

# PRACTICE EXAM 23: RACM RED SEAL SIMULATION (125 QUESTIONS)

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1. During lockout, after the equipment is shut down by its normal method, the next step is to:
  - A. Apply the personal lock and tag before isolating
  - B. Isolate each energy source at its disconnect or valve
  - C. Verify zero energy with a meter
  - D. Begin opening the refrigerant panels
  
2. The final step of a lockout procedure, performed just before work begins, is to:
  - A. Verify the zero-energy state with the appropriate instrument
  - B. Notify affected workers of the lockout
  - C. Shut the equipment down normally
  - D. Apply the identifying tag
  
3. If a worker enters an enclosed mechanical room and immediately feels lightheaded with a refrigerant odour present, the correct first action is to:
  - A. Open the manifold gauges
  - B. Don a dust mask and continue
  - C. Leave the space and ventilate before re-entry
  - D. Reset the high-pressure control
  
4. When a recovery cylinder reaches 80% of its capacity during recovery, the next correct action is to:
  - A. Stop and switch to another rated cylinder

- B. Continue filling to 95%
- C. Fill to 100% and bleed off later
- D. Chill the cylinder to add more

5. The correct sequence for handling a hazardous product newly arriving on site is to first:

- A. Decant it into an unlabelled container
- B. Discard the supplier label
- C. Begin using it immediately
- D. Read the supplier label and locate the SDS

6. Before a capacitor is handled after lockout, the step that must occur is:

- A. Recording its microfarad rating
- B. Photographing its case
- C. Discharging it through a resistor
- D. Charging it for a test

7. When mentoring an apprentice through a pump-down, the most effective teaching action is to:

- A. Explain why each step occurs as it is performed
- B. Have the apprentice memorize the steps silently
- C. Perform it quickly without commentary
- D. Defer all questions to later

8. Before striking a brazing torch near combustibles, the last preparation step is to:

- A. Record the compressor amperage

- B. Charge the system
- C. Lower the thermostat setpoint
- D. Confirm the fire watch and extinguisher are in place

9. At the end of a service call where refrigerant was recovered, the documentation step required is to:

- A. Log the refrigerant type and quantity handled
- B. Record the ambient temperature
- C. Note the service-valve torque
- D. Photograph the paint finish

10. To check a running compressor's current against its RLA, the correct instrument and connection is to:

- A. Apply an ohmmeter to the common terminal
- B. Connect a micron gauge to the suction port
- C. Clamp an ammeter around one supply lead
- D. Read voltage across the contactor only

11. When breaking into a charged liquid line, the PPE step specific to the refrigerant hazard is to:

- A. Wear gloves and eye protection rated for refrigerant
- B. Don hearing protection
- C. Put on a high-visibility vest
- D. Wear a particulate dust mask

12. If a second technician must work on an already locked-out machine, the required step is that they:

- A. Work under the first technician's lock

- B. Use the supervisor's master key
- C. Tag the machine without a lock
- D. Apply their own personal lock

13. The reason verification with a meter is placed last in the lockout sequence is that it:

- A. Notifies the affected workers
- B. Applies the identifying tag
- C. Confirms the isolation actually achieved zero energy
- D. Shuts the equipment down

14. The correct order of operations when preparing a cut copper tube for a flare is:

- A. Flare, then cut, then deburr
- B. Deburr, then cut, then flare
- C. Cut, then flare, then deburr
- D. Cut, then deburr, then flare

15. After a system passes its nitrogen leak test, the next step before charging is to:

- A. Charge it immediately with refrigerant
- B. Pressurize it with oxygen
- C. Add refrigerant oil
- D. Evacuate it to a deep vacuum

16. During brazing, the sequence of heat application is to first:

- A. Touch the rod to the cold joint

- B. Heat the base metal to flow temperature, then apply the rod
- C. Melt the rod in the flame before heating the joint
- D. Quench the joint, then apply the rod

17. If a standing vacuum rises and then levels off, the next correct action is to:

- A. Charge the system
- B. Return to leak testing
- C. Continue evacuating to remove moisture
- D. Replace the compressor

18. The correct sequence for finishing a newly piped system is:

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

19. When a nitrogen purge is set up for brazing, the flow should be:

- A. As high as the regulator allows
- B. Pulsed on and off
- C. Reversed after each joint
- D. Low and steady throughout

