PRACTICE EXAM 11: RACM RED SEAL SIMULATION (125 QUESTIONS)

1. A recovery cylinder has a water capacity that holds a maximum of 18 kg of R-410A when full. Following the 80% fill rule, the maximum mass of refrigerant the cylinder may safely hold is:

A. 18 kg

B. 9 kg

C. 14.4 kg

D. 16.2 kg

2. Under NIOSH hearing-protection ratings, a mechanic in a plant room measured at 97 dBA uses muffs with an NRR that derates to about 12 dBA of real-world protection. The approximate exposure at the ear is:

A. 85 dBA

B. 109 dBA

C. 97 dBA

D. 73 dBA

3. A multimeter on the ohms range reads "OL" (infinite) across a compressor's run winding, common to run terminals. With the unit locked out, this most directly indicates:

A. A shorted winding

B. An open winding

C. A correctly intact winding

D. A grounded winding

4. WHMIS 2015 hazard classes are communicated by pictograms bordered in:

A. Solid black squares

B. Yellow triangles

C. Red diamonds

D. Blue circles

5. A lockout procedure lists six steps. The step that most directly prevents a fatal shock when opening a panel is:

A. Verifying the zero-energy state with a meter

B. Notifying affected workers

C. Applying the personal lock

D. Shutting the equipment down normally

6. A torque wrench specifies 20 N·m on a flare nut. Expressed in approximate foot-pounds (1 N·m ≈ 0.738 ft·lb), this is closest to:

A. 15 ft·lb

B. 27 ft·lb

C. 7 ft·lb

D. 41 ft·lb

7. A refrigerant log must record, at minimum, the:

A. Ambient temperature and barometric pressure

B. Torque values applied to service valves

C. Refrigerant type and quantity handled

D. Paint color of the equipment

8. A capacitor rated 370 V is measured at 0 V after the unit is locked out, but the technician still discharges it through a resistor before handling because:

A. Stored charge can persist or rebuild and a meter reading can be momentary

B. The capacitor contains pressurized refrigerant

C. The resistor recharges the capacitor for testing

D. WHMIS requires it for all electrical parts

9. Effective communication on a multi-trade site is best demonstrated when the mechanic:

A. Proceeds without informing other trades to save time

B. Confirms routing conflicts with affected trades before cutting in

C. Records only the refrigerant charge

D. Defers all coordination to the general contractor only

10. A hot-work permit is required before brazing primarily to ensure:

A. Fire-prevention controls and a fire watch are in place

B. The refrigerant charge is recorded

C. The compressor amperage is logged

D. The thermostat is set to its lowest point

11. A clamp ammeter reads 14.2 A on a compressor with a nameplate RLA of 11.0 A. Expressed as a percentage of RLA, the draw is closest to:

A. 78%

B. 129%

C. 100%

D. 65%

12. The PPE item that specifically addresses the eye-frostbite hazard of liquid refrigerant is:

A. Goggles rated for refrigerant contact

B. A disposable dust mask

C. Hearing protection

D. A high-visibility vest

13. When a recovered-refrigerant cylinder is later sent off-site to be reprocessed to a recognized purity standard for resale, the process is:

A. Reclaim

B. Recovery

C. Recycling

D. Venting

14. A standing vacuum is pulled to 400 microns, the pump is isolated, and over 10 minutes the reading rises to 900 microns and then holds steady. This indicates:

A. A leak in the system

B. Moisture boiling off in the system

C. A correctly dry, tight system

D. A failed micron gauge

15. A refrigeration flare is formed at an included angle of:

A. 45 degrees

B. 30 degrees

C. 37 degrees

D. 60 degrees

16. Brazing filler metal is defined as melting above:

A. 840 °F (450 °C)

B. 212 °F (100 °C)

C. 600 °F (316 °C)

D. 1,200 °F (649 °C)

17. A copper line is pressure-tested with dry nitrogen to 300 psig. Over 24 hours, temperature-corrected pressure drops to 250 psig. The correct interpretation is:

A. The system is leak-free

B. A leak is present and must be found

C. The nitrogen has condensed

D. The gauge is overreading

18. A tube cut leaves a burr. The reaming step is performed with the tube end pointed downward so that:

A. The burr anneals before flaring

B. The tube outside diameter increases

C. Metal chips fall out instead of into the line

D. The factory nitrogen escapes

19. A nitrogen purge during brazing is held at a low flow because excessive pressure would:

A. Blow molten filler out of the joint

B. Prevent oxide scale

C. Improve capillary action

D. Cool the joint too quickly

20. A swaged socket for a brazed slip joint should have a depth approximately equal to:

A. One-tenth the tube diameter

B. Twice the tube diameter

C. One tube diameter

D. The tube wall thickness

21. A system holds 2.5 kg of R-410A and the recovery machine pulls it into a cylinder. Converting to pounds (1 kg ≈ 2.205 lb), the recovered mass is closest to:

A. 1.1 lb

B. 3.6 lb

C. 5.5 lb

D. 8.0 lb

22. A correct order for finishing a newly piped system is:

A. Charge, evacuate, leak test

B. Evacuate, charge, leak test

C. Charge, leak test, evacuate

D. Leak test, evacuate, charge

23. A cold joint that leaks after brazing is most often caused by:

A. The base metal not reaching filler flow temperature

B. Purging with dry nitrogen

C. Using a tubing cutter to square the end

D. Sloping the line toward the compressor

24. Soft annealed copper differs from hard-drawn copper chiefly in that it:

A. Cannot be brazed

B. Is sized only by inside diameter

C. Can be bent and flared by hand

D. Is rated for higher pressure only

25. An oversized suction riser returns oil poorly at part load because:

A. Pressure drop is too high

B. The line cannot be insulated

C. The condensing temperature rises

D. Refrigerant velocity falls below oil-return speed

26. A leak-test reading that stays rock-steady at the test pressure (temperature-corrected) over 24 hours indicates:

A. A tight system with no detectable leak

B. Moisture in the system

C. A large high-side leak

D. Non-condensables present

27. ACR copper tubing is specified by its:

A. Actual outside diameter

B. Nominal inside diameter

C. Wall thickness only

D. Coil length

28. A horizontal suction line with no slope causes:

A. Excessive subcooling

B. Oil to pool rather than return

C. Lower head pressure

D. Reduced refrigerant charge

29. A vacuum that rises continuously and never stabilizes during a standing test indicates:

A. A leak admitting gas from outside

B. Moisture finishing boiling off

C. A dry, tight system

D. An oversized vacuum pump

30. Site preparation before brazing near combustibles requires, above all:

A. Recording the compressor amps

B. Charging the system

C. Lowering the thermostat

D. Clearing combustibles and posting a fire watch

31. A swaging tool is used to:

A. Square the end of a cut tube

B. Remove the internal burr

C. Form a 45-degree flare

D. Expand a tube end into a socket for brazing

32. A flare joint is preferred over a brazed joint where the connection:

A. Will be permanent and buried

B. May need to be opened for future service

C. Carries no refrigerant

D. Is larger than 2 inches

33. A load is calculated at 48,000 BTU/h. In tons of refrigeration this is:

A. 2 tons

B. 8 tons

C. 4 tons

D. 48 tons

34. One ton of refrigeration expressed in kilowatts (1 ton ≈ 3.517 kW) is closest to:

A. 1.0 kW

B. 12 kW

C. 3.5 kW

D. 0.3 kW

35. When manufacturer data conflicts with a rule of thumb a planner used on a past job, the planner must follow:

A. The past job's approach

B. The supplier's catalogue price

C. The crew's preference

D. The manufacturer's installation instructions

36. A 5-ton system is being specified. In BTU/h this is:

A. 12,000 BTU/h

B. 60,000 BTU/h

C. 24,000 BTU/h

D. 5,000 BTU/h

37. Oversizing a comfort-cooling system most directly degrades:

A. Condenser subcooling

B. The supply voltage

C. The refrigerant purity

D. Dehumidification, due to short-cycling

38. A thermostat set to 22 °C with a 1.5 °C differential will cut in (call for cooling) at approximately:

A. 23.5 °C

B. 20.5 °C

C. 22.0 °C

D. 19.0 °C

39. Safety controls are arranged in series in the control circuit so that:

A. They share the load current

B. They modulate the metering valve

C. They operate only in defrost

D. Any single control opening stops the equipment

40. A walk-in cooler's product load is the heat:

A. Conducted through the slab only

B. Removed from the stored product

C. Generated by the control transformer

D. Drawn by the compressor motor

41. A DDC-based Building Automation System uses:

A. Compressed-air signals only

B. Networked microprocessors reading sensors and driving outputs

C. Bimetal contacts only

D. Manual hand valves only

42. The document that describes, step by step, how a planned system starts, cycles, and shuts down is the:

A. Refrigerant log

B. WHMIS inventory

C. Bill of materials

D. Sequence of operation

43. A TXV is selected over a fixed orifice for a varying-load application because it:

A. Eliminates superheat entirely

B. Holds constant superheat across the load range

C. Sets condenser subcooling directly

D. Removes the need for a metering device

44. A planner sizes a condenser location with clearance chiefly to:

A. Store the recovery cylinder

B. Shorten control wiring

C. Provide forklift access only

D. Ensure unrestricted airflow for heat rejection

45. A latent-dominated space (high occupancy) requires the planner to emphasize:

A. Conduction through opaque walls

B. Solar gain only

C. Moisture-removal capacity

D. Control transformer sizing

46. A low-pressure control set to stop the compressor on loss of charge functions as a(n):

A. Safety control

B. Operating pump-down control

C. Defrost terminator

D. Modulating actuator

47. Total cooling load combines sensible and latent components. A "sensible heat ratio" of 0.80 means that of the total load, the latent portion is:

A. 80%

B. 100%

C. 20%

D. 50%

48. Compressed-air control signals positioning dampers indicate which technology?

A. Pneumatic

B. DDC electronic

C. Electromechanical relay

D. Variable-frequency drive

49. Matching all four primary components to one another and to the load ensures the system will:

A. Use the least refrigerant regardless of capacity

B. Deliver rated performance at design conditions

C. Need no commissioning

D. Require no safety controls

50. A clearly operating (not safety) control is the:

A. Thermostat cycling the compressor to hold setpoint

B. High-pressure cutout

C. Relief valve

D. Motor overload

51. A condenser fan motor draws 4.0 A at 240 V. Its power consumption ($P = V \times I$) is:

A. 60 W

B. 240 W

C. 960 W

D. 480 W

52. A worker must guide a craned rooftop unit onto its curb. The correct method is to:

A. Stand under the load to center it

B. Stand under it only with a hard hat

C. Ride the load down

D. Use a tag line while staying clear of the load

53. A heater element is rated 240 V and 10 Ω. Using Ohm's law, its current draw is:

A. 2,400 A

B. 0.04 A

C. 240 A

D. 24 A

54. A long vertical suction riser is installed. To protect oil return at the base of the riser, the installer fits a:

A. Liquid receiver

B. Relief valve

C. P-trap

D. Sight glass only

55. Equipment set out of level causes oil-return and drainage problems; the corrective step is to:

A. Add refrigerant

B. Enlarge the suction line

C. Raise the control voltage

D. Re-set the unit dead level

56. A three-phase compressor runs but with poor capacity and abnormal sound after a panel rewire. The correction is to:

A. Replace the compressor

B. Swap any two of the three supply leads

C. Add refrigerant

D. Raise the setpoint

57. A control transformer with a 240 V primary and 24 V secondary has a turns ratio of approximately:

A. 1:10

B. 24:1

C. 10:1

D. 1:24

58. A high-pressure cutout must be wired in the control circuit:

A. In parallel with the compressor load

B. To the condensate drain

C. In series so it can interrupt the circuit

D. Across the run capacitor

59. Insufficient airflow across the evaporator coil during install will most likely:

A. Raise subcooling sharply

B. Cause the coil to frost or freeze

C. Increase dehumidification

D. Lower head pressure to zero

60. A 24 V control circuit draws 0.5 A through a contactor coil. The coil's resistance ($R = V \div I$) is:

A. 12 Ω

B. 48 Ω

C. 0.02 Ω

D. 24 Ω

61. Refrigerant lines are kept short and direct to:

A. Ease painting

B. Increase subcooling

C. Reduce fitting count only

D. Limit pressure drop and refrigerant charge

62. A vibration-isolation loop near the compressor protects:

A. The thermostat from drafts

B. The condenser from sun

C. The drier from moisture

D. Brazed joints from fatigue cracking

63. Line-voltage and low-voltage control wiring are kept separated to:

A. Improve refrigerant flow

B. Shorten the lines

C. Maintain safety and prevent interference

D. Increase torque

64. A condensate pan and drain are required under an evaporator that:

A. Dehumidifies and produces condensate

B. Runs only in heating

C. Uses hard-drawn copper

D. Is three-phase

65. An outdoor condensing unit boxed in tightly on two sides will most likely:

A. Lower head pressure

B. Raise subcooling

C. Recirculate hot air and raise head pressure

D. Reduce control voltage

66. After integrating the controls, the installer energizes the system and verifies that it:

A. Follows its planned sequence of operation

B. Draws zero compressor current

C. Has minimum refrigerant charge

D. Bypasses the safety string

67. A three-phase resistive load of 10 kW at 600 V draws a line current using $P = \sqrt{3} \times V \times I$; solving for I gives approximately ($\sqrt{3} \approx 1.732$):

