restriction and circulating chips
- B. Condensate dripping in occupied spaces
- C. High head pressure from the condenser
- D. A reverse-rotating compressor

31. A swaged socket depth that is too shallow versus correct depth differs in that the correct depth is approximately:

- A. One-tenth the tube diameter
- B. The tube wall thickness
- C. Three tube diameters
- D. One tube diameter

32. Of leak-testing with nitrogen versus oxygen, nitrogen is mandatory because oxygen:

- A. Can ignite explosively with refrigeration oil under pressure
- B. Condenses inside the tubing
- C. Is too expensive to use
- D. Cannot reach test pressure

33. Comparing sensible and latent load, the latent load is distinguished as the heat associated with:

- A. Raising the dry-bulb temperature
- B. Removing moisture from the air
- C. Conduction through the walls
- D. Solar gain through glazing

34. Of a TXV and an automatic expansion valve (AXV), the AXV is distinguished because it maintains constant:

- A. Superheat at the evaporator outlet
- B. Subcooling at the condenser
- C. Discharge temperature
- D. Evaporator pressure

35. A planner must choose the authoritative sizing source between a past job and the manufacturer data. The correct choice and reason is:

- A. The past job, because it worked before
- B. The supplier price list, because it lists models
- C. The crew's preference, for speed
- D. The manufacturer data, because it governs and ties to warranty

36. Comparing operating and safety controls, the clearest operating control is:

- A. A thermostat cycling the compressor to a setpoint
- B. A high-pressure cutout
- C. A relief valve
- D. A motor overload

37. One ton of refrigeration, compared to other common figures, equals:

- A. 12,000 BTU/h
- B. 3,412 BTU/h
- C. 1,000 BTU/h
- D. 24,000 BTU/h

38. Of oversizing and undersizing a comfort system, oversizing is distinguished by causing:

- A. Inability to meet the load on a design day
- B. Continuous low head pressure
- C. Permanently high subcooling
- D. Short-cycling and poor dehumidification

39. Comparing series and parallel wiring of controls, safety controls are placed in series so that:

- A. They share the load current
- B. They modulate the valve
- C. Any one opening stops the equipment
- D. They function only in defrost

40. A 48,000 BTU/h load, compared to other tonnages, equals:

- A. 2 tons
- B. 4 tons
- C. 8 tons
- D. 48 tons

41. Of pneumatic and DDC controls, the pneumatic system is distinguished by using:

- A. Networked microprocessors
- B. Compressed-air signals to position actuators
- C. Bimetal contacts only
- D. Manual hand valves

42. Comparing the documents a planner produces, the one describing step-by-step system behaviour is the:

- A. Bill of materials
- B. Refrigerant log
- C. Sequence of operation
- D. WHMIS inventory

43. A thermostat differential, compared to a setpoint, is best described as:

- A. The single temperature the system holds exactly
- B. The maximum capacity of the system
- C. The gap between cut-in and cut-out preventing short-cycling
- D. The refrigerant charge by weight

44. Of a walk-in cooler's load components, the product load is distinguished as the heat:

- A. Removed from the stored product itself
- B. Conducted through the slab only
- C. Drawn by the compressor motor
- D. Generated by the control transformer

45. Comparing condenser-location factors, the most important clearance reason is to:

- A. Store the recovery cylinder nearby
- B. Shorten the control wiring
- C. Provide forklift access
- D. Ensure unrestricted airflow for heat rejection

46. Of a fixed orifice and a TXV for a varying load, the TXV is preferred because it:

- A. Eliminates superheat entirely
- B. Modulates flow to hold constant superheat
- C. Sets subcooling directly
- D. Removes the metering device

47. A 5-ton load, compared to other BTU/h figures, equals:

- A. 60,000 BTU/h
- B. 12,000 BTU/h
- C. 24,000 BTU/h
- D. 5,000 BTU/h

48. Comparing electronic and electromechanical controls, the electronic system is distinguished by:

- A. Using bimetal strips and bellows
- B. Operating only on compressed air
- C. Using sensors and a microprocessor for modulating control
- D. Requiring no sensors

49. Of the low-pressure control's two possible roles, it acts as a safety control when it:

- A. Initiates a pump-down on a call to stop
- B. Terminates a defrost cycle
- C. Modulates the expansion valve
- D. Stops the compressor on loss of charge

50. Comparing how components are selected, matching all four to one another and to the load ensures:

- A. Rated performance at design conditions
- B. The least refrigerant regardless of capacity
- C. No need for commissioning
- D. No need for safety controls

51. Of insulating the suction line and the liquid line, the suction line is insulated chiefly to:

- A. Raise the discharge pressure
- B. Prevent heat gain and surface condensation
- C. Increase refrigerant velocity
- D. Reduce compressor amperage

