PRACTICE TEST 13: ICE PROTECTION AND ENVIRONMENTAL SYSTEMS

Instructions: Select the best answer for each question. Each question is based on the Airframe Mechanic Certification Standards

1. Anti-icing systems prevent ice from:
   A. Forming on protected surfaces
   B. Melting after formation
   C. Falling off aircraft
   D. Conducting electricity
2. Deicing systems remove ice:
   A. Before formation
   B. During formation
   C. After it has formed
   D. Never
3. Critical ice-prone areas on aircraft include:
   A. Cabin interior
   B. Landing gear only
   C. Cargo area
   D. Wing/tail leading edges, engine inlets, pitot tubes
4. Ice accumulation on wings reduces:
   A. Weight
   B. Lift and increases drag
   C. Fuel consumption
   D. Visibility only
5. Ice on control surfaces affects:
   A. Color
   B. Weight slightly
   C. Appearance only
   D. Control effectiveness and aerodynamics
6. Wing leading edge deice boots:
   A. Inflate with pneumatic pressure breaking ice
   B. Heat continuously

C. Are painted surfaces
D. Provide fuel storage

7. Deice boot operation cycle:
   A. Continuous inflation
   B. Random timing
   C. Periodic inflation/deflation
   D. Manual pumping only

8. Deice boot adhesion failure appears as:
   A. Improved performance
   B. Wrinkles, bulges, or separations
   C. Color change
   D. No visible signs

9. Deice boot inspection includes checking for:
   A. Cuts, cracks, adhesion, proper inflation
   B. Color only
   C. Age markings
   D. Weight

10. Pneumatic deice boot pressure typically:
   A. 1–5 psi
   B. 100 psi
   C. 50 psi
   D. 15–20 psi

11. Thermal anti-ice systems use:
   A. Pneumatic pressure
   B. Chemicals
   C. Heat to prevent ice formation
   D. Mechanical scrapers

12. Wing thermal anti-ice (hot wing) uses:
   A. Electric heating only
   B. Engine bleed air heating leading edges
   C. Chemical spray
   D. Pneumatic boots

13. Piccolo tubes in thermal anti-ice:
   A. Distribute hot bleed air through perforations
   B. Collect ice
   C. Measure temperature
   D. Store chemicals

14. Thermal anti-ice system malfunctions may cause:
    A. Ice protection only
    B. No problems
    C. Improved performance
    D. Overheating, warping, or inadequate protection

15. Engine inlet anti-ice prevents:
    A. Fuel flow
    B. Oil circulation
    C. Ice formation causing inlet blockage or ingestion
    D. Normal operation

16. Turbine engine inlet anti-ice uses:
    A. Pneumatic boots
    B. Hot bleed air
    C. Propeller deice
    D. Chemical spray

17. Carburetor heat prevents:
    A. Fuel vaporization
    B. Air intake
    C. Engine cooling
    D. Ice formation from fuel evaporation and moisture

18. Carburetor ice forms when:
    A. Temperature and humidity conditions allow evaporative cooling
    B. Engine is off
    C. Fuel tank is full
    D. Outside temperature is very cold

19. Fuel system icing inhibitor (FSII):
    A. Increases octane
    B. Improves color
    C. Prevents ice crystal formation in fuel
    D. Cleans injectors

20. Propeller deice systems use:
    A. Pneumatic boots only
    B. Electric heating elements or fluid
    C. Manual removal
    D. Chemical spray only

21. Electric propeller deice:
    A. Heats leading edges with resistance elements

B. Uses pneumatic pressure
C. Sprays fluid
D. Mechanically removes ice

22. Fluid propeller deice:
A. Uses hot oil
B. Heats blades
C. Inflates boots
D. Distributes alcohol-based fluid via centrifugal force

23. Propeller deice fluid is:
A. Water-based
B. Alcohol-based (isopropyl alcohol)
C. Gasoline
D. Hydraulic fluid

24. Windshield anti-ice may use:
A. Pneumatic boots
B. Mechanical wipers only
C. Electric heating or hot air
D. No protection

25. Heated windshield elements:
A. Are painted on
B. Cool the glass
C. Provide lighting
D. Prevent ice/fog formation

26. Pitot-static system ice protection:
A. Electric pitot heat
B. Pneumatic deice
C. Chemical treatment
D. Manual removal

27. Pitot heat failure causes:
A. Engine failure
B. Airspeed indication loss from ice blockage
C. Fuel starvation
D. Hydraulic failure

28. Stall warning vane heater prevents:
A. Engine icing
B. Fuel icing

C. Ice blocking vane movement
D. Wing icing

29. Engine inlet temperature probes:
A. Are heated to prevent ice accumulation
B. Have no heating
C. Use chemicals
D. Are painted

