RED SEAL EXAM PREP

313A Refrigeration & AC Mechanic

Free 49-Question Mock Exam

Practice for the Red Seal / Certificate of Qualification exam

Pass mark: 70% · Aligned to the published occupational standard topic weightings
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Mock Exam — answer all questions, then check the key

Q1. An EPR (Evaporator Pressure Regulator) valve is installed in the suction line of a multi-evaporator system. Its function is to:

A) Maintain a minimum evaporator pressure setpoint

B) Regulate head pressure at the condenser outlet

C) Limit maximum evaporator pressure to prevent overloading the compressor

D) Balance refrigerant flow between multiple evaporators

Q2. When recovering refrigerant from a system with a compressor that has burned out internally, what special procedure is required?

A) Vent the refrigerant to atmosphere — contaminated refrigerant cannot be safely recovered

B) Standard recovery with a standard recovery machine — a burnt compressor does not affect the recovery procedure

C) Flush the system with nitrogen before recovering to dilute the acid

D) Use dedicated recovery equipment for acid-contaminated refrigerant and send it for reclamation

Q3. What is the purpose of a suction line accumulator in a refrigeration system?

A) To catch liquid refrigerant and oil before they reach the compressor

B) To subcool liquid refrigerant before the metering device

C) To separate oil from the discharge gas before it enters the condenser

D) To store additional refrigerant charge for use during peak demand

Q4. A refrigeration system was repaired after a compressor burnout. Before installing the new compressor, the MOST critical step is:

A) Flush the system with dry nitrogen and install oversized filter-driers

B) Run the system on the new compressor for 100 hours then change the oil

C) Install the new compressor immediately and charge with fresh refrigerant

D) Replace only the filter-drier and add acid neutralizer to the new oil charge

Q5. Under Canadian federal regulations (HPFCR), what is required before venting or disposing of refrigerants from a system?

A) Refrigerants may be vented during system commissioning if they contain no CFCs

B) Refrigerants may be vented to atmosphere if the total system charge is under 1 kg

C) Refrigerants must be recovered only if the system contains more than 2 kg of charge

D) Refrigerants must be recovered with approved equipment regardless of charge quantity

Q6. **R-410A operates at significantly higher pressures than R-22. What is the approximate high-side pressure of R-410A at 35°C condensing temperature?**

A) 450 psi

B) 280 psi

C) 380 psi

D) 175 psi

Q7. **Which refrigerant has been phased out in Canada for new equipment because it depletes the ozone layer (high ODP)?**

A) R-410A

B) R-134a

C) R-22

D) R-404A

Q8. **A refrigeration system has normal suction pressure but HIGH discharge pressure. The MOST likely cause is:**

A) Poor condenser heat rejection

B) TXV stuck fully closed

C) Compressor valve failure

D) Refrigerant undercharge

Q9. **What is the purpose of a crankcase heater on a refrigeration or AC compressor?**

A) To heat the compressor oil to reduce viscosity during cold weather starts

B) To maintain compressor operating temperature during low ambient conditions

C) To heat the suction line to prevent ice formation at the compressor inlet

D) To prevent refrigerant migration into the crankcase oil during the off cycle

Q10. **A hot gas defrost system is used in commercial refrigeration. How does it work?**

A) Hot compressor discharge gas is routed through the evaporator to melt frost

B) The refrigerant charge is partially recovered into a storage tank, allowing the evaporator to warm naturally

C) Electric heating elements mounted on the evaporator fins are energized during defrost

D) Hot ambient air is blown over the evaporator to melt frost

Q11. **A technician adds nitrogen to a refrigeration system for pressure testing after a repair. After the repair is complete, the nitrogen is vented and refrigerant is added. The system short-cycles and has low cooling capacity. What likely happened?**

A) The nitrogen was absorbed by the refrigerant oil, changing its viscosity

B) The system was not properly evacuated before charging, allowing air to mix with the refrigerant

C) The nitrogen oxidized the refrigerant oil, creating acid in the system

D) The nitrogen was not fully vented — residual nitrogen acts as a non-condensable gas

Q12. **Under CSA B52, what primarily determines whether a refrigeration system must be isolated in a dedicated machinery room rather than installed in an occupied space?**

A) The compressor type (scroll, reciprocating, or screw)

B) The electrical supply voltage of the condensing unit

C) The physical footprint of the condenser only

D) The refrigerant safety group and total charge relative to the occupancy and room volume

Q13. **What is the function of a high-pressure cutout switch in a refrigeration/air conditioning system?**

A) To limit compressor speed when head pressure is elevated

B) To shut down the compressor when discharge pressure exceeds a safe limit

C) To bypass the TXV when discharge pressure is too high

D) To open the relief valve on the refrigerant cylinder when pressure exceeds maximum

Q14. **What type of oil is required for systems using HFC refrigerants (such as R-134a, R-404A, R-410A)?**

A) Mineral oil — the same oil used with R-12 and R-22 systems

B) PAG (Polyalkylene Glycol) oil — this is standard for all refrigeration applications

