Meteorology Feedback

1. Hoar frost could form on an aircraft in flight;

   (a) climbing through stratus
   (b) climbing through nimbostratus
   (c) climbing through an inversion
   (d) in the area of supercooled water droplets

2. Advection fog may form with

   (a) warm moist air over a cold surface
   (b) cold dry air over a warm surface
   (c) warm dry air over a cold surface
   (d) cold moist air over a warm surface

3. When are thunderstorms most likely over Europe?

   (a) mid-day
   (b) mid-night
   (c) late afternoon
   (d) just after dawn

4. The fastest moving types of thunderstorm are:

   (a) air mass
   (b) frontal
   (c) thermal
   (d) orographic

5. An aircraft routing between Bangkok and Karachi has a tailwind, then a light headwind in July, but an average 50kt headwind in January. Is this:

   (a) normal
   (b) abnormal for January
   (c) abnormal for July
   (d) cannot be determined

6. In a warm occlusion

   (a) cold air undercuts colder air
   (b) cold air overrides colder air
   (c) colder air overrides cold air
   (d) colder air undercuts cold air

7. In which layer is the majority of the atmosphere?

   (a) stratosphere
   (b) mesosphere
   (c) tropopause
   (d) troposphere

8. The definition of QNH is:

(a) QFE reduced to MSL using ISA
(b) QFE reduced to MSL using the actual temperature
(c) the pressure at MSL using the actual temperatures
(d) the pressure at MSL using ISA

9 When is radiation fog most likely?

(a) mid-day
(b) midnight
(c) late afternoon
(d) just after dawn

10. In a northern hemisphere polar front jet stream, where is the greatest likelihood of the worst CAT?

(a) in the jet core
(b) looking downstream, on the right
(c) looking downstream on the left
(d) above the jet core

11. What causes winds?

(a) rotation of the earth
(b) frontal systems
(c) pressure differential
(d) temperature differential

12. Which way does the surface wind blow in a land breeze?

(a) from the sea by day
(b) from the sea by night
(c) from the land by day
(d) from the land by night

13. In the northern hemisphere, how does the tropopause level vary with latitude?

(a) decreasing from south to north
(b) decreasing from north to south
(c) maintains a constant level
(d) varies with longitude

14. Which of the following describes conditional instability?

(a) 0.75°C/100m
(b) 0.40°C/100m
(c) 1.0°C/100m
(d) none of the above

15. Which of the following describes the tropopause?

    (a) the point where temperature increases with height
    (b) a layer between the troposphere and the stratosphere
    (c) the boundary between the troposphere and the stratosphere
    (d) all of the above

16. Landing at an airfield with QNH set, the altimeter reads:

    (a) zero
    (b) zero if ISA conditions prevail
    (c) the elevation of the airfield
    (d) the elevation of the airfield if ISA conditions prevail

17. What do lenticular clouds indicate?

    (a) instability
    (b) potential Cb development
    (c) windshear
    (d) mountain waves

18. What is the ICAO definition of turbulence when PAX feel definite strain against seatbelts, loose objects may become dislodged and walking is difficult?

    (a) moderate
    (b) extreme
    (c) severe
    (d) light

19. Heading south in the southern hemisphere you experience starboard drift when:

    (a) flying towards low pressure
    (b) flying towards low temperature
    (c) flying away from high pressure
    (d) flying away from low temperature

20. There are no clouds in a stationary anticyclonic system because of:

    (a) divergence
    (b) convergence
    (c) subsidence
    (d) convection

21. Air that is forced to rise to just below condensation level then sinks back to it original position. It would then be:

    (a) warmer than original
    (b) colder than original
    (c) same as original
    (d) depends on the pressure

22. Two aircraft fly at the same TAS through cloud containing supercooled water drops, one with a thick wing and one with a thin wing, the icing to be expected is

    (a) both will experience the same amount of icing
    (b) thick wing more than thin wing
    (c) thin wing more than thick wing
    (d) neither will experience icing

23. On the route Dakar to Rio de Janeiro in January, the aircraft will cross the ITCZ

    (a) 0° - 7°N
    (b) 3° - 8°S
    (c) 10° - 20°N
    (d) the aircraft does not cross the ITCZ