52. Comparing a tag line and standing under a load, the safe rigging practice is to:

- A. Stand under the load to center it
- B. Ride the load to the roof
- C. Use a tag line while staying clear of the load
- D. Stand under it only with a hard hat

53. Of setting equipment level versus out of level, level setting is required chiefly to ensure:

- A. The nameplate faces the door
- B. Higher airflow across the coil
- C. Proper oil return and condensate drainage
- D. A correct control voltage

54. Comparing the effect of too little and too much evaporator airflow, too little airflow causes the coil to:

- A. Reject heat to the room
- B. Frost or freeze and lose capacity
- C. Raise subcooling sharply
- D. Dehumidify excessively

55. Of a control transformer's functions, the correct one is to:

- A. Increase compressor starting torque
- B. Filter moisture from refrigerant
- C. Measure system power factor
- D. Step line voltage down to control voltage

56. Comparing series and parallel wiring of a high-pressure cutout, it must be wired in series so it can:

- A. Interrupt the control circuit and stop the compressor
- B. Share current with the load
- C. Modulate the metering valve
- D. Power the condenser fan

57. Of a P-trap at a riser base and a receiver, the P-trap's installation purpose is to:

- A. Store the system's liquid charge
- B. Provide a service access port
- C. Collect and lift oil up the riser
- D. Filter the refrigerant

58. Comparing line-voltage and low-voltage circuits, the line-voltage circuit energizes:

- A. The compressor and fan motor loads
- B. The 24 V thermostat only
- C. The micron gauge
- D. The recovery machine

59. Of correcting a reverse-running three-phase compressor, the proper action is to:

- A. Replace the compressor
- B. Swap any two of the three supply leads
- C. Add refrigerant charge
- D. Raise the thermostat setpoint

60. Comparing where accessories sit, the suction accumulator's correct location is:

- A. In the liquid line after the condenser
- B. At the compressor discharge
- C. Between condenser and metering device
- D. On the suction side ahead of the compressor

61. Of an electronic expansion valve's connections, beyond refrigerant piping the installer must wire its:

- A. Capillary tube to the receiver
- B. Flare nut to the king valve
- C. Sensors and stepper-motor leads to the controller
- D. Air line to a compressor

62. Comparing a boxed-in and a clear condenser location, the boxed-in unit will most likely:

- A. Recirculate hot air and raise head pressure
- B. Lower head pressure
- C. Raise subcooling
- D. Reduce control voltage

63. Of the purposes of a roof curb, the distinguishing one beyond support is to provide:

- A. Electrical disconnection
- B. Refrigerant storage
- C. Airflow measurement
- D. Weatherproofing and a penetration path

64. Comparing the effect of an uninsulated suction line in an occupied space versus a mechanical room, in the occupied space it most directly:

- A. Raises the discharge pressure
- B. Freezes the liquid line
- C. Sweats and drips condensate, risking damage
- D. Reduces superheat

65. Of integrating controls correctly versus merely wiring them, integration is distinguished by ensuring the system:

- A. Draws zero current
- B. Uses minimum refrigerant
- C. Bypasses safety controls
- D. Behaves per its sequence of operation

66. Comparing undersized and oversized ductwork, undersized duct most directly causes:

- A. Higher subcooling
- B. Zero compressor current
- C. Reduced airflow that can freeze the coil
- D. Faster dehumidification

67. Of a vibration loop's purpose, it protects:

- A. The thermostat from drafts
- B. Brazed joints from fatigue cracking
- C. The condenser from solar gain
- D. The drier from moisture

68. Comparing line- and low-voltage wiring practice, the two are kept separated chiefly to:

- A. Improve refrigerant flow
- B. Maintain safety and prevent interference
- C. Shorten the line set
- D. Increase compressor torque

69. Of a condensate pan's necessity, it is required under an evaporator that:

- A. Dehumidifies and produces condensate
- B. Operates only in heating
- C. Uses hard-drawn copper
- D. Runs on three phases

70. Comparing the corrective action for a reverse-running three-phase fan and compressor, the single fix is to:

- A. Swap any two incoming supply leads
- B. Replace both motors
- C. Add refrigerant to each
- D. Raise the control transformer rating

71. Of short and long line routing, short routing is preferred chiefly to:

- A. Ease painting
- B. Limit pressure drop and refrigerant charge
- C. Increase subcooling
- D. Reduce fitting count only

72. Comparing the planning step that prevents an unbalanced lift, the key knowledge is the load's:

- A. Weight and centre of gravity
- B. Paint color
- C. Refrigerant charge
- D. Thermostat differential

73. Of an economizer's functions during install, it provides ventilation and:

- A. Free cooling when outdoor conditions permit
- B. Refrigerant storage
- C. Oil separation
- D. Vibration isolation

74. Comparing a high-pressure cutout wired in parallel versus series, the parallel-wired cutout:

- A. Trips too early
- B. Cannot interrupt the circuit and gives no protection
- C. Modulates the valve
- D. Powers the fan