30. Ice detector systems:
A. Remove ice
B. Create ice
C. Measure temperature only
D. Sense ice formation alerting crew

31. Ice detectors may use:
A. Visual observation only
B. Temperature only
C. Vibration, optical, or magnetostrictive sensing
D. No technology

32. Rain removal systems include:
A. Heating only
B. Wipers, rain repellent, or air blast
C. Pneumatic boots
D. Fuel spray

33. Windshield wipers are:
A. Not used on aircraft
B. Manual only
C. Decorative
D. Electric or hydraulic powered

34. Rain repellent coating:
A. Causes water to bead and shed
B. Attracts water
C. Freezes water
D. Has no effect

35. Windshield air blast systems:
A. Heat windshield
B. Clean interior
C. Use high-velocity air removing rain at high speed
D. Provide cooling

36. Cabin pressurization maintains:
    A. Fuel pressure
    B. Comfortable cabin altitude at high flight altitudes
    C. Engine power
    D. Landing gear pressure

37. Pressurization allows flight:
    A. Above 10,000 feet with crew/passenger comfort
    B. Below 1,000 feet only
    C. At sea level only
    D. Without oxygen

38. Cabin pressure differential is:
    A. Always zero
    B. Random
    C. Temperature difference
    D. Difference between cabin and outside pressure

39. Maximum cabin differential pressure:
    A. Has no limit
    B. Is always 1 psi
    C. Limits maximum cabin altitude at flight altitude
    D. Never changes

40. Pressurization source typically:
    A. Battery power
    B. Engine bleed air or cabin compressor
    C. Hydraulic system
    D. Fuel system

41. Bleed air for pressurization comes from:
    A. Exhaust
    B. Fuel system
    C. Hydraulic reservoir
    D. Engine compressor section

42. Cabin compressors:
    A. Pressurize cabin on non-bleed air systems
    B. Cool cabin only
    C. Remove air
    D. Filter only

43. Pressure controller (outflow valve controller):
    A. Increases pressure only

B. Decreases pressure only
C. Modulates outflow valve maintaining cabin pressure
D. Has no function

44. Outflow valve:
A. Adds air
B. Controls cabin pressure by releasing excess air
C. Filters air
D. Heats air

45. Safety relief valve prevents:
A. Excessive cabin overpressure
B. Low pressure
C. Temperature rise
D. Noise

46. Negative pressure relief valve:
A. Increases pressure
B. Reduces pressure
C. Has no purpose
D. Prevents cabin pressure below ambient

47. Cabin altitude warning alerts when:
A. Pressure is perfect
B. Temperature is high
C. Cabin altitude exceeds safe limit (typically 10,000 ft)
D. Fuel is low

48. Rapid decompression occurs when:
A. Climbing slowly
B. Sudden structural failure causes pressure loss
C. Landing
D. Refueling

49. Oxygen masks deploy:
A. During takeoff
B. During landing
C. On ground
D. Automatically if cabin altitude exceeds threshold

50. Cabin pressure schedule determines:
A. Cabin altitude maintained at various flight altitudes
B. Fuel flow

C. Airspeed
D. Engine RPM

51. Isobaric mode maintains:
    A. Variable pressure
    B. No pressure
    C. Constant cabin altitude regardless of flight altitude
    D. Maximum pressure always

52. Cabin rate of climb/descent:
    A. Matches aircraft
    B. Controlled for passenger comfort (typically 300–500 fpm)
    C. Is uncontrolled
    D. Has no limits

53. Air conditioning systems provide:
    A. Temperature control, ventilation, pressurization air
    B. Fuel cooling
    C. Engine cooling only
    D. Hydraulic cooling

54. Air cycle cooling (air conditioning packs):
    A. Use refrigerant
    B. Are electric
    C. Use no components
    D. Cool bleed air through expansion turbine

55. Vapor cycle air conditioning uses:
    A. Bleed air only
    B. Refrigerant compression/expansion cycle
    C. No cooling
    D. Water cooling

56. Pack (air conditioning pack) components include:
    A. Fuel pump
    B. Hydraulic reservoir
    C. Heat exchanger, turbine, compressor
    D. Oil filter

57. Air cycle machine (ACM):
    A. Heats air
    B. Adds pressure
    C. Filters only
    D. Cools air through expansion

58. Ram air cooling:
   A. Uses outside air through heat exchangers
   B. Uses fuel
   C. Uses hydraulics
   D. Uses batteries