C) Alkylbenzene oil — this is the universal oil compatible with all refrigerant types

D) POE (Polyolester) oil — HFCs are not miscible with mineral oil

Q15. **What is the purpose of a check valve in a refrigeration system, and where is it typically installed?**

A) To regulate refrigerant flow rate — installed in the liquid line as a primary metering device

B) To prevent oil from leaving the compressor — installed at the compressor suction port

C) To limit maximum system pressure — installed at the compressor discharge as a pressure relief

D) To prevent backflow during the off-cycle — installed in heat pump discharge lines

Q16. **A technician is called to a system with oil logging (oil trapped in the evaporator). What causes oil logging and how is it corrected?**

A) Oil leaving the compressor is not returning — low suction line velocity or wrong oil type

B) Oil logging occurs only in systems with TXV valves — replace with cap tube to correct

C) Oil logging is caused by excessive oil charge — drain excess oil from the system and recheck performance

D) Oil logging is caused by water contamination mixing with the oil — replace filter drier and all oil

Q17. **A reciprocating compressor has a broken valve reed. How would this affect compressor performance and what test would confirm it?**

A) Broken reed allows gas to bypass compression — confirmed by a very low compression ratio

B) Broken valve reed causes the compressor to short-cycle — confirmed by rapid on/off cycling

C) Broken valve reed increases compression efficiency — confirmed by higher than normal discharge temperature

D) Broken valve reed only affects oil pressure — confirmed by low oil pressure switch tripping

Q18. **An electronic expansion valve (EEV or EXV) offers advantages over a TXV because:**

A) It does not require a sensing bulb installation

B) It is completely self-contained and never needs calibration

C) It is precisely controlled by the system controller

D) It requires no electrical power and operates purely on refrigerant pressure

Q19. **The refrigerant R-600a (isobutane) is being used in domestic refrigerators. What special precaution is required when servicing these units?**

A) R-600a requires POE oil — no other special precautions needed

B) R-600a operates at very high pressure — standard service gauges cannot be used

C) R-600a has a very high GWP and requires a special EPA-certified contractor licence for handling

D) It is a highly flammable A3 hydrocarbon — no ignition sources; use flammable-rated equipment

Q20. **The sight glass in a refrigeration liquid line shows bubbles continuously while the system runs normally. This indicates:**

A) Insufficient subcooling causing flash gas

B) The condenser is working too efficiently

C) Air in the refrigerant

D) Normal operation — bubbles are expected in the liquid line

Q21. **A scroll compressor is producing a loud metallic grinding noise immediately on startup that clears after a few seconds. Oil level in the sight glass is normal. What is the MOST likely cause?**

A) The compressor is worn out — metallic noise on startup always indicates imminent failure

B) The compressor discharge valve is worn, allowing high-pressure gas to blow back

C) The compressor motor windings are shorting, causing vibration and noise on startup

D) Liquid refrigerant migrated to the compressor during the off cycle — slugging on startup

Q22. **In the refrigeration cycle, where does the refrigerant ABSORB heat from the space being cooled?**

A) Condenser

B) Compressor

C) Expansion valve

D) Evaporator

Q23. **After a compressor burnout, what contamination must be addressed before installing a replacement compressor, and what is the procedure?**

A) Only the condenser and evaporator need flushing — the compressor discharge and suction lines self-clean during operation

B) Acid, carbon, and moisture must be removed: flush, burnout driers, oil acid check, deep evacuation

C) Install the new compressor and run it until the contamination is naturally removed through normal operation over several weeks

D) Only the refrigerant oil needs replacement — flush the system with new refrigerant twice and recharge

Q24. **A system has high suction pressure and high discharge pressure. What does this indicate?**

A) Restriction in the liquid line

B) Compressor valve failure

C) Overcharge or poor heat rejection

D) Refrigerant undercharge

Q25. **A refrigeration system has high discharge temperature and high discharge pressure, but normal suction pressure. The condenser coil is clean. What is the MOST LIKELY cause?**

A) Non-condensable gases (air) in the system, or an overcharge of refrigerant

B) A restricted filter drier causing a large pressure drop in the liquid line

C) Low refrigerant charge causing the compressor to overheat

D) A worn compressor unable to build adequate compression pressure

Q26. **A refrigeration system has higher-than-normal suction pressure AND higher-than-normal discharge pressure simultaneously. What does this pattern most likely indicate?**

A) A restricted liquid line — restriction increases discharge pressure and starves the evaporator

B) Refrigerant overcharge or poor condenser heat rejection (dirty coil, failed fan, or high ambient)

C) Loss of compressor efficiency — worn valves make both pressures converge toward the middle

D) Refrigerant undercharge — low charge causes both pressures to be low

Q27. **A refrigeration system compressor contactor has pitted, burned contacts. What is the MOST LIKELY cause?**

A) The contactor is too large for the application — oversized contactors pit more easily

B) Excessive inrush current during compressor starting or short-cycling causing repeated arcing at the contacts