75. Of where a filter-drier sits, it is installed in the:

- A. Suction line ahead of the compressor
- B. Discharge line after the compressor
- C. Hot-gas bypass line
- D. Liquid line ahead of the metering device

76. Comparing the effect of sloping a suction run toward versus away from the compressor, sloping toward the compressor:

- A. Raises head pressure
- B. Reduces the charge
- C. Aids oil return
- D. Increases subcooling

77. Comparing how charge is verified on TXV versus fixed-orifice systems, on a fixed-orifice system it is verified by:

- A. Suction-line superheat
- B. Condenser subcooling
- C. Compressor nameplate amperage
- D. Outdoor wet-bulb temperature

78. Of superheat and subcooling, superheat is distinguished as measured on the:

- A. Liquid line at the condenser outlet
- B. Discharge line at the compressor
- C. Receiver outlet
- D. Suction line at the evaporator outlet

79. Comparing readings on an undercharged versus overcharged system, the undercharge pattern is:

- A. High superheat with low subcooling
- B. Low superheat with high subcooling
- C. Low superheat with low subcooling
- D. High superheat with high subcooling

80. Of the steps before recording readings, the essential one is to:

- A. Run the unit in reverse briefly
- B. Allow the system to stabilize at near-design conditions
- C. Complete the nitrogen purge
- D. Cool the vacuum pump

81. Comparing vapour and liquid charging of a blend, the blend must be charged as a liquid to:

- A. Speed the process
- B. Preserve the blend composition
- C. Lower cylinder pressure
- D. Raise subcooling

82. Of verifying refrigerant type, the correct reference before charging is the:

- A. Equipment nameplate
- B. Liquid-line color
- C. Vacuum-pump brand
- D. Line-set length

83. Comparing how charge is verified on TXV versus fixed-orifice systems, on a TXV system it is verified by:

- A. Condenser subcooling
- B. Suction-line superheat
- C. The nameplate amperage
- D. The ambient dry-bulb

84. Of the commissioning steps for controls, proving a high-pressure cutout actually stops the compressor matters because:

- A. It charges the system
- B. It calibrates the micron gauge
- C. An untested safety control may give no protection
- D. It evacuates moisture

85. Comparing instruments for calibrating an enthalpy control, the correct set measures:

- A. Suction pressure only
- B. Supply voltage only
- C. Temperature, humidity, and the control's output
- D. Line length only

86. Of the readings describing overall performance, the complete set is:

- A. Refrigerant brand and color
- B. Wiring-diagram revision date
- C. Building age and occupancy
- D. Pressures, superheat, subcooling, split, and current

87. Comparing a held and a rising standing vacuum before charging, a held deep vacuum confirms the system is:

- A. Overcharged
- B. Tight and dry
- C. Running in reverse
- D. Freshly painted

88. Of start-up checks on three-phase equipment, the first to confirm is:

- A. The cylinder weight
- B. The occupancy schedule
- C. Correct rotation of compressor and fans
- D. The thermostat differential

89. Comparing the cause of high head with high subcooling versus an undercharge, the high-head/high-subcooling pattern points to:

- A. A dirty condenser or non-condensables
- B. A severe undercharge
- C. A flooding evaporator
- D. An open thermostat

90. Of air balancing's purpose, it ensures:

- A. The charge is set by weight
- B. The compressor draws no current
- C. Each space receives its designed airflow
- D. Subcooling is maximized

91. Comparing why the refrigerant charge is recorded, the correct reason is that it is:

- A. A regulatory record and a service baseline
- B. Only for warranty
- C. For duct sizing
- D. Optional documentation

92. Of the patterns indicating overcharge, the correct one is:

- A. High superheat with low subcooling
- B. Zero compressor current
- C. Low superheat with high subcooling
- D. A continuously rising vacuum

93. Comparing the temperature-split reading to design, a split far below design points to a problem with:

- A. The nameplate accuracy
- B. Charge, airflow, or capacity
- C. The thermostat color
- D. The recovery cylinder

94. Of the commissioning report's roles, its primary long-term value is as:

- A. The baseline of normal readings for future service
- B. The supplier invoice
- C. The occupancy permit
- D. The warranty claim form

95. Comparing how a reversing valve is exercised at commissioning, it is verified through the thermostat's:

- A. G terminal
- B. O or B terminal
- C. W terminal
- D. C terminal

96. Of the signs of an overloaded compressor at commissioning, the key reading is:

- A. Current well above nameplate RLA
- B. Zero current draw
- C. A level mounting
- D. A correct blend

97. Comparing superheat verification on a fixed-orifice system, a high superheat with low subcooling indicates:

- A. An overcharge
- B. A flooding evaporator
- C. An undercharge
- D. Excessive condenser airflow

98. Comparing the classic causes of high suction pressure on a heat pump, the reading with a warm suction line points to:

- A. An undercharge
- B. A clogged liquid drier
- C. A frozen outdoor coil
- D. A reversing valve leaking discharge gas to suction

99. Of topping up versus repairing a leaking system, the correct approach is to:

- A. Add refrigerant and an additive
- B. Reset the low-pressure control
- C. Replace the thermostat
- D. Find and repair the leak, then evacuate and recharge

100. Comparing a failed start capacitor and a failed run capacitor, the failed start capacitor classically causes a compressor that:

- A. Runs hot at high efficiency
- B. Operates only in defrost
- C. Hums, fails to start, and trips on overload
- D. Runs faster than rated

101. Of the consequences of a fouled condenser, the most direct is:

- A. Low control voltage
- B. A frozen evaporator
- C. High head pressure and compressor strain
- D. Loss of the commissioning report

102. Comparing a healthy and a restricted filter-drier, the restricted drier is distinguished by:

- A. No temperature change across it
- B. A cold spot and temperature drop across it
- C. Reverse compressor rotation
- D. A failed run capacitor

103. Of defrost faults, a heavily iced outdoor coil with collapsed heating output indicates defrost that:

- A. Fails to initiate
- B. Terminates too early
- C. Runs continuously
- D. Is unnecessary

104. Comparing a symptom and a root cause, replacing a burned-out compressor without finding the cause is wrong because:

- A. The replacement is always defective
- B. Evacuation is then unnecessary
- C. The underlying cause will destroy the new compressor
- D. The nameplate must be repainted

105. Of a faulty control and a real condition, a low-pressure control cutting out while the measured pressure is normal indicates:

- A. A genuine loss of charge
- B. A faulty control or its wiring
- C. A dirty condenser
- D. A leaking reversing valve

106. Comparing measurement conditions, resistance and continuity are measured only on a circuit that is:

- A. Energized and loaded
- B. Pressurized with nitrogen
- C. Charged with refrigerant
- D. De-energized and locked out

107. Of the effects of non-condensables, the characteristic one is:

- A. Abnormally low head pressure
- B. Abnormally high head pressure
- C. Zero superheat
- D. A frozen liquid line

108. Comparing the undercharge and overcharge patterns, low suction with high superheat and low subcooling indicates:

- A. An overcharge
- B. A flooding metering device
- C. An undercharge or leak
- D. Excessive evaporator airflow

109. Of the defrost faults, failure to terminate is distinguished by:

- A. The outdoor coil icing solid
- B. Zero compressor current
- C. Staying in defrost too long, blowing cool air and wasting energy
- D. Freezing the liquid line

110. Comparing a megohmmeter trend over visits, declining insulation resistance indicates:

- A. A healthy improving winding
- B. An overcharge
- C. A dirty condenser
- D. Winding insulation breaking down toward failure

111. Of the techniques for diagnosing a refrigerant-side fault, the most powerful is:

- A. Measuring only suction pressure
- B. Checking the nameplate color
- C. Counting the fittings
- D. Reading pressures, superheat, and subcooling together

112. Comparing a defrost that fails to initiate with one that fails to terminate, failure to initiate results in:

- A. Continuous indoor cooling
- B. Zero head pressure
- C. The outdoor coil icing over and lost heating
- D. An overcharged liquid line

113. Of a tripped safety control's correct handling, the first step is to:

- A. Jumper it out
- B. Replace it without checks
- C. Add refrigerant
- D. Measure the actual condition it senses

114. Comparing normal and abnormal heat-pump behaviour, a brief reversal to cooling with steam from the outdoor coil is:

- A. A reversing-valve leak
- B. Normal defrost operation
- C. A failed compressor
- D. An overcharge

115. Of the instruments for confirming a motor's running current, the correct one is the:

- A. Ohmmeter on a live circuit
- B. Micron gauge
- C. Subcooling calculation
- D. Clamp-on ammeter on the running motor

116. Comparing the overcharge and undercharge patterns, low superheat with high subcooling confirms:

- A. An undercharge
- B. An overcharge
- C. A liquid-line restriction
- D. A reversing-valve leak

117. Of recovered-refrigerant handling, the correct practice is to:

- A. Vent it if the quantity is small
- B. Capture it in a rated recovery cylinder, never vented
- C. Store it in a disposable cylinder
- D. Mix it with another refrigerant

118. Comparing an overload trip coinciding with seized bearings to a control defect, the trip is:

- A. A control defect to bypass
- B. A normal start event
- C. Caused by excessive subcooling
- D. A symptom of a real mechanical fault

119. Of the first step in systematic troubleshooting, the correct one is to:

- A. Gather information and verify the complaint
- B. Replace the costliest part
- C. Add refrigerant
- D. Reset all safety controls

120. Comparing thermostat terminals, the reversing-valve solenoid is controlled by the:

- A. G terminal
- B. O or B terminal
- C. W terminal
- D. C terminal

121. Of why topping up a leaking system is unacceptable, the key reason is that it:

- A. Raises control voltage
- B. Improves efficiency
- C. Calibrates the gauge
- D. Vents refrigerant and lets the fault continue