24. Flying level with an alp with a QNH of 1011hPa and with a temperature lower than ISA, your altimeter will read:

    (a) lower than the alp elevation
    (b) higher than the alp elevation
    (c) same as the alp elevation
    (d) cannot be determined

25. Which of the following would give the worst airframe icing?

    (a) SN
    (b) +FZRA
    (c) FZFG
    (d) GR

26. A pressure system with air bulging upwards and outwards would be

    (a) a warm low
    (b) a cold low
    (c) a warm high
    (d) a cold high

27. Steaming fog could be likely with:

    (a) cold air over a warm sea
    (b) warm air over a cold sea
    (c) cold air over land
    (d) warm air over land

28. What is subsidence?

    (a) vertical up movement of air
    (b) vertical down movement of air
    (c) horizontal movement of air
    (d) adiabatic cooling of air

29. Where does tropical continental air in summer in Europe originate?

(a) South of France
(b) Italy
(c) Balkans and Near East
(d) Azores

30. Moderate turbulence can be expected in

(a) cirrocumulus
(b) nimbostratus
(c) Ac lenticularis
(d) stratus

31. When is diurnal variation of surface temperature at maximum?

(a) clear skies, calm wind
(b) clear skies, strong wind
(c) overcast, calm wind
(d) overcast, strong wind

32. Under ICAO, the statement, "no diversion necessary, de-icing is not required " describes the icing as:

(a) light
(b) moderate
(c) severe
(d) extreme

33. Moist stable air is forced to rise over a mountain, which of the following would be likely?

(a) thunderstorms
(b) turbulence
(c) inversion
(d) stratiform cloud

34. What is the coldest time of the day?

(a) one hour before dawn
(b) thirty minutes before dawn
(c) dawn
(d) thirty minutes after dawn

35. The core of the Arctic Jet is at:

(a) 20,000 ft
(b) 30,000 ft
(c) 40,000 ft
(d) 50,000 ft

36. Why does air cool when it rises?

(a) expansion
(b) compression
(c) it is colder with height
(d) it is colder at higher latitudes

37. When is the greatest difference between temperature and dewpoint?

(a) dry air
(b) moist air
(c) cool air
(d) warm air

38. When would a cold occlusion be more likely over Europe?

(a) summer
(b) winter
(c) winter and spring
(d) autumn and winter

39. Which of the following would produce the worst icing?

(a) -2°C to -15°C OAT
(b) -15°C to -20°C OAT
(c) -25°C to -30°C OAT
(d) near the freezing level

40. "After such a nice day yesterday, the ring around the moon indicated bad weather today. Sure enough, there is low cloud and it is pouring down with rain but it is a bit warmer". This is describing:

(a) a warm front
(b) a cold front
(c) weather behind a cold front
(d) an anti-cyclone

41. Altostratus is:

(a) low level cloud
(b) medium level cloud
(c) high level cloud
(d) a heap type cloud

42. Where are TRS's not likely to form?

(a) South China Sea
(b) South Pacific
(c) South Atlantic
(d) South Indian Ocean

43. In what cloud is icing and turbulence most severe?

(a) Ns
(b) Cb
(c) Sc
(d) Ci

44. In a tropical downpour the visibility is sometimes reduced to:

(a) 1000m
(b) 500m
(c) 200m
(d) less than 100m

45. The environmental lapse rate in the real atmosphere:

(a) has a fixed value of 2°C/1000 ft
(b) has a fixed value of 0.65°C/100m
(c) varies with time
(d) has a fixed value of 1°C/100m

46. Where is the most dangerous part of a TRS?

(a) near the eye
(b) in the wall of cloud surrounding the eye
(c) 300 km from the eye
(d) in the eye

47. What type of cloud is usually found at low level?

(a) St
(b) Ac
(c) Cc
(d) Cs

48. What type of cloud is snow most likely to fall from?

(a) Sc
(b) St
(c) Ns
(d) Cb

49. Which of the following moves the fastest?

(a) warm front
(b) warm occlusion
(c) cold front
(d) cold occlusion

50. Supercooled water droplets are found in:

(a) clouds only
(b) clouds, fog and precipitation
(c) clouds and precipitation
(d) precipitation