A. 9.6 A

B. 16.7 A

C. 1.0 A

D. 60 A

68. A roof curb provides support, weatherproofing, and:

A. Electrical disconnection

B. A path for duct and pipe penetrations

C. Refrigerant storage

D. Airflow measurement

69. An electronic expansion valve install also requires wiring its:

A. Capillary tube to the receiver

B. Flare to the king valve

C. Sensors and stepper-motor leads to the controller

D. Air line to a compressor

70. A high-pressure cutout mistakenly wired in parallel with the load instead of in series will:

A. Provide no protection because it cannot break the circuit

B. Trip too early

C. Modulate the valve

D. Power the fan

71. Sloping a long horizontal suction run toward the compressor:

A. Raises head pressure

B. Reduces the charge

C. Aids oil return

D. Increases subcooling

72. A condenser fan motor at 120 V drawing 6.0 A consumes power of:

A. 720 W

B. 126 W

C. 20 W

D. 360 W

73. Undersized supply ductwork most directly causes:

A. Higher subcooling

B. Zero compressor current

C. Faster dehumidification

D. Reduced airflow that can freeze the coil

74. Knowing a load's weight and centre of gravity before a lift primarily ensures:

A. The correct refrigerant charge

B. A shorter line set

C. A lower thermostat differential

D. A safe, balanced lift within gear ratings

75. A line-voltage circuit in a typical install energizes:

A. The 24 V thermostat only

B. The compressor and fan motor loads

C. The micron gauge

D. The recovery machine

76. A three-phase fan and compressor both run backward after a service-panel change. The single fix is to:

A. Swap any two incoming supply leads

B. Replace both motors

C. Add refrigerant

D. Increase the control transformer rating

77. Suction pressure gives a saturation temperature of 4 °C and the suction line measures 12 °C. The superheat is:

A. 16 °C

B. 4 °C

C. 12 °C

D. 8 °C

78. Liquid-line saturation (condensing) temperature is 45 °C and the liquid line measures 38 °C. The subcooling is:

A. 7 °C

B. 83 °C

C. 45 °C

D. 38 °C

79. On a fixed-orifice system, commissioning charge is verified primarily by:

A. Condenser subcooling

B. Suction-line superheat

C. The nameplate amperage only

D. Outdoor wet-bulb temperature

80. On a TXV system, charge is verified primarily by:

A. Suction superheat

B. Ambient dry-bulb

C. Condenser subcooling

D. Winding resistance

81. A system shows superheat of 25 °C (high) and subcooling of 2 °C (low). This pattern indicates the system is:

A. Overcharged

B. Flooding the evaporator

C. Undercharged

D. Over-ventilated

82. A zeotropic blend must be charged as a liquid to:

A. Speed charging

B. Preserve the blend composition

C. Lower cylinder pressure

D. Raise subcooling

83. Before recording commissioning readings, the system must be allowed to:

A. Run in reverse briefly

B. Complete the nitrogen purge

C. Stabilize at near-design conditions

D. Cool the vacuum pump

84. Readings that together best describe overall performance are:

A. Refrigerant brand and color

B. Wiring-diagram revision date

C. Building age and occupancy

D. Pressures, superheat, subcooling, split, and current

85. Commissioning the controls includes proving that a high-pressure cutout actually:

A. Modulates the TXV

B. Powers the condenser fan

C. Stops the compressor at its setpoint

D. Lowers the suction pressure

86. A reading set of low superheat (3 °C) and high subcooling (15 °C) indicates the system is:

A. Undercharged

B. Leaking

C. Air-starved on the indoor side

D. Overcharged

87. Calibrating an economizer enthalpy control requires instruments measuring:

A. Suction pressure only

B. Supply voltage only

C. Line length only

D. Temperature, humidity, and the control's output

88. During start-up of three-phase equipment, the first item confirmed is:

A. Correct rotation of compressor and fans

B. The cylinder weight

C. The occupancy schedule

D. The thermostat differential

89. The refrigerant type is verified before charging against the:

A. Liquid-line color

B. Vacuum-pump brand

C. Equipment nameplate

D. Line-set length

90. A temperature split across the evaporator far below design suggests a problem with:

A. The nameplate

B. Charge, airflow, or capacity

C. The recovery cylinder

D. The thermostat color

91. High head pressure, high subcooling, and normal suction on an air-cooled unit most likely indicates:

A. An undercharge

B. A flooding TXV

C. A return-air filter issue

D. A dirty condenser or non-condensables

92. A measured compressor current well above nameplate RLA at commissioning indicates the compressor is:

A. Charged with the wrong blend

B. Mounted out of level

C. Drawing too little power

D. Operating under an overload

93. Air balancing during commissioning ensures:

A. Each space receives its designed airflow

B. The charge is set by weight

C. The compressor draws no current

D. Subcooling is maximized

94. Recording refrigerant type and exact charge at commissioning is:

A. Optional record-keeping

B. Only for warranty

C. A regulatory record and service baseline

D. For duct sizing

95. A standing vacuum that held at a deep micron level before charging confirms the system was:

A. Overcharged

B. Tight and dry

C. Running in reverse

D. Freshly painted

96. Suction pressure gives a saturation temperature of −2 °C and the suction line reads 9 °C. Superheat equals:

A. 7 °C

B. 11 °C

C. 2 °C

D. 18 °C

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

A. The supplier invoice

B. The occupancy permit

C. The baseline of normal readings for future service

D. The warranty claim form

98. A heat pump in heating shows high suction pressure, reduced capacity, and a warm suction line. The most likely 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. A system is found low on charge. The correct service action is to:

A. Add refrigerant and a leak-stop additive

B. Reset the low-pressure control

C. Find and repair the leak, then evacuate and recharge

D. Replace the thermostat

100. A single-phase compressor hums, fails to start, and trips the overload in seconds. The most probable cause is a:

A. Slightly dirty condenser

B. Wide thermostat differential

C. Over-evacuated system

D. Failed start capacitor or relay

101. A condenser coil left heavily fouled will most directly cause:

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 on a poorly-cooling system indicates:

A. A healthy drier

B. A partial liquid-line restriction at the drier

C. A reverse-rotating compressor

D. A failed run capacitor

103. A motor's run capacitor measures 25 µF against a 45 µF rating. The likely service finding is the motor:

A. Runs at higher efficiency

B. Starts instantly with no current

C. Runs hot and draws high current

D. Operates only in defrost

104. A heat pump's outdoor coil is heavily iced and heating output has collapsed. The defrost fault is most likely:

A. Defrost terminating too early

B. Defrost failing to initiate

C. The reversing valve stuck in cooling

D. An overcharge

105. A burned-out compressor has acid-smelling oil. Before installing the replacement, the technician must:

A. Simply swap it in

B. Repaint the condenser

C. Raise the control voltage

D. Find the cause and clean the contamination

106. A low-pressure control cuts out while the measured suction pressure is actually normal. This indicates:

A. A genuine loss of charge

B. A faulty control or its wiring

C. A dirty condenser

D. A leaking reversing valve

107. Resistance/continuity measurements are taken only on a circuit that is:

A. Energized and loaded

B. Pressurized with nitrogen

C. Charged with refrigerant

D. De-energized and locked out

108. Non-condensables left in a system will:

A. Raise head pressure abnormally

B. Lower head pressure

C. Reduce superheat to zero

D. Freeze the liquid line

109. Low suction, high superheat, and low subcooling together indicate:

A. An overcharge

B. An undercharge or leak

C. A flooding metering device

D. Excessive evaporator airflow

110. A heat pump that fails to terminate defrost will:

A. Ice the outdoor coil solid

B. Stay in defrost too long, blowing cool air and wasting energy

C. Draw zero compressor current

D. Freeze the liquid line

111. A megohmmeter shows declining insulation resistance across PM visits. This indicates:

A. A healthy improving winding

B. An overcharge

C. A dirty condenser

D. Winding insulation breaking down toward failure

112. The most powerful field technique for diagnosing a refrigerant-side fault is:

A. Measuring only suction pressure

B. Reading pressures, superheat, and subcooling together

C. Checking the nameplate color

D. Counting the fittings

113. A defrost cycle failing to initiate in heating mode results in:

A. Continuous indoor cooling

B. Zero head pressure

C. An overcharged liquid line

D. The outdoor coil icing over and lost heating

114. A tripped high-pressure cutout that re-trips after each reset should prompt the technician to:

A. Jumper out the cutout

B. Replace it without checks

C. Add refrigerant

D. Measure the actual head pressure and find the cause

115. A clamp ammeter on a running fan motor confirms it is:

A. Free of moisture

B. Charged correctly

C. Drawing its rated current

D. Mounted level

116. Low superheat with high subcooling confirms:

A. An undercharge

B. An overcharge

C. A liquid-line restriction

D. A reversing-valve leak

117. Recovered refrigerant during service must be:

A. Captured in a rated recovery cylinder, never vented

B. Stored in a disposable cylinder

C. Vented if the amount is small

D. Mixed with another refrigerant

118. A repeatedly tripping overload found to coincide with seized bearings was:

A. A control defect to bypass

B. A normal start event

C. A symptom of a real mechanical fault

D. Caused by excessive subcooling

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. A heat pump briefly reversing to cooling with the outdoor fan off and steam rising is:

A. A failed compressor

B. An overcharge

C. Normal defrost operation

D. A reversing-valve leak

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

A. O or B terminal

B. G terminal

C. W terminal

D. C terminal

122. Topping up a leaking system instead of repairing it is unacceptable because it:

A. Raises control voltage

B. Vents refrigerant and lets the fault continue

C. Improves efficiency

D. Calibrates the gauge

123. A capacitor must be discharged before handling because it:

A. Holds pressurized refrigerant

B. Stores system oil

C. Contains nitrogen

D. Stores a dangerous electrical charge after power off

124. A tripped safety control whose sensed condition is measured and found genuinely out of range means the:

A. Control is defective

B. Control is working and a real fault must be found

C. System should be jumpered

D. Charge should be topped up

125. A no-cooling system is best diagnosed by reading pressures, superheat, and subcooling together because:

A. Single readings are always wrong

B. It avoids using instruments

C. Each fault produces a characteristic pattern a single reading can't reveal

D. It removes the need to find the root cause

Practice Exam 11: Answer Key and Explanations

1. C — 0.80 × 18 kg = 14.4 kg. Recovery cylinders are filled to no more than 80% of capacity to leave vapour space for liquid expansion as temperature rises. Exceeding this limit risks a hydrostatic rupture of the pressurized cylinder.