122. Comparing capacitor-handling steps, discharging before handling is required because the capacitor:

- A. Holds pressurized refrigerant
- B. Stores system oil
- C. Stores a dangerous electrical charge after power off
- D. Contains nitrogen

123. Of a tripped control whose sensed condition is genuinely out of range, the correct conclusion is the:

- A. Control is defective
- B. System should be jumpered
- C. Control is working and a real fault must be found
- D. Charge should be topped up

124. Comparing why pattern-reading beats single readings, the reason is that:

- A. Each fault produces a characteristic pattern a single reading can't reveal
- B. Single readings are always wrong
- C. It avoids using instruments
- D. It removes the need to find the root cause

125. Of a heat pump's normal frosting in heating mode, the correct description is that frost on the outdoor coil is:

- A. Always a refrigerant leak
- B. A sign of compressor failure
- C. Normal, and the defrost cycle manages it
- D. Caused by an overcharge

Practice Exam 22: Answer Key and Explanations

1. D — Verifying zero voltage with a meter on the conductors is the single step that proves electrical isolation before contact. A disconnect can appear open yet still be live, so the meter test is what prevents fatal shock.

2. A — Reclaim reprocesses refrigerant to a recognized purity standard for resale, while recovery merely removes it into a cylinder. The purity standard is the defining distinction between the two.

3. B — The hazard in a refrigerant-filled room is oxygen displacement, which a dust mask cannot remedy, so the space must be ventilated first. A mask filters particulate, not the lack of oxygen.
4. C — A workplace label is applied when a hazardous product is decanted into a different container on site, maintaining hazard communication. A supplier label is the one applied by the manufacturer.
5. A — A winding open is a resistance check: with the circuit de-energized and locked out, the multimeter on ohms reads infinite resistance on an open winding. The clamp ammeter measures live current and cannot check a dead winding's continuity.
6. D — Discharging the capacitor through a resistor before handling is the most critical safety step, because a charged capacitor can deliver a serious shock after power is removed. Ratings and case condition are secondary to that hazard.
7. C — Explaining the reasoning lets the apprentice adapt correctly to situations the demonstration never covered. Rote step-drilling does not build that transferable judgment.
8. C — A hot-work permit and extinguisher together control the fire risk created by the open brazing flame. Their shared purpose is fire prevention, not logging or calibration.
9. D — From least to most processing, the order is recovery (remove), recycling (clean for reuse), then reclaim (restore to a purity standard). This reflects increasing thoroughness.
10. B — Logging the refrigerant type and quantity handled satisfies the regulatory refrigerant record. This documents compliance with rules prohibiting venting.
11. A — Gloves and eye protection rated for refrigerant address the instant-frostbite hazard of breaking into a charged liquid line. The other PPE covers noise, dust, or visibility instead.
12. C — The correct pairing is that a clamp ammeter measures running current (live) and an ohmmeter measures resistance when the circuit is dead. Mixing these up causes both diagnostic and safety errors.

13. D — Verifying the zero-energy state is the lockout step most often skipped yet most likely to prevent injury. A meter confirms the circuit is truly dead before work begins.

14. D — A vacuum that rises and then holds steady indicates remaining moisture boiling off, which levels off once gone. A continuous, non-stabilizing rise indicates a leak instead.

15. B — A flare joint is preferred where the connection may need to be opened later for service, since it is mechanical and remakeable. Brazed joints are permanent.

16. D — Brazing uses filler that melts above 840 °F, producing a strong, pressure-tight joint; soldering uses filler below that point. This threshold defines the distinction.

17. A — A tubing cutter leaves a square end without internal filings, unlike a hacksaw which leaves chips and a ragged edge. The clean cut is essential to a leak-free joint; deburring is still required.

18. D — The nitrogen purge during brazing prevents internal copper-oxide scale by displacing oxygen. A separate nitrogen pressure test, not the purge, is what locates leaks.

19. C — An oversized suction line's characteristic failure is refrigerant velocity too low to return oil, starving the compressor of lubrication. An undersized line, by contrast, causes excessive pressure drop.

20. D — A cold joint forms when the base metal never reached filler flow temperature, so capillary action did not draw the filler in. A sound joint shows a smooth, continuous fillet with full penetration.

21. A — Soft annealed copper is distinguished by being bendable and flareable by hand, suiting small lines and tight routing. Both tempers can be brazed.

22. B — The correct finishing sequence is leak test with nitrogen, then evacuate to a deep vacuum, then charge. Each step depends on passing the previous one.

23. B — Reaming with the end facing down lets chips fall out instead of into the line. Chips left inside can clog a metering device or damage the compressor.