51. What type of low is usually associated with frontal activity?

(a) polar front low
(b) warm low
(c) cold low
(d) mountain lee low

52. Which of the following most influences the probability that airframe icing will occur?

(a) speed and shape of airfoil
(b) RH and temperature
(c) droplet size and temperature
(d) freezing level

53. Clouds classified as low level are considered to have a base height of:

(a) 500 - 1000 ft
(b) 1000 - 2000 ft
(c) surface - 6500 ft
(d) 100 - 200 ft

54. Cb clouds in summer contain:

(a) water droplets
(b) ice crystals
(c) water droplets, ice crystals and super-cooled water droplets
(d) water droplets and ice crystals

55. Where would you expect to find the strongest wind <u>on the ground</u> in temperate latitudes?

(a) in an area of low pressure
(b) in an area of high pressure
(c) in the warm air between the fronts
(d) in a weak anticyclone

56. What surface weather is associated with a stationary high pressure region, over land in winter?

(a) Ns and continuous rain
(b) possibility of snow showers
(c) thunderstorms
(d) a tendency for fog and low stratus

57. What cloud does hail fall from?

(a) Ns
(b) Cb
(c) Cu
(d) Ci

58. When would a rotor cloud be ahead of a Cb?

(a) mature stage
(b) developing stage
(c) cumulus stage
(d) dissipating stage

59. What type of cloud is associated with drizzle?

(a) St
(b) Ci
(c) Ac
(d) Cb

60. Which jet blows constantly in the northern hemisphere?

(a) arctic
(b) polar front
(c) equatorial
(d) sub-tropical

61. From which of the following can the stability of the atmosphere be determined?

(a) surface temperature
(b) surface pressure
(c) DALR
(d) ELR

62. If you encounter freezing rain, you should:

(a) turn round before you become unable to manoeuvre
(b) climb into warmer air above
(c) accelerate
(d) descend

63. Flying at FL180 in the southern hemisphere, you experience a crosswind from the left, what is happening to your true altitude?

(a) it remains the same
(b) it is increasing
(c) it is decreasing
(d) it is impossible to tell

64. What type of cloud are you least likely to get icing from?

(a) Ci
(b) Cu
(c) Ns
(d) St

65. What best describes the movement of a secondary depression?

(a) it merges with the primary depression
(b) it moves around the primary depression in a cyclonic sense
(c) it moves around the primary depression in an anti-cyclonic sense
(d) it catches up with the primary depression

66. What is the height and temperature of the tropopause?

(a) 8 km and -40°C at the equator
(b) 16 km and -75°C at the equator
(c) 16 km and -40°C at poles
(d) 8 km and -75°C at the poles

67. Fair weather cumulus gives an indication of:

(a) thunderstorms
(b) poor visibility
(c) smooth flying conditions
(d) turbulence

68. How do you define convection?

(a) horizontal movement of air
(b) vertical movement of air
(c) same as advection
(d) same as conduction

69. In the northern hemisphere a man observes a low pressure system passing him to the south. What wind will he experience?

(a) back then veer
(b) constantly backing
(c) veer then back
(d) back then steady

70. Dewpoint is defined as:

(a) the lowest temperature at which evaporation will occur for a given pressure
(b) the lowest temperature to which air must be cooled in order to reduce the relative humidity
(c) the temperature below which the change of state for a given volume of air will result in the absorption of latent heat
(d) the temperature to which moist air must be cooled to reach saturation

71. What is the temperature decrease with height below 11 km?

(a) 1°C/100m
(b) 0.5°C/100m
(c) 0.65°C/100m
(d) 0.6°C/100m

72. A jet stream with a speed of 350kts is:

(a) possible but very rare
(b) impossible
(c) possible in polar areas
(d) common

73. Contours on a weather chart indicate:

(a) distance between pressure levels
(b) heights of pressure levels
(c) height of ground
(d) thickness between pressure levels

74. Why is clear ice such a problem?

(a) it is translucent and forms along leading edges
(b) it is not translucent and forms along leading edges
(c) it is very heavy and can affect aircraft controls and surfaces
(d) it forms in clear air