20. If a tube is cut with a hacksaw rather than a tubing cutter, the resulting effect is:

- A. Filings and a ragged edge left inside the line

- B. A perfectly square, clean end
- C. An annealed end ready to flare
- D. A factory nitrogen charge retained

21. The first thing to do after isolating a length of soft copper for a bend is to:

- A. Braze a coupling onto it
- B. Use a tube bender to form a smooth radius
- C. Swage the end
- D. Flare both ends

22. When a standing vacuum rises continuously without stabilizing, the indicated next step is to:

- A. Charge the system anyway
- B. Return to leak testing to find the leak
- C. Continue evacuating indefinitely
- D. Replace the micron gauge

23. The correct depth for a swaged socket, formed before brazing a slip joint, is approximately:

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

24. If a brazed joint is made with the base metal below flow temperature, the resulting effect is:

- A. A stronger, fully penetrated joint

- B. Excessive subcooling
- C. Improved capillary action
- D. A cold joint that leaks

25. When reaming a freshly cut tube, the tube should be held so that the cut end faces:

- A. Upward to speed reaming
- B. Sideways for visibility
- C. Toward the bender
- D. Downward so chips fall out

26. If a system is brazed without a nitrogen purge, the downstream consequence is:

- A. Oxide scale forms inside and later clogs the metering device
- B. The joint becomes stronger
- C. The system runs at lower pressure
- D. Heat transfer improves

27. The correct order to prove a newly brazed joint's integrity is to:

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

28. An oversized suction riser produces which effect at part load?

- A. Excessive pressure drop

- B. Inability to be insulated
- C. Velocity too low to return oil up the riser
- D. A raised condensing temperature

29. The first sign observed during a 24-hour temperature-corrected nitrogen pressure test that indicates a leak is:

- A. A perfectly steady pressure
- B. A rising pressure
- C. Condensation in the gauge
- D. A falling pressure

30. After cutting and deburring, the operation that forms a 45-degree mechanical connection is:

- A. Flaring
- B. Swaging
- C. Brazing
- D. Reaming

31. If a suction line in an occupied space is left uninsulated, the resulting effect is:

- A. Raised discharge pressure
- B. Condensation that sweats and drips
- C. A frozen liquid line
- D. Reduced superheat

32. ACR copper tubing arrives capped and charged with nitrogen so that, when first cut, it is:

- A. Clean and dry, ready for refrigerant service

- B. Pre-charged with refrigerant
- C. Annealed for bending
- D. Sized for water service

33. The first step in planning an installation, before developing the layout, is to:

- A. Order the refrigerant
- B. Establish the load and required conditions
- C. Mount the thermostat
- D. Charge the system

34. When manufacturer data and a past-job rule of thumb disagree on line length, the planner follows:

- A. The manufacturer's installation instructions
- B. The past job
- C. The supplier price list
- D. The crew's preference

35. A load of 36,000 BTU/h, converted in the next planning step, equals:

- A. 1.5 tons
- B. 3 tons
- C. 12 tons
- D. 36 tons

36. If a comfort-cooling system is oversized, the resulting operating effect is:

- A. Improved dehumidification

- B. Short-cycling and poor dehumidification
- C. Permanently high subcooling
- D. Continuous low head pressure

37. In a planned pump-down sequence, the first device to act on a call to stop is the:

- A. Compressor contactor
- B. High-pressure cutout
- C. Liquid-line solenoid valve
- D. Condenser fan relay

38. The reason safety controls are wired in series is so that the effect of any one opening is to:

- A. Share the load current
- B. Modulate the valve
- C. Operate only in defrost
- D. Stop the equipment

39. A thermostat setpoint of 22 °C with a 2 °C differential produces a cut-in (call for cooling) at approximately:

- A. 20 °C
- B. 22 °C
- C. 24 °C
- D. 18 °C

40. The document a planner creates that lists, in order, how the system starts, cycles, and shuts down is the:

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

41. When a planner selects a TXV over a fixed orifice for a varying load, the resulting benefit is that the valve:

- A. Holds constant superheat across the load range
- B. Eliminates superheat entirely
- C. Sets subcooling directly
- D. Removes the metering device

42. The product load in a walk-in cooler calculation is the heat that comes from:

- A. The control transformer
- B. The compressor motor
- C. Conduction through the slab only
- D. The stored product itself