59. Temperature control valves:
   A. Control fuel temperature
   B. Mix hot and cold air for desired cabin temperature
   C. Adjust engine temperature
   D. Control hydraulic temperature

60. Zone temperature control provides:
   A. Single temperature
   B. No control
   C. Individual temperature control for different cabin areas
   D. Heating only

61. Cabin air distribution uses:
   A. Overhead outlets, sidewall vents, floor returns
   B. Windows only
   C. Doors only
   D. No system

62. Gasper vents provide:
   A. Emergency exit
   B. Fuel venting
   C. Hydraulic cooling
   D. Individual passenger air flow control

63. Air filtration removes:
   A. Pressure
   B. Dust, particles, odors from cabin air
   C. All oxygen
   D. Heat only

64. HEPA filters:
   A. Have no purpose
   B. Remove heat only
   C. Remove very fine particles and microorganisms
   D. Add humidity

65. Recirculated air systems:
   A. Mix filtered cabin air with fresh air

B. Use no fresh air
C. Use all fresh air
D. Have no filtration

66. Oxygen systems provide:
A. Fuel
B. Hydraulic pressure
C. Cooling
D. Breathing oxygen at altitude or emergency

67. Continuous flow oxygen:
A. Stops automatically
B. Has no flow
C. Delivers constant flow to mask
D. Works only on ground

68. Demand-type oxygen:
A. Flows continuously
B. Delivers oxygen only on inhalation
C. Has no valve
D. Works without masks

69. Pressure-demand oxygen:
A. Low pressure only
B. Has no pressure
C. Works at low altitude only
D. Delivers oxygen under positive pressure at high altitude

70. Oxygen bottles (cylinders) contain:
A. Compressed gaseous oxygen or liquid oxygen
B. Nitrogen
C. Compressed air
D. Helium

71. Aviator's breathing oxygen purity:
A. 50%
B. 75%
C. Minimum 99.5% oxygen
D. 90%

72. Oxygen cylinder pressure typically:
A. 10 psi
B. 1,800–2,200 psi when full at 70°F

C. 50 psi
D. 5,000 psi

73. Green band on oxygen cylinder indicates:
    A. Empty
    B. Nitrogen
    C. Helium
    D. Aviator's breathing oxygen

74. Chemical oxygen generators:
    A. Produce oxygen through chemical reaction
    B. Compress air
    C. Store liquid oxygen
    D. Have no oxygen

75. Passenger oxygen masks:
    A. Are not needed
    B. Require manual retrieval
    C. Deploy automatically from overhead compartments
    D. Are stored in seats

76. Therapeutic oxygen provides:
    A. Engine power
    B. Medical oxygen to ill/injured passengers at low altitude
    C. Cabin pressurization
    D. Fuel system purging

77. Oxygen system inspection checks:
    A. Pressure, leaks, mask condition, hose integrity
    B. Color only
    C. Weight only
    D. Age markings

78. Oxygen system servicing requires:
    A. Any air compressor
    B. Hydraulic equipment
    C. Random procedures
    D. Clean equipment, proper oxygen grade, leak testing

79. Grease and oil on oxygen fittings:
    A. Improve sealing
    B. Are recommended
    C. Cause fire/explosion hazard
    D. Have no effect

80. Smoke detection systems:
    A. Create smoke
    B. Alert crew to smoke in cargo, lavatory, or cabin
    C. Remove smoke
    D. Add ventilation

81. Fire extinguishing in cargo compartments uses:
    A. Water sprinklers
    B. Manual extinguishers
    C. Fuel
    D. Halon or equivalent suppression agents

82. Lavatory fire detection:
    A. Monitors waste bin and lavatory areas
    B. Monitors engines only
    C. Has no sensors
    D. Works only on ground

83. Environmental control system malfunctions include:
    A. Perfect operation
    B. No problems
    C. Loss of pressurization, temperature control failure
    D. Improved performance

84. Pack overheat protection:
    A. Increases temperature
    B. Shuts down pack preventing fire/damage
    C. Has no function
    D. Adds pressure

85. Anti-ice system inspection includes:
    A. Boot condition, heating element continuity, valve operation
    B. Color verification
    C. Weight measurement
    D. Age documentation

86. Deice boot surface treatment:
    A. Uses paint
    B. Uses wax
    C. Requires no treatment
    D. Uses approved preservatives preventing deterioration

87. Thermal anti-ice leak check:
    A. Uses water

B. Uses fuel
C. Detects hot air leaks from ducting
D. Is not done

88. Pitot heat continuity test:
A. Uses voltmeter
B. Verifies electrical resistance/current draw
C. Measures pressure
D. Uses no equipment