C) Low line voltage causing the contacts to weld together and then tear apart

D) The contactor coil voltage is too high, causing excessive current through the contacts

Q28. **What is the purpose of the condenser in a refrigeration system?**

A) To regulate refrigerant flow to the evaporator

B) To compress refrigerant vapour for circulation

C) To evaporate the refrigerant using heat from the room

D) To reject heat and condense the refrigerant to a liquid

Q29. **What is the ASHRAE safety classification system for refrigerants (e.g., A1, B2L)?**

A) Letter indicates toxicity (A=lower, B=higher); number indicates flammability

B) Letter indicates pressure class (A=high, B=low); number indicates efficiency rating

C) Letter indicates application (A=air conditioning, B=refrigeration); number indicates required certification level

D) Letter indicates refrigerant family (A=CFC, B=HCFC); number indicates ozone depletion potential

Q30. **When measuring system pressures on a running refrigeration system, the suction gauge reads below atmospheric (in vacuum). This indicates:**

A) The system is in pump-down mode

B) Severely low charge or a blocked metering device

C) The system is working at maximum efficiency

D) The compressor is too large for the evaporator

Q31. **A walk-in cooler compressor trips repeatedly on the low-pressure cutout (LPC) during normal winter operation, yet the cooler is maintaining setpoint temperature. What is the MOST LIKELY cause and the correct remedy?**

A) The LPC setpoint is factory-set too high and should be adjusted upward in the field to stop nuisance trips

B) A restricted liquid line filter drier is reducing refrigerant flow and causing low suction pressure — replace the drier

C) Refrigerant overcharge is flooding the evaporator and lowering suction pressure — recover excess refrigerant

D) Low ambient is dropping head pressure and starving the TXV — install a head pressure control

Q32. **What is the purpose of a phase monitor relay in a three-phase refrigeration system?**

A) To convert single-phase power to three-phase for use with commercial compressors

B) To balance the electrical load across three phases to reduce energy consumption

C) To monitor refrigerant phase changes and shut down the system if the refrigerant is undercharged

D) To protect three-phase motors from phase loss, phase reversal, and phase imbalance

Q33. **Which component in a refrigeration system is responsible for the pressure drop that causes the refrigerant to change from high-pressure liquid to low-pressure liquid/vapor mixture?**

A) The filter drier

B) The evaporator

C) The compressor

D) The metering device

Q34. **What is the difference between refrigerant recovery, reclaim, and recycling?**

A) Recovery: venting refrigerant safely through a filter. Reclaim: any reuse of recovered refrigerant. Recycling: destroying old refrigerant

B) Recovery, reclaim, and recycling are all the same process with different names used by different manufacturers

C) Recovery: removing to a container. Recycling: basic cleanup for reuse. Reclaiming: reprocessing to virgin purity

D) Recovery and reclaim are identical; recycling means mixing refrigerants for reuse

Q35. **A split system air conditioner is not cooling and the outdoor unit is not running, but the indoor air handler fan is running. What should be checked first?**

A) The evaporator coil for ice formation blocking airflow

B) Power to the outdoor unit: breaker, disconnect, and contactor

C) The TXV sensing bulb position

D) Refrigerant charge level — low charge prevents outdoor unit from starting

Q36. **In the refrigeration cycle, what state (phase) is the refrigerant as it leaves the condenser under normal operating conditions?**

A) Supercritical fluid — beyond the critical point in high-pressure systems

B) Superheated vapour — all vapour, well above saturation temperature

C) Subcooled liquid — all liquid, cooled below the condensing saturation temperature

D) Saturated mixture — a two-phase liquid/vapour mixture

Q37. **R-410A is a zeotropic blend. This means:**

A) It is a single-component refrigerant that boils at a constant temperature

B) It can only be used in systems with copper piping

C) Its components separate completely in the liquid phase

D) It is a blend that boils and condenses over a range of temperatures

Q38. **A packaged rooftop unit (RTU) is running but not cooling adequately. Both refrigerant circuits (it is a dual-circuit unit) show normal pressures. The supply air temperature is 72°F (22°C) while the setpoint is 68°F (20°C). What should be checked?**

A) The refrigerant charge — add refrigerant until the temperature setpoint is reached

B) The compressors — if pressures are normal, the compressors must be the cause

C) The economizer or fresh-air damper stuck open, adding outdoor air heat load

D) The thermostat — replace the thermostat if temperature is not being achieved

Q39. **Why has R-22 refrigerant been phased out in Canada?**

A) It is too expensive to produce

B) It is an ozone-depleting HCFC

C) It is not efficient enough for modern systems

D) It reacts with copper tubing

Q40. **A low-pressure control (LPC) is set to cut out at 20 PSI and cut in at 45 PSI on an R-22 system. The LPC trips repeatedly. The MOST likely cause is:**

A) Compressor valves leaking

B) Condenser fan failure causing high head pressure

C) Low charge causing suction pressure to fall

D) Thermostat setting too cold

Q41. **What is the state of refrigerant as it leaves the condenser in a properly operating system?**