75. If you fly at right angles to a jet stream in Europe, with decreasing OAT, you will experience:

(a) increasing headwind
(b) increasing tailwind
(c) wind from the left
(d) wind from the right

76. If you are flying cross-country at FL 50 if you first see Ns, As, Cs then Ci, you can expect:

(a) increasing temperature
(b) decreasing temperature
(c) a veer of the wind
(d) a pressure increase

77. What is the pressure lapse rate at 5500m in the ISA atmosphere?

(a) 27 ft/mb
(b) 50 ft/mb
(c) 100 ft/mb
(d) 150 ft/mb

78. What is the most likely cause of stratiform clouds over flat ground?

(a) a clear night and calm wind
(b) a clear night and moderate wind
(c) a cold front
(d) temperatures below zero

79. ATC will only report the wind as gusting if:

(a) the gust speeds exceed the mean by more than 15 kts
(b) it gusts to over 25 kts
(c) the gusts exceed the mean by 10 kts
(d) it gusts to over 25 kts

80. At FL180 in the northern hemisphere, with a wind from the left, what can you say about temperature with a heading of 360°

(a) it is increasing from S to N
(b) it is increasing from N to S
(c) it is not possible to tell without the pressure
(d) it is constant

81. In which air mass can extreme cold temperatures be found?

(a) Polar Continental
(b) Arctic Maritime
(c) Polar Maritime
(d) Tropical Maritime

82. The Polar front jet in summer moves:

(a) north and increases in strength
(b) north and decreases in strength
(c) south and decreases in strength
(d) south and increases in strength

83. If an isohypse on a surface pressure chart of 500 hPa shows a figure of 540, this indicates:

(a) the topography of 540 m amsl
(b) the topography of 540 decametres amsl
(c) the pressure is 540 hpa
(d) low surface pressure.

84. Up and down draughts occur in which stage of a thunderstorm?

(a) The cumulus stage
(b) The dissipating stage
(c) The mature stage
(d) The precipitation stage

85. What is the lowest temperature in the International Standard Atmosphere (ISA)

(a) -50.6°C
(b) -56.5°C
(c) -216.5°C
(d) 56.5°C

86. The Bora is:

(a) a cold katabatic wind of maritime origin
(b) a cold katabatic wind of arctic origin
(c) a cold katabatic wind that may produce violent gusts
(d) a warm katabatic wind which may produce squally winds

87. What would reflect radar?

(a) hail
(b) fog
(c) mist
(d) cloud

88. Relative humidity increases in:

(a) warmer air compared to colder air
(b) warm air at a constant vapour pressure
(c) cold air at a constant vapour pressure
(d) colder air compared to warmer air

89. If flying in the Alps with a Fohn effect from the south:

(a) clouds will be covering the southern passes of the Alps
(b) there will be CAT on the northern side
(c) the wind will be veering and gusting on the northern side
(d) there will be convective weather on the southern passes of the Alps

90. Which of the following, with no orographic intensification, will give rise to moderate icing conditions?

(a) Ns and Cs
(b) As and Ac
(c) Cb and Ns
(d) Ns and Cc

91. Hill fog will be most likely with:

(a) clear skies, little wind and dry air
(b) humid and stable air blowing over a range of hills
(c) unstable air with a high RH
(d) precipitation lifted by air blowing over a range of hills.

92. Which is likely to cause aquaplaning?

(a) +RA
(b) SA
(c) FG
(d) DS

93. Why do upper level winds blow parallel to contour lines?

(a) geostrophic force more or less balances the pressure gradient force
(b) geostrophic force acts perpendicular to pressure gradient force
(c) geostrophic force acts perpendicular to line joining high and low pressure
(d) friction layer force acts perpendicular to wind direction

94. In temperate latitudes what conditions would you expect in the centre of a high pressure system in summer?

(a) TS, CB
(b) TS, SH
(c) NS
(d) calm winds, haze

95. Flying from Rome (QNH 1011 hPa) to Paris (QNH 1016 hPa) at FL150, if you did not reset your altimeter, why would the true altitude remain the same during the flight?