89. Oxygen system hydrostatic testing:
A. Uses air pressure
B. Is never done
C. Tests bottle at random pressure
D. Tests cylinder integrity at specified pressure intervals

90. Pressurization leak check uses:
A. Pressurizing cabin checking pressure decay
B. Fuel pressure
C. Hydraulic pressure
D. Random methods

91. Bleed air leak detection uses:
A. Visual inspection only
B. Random checks
C. Ultrasonic detector or soap solution
D. No testing

92. Environmental system troubleshooting:
A. Replaces all parts
B. Uses systematic approach checking controls, sources, distribution
C. Uses random methods
D. Ignores problems

93. Insufficient cabin heating indicates:
A. Bleed air source issue, valve failure, duct leak
B. Excess cooling
C. Perfect operation
D. High outside temperature

94. Cabin will not pressurize suggests:
A. Perfect sealing
B. High altitude

C. Good outflow valve
D. Air source failure, outflow valve stuck, door seal leak

95. Excessive cabin altitude rate indicates:
A. Slow climb
B. Controller malfunction, outflow valve issue
C. Perfect operation
D. Sea level flight

96. Windshield anti-ice inoperative may indicate:
A. Perfect operation
B. Low temperature
C. Heating element failure, power supply problem
D. Excess heating

97. Environmental control unit (ECU) failure:
A. Improves performance
B. Has no effect
C. Creates no problems
D. Affects temperature control, pressurization

98. Ice protection system certification requires:
A. Proper operation in icing conditions, inspection intervals
B. Color verification
C. Random testing
D. No requirements

99. Known icing conditions are defined as:
A. Any temperature
B. Summer only
C. Visible moisture and temps conducive to ice formation
D. Clear skies

100. Flight into known icing:
A. Is always prohibited
B. Requires certified ice protection systems and pilot training
C. Requires no equipment
D. Is recommended

Answer Explanations

1. A. Forming on protected surfaces Anti-icing systems prevent ice from initially forming on critical surfaces by applying heat or chemicals before ice accumulates. Proactive approach maintains clean aerodynamic surfaces and prevents ice buildup.

2. C. After it has formed Deicing systems remove ice after it has accumulated on surfaces through mechanical breaking (pneumatic boots), heating, or chemical means. Reactive approach allowing controlled ice buildup before removal.

3. D. Wing/tail leading edges, engine inlets, pitot tubes Critical ice-prone areas include wing and tail leading edges (affecting lift/control), engine inlets (affecting airflow/power), pitot-static system (affecting instruments), propellers, windshield, and antennas.

4. B. Lift and increases drag Ice accumulation on wings disrupts smooth airflow reducing lift significantly, increases drag substantially, changes stall characteristics, adds weight, and can cause severe performance degradation and control problems.

5. D. Control effectiveness and aerodynamics Ice on control surfaces adds weight, disrupts airflow, reduces control authority, increases hinge moments, may cause asymmetric icing creating control problems and potential loss of control.

6. A. Inflate with pneumatic pressure breaking ice Wing leading edge deice boots are rubber/synthetic surfaces adhered to leading edges, inflated with pneumatic pressure (15-20 psi) breaking accumulated ice which airstream removes.

7. C. Periodic inflation/deflation Deice boot operation cycles between inflated (breaking ice) and deflated (normal aerodynamic surface) states, typically controlled automatically by timer or manually by pilot allowing ice accumulation before activation.

8. B. Wrinkles, bulges, or separations Deice boot adhesion failure appears as wrinkles, bulges, separations from surface, or lifting edges indicating loss of bond requiring re-adhesion or replacement preventing ineffective ice removal.

9. A. Cuts, cracks, adhesion, proper inflation Deice boot inspection checks for cuts or punctures (allowing air loss), cracks in rubber, adhesion to surface, proper inflation/deflation, wear from abrasion, and deterioration from weather/chemicals.

10. D. 15-20 psi Pneumatic deice boot pressure typically operates at 15-20 psi providing sufficient force to break ice without over-stressing boot material or adhesive bond. Pressure supplied from engine vacuum pump or bleed air.

11. C. Heat to prevent ice formation Thermal anti-ice systems use heat (electric resistance or hot bleed air) continuously applied to prevent ice formation, maintaining surfaces above freezing temperature, more effective than deicing.

12. B. Engine bleed air heating leading edges Wing thermal anti-ice (hot wing systems) uses hot engine bleed air ducted through wing leading edge, heating skin preventing ice formation. Common on turbine aircraft with available bleed air.