24. D — A refrigeration flare is a 45-degree SAE flare, distinct from the 37-degree hydraulic flare. The correct angle lets it seat and seal against the fitting.

25. A — Swaging expands a tube end into a socket so a same-size tube can be inserted for brazing. Flaring, by contrast, forms a 45-degree cone for a mechanical joint.

26. B — A low nitrogen flow is used because high pressure would blow molten filler out of the joint and overpressurize the heated line. A gentle purge still displaces oxygen and prevents scale.

27. A — A temperature-corrected pressure drop over 24 hours indicates a leak that must be located. A steady reading would confirm a tight system.

28. B — ACR copper is distinguished by being sized by actual outside diameter and supplied clean and capped. Plumbing copper is sized by nominal inside dimension.

29. B — A suction run sloped toward the compressor aids oil return by letting oil drain back with the refrigerant. A level run lets oil pool.

30. A — Skipping the deburr most directly causes a flow restriction and circulating chips, since the burr obstructs flow and breaks loose. Skipping insulation, by contrast, causes condensation.

31. D — A swaged socket should be about one tube diameter deep for adequate brazed overlap. Too shallow a socket produces a weak joint.

32. A — Oxygen is prohibited for leak testing because it can ignite explosively with refrigeration oil under pressure. Dry nitrogen is the only acceptable test gas.

33. B — Latent load is the heat associated with removing moisture from the air, distinct from the sensible load that changes temperature. Conduction and solar gain are sensible sources.

34. D — An automatic expansion valve maintains a constant evaporator pressure, suiting constant-load applications. A TXV, by contrast, maintains constant superheat.

35. D — The manufacturer data governs sizing and ties to code and warranty, so it is the authoritative source over a past-job rule of thumb. Past habits are not authoritative.

36. A — A thermostat cycling the compressor to a setpoint is the clearest operating control. High-pressure cutouts, relief valves, and overloads are protective safety devices.

37. A — One ton of refrigeration equals 12,000 BTU/h, the rate equivalent to melting one ton of ice in 24 hours. This is the standard capacity unit.

38. D — Oversizing is distinguished by causing short-cycling and poor dehumidification, because the system satisfies the thermostat before removing moisture. Undersizing instead fails to meet the load.

39. C — Safety controls are placed in series so any one opening stops the equipment. This gives each protective device the authority to shut the system down.

40. B — $48,000 \text{ BTU/h} \div 12,000 \text{ BTU/h per ton} = 4 \text{ tons}$. The conversion uses the one-ton definition.

41. B — A pneumatic system is distinguished by using compressed-air signals to position actuators. DDC uses networked microprocessors instead.

42. C — The sequence of operation describes step-by-step system behaviour, tying the controls together. The bill of materials and logs serve other purposes.

43. C — A differential is the gap between cut-in and cut-out that prevents short-cycling, distinct from the single setpoint. An adequate differential protects the compressor.

44. A — The product load is the heat removed from the stored product itself, distinct from conduction, control, and compressor loads. It is central to refrigeration sizing.

45. D — Adequate condenser clearance ensures unrestricted airflow for heat rejection. Restricted airflow raises condensing pressure and cuts capacity.
46. B — A TXV modulates flow to hold constant superheat across the load range, which is why it suits varying loads. A fixed orifice cannot adjust.
47. A — $5 \text{ tons} \times 12,000 \text{ BTU/h per ton} = 60,000 \text{ BTU/h}$. The conversion applies the one-ton definition.
48. C — An electronic control is distinguished by using sensors and a microprocessor for modulating control. Electromechanical controls use bimetal strips and contacts.
49. D — A low-pressure control acts as a safety control when it stops the compressor on loss of charge, protecting it. In a pump-down circuit the same device acts as an operating control.
50. A — Matching all four components to one another and to the load ensures rated performance at design conditions. Mismatched components cannot meet the designed capacity.
51. B — The suction line is insulated chiefly to prevent heat gain and surface condensation, both of which harm performance and the building. The liquid line is insulated only where heat gain is a concern.
52. C — The safe rigging practice is to use a tag line while staying clear of the load; standing under a suspended load is never acceptable. Dropped loads cause fatal injuries.
53. C — Level setting ensures proper oil return and condensate drainage. An out-of-level unit suffers poor oil return and standing condensate.
54. B — Too little evaporator airflow lets the coil run too cold, causing it to frost or freeze and lose capacity. The refrigerant and air sides are interdependent.
55. D — A control transformer steps line voltage down to the low-voltage control voltage. This powers thermostats and relay or contactor coils.

56. A — A high-pressure cutout must be wired in series so it can interrupt the control circuit and stop the compressor. Series wiring gives it that protective authority.

57. C — A P-trap at the base of a riser collects and helps lift oil up the riser. A receiver, by contrast, stores the liquid charge on the high side.

58. A — The line-voltage circuit energizes the compressor and fan motor loads. The 24 V control circuit handles thermostats and coils.