(a) It is warmer at Paris than Rome
(b) It is warmer at Rome than Paris
(c) The altimeter is faulty
(d) The answer cannot be determined

96. Above a stable layer in the lower troposphere in an old high pressure system is a phenomenon called

(a) radiation inversion
(b) subsidence inversion
(c) frontal inversion
(d) terrestrial inversion

97. The equatorial easterly jet is found in the:

(a) Northern hemisphere in summer
(b) Northern hemisphere all year
(c) Southern hemisphere all year
(d) Southern hemisphere in winter

98. Why do TRS not occur in the SE pacific and S Atlantic?

(a) low water temperatures
(b) no coriolis force
(c) SE trade crosses equator
(d) SE trade winds blowing

99. In a TAF, TEMPO TS indicates a:

(a) TS that will last for a maximum of 1 hr in each instance
(b) TS that will last the whole period
(c) TS that will last at least 30 mins
(d) TS that will last for less than 30 mins

100. The worst turbulence in a jet stream is:

(a) in the core
(b) along the axis of the core to the right
(c) along the axis of the core to the left
(d) between the boundaries of the cold and warm air

101. If an active cold front is approaching, what will the altimeter read on a parked aircraft just before the front arrives?

(a) an increase
(b) a decrease
(c) it stays the same
(d) it fluctuates up and down 50 ft

102. When do you get TRS at Darwin?

(a) July to October
(b) in winter
(c) November to April
(d) never

103. When flying from south to north in the southern hemisphere, crossing over and above a polar front jet at FL 400, what might happen to the OAT?

(a) It will rise
(b) It will initially rise then fall
(c) It will fall
(d) It will initially fall then rise

104. With low pressure dominating the Mediterranean, what likely conditions would be found in central Europe?

(a) thunderstorms and snow
(b) thermal depressions
(c) northerly Fohn wind over the Alps
(d) warm clear sunny spells

105. When flying from Stockholm (55N 18E) to Rio de Janeiro (22S 80W) you might encounter:

(a) a polar front jetstream then a subtropical jet the a polar jet
(b) a polar front jet, then one or two sub tropical jets
(c) one sub tropical jet
(d) one sub tropical then one polar front jet

106 Prevailing winds in NW Africa, Gulf of Guinea (07N) will be

(a) SW monsoon in summer, NE trade winds in winter
(b) SE monsoon in summer, NW trade winds in winter
(c) SE trade winds in summer, NE monsoon in winter
(d) SW trade wind in winter, NE monsoon in summer

107. What flight hazard is associated with the Harmattan?

(a) sand up to fl150
(b) windshear
(c) dust and poor visibility
(d) dense fog

108. Flying from Dakar to Rio de Janeiro, where is the ITCZ in winter?

(a) beyond 8°S
(b) 0 to 7°N
(c) 8 to 12°N
(d) 12 to 16°N

109. The rains in North Africa occur:

(a) March to May and August to October
(b) March to May and October to November
(c) December to April
(d) June to August

110. Sub tropical highs are found:

(a) from 5 - 15° Latitude
(b) from 25 - 35° Latitude
(c) from 40 - 60° Latitude
(d) between the Polar and Ferrel cells

111. What causes echoes on airborne weather radar screens?

(a) water vapour
(b) all clouds
(c) fog
(d) hail

112. With a polar front jetstream, in the southern hemisphere, the highest probability of turbulence is:

(a) in the jet core
(b) above the jet core, in the boundary of the warm and cold air
(c) looking downstream on your right
(d) looking downstream on your left

113. Low level windshear is likely to be a maximum:

(a) at the condensation level when there is strong surface friction
(b) at the condensation level when there is no night radiation
(c) at the top of the friction layer when there is strong solar radiation
(d) at the top of a surfaced based inversion during strong night radiation

114. Which of the following METARs at 1850UTC will most likely give fog formation overnight?

(a) 22005KT 5000 -RA SCT014 0VC300 18/13 Q1000 NOSIG=
(b) VRB002KT 9999 SCT 180 17/M06 Q1010 NOSIG
(c) VRB001KT 7000 SCT280 11/10 Q1020 BECMG 2500
(d) VRB002KT 8000 FEW100 12/09 Q1024 BECMG 0700