13. A. Distribute hot bleed air through perforations Piccolo tubes are perforated ducts inside wing leading edges distributing hot bleed air through small holes providing uniform heating across protected surface area preventing ice formation.

14. D. Overheating, warping, or inadequate protection Thermal anti-ice malfunctions cause overheating potentially warping structure, inadequate heating allowing ice formation, excessive bleed air extraction reducing engine performance, or duct failures causing hot air leaks.

15. C. Ice formation causing inlet blockage or ingestion Engine inlet anti-ice prevents ice formation blocking airflow (reducing power), ice chunks ingesting into engine causing compressor/turbine damage (FOD), and maintaining proper inlet airflow characteristics.

16. B. Hot bleed air Turbine engine inlet anti-ice uses hot bleed air from engine compressor heating inlet lip and critical surfaces preventing ice formation in visible moisture and freezing temperatures.

17. D. Ice formation from fuel evaporation and moisture Carburetor heat prevents ice formation from fuel evaporation cooling (can occur 60°F+) and moisture freezing in venturi/throttle plate area, using heated air from exhaust shroud.

18. A. Temperature and humidity conditions allow evaporative cooling Carburetor ice forms when atmospheric moisture present and fuel evaporation causes temperature drop (venturi effect and evaporative cooling) below freezing even when outside temperature 40-70°F.

19. C. Prevents ice crystal formation in fuel Fuel System Icing Inhibitor (FSII), typically diethylene glycol monomethyl ether, prevents ice crystal formation in jet fuel at high altitude cold temperatures by depressing freezing point.

20. B. Electric heating elements or fluid Propeller deice systems use electric resistance heating elements bonded to leading edges cycling on/off, or alcohol-based fluid distributed centrifugally preventing ice accumulation on blades.

21. A. Heats leading edges with resistance elements Electric propeller deice uses resistance heating elements (wires or strips) bonded to blade leading edges, powered through slip rings, cycling automatically breaking ice through thermal expansion differential.

22. D. Distributes alcohol-based fluid via centrifugal force Fluid propeller deice pumps alcohol-based fluid to propeller hub, centrifugal force distributes fluid along blade leading edges through slinger ring preventing ice adhesion.

23. B. Alcohol-based (isopropyl alcohol) Propeller deice fluid is isopropyl alcohol-based solution preventing ice adhesion to blade leading edges, effective at low temperatures, distributed by centrifugal force.

24. C. Electric heating or hot air Windshield anti-ice uses electric resistance heating (conductive coating between glass layers) or hot air blown over inner surface preventing ice/fog formation maintaining visibility.

25. D. Prevent ice/fog formation Heated windshield elements (transparent conductive coating or embedded wires) maintain glass temperature above freezing/dewpoint preventing ice formation and fog condensation ensuring clear visibility.

26. A. Electric pitot heat Pitot-static system ice protection uses electric resistance heating in pitot tube preventing ice blockage ensuring accurate airspeed indication. Some systems heat static ports and angle-of-attack vanes.

27. B. Airspeed indication loss from ice blockage Pitot heat failure allows ice formation blocking ram air port causing airspeed indicator to freeze at blockage speed or show erroneous readings, critical safety issue.

28. C. Ice blocking vane movement Stall warning vane heater prevents ice accumulation blocking vane movement ensuring proper stall warning system operation in icing conditions maintaining critical safety function.

29. A. Are heated to prevent ice accumulation Engine inlet temperature probes are electrically heated preventing ice accumulation ensuring accurate temperature readings for engine monitoring and control system operation.

30. D. Sense ice formation alerting crew Ice detector systems sense ice accumulation on probe through vibration frequency changes, optical reflection, or magnetostrictive sensing, alerting crew to activate ice protection systems.

31. C. Vibration, optical, or magnetostrictive sensing Ice detectors use vibration frequency changes (resonant rod), optical reflection changes (light scattering), or magnetostrictive sensors detecting ice buildup providing automatic or manual activation alerts.

32. B. Wipers, rain repellent, or air blast Rain removal systems include electric/hydraulic wipers (mechanical clearing), chemical rain repellent (water beading/shedding), or high-velocity air blast (aerodynamic removal at high speed).

33. D. Electric or hydraulic powered Windshield wipers are electric motor or hydraulic actuator powered, sweeping rubber blades across windshield removing rain, snow, or contaminants maintaining visibility during precipitation.

34. A. Causes water to bead and shed Rain repellent coating applied to windshield causes water to bead and shed through surface tension, improving visibility in rain without mechanical wipers, temporary treatment requiring reapplication.

35. C. Use high-velocity air removing rain at high speed Windshield air blast systems direct high-velocity bleed air across windshield creating aerodynamic boundary layer preventing rain contact at high speeds, effective above approximately 250 knots.