43. If a condenser is given insufficient clearance, the resulting effect is:

- A. Restricted airflow and raised condensing pressure
- B. Storage room for the recovery cylinder
- C. Shorter control wiring
- D. Easier forklift access

44. A 60,000 BTU/h load, expressed in the next planning step, equals:

- A. 2 tons
- B. 12 tons
- C. 5 tons
- D. 60 tons

45. Compressed-air signals positioning dampers indicate that the planned control technology is:

- A. DDC electronic
- B. Pneumatic
- C. Electromechanical relay
- D. Variable-frequency drive

46. The latent component of a cooling load is associated with the effect of:

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

47. A low-pressure control set to protect the compressor against loss of charge functions as a:

- A. Pump-down operating control
- B. Defrost terminator
- C. Modulating actuator
- D. Safety control

48. The clearest operating (not safety) control in a planned circuit is the:

- A. High-pressure cutout
- B. Relief valve
- C. Thermostat cycling the compressor
- D. Motor overload

49. A DDC-based Building Automation System operates by:

- A. Compressed-air signals only
- B. Networked microprocessors reading sensors and driving outputs
- C. Bimetal contacts only
- D. Manual hand valves

50. Matching the four primary components to one another and to the load produces the effect of:

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

51. The first action when a craned rooftop unit must be guided onto its curb is to:

- A. Stand under it to center it
- B. Ride it down to the roof
- C. Use a tag line while staying clear
- D. Remove the rigging early

52. After setting equipment on its pad, the next step that protects oil return and drainage is to:

- A. Add refrigerant
- B. Enlarge the suction line
- C. Raise the control voltage
- D. Confirm the unit is level

53. If a three-phase compressor runs backward after a panel rewire, the corrective step is to:

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

54. When installing a tall vertical suction riser, the feature added at its base to protect oil return is a:

- A. Liquid receiver
- B. P-trap
- C. Relief valve
- D. Sight glass only

55. If the evaporator coil receives insufficient airflow during operation, the resulting effect is that the coil:

- A. Rejects heat to the room
- B. Raises subcooling sharply
- C. Dehumidifies excessively
- D. Frosts or freezes and loses capacity

56. The function of a control transformer in the install is to:

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

57. A high-pressure cutout must be wired in series so that the effect when it opens is to:

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

58. The first verification after integrating the controls and energizing the system is that it:

- A. Draws zero compressor current
- B. Behaves per the planned sequence of operation
- C. Uses minimum refrigerant
- D. Bypasses the safety string

59. If a condensing unit is boxed in tightly on two sides, the resulting effect is:

- A. Lower head pressure
- B. Higher subcooling
- C. Recirculated hot air raising head pressure
- D. Reduced control voltage

60. When wiring an electronic expansion valve, beyond the refrigerant connections the next step is to wire its:

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

61. Keeping refrigerant lines short and direct during install produces the effect of:

- A. Limited pressure drop and reduced refrigerant charge
- B. Easier painting
- C. Increased subcooling
- D. A higher fitting count

62. A vibration-isolation loop installed near the compressor produces the effect of:

- A. Protecting brazed joints from fatigue cracking
- B. Reducing the thermostat differential
- C. Increasing condenser airflow
- D. Filtering moisture

63. A roof curb, once installed, provides support, weatherproofing, and:

- A. Electrical disconnection
- B. Refrigerant storage
- C. A path for duct and pipe penetrations
- D. Airflow measurement

64. If a suction line in an occupied space is installed without insulation, the resulting effect is:

- A. Sweating and dripping condensate
- B. Raised discharge pressure
- C. A frozen liquid line
- D. Reduced superheat

65. The first reason line- and low-voltage control wiring are separated during install is to:

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

66. A condensate pan and drain are required under an evaporator because the coil produces condensate when it:

- A. Operates only in heating
- B. Dehumidifies the air
- C. Uses hard-drawn copper
- D. Runs three-phase

67. When sloping a long horizontal suction run, it is pitched toward the compressor so that the effect is:

- A. Raised head pressure
- B. Aided oil return
- C. Reduced charge
- D. Increased subcooling