115. On which pressure chart would you find the contour line of 18,250 ft?

(a) 200 hPa
(b) 300 hPa
(c) 500 hPa
(d) 700 hPa

116. Relative humidity increases:

(a) in cooler air compared to warmer air
(b) in warmer air compared to cooler air
(c) if air is cooled at constant vapour pressure
(d) if air is warmed at constant vapour pressure

117. Flying towards a depression in the northern hemisphere at 1000 ft AGL, where is the wind from?

(a) left
(b) right
(c) left and behind
(d) right and on the nose

118. If the surface temperature is below 0°C in central Europe (winter) and freezing rain is observed, it is due to a:

(a) cold occlusion
(b) warm front or warm occlusion
(c) cold front
(d) stationary front

119. If you fly with left drift (port) in the northern hemisphere, what happens to your true altitude?

(a) it increases
(b) it decreases
(c) it stays the same
(d) the answer cannot be determined

120. A steep pressure gradient is characterised by

(a) close isobars and strong wind
(b) well spaced isobars and low wind speed
(c) close isobars and rising temperatures
(d) well spaced isobars and falling temperatures

121. At a stationary front :

(a) winds blow parallel to the isobars and front
(b) winds blow perpendicular to the isobars
(c) winds are always very strong
(d) the weather varies between active warm and active cold front conditions

122. Where are icing conditions on a runway specified?

(a) TAF
(b) METAR
(c) SIGMET
(d) PIREP

123. What is sublimation?

(a) The transition from solid to vapour
(b) The transition from vapour to liquid
(c) The transition from liquid to vapour
(d) The transition from liquid to solid

124. In a METAR the coding R25/P1500 means the:

(a) RVR is assessed at more than 1500m
(b) RVR equipment has problems
(c) RVR is improving
(d) RVR is varying

125. RVR is:

(a) measured using ceilometers along the runway
(b) usually greater than met visibility
(c) displayed in TAFs and METARs
(d) given when the met visibility is below 2000m

126. Polar front jetstreams are at what height?

(a) 20000 ft
(b) 30000 ft
(c) 40000 ft
(d) 50000 ft

127. With a ground temperature of -5°C, the zero degree isotherm at 3000 ft AGL, NS at 4000 ft and continuous rain, where if at all would icing be expected?

(a) no icing would be expected
(b) no icing would be expected unless in cloud
(c) icing would be expected between 3000 and 4000 ft
(d) icing would be expected from the surface to 3000 ft

128. In the northern hemisphere with a jetstream north to south, cold air would be to the:

(a) east and below
(b) east and above
(c) west and below
(d) north and above

129. Where are en-route icing conditions specified?

(a) TAF and METAR
(b) METAR and SIGMET
(c) SIG WX chart and SIGMET
(d) SPECI and TREND

130. What is the best description of equatorial weather?

(a) Showers and thunderstorms all year but worst in April/May
(b) Showers and thunderstorms in July and December
(c) Frequent low stratus and drizzle
(d) Hot and dry throughout the year

131. When is the night time surface temperature the least?

(a) With clear skies and calm winds
(b) With cloudy skies and strong winds
(c) With clear skies and strong winds
(d) With cloudy skies and calm winds

132. Small supercooled water droplets are hitting an airfoil. They will:

(a) freeze on impact giving clear ice
(b) partially freeze and run back giving clear ice
(c) freeze on impact giving rime ice
(d) partially freeze and run back giving rime ice

133. In Europe, where are the strongest winds found?

(a) At 5500m
(b) At the tropopause level
(c) Where air converges aloft
(d) Over the Alps

134. Several aircraft report severe CAT in an area on route. Which of the following statements is correct?

(a) ATC should close the area
(b) ATC should issue a storm report
(c) A competent ATSU should issue a SPECI
(d) A competent ATSU should issue a SIGMET