A) High-pressure subcooled liquid

B) Low-pressure saturated mixture

C) High-pressure superheated vapor

D) Low-pressure superheated vapor

Q42. **A commercial refrigeration system uses a floating head pressure control strategy. What does this mean and what is its benefit?**

A) The discharge pressure is fixed at the minimum possible setpoint regardless of ambient temperature

B) The head pressure is allowed to rise and fall with refrigerant charge level, reducing the need for precise charging

C) Head pressure fluctuates freely without controls, reducing wear on condenser fan motors

D) Condenser fans are controlled to let head pressure drop as low as ambient allows

Q43. **An oil separator is installed in the discharge line of a large refrigeration system. Its purpose is to:**

A) Remove moisture from compressor discharge gas

B) Separate compressor oil from the hot discharge gas

C) Prevent liquid refrigerant from reaching the compressor

D) Reduce discharge gas temperature before the condenser

Q44. **A hermetic compressor has a locked rotor condition. The FIRST check before replacement is:**

A) Check for liquid flood-back and verify supply voltage

B) Recharge the system with refrigerant

C) Replace the compressor immediately — locked rotor is always a mechanical failure

D) Check the thermostat setpoint

Q45. **A technician is recovering refrigerant from a system. Under Canadian environmental regulations, what is required?**

A) Only CFCs must be recovered; HFCs can be released

B) All refrigerant must be recovered — venting is illegal

C) Recovery is only required for systems over 5kg charge

D) Refrigerant can be vented to atmosphere if the system is small

Q46. **A walk-in refrigerator has normal suction and discharge pressure but cannot maintain box temperature. The product temperature is much higher than the setpoint. The MOST likely cause is:**

A) Low refrigerant charge

B) TXV stuck closed

C) Excessive box heat load

D) Compressor valve failure

Q47. **A room air conditioner runs but does not cool. The evaporator coil is completely iced over. The MOST likely cause is:**

A) Restricted evaporator airflow

B) Condenser fan failure

C) Refrigerant overcharge

D) TXV stuck wide open causing over-feeding

Q48. **A split-system air conditioner produces adequate cooling but the indoor unit is producing water dripping from the front panel into the conditioned space rather than draining properly. What is the MOST common cause?**

A) The indoor fan speed is too high, blowing condensate off the evaporator coil

B) Low refrigerant charge is causing excessive coil icing, which melts and overflows

C) The refrigerant charge is too high, causing condensation on the exterior of the refrigerant lines

D) The condensate drain is blocked or the drain pan slope is insufficient

Q49. **A defrost control is set to initiate defrost every 6 hours and terminate either by temperature (28°F termination thermostat) or a 30-minute time limit. The evaporator coil consistently reaches full defrost (temperature termination) only once per day — the other 3 cycles terminate on time. This indicates:**

A) The defrost heaters are undersized for the application

B) Normal operation — defrost cycles run on a fixed schedule regardless of need

C) Refrigerant undercharge causing excess frost accumulation

D) The termination thermostat is faulty or positioned incorrectly

Answer Key & Explanations

Q1. Answer: A

EPR valve: sets minimum evaporator pressure (warmer setpoint), preventing the evaporator from getting too cold. In multi-temperature systems, different evaporators need different temperatures. The EPR valve limits how cold a warmer evaporator can get by maintaining minimum suction pressure above the lower-temperature coil setpoint. Example: produce case at 35°F uses an EPR; freezer evaporator at -10°F does not.

Q2. Answer: D

Burned-out compressor: refrigerant is acid-contaminated — use dedicated equipment and send for reclamation. A burned motor creates acid and carbon deposits from the breakdown of motor windings (copper, varnish, refrigerant oil). This acid-contaminated refrigerant cannot be recycled back into a system — it must be sent to a reclamation facility (not just recycling). Use dedicated "burnout" recovery equipment to prevent contaminating your regular recovery machine, and clearly label the recovery cylinder as contaminated.

Q3. Answer: A

Suction accumulator: liquid trap in suction line that holds back liquid refrigerant and oil that might otherwise enter and damage the compressor (liquid slugging). Positioned between the evaporator and compressor, it allows vapor to pass through while holding back liquid. A small metered orifice slowly returns trapped oil back to the compressor. Common on heat pumps (liquid can return during defrost) and systems with large refrigerant charges. Oil trapped too long = compressor oil starvation.

Q4. Answer: A

Burnout cleanup is critical before installing a new compressor. A burned compressor leaves acid, carbon deposits, and metallic particles throughout the system. These contaminate the new compressor oil, degrade new windings, and block metering devices. Full system flush with dry nitrogen, oversized acid-removal filter-driers to remove all acid and contamination, and fresh oil is mandatory.

Q5. Answer: D

Canadian HPFCR (Halocarbons and Perfluorocarbons and their Substitutes Regulations): refrigerant venting is prohibited regardless of quantity. All refrigerants (HFCs, HCFCs, CFCs, HFOs) must be recovered using certified equipment before opening a system or disposing of equipment. Recovered refrigerant must be stored in approved cylinders, reclaimed, or destroyed. Technician certification required for purchasing refrigerants above threshold quantities. Violations: significant fines under CEPA (Canadian Environmental Protection Act).