68. If supply ductwork is undersized, the resulting effect on the refrigeration side is:

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

69. The first planning knowledge needed before rigging a heavy compressor is the load's:

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

70. When a high-pressure cutout is mistakenly wired in parallel with the load, the resulting effect is that it:

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

71. The suction accumulator is installed at which point in the circuit?

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

72. If both a three-phase fan and compressor run backward after a service change, the single corrective step is to:

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

73. An economizer with an outdoor-air intake is installed to provide ventilation and the effect of:

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

74. The filter-drier is installed at which point in the circuit?

- A. In the suction line
- B. At the compressor discharge
- C. In the liquid line ahead of the metering device
- D. In a hot-gas bypass line

75. If equipment is set out of level, the resulting effect is:

- A. Higher airflow across the coil
- B. A correct control voltage
- C. Poor oil return and standing condensate
- D. The nameplate facing the door

76. The corrective action for a three-phase condenser fan found running in reverse is to:

- A. Replace the fan motor
- B. Swap any two of the three supply leads
- C. Add refrigerant
- D. Raise the control voltage

77. The first step before recording commissioning readings is to:

- A. Add charge based on initial numbers
- B. Allow the system to stabilize at near-design conditions
- C. Recover charge based on initial numbers
- D. Replace the TXV

78. To calculate superheat, the technician first measures suction pressure, converts it to saturation temperature, and then:

- A. Subtracts the saturation temperature from the measured suction-line temperature
- B. Adds the two temperatures together
- C. Subtracts the line temperature from ambient
- D. Multiplies the pressures

79. On a fixed-orifice system, the reading used to verify charge is:

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

80. On a TXV system, the reading used to verify charge is:

- A. Suction-line superheat
- B. Ambient dry-bulb
- C. Condenser subcooling
- D. Winding resistance

81. If a fixed-orifice system shows high superheat and low subcooling, the indicated condition is:

- A. Undercharge
- B. Overcharge
- C. Flooding evaporator
- D. Excess condenser airflow

82. Before charging a new system, the first verification is the refrigerant type against the:

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

83. A zeotropic blend is charged as a liquid so that the effect is to:

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

84. During commissioning of the controls, simulating a high-pressure condition verifies that the cutout:

- A. Modulates the TXV
- B. Stops the compressor at its setpoint
- C. Powers the condenser fan
- D. Lowers the suction pressure

85. If a commissioning check shows low superheat and high subcooling, the indicated condition is:

- A. Undercharge
- B. Leak
- C. Overcharge
- D. Air-starved indoors

86. The instruments required to calibrate an economizer enthalpy control measure:

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

87. The first thing confirmed during start-up of three-phase equipment is:

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

88. Suction saturation temperature is 3 °C and the suction line measures 11 °C, so the superheat is:

- A. 14 °C
- B. 8 °C
- C. 3 °C
- D. 11 °C

89. Condensing saturation temperature is 46 °C and the liquid line measures 39 °C, so the subcooling is:

- A. 85 °C
- B. 46 °C
- C. 39 °C
- D. 7 °C

90. If high head pressure, high subcooling, and normal suction are found on an air-cooled unit, the indicated cause is:

- A. An undercharge
- B. A flooding TXV
- C. A dirty condenser or non-condensables
- D. A return-air filter issue

91. Air balancing during commissioning produces the effect of:

- A. Setting the charge by weight
- B. Each space receiving its designed airflow
- C. Zero compressor current
- D. Maximized subcooling

92. The reason the refrigerant type and charge are recorded at commissioning is that the record serves as:

- A. The duct-sizing basis
- B. A warranty-only document
- C. Optional paperwork
- D. A regulatory record and service baseline

93. If a temperature split across the evaporator is far below design, the indicated problem is with:

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

94. Confirming a system was properly evacuated before charging is done by verifying that the:

- A. Standing vacuum held at a deep micron level
- B. Compressor ran in reverse
- C. Recovery cylinder was full
- D. Condenser was painted

95. On a heat pump, the reversing-valve shift is verified at commissioning by exercising the thermostat's:

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

96. If compressor current is measured well above nameplate RLA at commissioning, the indicated condition is the compressor:

- A. Charged with the wrong blend
- B. Operating under an overload
- C. Mounted out of level
- D. Drawing too little power

97. The commissioning report's primary long-term role is to serve as the:

- A. Supplier invoice
- B. Baseline of normal readings for future service
- C. Occupancy permit
- D. Warranty claim form

98. If a heat pump in heating shows high suction pressure, reduced capacity, and a warm suction line, the indicated cause is:

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

99. When a system is found low on charge, the correct sequence 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. If a single-phase compressor hums, fails to start, and trips the overload in seconds, the indicated cause is a:

- A. Slightly dirty condenser
- B. Wide thermostat differential
- C. Failed start capacitor or relay
- D. Over-evacuated system

101. If a condenser coil is left heavily fouled, the resulting effect is:

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

102. A cold spot with a temperature drop across the filter-drier indicates the next finding is a:

- A. Healthy drier
- B. Reverse-rotating compressor
- C. Partial liquid-line restriction at the drier
- D. Failed run capacitor

103. If a heat pump's outdoor coil is heavily iced and heating output has collapsed, the indicated defrost fault is that defrost:

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

104. Before installing a replacement for a compressor that burned out with acid-smelling oil, the required step is to:

- A. Simply swap it in
- B. Repaint the condenser
- C. Raise the control voltage
- D. Find and correct the cause and clean the contamination

105. If a low-pressure control cuts out while the measured suction pressure is actually normal, the indicated finding is:

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

106. Resistance and continuity measurements are taken only after the circuit is:

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

107. If non-condensables remain in a system after a poor evacuation, the resulting effect is:

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

108. Low suction, high superheat, and low subcooling together indicate the condition:

- A. Overcharge
- B. Undercharge or leak
- C. Flooding metering device
- D. Excessive evaporator airflow

109. If a heat pump fails to terminate defrost, the resulting effect is that it:

- A. Ices the outdoor coil solid
- B. Draws zero compressor current
- C. Stays in defrost too long, blowing cool air and wasting energy
- D. Freezes the liquid line

110. A megohmmeter showing declining insulation resistance across PM visits indicates the effect of:

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

111. The most powerful technique for diagnosing a refrigerant-side fault is to:

- A. Measure only suction pressure
- B. Check the nameplate color
- C. Count the fittings
- D. Read pressures, superheat, and subcooling together

112. If a defrost cycle fails to initiate in heating mode, the resulting effect is:

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

113. When a safety control trips, the first diagnostic step is to:

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

114. If a heat pump briefly reverses to cooling with the outdoor fan off and steam rising, the correct interpretation is:

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

115. To confirm a running fan motor is drawing its rated current, the instrument used is a:

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

116. Low superheat with high subcooling indicates the condition:

- A. Undercharge
- B. Overcharge
- C. Liquid-line restriction
- D. Reversing-valve leak

117. During service, recovered refrigerant must next be:

- A. Vented if the amount is small
- B. Stored in a disposable cylinder
- C. Mixed with another refrigerant
- D. Captured in a rated recovery cylinder, never vented

118. If an overload trips repeatedly and is found to coincide with seized bearings, the trip was:

- 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. The first step in systematic troubleshooting is to:

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

120. The reversing-valve solenoid on a heat pump is controlled by the thermostat's:

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

121. If a leaking system is repeatedly topped up rather than repaired, the resulting effect is that it:

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

122. Before a capacitor on a failed motor is handled, the required step is to:

- A. Charge it further for testing
- B. Pressurize it with nitrogen
- C. Store system oil in it
- D. Discharge it safely through a resistor

123. If a tripped safety control's sensed condition is measured and found genuinely out of range, the correct conclusion is the:

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

124. Reading pressures, superheat, and subcooling together is preferred over a single reading because:

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

125. Frost forming on a heat pump's outdoor coil during heating mode is correctly interpreted as:

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

## Practice Exam 23: Answer Key and Explanations

1. B — After normal shutdown, the next step is isolating each energy source at its disconnect or valve, before locks are applied. Isolation must physically separate the energy before the lock secures it.
2. A — Verifying the zero-energy state with the appropriate instrument is the final step before work begins. A disconnect can appear open yet still be live, so verification prevents fatal shock.
3. C — Lightheadedness with a refrigerant odour signals oxygen displacement, so the first action is to leave and ventilate before re-entry. A mask cannot remedy a lack of oxygen.
4. A — At 80% of capacity, recovery must stop and continue into another rated cylinder. Filling past 80% leaves no vapour space for liquid expansion, risking rupture.
5. D — The first step with a newly arrived hazardous product is to read the supplier label and locate the SDS. This establishes the hazards and handling before any use.
6. C — Before a capacitor is handled, it must be discharged through a resistor, because it stores a dangerous charge after power is removed. Ratings and photos do not address the shock hazard.