59. B — A reverse-running three-phase compressor is corrected by swapping any two of the three supply leads. Reverse rotation is a phase-sequence issue, not a compressor fault.

60. D — The suction accumulator sits on the suction side ahead of the compressor, where it traps returning liquid and protects against floodback. Receivers and driers sit on the high/liquid side.

61. C — An electronic expansion valve requires its sensors and stepper-motor leads wired to the controller in addition to the refrigerant connections. The controller uses these to position the valve.

62. A — A boxed-in condenser recirculates its own hot discharge air, raising head pressure and cutting capacity. Adequate clearance prevents recirculation.

63. D — A roof curb provides weatherproofing and a penetration path beyond support. It integrates the packaged unit with the roof structure.

64. C — An uninsulated suction line in an occupied space sweats and drips condensate, risking water damage, because its cold surface falls below the air's dew point. Insulation prevents this.

65. D — Integration is distinguished by ensuring the system behaves per its sequence of operation, not merely that wires are connected. A miswired control can defeat the sequence.

66. C — Undersized duct most directly causes reduced airflow that can freeze the coil. The refrigerant and air sides are interdependent.

67. B — A vibration loop protects brazed joints from fatigue cracking caused by transmitted compressor vibration. Without it, vibration cracks joints over time.

68. B — Line- and low-voltage wiring are kept separated to maintain safety and prevent interference, as required by code. It is not about flow, length, or torque.

69. A — A condensate pan and drain are required under an evaporator that dehumidifies and produces condensate, which must drain to prevent overflow. This is an air-conditioning installation requirement.

70. A — Both a reverse-running three-phase fan and compressor are corrected by swapping any two incoming supply leads, which reverses the phase sequence for all three-phase loads.

71. B — Short line routing limits pressure drop and the refrigerant charge required. Excess length reduces performance and increases charge.

72. A — Knowing the load's weight and centre of gravity prevents an unbalanced lift and keeps it within gear ratings. Planning precedes lifting.

73. A — An economizer provides ventilation and free cooling when outdoor conditions permit. It is not a refrigerant-side or vibration device.

74. B — A high-pressure cutout wired in parallel cannot interrupt the control circuit and provides no protection. It must be in series to break the circuit.

75. D — A filter-drier is installed in the liquid line ahead of the metering device, where it removes moisture and filters particulate before the refrigerant reaches the metering device.

76. C — Sloping a suction run toward the compressor aids oil return by letting oil drain back with the refrigerant. Level or rising runs let oil pool.

77. A — On a fixed-orifice system, charge is verified by suction-line superheat because the orifice does not self-regulate. Subcooling is the method for TXV systems.

78. D — Superheat is measured on the suction line at the evaporator outlet, where it confirms all liquid has boiled before the vapour reaches the compressor. Subcooling is measured on the liquid line instead.

79. A — The undercharge pattern is high superheat with low subcooling: too little refrigerant starves the evaporator and leaves the condenser short of liquid. The pair read together reveals the charge state.

80. B — The essential step before recording readings is to allow the system to stabilize at near-design conditions, since pressures and temperatures shift until equilibrium. Early readings mislead.

81. B — A blend is charged as a liquid to preserve its composition. Drawing vapour removes the more volatile components first and fractionates the blend.

82. A — The refrigerant type is verified against the equipment nameplate before charging. Line color and pump brand are not reliable proof.

83. A — On a TXV system the valve already controls superheat, so charge is verified by condenser subcooling. Reading superheat would not verify charge on a TXV system.

84. C — Proving the high-pressure cutout actually stops the compressor matters because an untested safety control may give no protection. Commissioning verifies that safeties function.

85. C — An enthalpy control acts on total heat, so calibration requires measuring temperature, humidity, and the control's electrical output — thermometer, psychrometer, and multimeter. The instruments must match the controlled quantities.

86. D — Overall performance is described by pressures, superheat, subcooling, temperature split, and current taken together. No single reading tells the whole story.

87. B — A held deep standing vacuum confirms the system is tight and dry before charging. A rising vacuum would indicate moisture or a leak.

88. C — On start-up of three-phase equipment, correct rotation of the compressor and fans is confirmed first, since reverse rotation damages the compressor. Rotation is checked before performance readings.

89. A — High head with high subcooling points to a dirty condenser or non-condensables, both of which impair heat rejection and raise head pressure. A severe undercharge would show low subcooling.

90. C — Air balancing ensures each space receives its designed airflow. A correctly charged system can still underperform in part of a building if it is unbalanced.

91. A — Recording the refrigerant charge is a regulatory record and a service baseline. It is neither optional nor solely for warranty.

92. C — The overcharge pattern is low superheat with high subcooling: excess refrigerant floods the condenser and overfeeds the evaporator. It is the inverse of the undercharge pattern.

93. B — A temperature split far below design points to a problem with charge, airflow, or capacity. The split reflects how effectively the coil removes heat.