2. A — 97 dBA minus about 12 dBA of real-world attenuation gives roughly 85 dBA at the ear. NIOSH derates the rated NRR to reflect field performance, so the exposure sits near the 85 dBA action level. This confirms additional control may still be needed.

3. B — An "OL" (infinite) ohms reading across a winding means the circuit path is broken — an open winding. A good winding reads a specific low resistance, and a short reads abnormally low; infinite means no continuity through the winding.

4. C — WHMIS 2015 pictograms use a red-bordered diamond (square on point) following the GHS format. Recognizing the red diamond is the first step in identifying a chemical hazard.

5. A — Verifying the zero-energy state with a meter is the step that most directly prevents fatal shock, because a disconnect can appear open yet still be live. Notifying, shutting down, and locking are essential, but the meter test is the final proof before contact.

6. A — 20 N·m × 0.738 ft·lb per N·m ≈ 14.8 ft·lb, closest to 15 ft·lb. Correct unit conversion prevents over- or under-torquing the flare nut.

7. C — A refrigerant log must record the type and quantity of refrigerant handled, satisfying the regulatory requirement that prohibits venting and tracks refrigerant flow.

8. A — Stored charge can persist or rebuild and a single meter reading can be momentary, so the capacitor is discharged through a resistor before handling. A charged capacitor can deliver a serious shock even after the unit is locked out.

9. B — Confirming routing conflicts with affected trades before cutting in demonstrates effective coordination, preventing rework and conflicts. Proceeding alone or deferring entirely undermines the multi-trade installation.

10. A — A hot-work permit ensures fire-prevention controls and a fire watch are in place before brazing. The open flame can ignite combustibles, so these controls are confirmed first.

11. B — 14.2 A ÷ 11.0 A RLA = 1.29, or about 129% of rated load amps. A draw well above RLA signals an overload condition to investigate.

12. A — Goggles rated for refrigerant contact specifically protect against the eye-frostbite hazard of liquid refrigerant. The other PPE addresses dust, noise, or visibility, not the cold-burn risk to the eyes.

13. A — Sending recovered refrigerant off-site to be reprocessed to a recognized purity standard for resale is reclaim. Recovery only removes it and recycling cleans it for on-site reuse without certifying purity.

14. B — A vacuum that rises and then holds steady indicates moisture boiling off, not a leak; the rise stops once the moisture is gone. A true leak produces a continuous rise that never stabilizes.

15. A — A refrigeration flare is a 45-degree SAE flare, not the 37-degree flare used in some hydraulic work. The correct angle lets the flare seat and seal against the fitting.

16. A — Brazing filler melts above 840 °F (450 °C), producing a strong, pressure-tight joint; soldering uses filler below that temperature. This threshold defines the distinction between the two processes.

17. B — A temperature-corrected pressure drop from 300 to 250 psig over 24 hours means gas is escaping — a leak is present and must be found. A leak-free system holds its corrected pressure.

18. C — Reaming with the tube end pointed downward lets metal chips fall out instead of into the line. Chips left inside can clog a metering device or damage the compressor.

19. A — Excessive nitrogen pressure during brazing can blow molten filler out of the joint and overpressurize the heated line, so only a low, steady flow is used. The gentle purge still displaces oxygen and prevents scale.

20. C — A swaged socket should be about one tube diameter deep to give the brazed joint adequate overlap and strength. Too shallow a socket produces a weak joint.

21. C — 2.5 kg × 2.205 lb/kg ≈ 5.5 lb. Correct mass conversion ensures the recovery cylinder's fill limit is respected.

22. D — The fixed sequence is leak test with nitrogen, then evacuate to a deep vacuum, then charge. Each step depends on passing the previous one, and charging before evacuation is never acceptable.

23. A — A cold joint that leaks results from the base metal not reaching filler flow temperature, so capillary action never draws the filler in. The tube and fitting must reach temperature so the metal — not the flame — melts the rod.

24. C — Soft annealed copper can be bent and flared by hand, suiting it to smaller lines and tight routing. Hard-drawn copper is rigid and joined with fittings; both can be brazed and both are rated for refrigerant pressures.

25. D — An oversized riser lets refrigerant velocity fall below the speed needed to sweep oil up the vertical run, so oil returns poorly at part load. Correct sizing maintains oil-carrying velocity.

26. A — A reading that stays rock-steady at test pressure (temperature-corrected) over 24 hours indicates a tight system with no detectable leak. A drop would indicate a leak.