36. B. Comfortable cabin altitude at high flight altitudes Cabin pressurization maintains comfortable cabin altitude (typically 8,000 feet or lower) while aircraft flies at high altitudes, eliminating need for continuous supplemental oxygen improving passenger comfort.

37. A. Above 10,000 feet with crew/passenger comfort Pressurization allows comfortable flight above 10,000 feet (where supplemental oxygen normally required) maintaining sea-level or low-altitude cabin environment supporting normal physiological function.

38. D. Difference between cabin and outside pressure Cabin pressure differential is difference between internal cabin pressure and outside atmospheric pressure, measured in psi. Structural design limits maximum differential preventing fuselage overstress.

39. C. Limits maximum cabin altitude at flight altitude Maximum cabin differential pressure (typically 8-10 psi for airliners) limits how low cabin altitude can be maintained at high flight altitudes, balancing comfort with structural weight/strength.

40. B. Engine bleed air or cabin compressor Pressurization source typically uses engine bleed air (turbine engines) tapped from compressor section or dedicated cabin compressors (piston engines or electric systems) providing conditioned air.

41. D. Engine compressor section Bleed air for pressurization extracted from engine compressor section at high pressure and temperature, routed through air conditioning packs for cooling/conditioning before cabin delivery.

42. A. Pressurize cabin on non-bleed air systems Cabin compressors on non-bleed air systems (787, some business jets) use electric motor-driven compressors pressurizing outside air, improving engine efficiency by eliminating bleed air extraction.

43. C. Modulates outflow valve maintaining cabin pressure Pressure controller (outflow valve controller) automatically modulates outflow valve opening controlling air release rate maintaining programmed cabin altitude and rate of change.

44. B. Controls cabin pressure by releasing excess air Outflow valve controls cabin pressure by releasing excess pressurized air to atmosphere, modulated by controller maintaining desired cabin altitude and preventing overpressure.

45. A. Excessive cabin overpressure Safety relief valve prevents excessive cabin overpressure from controller failure by automatically opening at predetermined differential limit (typically 0.5 psi above normal maximum) protecting structure.

46. D. Prevents cabin pressure below ambient Negative pressure relief valve prevents cabin pressure dropping below outside pressure during descent, allowing outside air to enter preventing negative differential stressing structure inward.

47. C. Cabin altitude exceeds safe limit (typically 10,000 ft) Cabin altitude warning alerts crew when cabin altitude exceeds safe threshold (typically 10,000 feet), requiring immediate action including emergency descent and passenger oxygen deployment.

48. B. Sudden structural failure causes pressure loss Rapid decompression occurs from sudden structural failure (window, door, fuselage breach) causing immediate pressure loss, temperature drop, condensation fog, requiring emergency descent and oxygen.

49. D. Automatically if cabin altitude exceeds threshold Oxygen masks automatically deploy from overhead compartments if cabin altitude exceeds approximately 14,000 feet, providing emergency oxygen during decompression or pressurization system failure.

50. A. Cabin altitude maintained at various flight altitudes Cabin pressure schedule determines cabin altitude maintained at different flight altitudes programmed into controller, typically maintaining 8,000 feet cabin at maximum cruise altitude.

51. C. Constant cabin altitude regardless of flight altitude Isobaric mode maintains constant cabin altitude (typically 8,000 feet) regardless of aircraft altitude changes within differential limits, maximizing passenger comfort during cruise.

52. B. Controlled for passenger comfort (typically 300-500 fpm) Cabin rate of climb/descent controlled by outflow valve modulation maintaining comfortable rate (typically 300-500 fpm) preventing ear discomfort, slower than aircraft climb/descent rates.

53. A. Temperature control, ventilation, pressurization air Air conditioning systems provide temperature-controlled air, fresh air ventilation replacing cabin air, pressurization source, humidity control, and contaminant removal creating comfortable environment.

54. D. Cool bleed air through expansion turbine Air cycle cooling (packs) cool hot bleed air through heat exchangers (ram air cooling) and expansion turbine (air expanding doing work drops temperature), no refrigerant required.

55. B. Refrigerant compression/expansion cycle Vapor cycle air conditioning uses refrigerant (Freon) compressed (heating), condensed (rejecting heat), then expanded (cooling) in closed cycle, similar to home air conditioner.

56. C. Heat exchanger, turbine, compressor Pack (air conditioning pack) components include primary/secondary heat exchangers (ram air cooling), air cycle machine with compressor and turbine, temperature control valve, and water separator.