94. A — The commissioning report's long-term value is to serve as the baseline of normal readings for future service. It tells the next technician what normal looked like for that installation.

95. B — The reversing-valve solenoid is exercised through the thermostat's O or B terminal, which switches the valve between heating and cooling. The G, W, and C terminals serve other functions.

96. A — Compressor current well above nameplate RLA indicates the compressor is operating under an overload. High draw signals excess load, not a level or charge issue.

97. C — On a fixed-orifice system, high superheat with low subcooling indicates an undercharge: too little refrigerant starves the evaporator and leaves the condenser short of liquid. The pattern is the signature of low charge.

98. D — Higher-than-normal suction pressure with a warm suction line is the classic signature of a reversing valve leaking hot discharge gas to the suction side. The internal leak connects the high side to the low side.

99. D — A leak must be found and repaired, then the system evacuated and recharged; topping up vents refrigerant and lets the fault recur. Additives and resets do not fix the leak.

100. C — A failed start capacitor classically causes a compressor that hums, fails to start, and trips on overload, because it lacks starting torque. The overload protects it from the locked-rotor draw.

101. C — A fouled condenser left uncleaned causes high head pressure and compressor strain because it cannot reject heat. This raises energy use and shortens compressor life.

102. B — A restricted filter-drier is distinguished by a cold spot and temperature drop across it, caused by the pressure drop at the restriction. A healthy drier shows no such drop.

103. A — A heavily iced outdoor coil with collapsed heating output indicates defrost failing to initiate, letting frost build until it insulates the coil. Defrost exists to clear that frost.

104. C — Replacing a burned-out compressor without finding the cause is wrong because the underlying cause will destroy the new compressor. The root cause and contamination must be addressed first.

105. B — A low-pressure control cutting out while the measured pressure is normal indicates a faulty control or its wiring. If the pressure were truly low, the control would be doing its job.

106. D — Resistance and continuity are measured only on a de-energized, locked-out circuit. Applying an ohmmeter to a live circuit damages the meter and creates a shock hazard.

107. B — Non-condensables produce abnormally high head pressure, because trapped air occupies condenser space and adds its partial pressure. The fix is proper evacuation.

108. C — Low suction with high superheat and low subcooling indicates an undercharge or leak, with too little refrigerant to feed the evaporator and fill the condenser. The pattern is the signature of low charge.

109. C — Failure to terminate defrost is distinguished by the system staying in defrost too long, blowing cool air indoors and wasting energy. Defrost should end once the coil is clear.

110. D — Declining insulation resistance across megohmmeter readings indicates winding insulation breaking down toward failure. The trend warns of failure before the winding fails outright.

111. D — The most powerful technique is reading pressures, superheat, and subcooling together, because each fault produces a characteristic pattern a single reading cannot reveal.

112. C — Failure to initiate defrost results in the outdoor coil icing over and lost heating capacity. The frost insulates the coil and blocks airflow.

113. D — The first step with a tripped safety control is to measure the actual condition it senses, distinguishing a real fault from a defective control. Jumpering or blind replacement is wrong.

114. B — A brief reversal to cooling with steam from the outdoor coil is normal defrost operation. Mistaking it for a fault is a common error.

115. D — A clamp-on ammeter on the running motor confirms its running current. Current is measured live; an ohmmeter on a live circuit is unsafe and a micron gauge is unrelated.

116. B — Low superheat with high subcooling confirms an overcharge, as excess refrigerant floods the condenser and overfeeds the evaporator. High superheat with low subcooling would indicate the opposite.

117. B — Recovered refrigerant must be captured in a rated recovery cylinder and never vented. Disposable cylinders are not rated for refilling and mixing refrigerants contaminates the charge.

118. D — An overload tripping in step with seized bearings is a symptom of a real mechanical fault, not a control defect. Bypassing it would let the motor destroy itself.

119. A — The first step in systematic troubleshooting is to gather information and verify the complaint. Observing the actual behaviour prevents chasing the wrong fault.

120. B — The reversing-valve solenoid is controlled by the thermostat's O or B terminal, which switches the valve between heating and cooling. The G, W, and C terminals serve other functions.

121. D — Topping up a leaking system vents refrigerant to the atmosphere and lets the fault continue. It is both illegal and damaging to the compressor.

122. C — A capacitor must be discharged before handling because it stores a dangerous electrical charge after power is removed. A charged capacitor can deliver a serious shock.

123. C — When the sensed condition is genuinely out of range, the control is working correctly and a real fault must be found. The trip is the indicator of a problem, not a control defect.

124. A — Pattern-reading beats single readings because each fault produces a characteristic pattern that a single value cannot reveal. The pattern identifies the fault.

125. C — Frost on a heat pump's outdoor coil in heating mode is normal, and the defrost cycle manages it. The outdoor coil runs below freezing as the evaporator, so frost is expected.