27. A — ACR refrigeration tubing is specified by its actual outside diameter, unlike plumbing copper sized by nominal inside dimension. Confirming OD sizing prevents mismatched fittings.

28. B — A dead-level suction run with no slope lets oil pool rather than return to the compressor. A slight slope toward the compressor drains oil back with the refrigerant.

29. A — A vacuum that rises continuously and never stabilizes indicates a leak admitting gas from outside. Moisture, by contrast, levels off once it finishes boiling.

30. D — Site preparation before brazing near combustibles requires clearing the combustibles and posting a fire watch above all. The open flame is the fire hazard until those controls are in place.

31. D — A swaging tool expands a tube end into a socket so a same-size tube can be inserted for brazing, eliminating a coupling. It does not square, deburr, or flare the tube.

32. B — A flare joint is preferred where the connection may need to be opened for future service, since it is mechanical and can be remade. Brazed joints are permanent.

33. C — 48,000 BTU/h ÷ 12,000 BTU/h per ton = 4 tons. The conversion uses the definition of one ton as 12,000 BTU/h.

34. C — One ton ≈ 3.517 kW, closest to 3.5 kW. This conversion links cooling capacity expressed in tons to electrical/thermal kW.

35. D — When manufacturer data conflicts with a rule of thumb, the manufacturer's installation instructions govern and are typically a code and warranty requirement. Past-job habits are not authoritative.

36. B — 5 tons × 12,000 BTU/h per ton = 60,000 BTU/h. The conversion applies the one-ton definition.

37. D — Oversizing degrades dehumidification because the system short-cycles, satisfying the thermostat before running long enough to remove moisture. The frequent starts also stress the compressor.

38. A — With a setpoint of 22 °C and a 1.5 °C differential, the thermostat calls for cooling when the space rises to about 23.5 °C and stops near 22 °C. The differential separates cut-in from cut-out to prevent short-cycling.

39. D — Safety controls in series mean any single control opening stops the equipment. This gives each protective device the authority to shut the system down.

40. B — A walk-in cooler's product load is the heat removed from the stored product itself. It is distinct from conduction, control, and compressor electrical loads.

41. B — A DDC-based Building Automation System uses networked microprocessors reading sensors and driving outputs. This enables centralized monitoring, scheduling, and energy management.

42. D — The sequence of operation describes step by step how the system starts, cycles, and shuts down. It ties the controls together and guides commissioning and service.

43. B — A TXV holds constant superheat across the load range, which is why it is selected for varying-load applications. A fixed orifice cannot adjust to changing load.

44. D — Condenser clearance ensures unrestricted airflow for heat rejection. Restricted airflow raises condensing pressure and cuts capacity.

45. C — A high-occupancy, latent-dominated space requires emphasis on moisture-removal capacity, since occupants add significant latent load. Sizing only for sensible heat would leave the space humid.

46. A — A low-pressure control set to stop the compressor on loss of charge acts as a safety control, protecting the compressor. The same device acts as an operating control in a pump-down circuit, but the protective role applies here.

47. C — A sensible heat ratio of 0.80 means 80% of the total load is sensible, so the latent portion is the remaining 20%. SHR is the sensible fraction of total load.

48. A — Compressed-air signals positioning dampers indicate pneumatic control technology. A controller modulates air pressure to drive the actuator.

49. B — Matching all four primary components to one another and to the load ensures the system delivers rated performance at design conditions. Mismatched components cannot meet the designed capacity.

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

51. C — $P = V \times I = 240\ V \times 4.0\ A = 960\ W$. Power equals voltage times current for this motor.

52. D — A worker guides a craned load with a tag line while staying clear; standing under a suspended load is never acceptable. Dropped loads cause fatal injuries.

53. D — $I = V \div R = 240\ V \div 10\ \Omega = 24\ A$. Ohm's law gives the current from voltage and resistance.

54. C — A P-trap at the base of a vertical suction riser collects oil and helps lift it up the riser. Without it, oil pools at the bottom of the riser.

55. D — An out-of-level unit causing oil-return and drainage problems is corrected by re-setting it dead level. Adding charge or enlarging lines does not address the level fault.

56. B — Poor capacity and abnormal sound from a reverse-rotating three-phase compressor are corrected by swapping any two supply leads. Reverse rotation is a phase-sequence issue, not a compressor fault.

57. C — A 240 V primary to 24 V secondary is a 240:24 ratio, which reduces to 10:1. The turns ratio matches the voltage ratio.

58. C — 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.

59. B — Insufficient airflow lets the evaporator coil run too cold, causing it to frost or freeze. The refrigerant and air sides are interdependent.

60. B — $R = V \div I = 24\ V \div 0.5\ A = 48\ \Omega$. Ohm's law gives the coil resistance from voltage and current.

61. D — Short, direct line routing limits pressure drop and the refrigerant charge required. Excess line length reduces performance and increases charge.