Q6. Answer: B

R-410A at a 35°C condensing temperature ≈ 290 PSI high side (option B, 280, is closest). R-410A operates at roughly 1.5× the pressure of R-22: at 35°C its saturation pressure is about 290 PSI versus about 195 PSI for R-22. (On a hot day the measured head pressure runs higher still, because the condensing temperature sits well above ambient.) This is why R-410A systems require components, hoses, and gauges rated for higher pressure.

Q7. Answer: C

R-22 phased out for new equipment since 2010. R-22 (HCFC) depletes the ozone layer and has moderate GWP — its phase-out was driven by ozone depletion under the Montreal Protocol, not by GWP. Canada phased it out of new equipment in 2010. It can still be used in existing equipment (using recovered/recycled R-22) but new production is banned. Current transition is also moving away from R-404A and R-410A (high GWP HFCs) to HFOs and natural refrigerants.

Q8. Answer: A

High discharge, normal suction = condenser problem. The condenser can't reject heat fast enough, causing discharge pressure to rise. Causes: fouled/dirty coil, failed condenser fan, high ambient temperature, air in system (non-condensable gas). Undercharge typically causes LOW discharge AND low suction. TXV issue = high superheat, normal/low discharge.

Q9. Answer: D

Crankcase heater: prevents refrigerant from migrating into compressor oil during the off-cycle, which would cause liquid slugging on start-up. During shutdown, refrigerant vapor migrates toward the coldest point — often the compressor crankcase. It dissolves in the oil. When the compressor starts, rapid pressure drop causes the refrigerant to boil violently out of the oil, foaming and carrying liquid into the compression chamber — liquid slugging. The crankcase heater keeps the compressor warm to prevent this migration. Must be energized during extended shutdown periods (especially winter).

Q10. Answer: A

Hot gas defrost: discharge gas heats evaporator from inside — efficient and fast. During hot gas defrost, solenoid valves redirect superheated compressor discharge gas directly to the evaporator inlet (in some designs the coil is fed in reverse flow). The hot gas condenses inside the evaporator coil, releasing its heat of condensation directly to the frost accumulation. This is faster and more energy-efficient than electric defrost. Common in commercial walk-in coolers and display cases.

Q11. Answer: D

Residual nitrogen = non-condensable gas — raises head pressure and reduces efficiency. Non-condensable gases (nitrogen, air) accumulate in the condenser, reducing the condenser surface area available for refrigerant condensation, reducing heat transfer, and raising head pressure — cutting system efficiency. Symptoms: higher-than-normal head pressure for ambient conditions, high subcooling (liquid refrigerant backed up behind non-condensables in condenser), shorter cycles. Always evacuate to the required vacuum after pressure testing before charging.

Q12. Answer: D

CSA B52 bases the requirement on refrigerant safety classification, charge quantity, occupancy, and room volume. Each refrigerant has a Refrigerant Concentration Limit (RCL). If the full system charge could exceed the allowable concentration in the occupied space during a leak, the system must be isolated in a machinery room with detection and ventilation. Higher-risk occupancies (institutional, public assembly) lower the allowable limits. Compressor type, supply voltage, and condenser size do not drive this determination.

Q13. Answer: B

High-pressure cutout: safety device that shuts down compressor at excessive head pressure. High head pressure can be caused by: dirty/blocked condenser, condenser fan failure, refrigerant overcharge, non-condensables in the system, or high ambient temperature. If head pressure reaches the cutout setpoint (typically 590–650 PSI for R-410A systems), the compressor is de-energized — protecting the compressor, condenser, and refrigerant circuit from over-pressure damage. The manual reset type requires a technician reset, preventing restart until the cause is investigated.

Q14. Answer: D

HFC refrigerants require synthetic POE (polyolester) oil for proper lubrication and oil return — mineral oil is not miscible and will cause oil logging and lubrication failure. R-12 and R-22 (CFC/HCFC) systems use mineral oil or alkylbenzene oil. HFCs (R-134a, R-404A, R-410A, R-407C) require POE oil, which mixes with HFCs for proper oil return through the system. Mixing mineral oil with HFCs causes oil to separate out and pool in the evaporator, starving the compressor. POE oil is hygroscopic — keep containers sealed and minimize atmospheric exposure.

Q15. Answer: D

Check valve: allows flow in one direction only — prevents refrigerant flowing backward during the off-cycle. Used in discharge lines on heat pumps and tandem/parallel compressor systems. On heat pumps: discharge line check valves direct refrigerant correctly when the reversing valve switches modes. On parallel/tandem compressor systems: individual discharge line check valves prevent the running compressor from pushing hot discharge gas into the stopped compressor. Also used in liquid lines of multi-evaporator systems to prevent migration.