7. A — Explaining why each step occurs as it is performed is the most effective mentoring action, building judgment the apprentice can transfer to new situations. Silent memorization does not.
8. D — The last step before striking the torch is confirming the fire watch and extinguisher are in place. The open flame can ignite combustibles, so fire controls come first.
9. A — At the end of a call where refrigerant was recovered, the required record is the refrigerant type and quantity handled. This satisfies the regulatory refrigerant log.
10. C — To read a running compressor's current against RLA, a clamp ammeter is placed around one supply lead, measuring current without breaking the circuit. An ohmmeter and micron gauge measure unrelated quantities.
11. A — Breaking into a charged liquid line requires gloves and eye protection rated for refrigerant, addressing the instant-frostbite hazard. The other PPE covers noise, dust, or visibility.
12. D — A second technician working on a locked-out machine must apply their own personal lock. A shared lock or master key cannot protect a second worker independently.
13. C — Verification is placed last because it confirms the isolation actually achieved zero energy before contact. It is the proof step that prevents shock.
14. D — The correct order is cut, then deburr, then flare. Deburring after cutting removes the stress-raising burr before the flare is formed, producing a clean, sealing flare.
15. D — After a system passes its nitrogen leak test, the next step is to evacuate it to a deep vacuum. Evacuation removes air and moisture before charging.
16. B — The correct heat sequence is to heat the base metal to flow temperature, then apply the rod so the metal melts it. Melting the rod in the flame first produces a cold joint.

17. C — A vacuum that rises and levels off indicates remaining moisture, so the next step is to continue evacuating to remove it. The leveling-off distinguishes moisture from a leak.

18. C — The correct sequence is leak test, then evacuate, then charge. Each step depends on passing the previous one, and charging before evacuation is never acceptable.

19. D — A nitrogen purge for brazing is set low and steady throughout, displacing oxygen without blowing filler out or overpressurizing the heated line. High flow is hazardous.

20. A — Cutting with a hacksaw leaves filings and a ragged edge inside the line, unlike a tubing cutter. The filings circulate and damage the compressor and metering devices.

21. B — After isolating soft copper for a bend, the first action is to use a tube bender to form a smooth radius without kinking. Brazing, swaging, or flaring are not bending operations.

22. B — A vacuum that rises continuously without stabilizing indicates a leak, so the next step is to return to leak testing. Moisture, by contrast, levels off once boiled away.

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

24. D — A joint brazed with the base metal below flow temperature is a cold joint that leaks, because capillary action never drew the filler in. The metal, not the flame, must melt the rod.

25. D — When reaming, the cut end is held downward so chips fall out rather than into the line. Chips left inside can clog a metering device or damage the compressor.

26. A — Brazing without a nitrogen purge lets oxide scale form inside, which later flakes off and clogs the metering device. The purge displaces oxygen to prevent this.

27. C — The correct order to prove integrity is leak test with nitrogen first, then evacuate, then charge. Each step depends on the previous one passing.

28. C — An oversized suction riser drops velocity too low to return oil up the riser at part load. Oil then pools and the compressor is starved of lubrication.
29. D — A falling (temperature-corrected) pressure during a 24-hour nitrogen test is the sign of a leak. A steady reading would confirm a tight system.
30. A — After cutting and deburring, flaring forms the 45-degree mechanical connection. Swaging, brazing, and reaming serve other purposes.
31. B — An uninsulated suction line in an occupied space sweats and drips condensate, because its cold surface falls below the air's dew point. Insulation prevents this.
32. A — Capped, nitrogen-charged ACR copper is clean and dry, ready for refrigerant service when first cut. Internal moisture or contamination would damage the system.
33. B — The first planning step, before layout, is to establish the load and required conditions. Everything downstream depends on knowing what the system must do.
34. A — When manufacturer data and a past-job rule of thumb disagree, the manufacturer's installation instructions govern and tie to code and warranty. Past habits are not authoritative.
35. B —  $36,000 \text{ BTU/h} \div 12,000 \text{ BTU/h per ton} = 3 \text{ tons}$ . The conversion uses the one-ton definition.
36. B — An oversized comfort system short-cycles and dehumidifies poorly, satisfying the thermostat before removing moisture. The frequent starts also stress the compressor.
37. C — In a pump-down sequence, the liquid-line solenoid valve acts first on a call to stop; the compressor then pumps the evaporator down until the low-pressure control stops it.
38. D — Safety controls are wired in series so that any one opening stops the equipment. This gives each protective device the authority to shut the system down.