62. D — 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 — Separating line-voltage and low-voltage control wiring maintains safety and prevents interference between circuits, as required by code. It is not about flow, length, or torque.

64. A — A condensate pan and drain are required under an evaporator that dehumidifies and produces condensate, which must drain away to prevent overflow and damage.

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

66. A — After integrating controls, the installer verifies the system follows its planned sequence of operation. This confirms the controls were connected correctly.

67. A — $I = P \div (\sqrt{3} \times V) = 10{,}000 \div (1.732 \times 600) = 10{,}000 \div 1{,}039 \approx 9.6$ A. The three-phase power formula gives the line current.

68. B — A roof curb provides weatherproofing and a path for duct and pipe penetrations in addition to support. It integrates the packaged unit with the roof.

69. 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 inputs to position the valve.

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

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

72. A — P = V × I = 120 V × 6.0 A = 720 W. Power equals voltage times current.

73. D — Undersized supply ductwork reduces airflow, which can freeze the evaporator coil. The refrigerant and air sides are interdependent.

74. D — Knowing the load weight and centre of gravity ensures a safe, balanced lift within the rigging gear's rated capacity. Planning precedes lifting.

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

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

77. D — Superheat = line temperature − saturation temperature = 12 °C − 4 °C = 8 °C. It confirms all liquid has boiled before the vapour reaches the compressor.

78. A — Subcooling = saturation (condensing) temperature − liquid-line temperature = 45 °C − 38 °C = 7 °C. It confirms a solid column of liquid feeds the metering device.

79. B — 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. C — High superheat (25 °C) with low subcooling (2 °C) indicates an undercharge: too little refrigerant starves the evaporator and leaves the condenser short of liquid. The pair read together reveals the charge state.

82. 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.

83. C — Readings must wait until the system stabilizes at near-design conditions, because pressures and temperatures shift until equilibrium. Early readings lead to unnecessary charge changes.

84. D — Pressures, superheat, subcooling, temperature split, and current taken together describe overall performance. No single reading tells the whole story.

85. C — Commissioning the controls includes proving the high-pressure cutout actually stops the compressor at its setpoint. An untested safety control may provide no real protection.

86. D — Low superheat (3 °C) with high subcooling (15 °C) indicates an overcharge: excess refrigerant floods the condenser and overfeeds the evaporator. It is the inverse of the undercharge pattern.

87. D — 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.

88. 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. Rotation is checked before performance readings.

89. C — The refrigerant type is verified against the equipment nameplate before charging. Charging the wrong refrigerant contaminates the system and can create dangerous pressures.

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

91. D — 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 instead.

92. D — 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.

93. A — 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.

94. C — Recording refrigerant type and exact charge is a regulatory record and a service baseline. It documents compliance and aids future diagnosis.

95. B — A standing vacuum that held at a deep micron level confirms the system was tight and dry before charging. A holding vacuum proves both tightness and dryness.

96. B — Superheat = line temperature − saturation temperature = 9 °C − (−2 °C) = 11 °C. Subtracting a negative saturation temperature adds the magnitudes.

97. C — 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.

98. D — High suction pressure, reduced capacity, and a warm suction line are the classic signature of a reversing valve leaking discharge gas internally to the suction side. The internal leak connects the high side to the low side.

99. C — 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. D — 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 from the locked-rotor draw.

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

102. B — 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. C — A run capacitor measuring 25 μF against a 45 μF rating is failed, so the motor runs hot and draws high current. The weak capacitor degrades running efficiency.

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

105. D — A burned-out compressor with acid-smelling oil requires finding and correcting the cause and cleaning the contamination before installing the replacement, or the new compressor will fail too.

106. B — A control that cuts 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.

107. D — A continuity/resistance check is taken with the circuit de-energized and locked out. Applying an ohmmeter to a live circuit damages the meter and creates a shock hazard.

108. A — 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.

109. 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.

110. B — 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.

111. D — Steadily declining insulation resistance on successive megohmmeter tests indicates winding insulation breaking down toward failure. The trend warns of failure before the winding fails outright.

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

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

114. D — A high-pressure cutout that re-trips after each reset means head pressure is genuinely high, so the technician measures the actual head pressure and finds the cause. Jumpering removes protection and adding charge worsens it.

115. C — A clamp ammeter on a running fan motor confirms it is drawing its rated current. Current is measured live; it does not indicate moisture, charge, or level.

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. A — 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. C — 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. C — A heat pump briefly reversing to cooling with the outdoor fan off and steam rising is normal defrost operation. Mistaking it for a fault is a common error.

121. A — 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.

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

123. D — 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.

124. B — When the sensed condition is measured and found 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.

125. C — Reading pressures, superheat, and subcooling together is favoured because each fault produces a characteristic pattern that a single reading cannot reveal. The pattern, not one value, identifies the fault.