57. D. Cools air through expansion Air cycle machine (ACM) cools air through expansion turbine where compressed air expands doing work spinning turbine, temperature dropping significantly (can reach near-freezing temperatures).

58. A. Uses outside air through heat exchangers Ram air cooling uses outside air flowing through heat exchangers (increased by ram air scoops) removing heat from hot bleed air before reaching expansion turbine.

59. B. Mix hot and cold air for desired cabin temperature Temperature control valves mix hot bleed air (bypassing pack) with cold pack discharge air achieving desired temperature, controlled manually by crew or automatically by zone controllers.

60. C. Individual temperature control for different cabin areas Zone temperature control provides independent temperature adjustment for different cabin areas (cockpit, forward cabin, aft cabin) accommodating individual comfort preferences.

61. A. Overhead outlets, sidewall vents, floor returns Cabin air distribution uses overhead individual gasper outlets, sidewall distribution vents delivering conditioned air, and floor/lower sidewall return grills extracting cabin air for recirculation/exhaust.

62. D. Individual passenger air flow control Gasper vents (individual air outlets) provide adjustable airflow direction and volume control at each passenger seat allowing personal comfort adjustment independent of overall cabin temperature.

63. B. Dust, particles, odors from cabin air Air filtration removes dust particles, allergens, odors, and contaminants from recirculated cabin air through mechanical filters and optional HEPA filters improving air quality.

64. C. Remove very fine particles and microorganisms HEPA (High Efficiency Particulate Air) filters remove 99.97% of particles 0.3 microns or larger including bacteria, viruses, and fine dust significantly improving cabin air quality.

65. A. Mix filtered cabin air with fresh air Recirculated air systems mix filtered cabin return air (typically 50%) with fresh outside air improving fuel efficiency by reducing conditioning load while maintaining air quality through filtration.

66. D. Breathing oxygen at altitude or emergency Oxygen systems provide breathing oxygen for crew/passengers at high altitude (above 10,000-12,500 feet), during pressurization failures, smoke/fumes emergencies, or medical requirements.

67. C. Delivers constant flow to mask Continuous flow oxygen delivers constant oxygen flow (adjustable by altitude or manual setting) to mask regardless of breathing, simple economical system used in many general aviation aircraft.

68. B. Delivers oxygen only on inhalation Demand-type oxygen delivers oxygen only when user inhales (creating suction opening valve), conserving oxygen supply, commonly used in military and commercial applications.

69. D. Delivers oxygen under positive pressure at high altitude Pressure-demand oxygen delivers oxygen under positive pressure above certain altitude (typically 40,000 feet) forcing oxygen into lungs overcoming reduced atmospheric pressure maintaining adequate blood oxygenation.

70. A. Compressed gaseous oxygen or liquid oxygen Oxygen bottles contain compressed gaseous oxygen (1,800-2,200 psi high pressure cylinders) or liquid oxygen (LOX, -297°F, converts to gas when used) stored in insulated containers.

71. C. Minimum 99.5% oxygen Aviator's breathing oxygen must be minimum 99.5% pure oxygen with maximum water vapor content ensuring safe breathing without contaminants. Medical oxygen (99.0%) not approved for aviation.

72. B. 1,800-2,200 psi when full at 70°F Oxygen cylinder pressure typically 1,800-2,200 psi when full at 70°F standard temperature. Pressure varies with temperature requiring correction for accurate quantity determination.

73. D. Aviator's breathing oxygen Green band on oxygen cylinder indicates aviator's breathing oxygen meeting purity specifications. Color coding prevents filling with wrong gas or contaminated oxygen.

74. A. Produce oxygen through chemical reaction Chemical oxygen generators produce oxygen through exothermic chemical reaction (sodium chlorate decomposition) when activated by pull-down, used in passenger emergency oxygen systems.

75. C. Deploy automatically from overhead compartments Passenger oxygen masks automatically deploy from overhead compartments when cabin altitude exceeds threshold (typically 14,000 feet), pulling down activates chemical oxygen generator.

76. B. Medical oxygen to ill/injured passengers at low altitude Therapeutic oxygen provides medical-grade oxygen to ill or injured passengers at cabin altitudes where supplemental oxygen not normally required, portable bottles with regulators.

77. A. Pressure, leaks, mask condition, hose integrity Oxygen system inspection checks cylinder pressure and hydrostatic test dates, leak testing connections, mask condition (cracks, deterioration), hose condition, regulator operation, indicator operation.

78. D. Clean equipment, proper oxygen grade, leak testing Oxygen system servicing requires scrupulously clean oil/grease-free equipment, aviator's breathing oxygen (99.5%+ purity), proper filling procedures, and thorough leak testing after servicing.