39. C — With a 22 °C setpoint and a 2 °C differential, the thermostat calls for cooling when the space rises to about 24 °C and stops near 22 °C. The differential separates cut-in from cut-out.
40. A — The sequence of operation lists, in order, how the system starts, cycles, and shuts down. The bill of materials and logs serve other purposes.
41. A — A TXV holds constant superheat across the load range, which is why it suits varying loads. A fixed orifice cannot adjust to changing load.
42. D — The product load is the heat from the stored product itself, distinct from conduction, control, and compressor loads. It is central to refrigeration sizing.
43. A — Insufficient condenser clearance restricts airflow and raises condensing pressure. Adequate clearance ensures the condenser can reject heat.
44. C —  $60,000 \text{ BTU/h} \div 12,000 \text{ BTU/h per ton} = 5 \text{ tons}$ . The conversion uses the one-ton definition.
45. B — Compressed-air signals positioning dampers indicate pneumatic control technology. A controller modulates air pressure to drive the actuator.
46. C — The latent component is associated with removing moisture from the air, distinct from the sensible heat that changes temperature. Conduction and solar gain are sensible.
47. D — A low-pressure control set to protect against loss of charge functions as a safety control. In a pump-down circuit the same device acts as an operating control.
48. C — A thermostat cycling the compressor is the clearest operating control. High-pressure cutouts, relief valves, and overloads are protective safety devices.
49. B — A DDC-based Building Automation System operates by networked microprocessors reading sensors and driving outputs. This enables centralized monitoring and scheduling.

50. B — Matching the four components to one another and to the load produces rated performance at design conditions. Mismatched components cannot meet the designed capacity.

51. C — The first action when guiding a craned unit is to use a tag line while staying clear; standing under a suspended load is never acceptable. Dropped loads cause fatal injuries.

52. D — After setting equipment on its pad, confirming it is level protects oil return and condensate drainage. An out-of-level unit suffers poor oil return and standing water.

53. 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.

54. B — A P-trap at the base of a tall suction riser collects and lifts oil up the riser. A receiver, by contrast, stores liquid charge on the high side.

55. D — Insufficient airflow lets the evaporator coil run too cold, so it frosts or freezes and loses capacity. The refrigerant and air sides are interdependent.

56. D — A control transformer steps line voltage down to the low-voltage control voltage. This powers thermostats and relay or contactor coils.

57. C — A high-pressure cutout wired in series interrupts the circuit and stops the compressor when it opens. Series wiring gives it that protective authority.

58. B — The first verification after integrating controls and energizing is that the system behaves per the planned sequence of operation. This confirms correct integration.

59. C — A boxed-in condensing unit recirculates its own hot discharge air, raising head pressure and cutting capacity. Adequate clearance prevents recirculation.

60. D — When wiring an electronic expansion valve, the next step beyond refrigerant connections is to wire its sensors and stepper-motor leads to the controller. The controller uses these to position the valve.

61. A — Short, direct line routing limits pressure drop and reduces the refrigerant charge required. Excess length reduces performance and increases charge.
62. A — A vibration-isolation loop near the compressor protects brazed joints from fatigue cracking caused by transmitted vibration. Without it, vibration cracks joints over time.
63. C — A roof curb provides support, weatherproofing, and a path for duct and pipe penetrations. It integrates the packaged unit with the roof.
64. A — An uninsulated suction line in an occupied space sweats and drips condensate, because its cold surface falls below the air's dew point. Insulation prevents this.
65. C — Line- and low-voltage control wiring are separated to maintain safety and prevent interference, as required by code. It is not about flow, length, or torque.
66. B — A condensate pan and drain are required because the coil produces condensate when it dehumidifies the air. The water must drain away to prevent overflow.
67. B — Sloping a horizontal suction run toward the compressor aids oil return by letting oil drain back with the refrigerant. Level or rising runs let oil pool.
68. C — Undersized supply ductwork reduces airflow, which can freeze the evaporator coil. The refrigerant and air sides are interdependent.
69. C — The first planning knowledge before rigging a heavy compressor is its weight and centre of gravity, which ensures a safe, balanced lift within gear ratings.
70. B — A high-pressure cutout wired in parallel with the load cannot interrupt the control circuit and gives no protection. It must be in series to break the circuit.
71. A — The suction accumulator is installed 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.