Q16. Answer: A

Oil logging: oil circulates out of the compressor but cannot return — inadequate oil circulation lets it accumulate in low points and the evaporator. Refrigerant velocity carries oil through the system. If suction line velocity is too low (system running at partial load, oversized or incorrectly sized/routed piping), oil drops out of the refrigerant stream and pools. Risers need oil traps (P-traps) sized to maintain velocity even at minimum load. Wrong oil type/viscosity: too thick to flow at evaporator temperature. Low refrigerant charge also reduces velocity. Correction: verify line sizing and re-pipe as needed, add traps/risers, correct refrigerant velocity, verify oil specification and compatibility.

Q17. Answer: A

Broken compressor valve reed: gas bypasses past the damaged valve during the compression stroke, severely reducing compression efficiency and capacity. A broken suction reed: suction gas leaks back during compression stroke — low suction pressure, reduced mass flow. A broken discharge reed: compressed gas leaks back into cylinder during suction stroke — suction pressure rises, discharge pressure drops. Both reduce compression ratio drastically. Test: compressor amp draw will be lower than normal (less work done). Also: very hot discharge line (compressor recirculating hot gas). Verify with valve plate inspection after diagnosis.

Q18. Answer: C

EEV: electronic precision control based on multiple sensor inputs. The EEV controller reads suction temperature, suction pressure (superheat calculation), and other inputs. It adjusts the valve position via a stepper motor with much faster response and wider control range than a mechanical TXV — allowing operation at variable conditions. Enables inverter-driven VRF systems to work efficiently across a wide range of conditions.

Q19. Answer: D

R-600a (isobutane): highly flammable A3 refrigerant — flammability is the primary hazard. Hydrocarbon refrigerants (R-600a, R-290/propane) have excellent thermodynamic properties but are flammable. Used in small-charge domestic appliances where the charge is small enough to be below flammability limits in room air. Servicing: ventilated areas only, no open flames or sparks, non-sparking tools. Recovery equipment must be rated for flammable gases. These fridges must not be serviced in enclosed spaces.

Q20. Answer: A

Bubbles in sight glass = flash gas = subcooling problem. Liquid refrigerant should arrive at the metering device as a solid liquid (no bubbles). Bubbles (flash gas) indicate: refrigerant is partially vaporizing before the metering device — caused by low charge (low subcooling), restriction in liquid line (pressure drop = boiling), or high liquid line temperature.

Q21. Answer: D

Liquid refrigerant migration to compressor during off cycle causes liquid slugging on startup — grinding/rattling noise that clears as liquid is pumped out. The migrated liquid is often an oil-refrigerant mixture in the crankcase. Scroll compressors are less tolerant of liquid than reciprocating compressors — the scrolls momentarily separate but can still be damaged. Causes: low ambient temperature with refrigerant migrating to coldest point (compressor), crankcase heater failed/not installed, refrigerant overcharge. Prevention: crankcase heater, pump-down cycle on shutdown, check valve in suction line.

Q22. Answer: D

Evaporator = heat absorption. The low-pressure liquid refrigerant enters the evaporator and boils (evaporates) by absorbing heat from the surrounding air or product. This is how cooling occurs — heat moves from the warm space into the refrigerant.

Q23. Answer: B

After compressor burnout: acid, carbon, and moisture contaminate the entire system — must be fully remediated before installing new compressor. Acid (from refrigerant/oil thermal breakdown) attacks new compressor copper windings and valves. Procedure: 1) Recover refrigerant. 2) Flush system with approved refrigerant flush agent or purge with dry nitrogen. 3) Replace filter drier with oversized burnout drier (suction side too). 4) Install new compressor. 5) Charge with new oil and refrigerant after triple-evacuating to below 300 microns. 6) Run system, then pull oil sample in 500 hours — check acid level. May need second drier replacement.

Q24. Answer: C

Both pressures high = too much refrigerant or poor heat rejection. Overcharge adds extra refrigerant that can't be stored in the condenser, raising both pressures. A dirty/blocked condenser or high ambient temperature prevents the condenser from rejecting heat efficiently — same result. Check condenser cleanliness and airflow first.

Q25. Answer: A

High head pressure with clean condenser and normal suction = non-condensable gases or refrigerant overcharge. Non-condensables: collect in condenser, increase total pressure without contributing to heat transfer — discharge temp also high. Overcharge: excess liquid in condenser, reduced condensing surface area — high head, possibly high subcooling, liquid slugging risk. Distinguish: check subcooling. Overcharge = very high subcooling. Non-condensables = high head pressure on warm day, subcooling may be normal or low. Recover system, evacuate, recharge to spec.

Q26. Answer: B

High suction + high discharge simultaneously = refrigerant overcharge or a condenser that cannot reject heat. An overcharge backs liquid up in the condenser and raises both pressures; a dirty or blocked condenser, a failed condenser fan, or high ambient temperature prevents heat rejection with the same result. Check condenser cleanliness, fan operation, and refrigerant charge. Contrast this with worn compressor valves, where suction rises while discharge FALLS and the two pressures converge toward the middle — that is compressor inefficiency, not this pattern.