79. C. Cause fire/explosion hazard Grease and oil on oxygen fittings create severe fire/explosion hazard because petroleum products ignite violently in high-pressure oxygen. All oxygen system components must be kept scrupulously clean.

80. B. Alert crew to smoke in cargo, lavatory, or cabin Smoke detection systems use optical or ionization sensors detecting smoke particles in cargo compartments, lavatories, and cabin areas alerting crew to potential fire requiring immediate action.

81. D. Halon or equivalent suppression agents Cargo compartment fire extinguishing uses Halon 1301 (being phased out) or equivalent clean agents (HFC-125) flooding compartment suppressing fire without damaging cargo.

82. A. Monitors waste bin and lavatory areas Lavatory fire detection monitors waste receptacle and lavatory space with heat/smoke sensors and automatic extinguisher in waste bin preventing fire from discarded smoking materials.

83. C. Loss of pressurization, temperature control failure Environmental control system malfunctions include pressurization loss (outflow valve, bleed air source), temperature control failures (pack malfunction, valve failure), contaminated air (bleed air leak, oil seal failure).

84. B. Shuts down pack preventing fire/damage Pack overheat protection automatically shuts down air conditioning pack if temperature exceeds safe limit preventing fire or structural damage from overheated ducting.

85. A. Boot condition, heating element continuity, valve operation Anti-ice system inspection checks deice boot condition (cuts, adhesion), electric heating element continuity and current draw, control valve operation, pressure/temperature parameters, and indicator function.

86. D. Uses approved preservatives preventing deterioration Deice boot surface treatment uses approved preservatives preventing ozone cracking and weather deterioration. Never use unapproved chemicals, cleaners, or solvents damaging rubber.

87. C. Detects hot air leaks from ducting Thermal anti-ice leak check detects hot bleed air leaks from ducting by visual inspection (scorching, discoloration), operational testing (overheating), or thermal imaging revealing hot spots.

88. B. Verifies electrical resistance/current draw Pitot heat continuity test measures electrical resistance or current draw of heating element verifying proper operation, detecting open circuits or short circuits preventing ice protection.

89. D. Tests cylinder integrity at specified pressure intervals Oxygen system hydrostatic testing pressurizes cylinder with water to test pressure (typically 5/3 operating pressure) at specified intervals (typically 3-5 years) verifying structural integrity.

90. A. Pressurizing cabin checking pressure decay Pressurization leak check pressurizes cabin to specified differential (typically 2-5 psi), monitors pressure decay over time locating leaks through soap solution or ultrasonic detection.

91. C. Ultrasonic detector or soap solution Bleed air leak detection uses ultrasonic detectors hearing high-frequency sound from leaks or soap solution creating bubbles at leak points in ducting, fittings, valves.

92. B. Uses systematic approach checking controls, sources, distribution Environmental system troubleshooting systematically checks control settings, air sources (bleed air, compressors), distribution (valves, ducting), sensors, and components before replacement.

93. A. Bleed air source issue, valve failure, duct leak Insufficient cabin heating indicates inadequate bleed air supply (engine power, valve position), temperature control valve failure, heat exchanger blockage, or duct leakage losing hot air.

94. D. Air source failure, outflow valve stuck, door seal leak Cabin pressurization failure suggests air source problem (bleed air failure, compressor inop), outflow valve stuck open, major door/window seal leak, or controller malfunction.

95. B. Controller malfunction, outflow valve issue Excessive cabin altitude rate (rapid climb/descent) indicates controller malfunction, outflow valve stuck or responding incorrectly, or excessive air source variation requiring adjustment.

96. C. Heating element failure, power supply problem Windshield anti-ice inoperative indicates heating element failure (open circuit), power supply problem (circuit breaker, wiring), control switch failure, or sensing system malfunction.

97. D. Affects temperature control, pressurization Environmental Control Unit (ECU) failure affects automatic temperature control, pressurization scheduling, pack operation, and system integration requiring manual control or alternate systems.

98. A. Proper operation in icing conditions, inspection intervals Ice protection system certification requires demonstrated effectiveness in icing conditions, inspection procedures, maintenance intervals, operational limitations, and pilot procedures documented in flight manual.

99. C. Visible moisture and temps conducive to ice formation Known icing conditions defined as visible moisture (clouds, precipitation) and temperature at or below freezing (0°C to -20°C range most critical) conducive to ice accumulation.

100. B. Requires certified ice protection systems and pilot training Flight into known icing requires aircraft certificated for icing (approved ice protection systems operational), pilot trained/rated for icing operations, following operational limitations and procedures.