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

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

74. C — The 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.

75. C — Equipment set out of level causes poor oil return and standing condensate. Levelling protects oil return and drainage.

76. B — A three-phase condenser fan running in reverse is corrected by swapping any two of the three supply leads. Reverse rotation is a phase-sequence issue, not a motor fault.

77. B — The first 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.

78. A — Superheat is found by subtracting the saturation temperature from the measured suction-line temperature. It confirms all liquid has boiled before the vapour reaches the compressor.

79. C — 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.

80. C — 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.

81. A — High superheat with low subcooling on a fixed-orifice system indicates undercharge: too little refrigerant starves the evaporator and leaves the condenser short of liquid. The pair read together reveals the charge state.

82. D — Before charging, the first verification is the refrigerant type against the equipment nameplate. Line color and pump brand are not reliable proof.

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

84. B — Simulating a high-pressure condition verifies the cutout stops the compressor at its setpoint. An untested safety control may provide no real protection.

85. C — Low superheat with high subcooling indicates an overcharge: excess refrigerant floods the condenser and overfeeds the evaporator. It is the inverse of the undercharge pattern.

86. B — 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.

87. A — On start-up of three-phase equipment, correct rotation of the compressor and fans is confirmed first, since reverse rotation damages the compressor and cuts capacity.

88. B — Superheat = line temperature – saturation temperature =  $11\text{ }^{\circ}\text{C} - 3\text{ }^{\circ}\text{C} = 8\text{ }^{\circ}\text{C}$ . It confirms all liquid has boiled before the vapour reaches the compressor.

89. D — Subcooling = saturation (condensing) temperature – liquid-line temperature =  $46\text{ }^{\circ}\text{C} - 39\text{ }^{\circ}\text{C} = 7\text{ }^{\circ}\text{C}$ . It confirms a solid column of liquid feeds the metering device.

90. C — High head, high subcooling, and normal suction point to a dirty condenser or non-condensables, both of which impair heat rejection and raise head pressure. An undercharge would show low subcooling.

91. B — 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.

92. D — Recording the refrigerant type and charge serves as a regulatory record and a service baseline. It is neither optional nor solely for warranty.
93. A — 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 — Proper evacuation before charging is confirmed by verifying the standing vacuum held at a deep micron level. A holding vacuum proves the system is tight and dry.
95. D — The reversing-valve shift is verified 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. B — 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. B — The commissioning report's long-term role is to serve as the baseline of normal readings for future service. It tells the next technician what normal looked like for that installation.
98. D — High suction pressure, reduced capacity, and a warm suction line are the classic signature of a reversing valve leaking 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 compressor that hums, fails to start, and trips the overload most commonly has a failed start capacitor or relay, leaving it without starting torque. The overload protects it.
101. D — 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. C — A cold spot and temperature drop across the filter-drier indicate a partial liquid-line restriction at the drier. The pressure drop across the restriction causes the local cooling.

103. D — 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. D — A burned-out compressor with acid-smelling oil requires finding and correcting the cause and cleaning the contamination before the replacement is installed, or it will fail too.

105. B — A 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. C — 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 left in a system raise the head pressure abnormally, because trapped air occupies condenser space and adds its partial pressure. The fix is proper evacuation.

108. B — Low suction, high superheat, and low subcooling together indicate 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 — A heat pump that fails to terminate defrost stays in defrost too long, blowing cool air indoors and wasting energy. Defrost should end once the coil is clear.

110. A — 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. A — A defrost cycle failing to initiate lets the outdoor coil ice over, losing heating capacity. The frost insulates the coil and blocks airflow.

113. C — The first diagnostic 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. A — A brief reversal to cooling with the outdoor fan off and steam rising is normal defrost operation. Mistaking it for a fault is a common error.

115. B — 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 indicates an overcharge, as excess refrigerant floods the condenser and overfeeds the evaporator. High superheat with low subcooling would indicate the opposite.

117. D — 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. D — 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. A — Repeatedly 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. D — Before a capacitor is handled, it must be discharged safely through a resistor, because it stores a dangerous charge after power is removed. This prevents a serious shock.

123. A — 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. B — Reading pressures, superheat, and subcooling together is preferred because each fault produces a characteristic pattern a single reading cannot reveal. The pattern identifies the fault.

125. A — 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.