Q27. Answer: B

Burned/pitted contactor contacts: caused by repeated arcing during opening/closing under high current. Compressor motors have high inrush current on start (6–10x running current). Each time the contactor opens or closes under load, arcing occurs. Excessive short cycling (frequent starts) accelerates contact wear. Also: low voltage causes contacts to close slowly (extended arcing). Symptoms of failed contactor: welded contacts (compressor won't shut off), open contacts (no start), high resistance contacts (voltage drop, overheating).

Q28. Answer: D

Condenser: rejects heat, converts vapour to liquid. High-temperature, high-pressure vapour from the compressor enters the condenser. Heat is rejected to the outside environment — ambient air (air-cooled) or water (water-cooled). As heat leaves, the vapour condenses into a high-pressure liquid ready for the metering device.

Q29. Answer: A

ASHRAE safety class: letter = toxicity, number = flammability. A1 = safest class. A = low chronic toxicity; B = higher chronic toxicity. 1 = no flame propagation; 2L = lower flammability, slower burning speed; 2 = flammable; 3 = highly flammable. Common: R-410A = A1 (safe), R-22 = A1, R-32 = A2L (mildly flammable), R-1234yf = A2L, R-290 propane = A3 (highly flammable). A2L refrigerants require special handling and equipment design.

Q30. Answer: B

Suction pressure in vacuum = severely low evaporator pressure. A running system should never pull into vacuum under normal operation. This indicates: 1) Very low refrigerant charge (barely any gas), 2) Completely blocked TXV or liquid line (nothing getting through), 3) The compressor is too large for the load. An extremely cold evaporator setpoint can also pull suction toward vacuum. Pull into vacuum risks drawing air/moisture through shaft seals.

Q31. Answer: D

In cold weather, low ambient temperature around the condenser reduces condenser heat rejection, causing condensing pressure (head pressure) to fall. A thermostatic expansion valve (TXV) requires a minimum pressure differential across it to meter refrigerant properly; when head pressure drops too low, refrigerant flow through the TXV decreases, suction pressure falls below the LPC setpoint, and the LPC trips the compressor. The correct remedy is a head pressure control (HPC) — typically condenser fan cycling or a fan speed controller — that maintains minimum condensing pressure (commonly 100-120 psig / 690-830 kPa for R-404A) regardless of outdoor temperature. Adjusting the LPC setpoint downward would mask the real problem and risk compressor damage from loss of lubrication; a restricted drier would cause high superheat, not an LPC trip under normal load conditions.

Q32. Answer: D

Phase monitor relay: protects three-phase compressor motors from phase loss, reversal, and imbalance — which can cause motor overheating or reverse rotation. Phase loss (one phase fails): motor attempts to run on two phases, draws very high current, overheats rapidly. Phase reversal (phases swapped): three-phase motor runs backward — compressor pumps in reverse, no refrigerant flow, potential valve damage. Phase imbalance (unequal voltages): motor runs hotter, reduced life. Phase monitor detects these conditions and de-energizes the control circuit before damage occurs. Required for commercial refrigeration compressor protection.

Q33. Answer: D

Metering device (TXV or fixed orifice): creates the pressure drop separating the high and low sides of the system. The TXV (Thermostatic Expansion Valve) or fixed orifice/cap tube meters refrigerant flow, dropping pressure rapidly. This pressure drop causes partial flashing (evaporation), dramatically lowering refrigerant temperature. The resulting cold liquid/vapor mixture then enters the evaporator where it absorbs heat and fully evaporates.

Q34. Answer: C

Three distinct terms: Recovery (remove to cylinder), Recycling (on-site oil/moisture cleanup), Reclaiming (certified facility to AHRI 700 virgin purity). Recovery: extracting refrigerant from a system into an approved recovery cylinder — mandatory before opening. Recycling: passing recovered refrigerant through filters and oil separators for reuse on the SAME system or same owner's equipment. Reclaiming: sending to a certified reclaim facility for processing to AHRI Standard 700 purity (essentially virgin quality, sold for any use).

Q35. Answer: B

Indoor running but outdoor unit not starting: check power supply to the outdoor unit first. The indoor blower fan and outdoor compressor/condenser fan run on separate circuits. A tripped circuit breaker, open disconnect switch, or blown fuse at the outdoor unit disconnect kills the outdoor circuit while leaving indoor running. After confirming power: check the contactor (coil energized? contacts closed?), capacitor (start/run capacitors fail frequently — multimeter capacitance test), and check for safety control lockout (high/low pressure switch).

Q36. Answer: C

Condenser outlet: subcooled liquid under normal operation. The condenser removes heat from the refrigerant in three stages: 1) desuperheating (vapour cools to saturation), 2) condensing (vapour → liquid at constant pressure/temp), 3) subcooling (liquid cools further below saturation). Subcooling ensures that vapour bubbles do not form in the liquid line before the metering device. Normal subcooling: 8–15°F (4–8°C).

Q37. Answer: D

Zeotropic blend: temperature glide during phase change. R-410A is actually a near-azeotropic blend (very small glide). True zeotropic blends (like R-404A) have significant temperature glide — the components boil/condense at different temperatures, changing the composition as phase change occurs. Always charge zeotropic blends from the liquid phase of the cylinder.

Q38. Answer: C

RTU not meeting setpoint with normal refrigerant pressures: look beyond the refrigerant circuit. If pressures are correct, the refrigerant system is likely working properly — but it may not have sufficient capacity to overcome extra load. Investigate: economizer damper stuck open (adding outdoor heat load), excessive outdoor air (fresh air damper malfunction), dirty condenser coil (reducing efficiency), dirty evaporator coil (restricting airflow), duct leakage, missing supply duct insulation, return-air bypasses, or building load exceeding equipment capacity on an extreme heat day.

Q39. Answer: B

R-22 (HCFC) = ozone depleter. Because of its ozone-depleting potential, Canada phased out R-22 production and import under the Montreal Protocol. As of 2020, R-22 can only be used from recovered/recycled stock. Common replacements include R-410A (new systems) and R-407C (retrofit).

Q40. Answer: C

LPC tripping = suction pressure falling below cut-out. Low refrigerant charge reduces suction pressure below the cut-out setpoint. Restricted liquid line, dirty evaporator coil, or low evaporator load can also cause low suction. The LPC protects the system from operating at pressures where evaporator freeze-up or compressor damage could occur.

Q41. Answer: A

Refrigerant leaving the condenser: high-pressure subcooled liquid. In the condenser, refrigerant changes state from superheated vapor to saturated liquid, then cools further below the saturation temperature (subcooling). Subcooling ensures no flash gas enters the metering device, improving efficiency and capacity. Typical subcooling: 10–15°F (5–8°C). Measuring subcooling: condenser outlet temperature vs saturation temperature at condenser pressure.

Q42. Answer: D

Floating head pressure: condenser fan speed or staging is controlled to allow condensing pressure to drop to the lowest stable level based on ambient conditions — improving system efficiency. Traditional systems maintain high fixed head pressure year-round. Floating head control reduces fans (or varies their speed) to allow the head pressure to drop as ambient drops in winter, reducing compressor work (lower pressure ratio = less energy per unit of refrigeration). Must balance: head pressure cannot go so low that the metering device cannot feed the evaporator. Typical minimum condensing temperature: 80–90°F (27–32°C).

Q43. Answer: B

> **Oil separator: recovers compressor oil from discharge gas and returns it to the compressor crankcase.** All compressors pass some oil with discharge gas. Without separation, oil accumulates in evaporators (reducing heat transfer) and the compressor loses oil (lubrication failure). The separator uses velocity change and/or mesh to separate oil, returning it to the crankcase via a float valve.

Q44. Answer: A

> **Check cause before replacing compressor.** Refrigerant flood-back causes liquid slugging that hydraulically locks compressor pistons. Low voltage at the compressor terminals causes high current + thermal overload. Compressor may free itself after cooling — but replacing without fixing the cause means the replacement fails too. Check: liquid slugging (suction line frost/wet), power supply and voltage at the terminals, overload conditions.

Q45. Answer: B

> **Venting any refrigerant is illegal in Canada.** Under the Environmental Protection Act and related regulations, all refrigerants (CFCs, HCFCs, HFCs) must be recovered before servicing, using approved recovery equipment. No exceptions based on system size. Use certified recovery equipment.

Q46. Answer: C

> **Normal pressures but can't pull down = excessive heat load or insulation failure — the refrigeration system is overwhelmed.** If pressures are normal, the refrigeration system is working — but something is adding more heat than it can remove. Inspect: door gaskets (let in warm air), excessive door openings, insulation (settled, wet, or failing), door heater stuck on, unusually high product load, compressor undersized for current ambient.

Q47. Answer: A

> **Evaporator iced up = airflow restriction most commonly (dirty filter, blocked return).** Without sufficient air moving across the evaporator, the coil temperature drops below freezing and moisture freezes on it. Once iced, airflow is further reduced — a runaway condition. Check and clean the air filter first and clear any blocked return. Also possible: low refrigerant charge, dirty blower wheel, stuck indoor fan.

Q48. Answer: D

> **Blocked condensate drain (algae, mold, debris) is the most common cause of indoor water leakage — water backs up, the pan overflows, and it spills from the unit.** The condensate drain pan collects water that drips off the evaporator coil. A blocked drain causes the pan to fill and overflow. Algae growth in the drain line (common in humid environments) is the most common blockage cause. Additional causes: incorrect drain pan slope (should slope toward drain), cracked/leaking drain pan, drain line installed without adequate slope, condensate pump failure.

Q49. Answer: D

> **Time termination (not temp) means defrost is incomplete — the coil is not fully defrosting in most cycles.** If the coil were fully defrosted, the termination thermostat would trigger (28°F) before the 30-minute limit. When time terminates, frost remains. Causes: thermostat positioned wrong (reads coil temp, not frost area), failed termination thermostat, undersized heaters, or too-frequent defrost schedule.

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