135. What type of icing requires immediate diversion?

(a) extreme
(b) severe
(c) moderate
(d) light

136. What is the width of a tornado?

(a) 9 km
(b) less than100m
(c) 100 - 150m
(d) 2 - 6 km

137. Comparing the surface wind to the 3000 ft wind:

(a) The surface wind veers and is less than the 3000 ft wind
(b) The surface wind blows along the isobars and is less than the 3000 ft wind
(c) The surface wind blows across the isobars and is less than the 3000 ft wind
(d) Both are the same

138. What is the weather inside a warm sector in a frontal depression in central Europe?

(a) fair weather Cu
(b) Cb and thunderstorms
(c) low stratus and drizzle
(d) altostratus with light rain

139. If you encounter moderate turbulence with convective clouds en-route and you decide to continue, you should:

(a) decrease power and climb above the clouds if flight parameters allow
(b) decrease power and fly below the clouds
(c) increase power and climb above the clouds if flight parameters allow
(d) increase power and fly below the clouds

140. Moist stable air is forced to rise over a mountain, what would you get?

(a) thunderstorms
(b) turbulence
(c) inversion
(d) stratiform cloud

141. Clear ice is most likely to form in temperatures between:

(a) -01°C to -10°C
(b) -20°C to -30°C
(c) -30°C to -40°C
(d) -40°C to -50°C

142. Where are polar front depressions located?

(a) 10° to 15°N
(b) 25° to 35°N
(c) 35° to 55°N
(d) 55° to 75°N

143. Which of the following are medium level clouds?

(a) As and Ac
(b) Sc and Cb
(c) Ci and Ns
(d) Cs and As

144. What factor dictates stability?

(a) RH
(b) ELR
(c) DALR
(d) SALR

145. The lowest flight level depends on the:

(a) lowest QNH and lowest negative temperature below ISA
(b) highest QNH and lowest negative temperature below ISA
(c) highest QNH and highest temperature above ISA
(d) highest QNH and lowest temperature

146. The best way to avoid CAT is:

(a) to change level
(b) to change heading
(c) to change speed
(d) impossible to say

147. The main features of thunderstorms at the cumulus stage are:

(a) continuous updrafts
(b) up and down drafts
(c) fibrous top
(d) onset of precipitation

148. When flying at FL50 in the northern hemisphere, you experience a crosswind from the left. What happens to your true altitude?

(a) The true altitude decreases
(b) The true altitude increases
(c) The true altitude stays the same
(d) It is impossible to assess what happens without the temperatures at FL50

149. When flying from A (QNH 1013) to B (QNH 1015) the true altitude stays constant. Why?

(a) The air at A is warmer than at B
(b) The air at B is warmer than at A
(c) There is an error in the altimeter
(d) It is impossible to say

150. Clear ice is not likely in which cloud?

(a) Ci
(b) Cb
(c) Ns
(d) TCu

151. Pressure altitude equals density altitude when:

(a) the temperature is standard
(b) the temperature at msl is zero
(c) the temperature is warmer than standard if pressure is lower
(d) the temperature is lower than standard and the pressure is higher.

152. Which description of a cold occlusion is correct?

(a) less cold air is behind and warm air is aloft
(b) less cold air is ahead with warm air aloft
(c) coldest air is behind with cold air aloft
(d) coldest air is ahead with cold air aloft

153. The Icelandic low is worse in winter because:

(a) the sea off the coast of Canada is more active in winter, generating more lows
(b) the temperature gradient between the equator and the pole is greater in winter
(c) the temperature gradient between the equator and the pole is weaker in winter
(d) the sea off the coast of Canada is less active in winter which results in fewer but deeper lows

154. The Polar front in the Southern hemisphere, moves:

(a) south in summer and weakens
(b) north in summer and weakens
(c) south in summer and strengthens
(d) north in summer and strengthens

155. The Harmattan brings what type of conditions?

(a) moist and clear unstable air
(b) warm and thundery
(c) dry and dusty
(d) cool and thundery

156. Cold pools are

(a) formed on the lee side of the Alps by a NW wind
(b) formed when a polar air mass is cut off from source
(c) are only associated with anticyclones in the troposphere
(d) are only associated with circulation in the high troposphere

157. The ratio of depth to width of a jet stream is:

(a) 1:50
(b) 1:100
(c) 1:150
(d) 1:250

158. What is the Bora?

(a) cold katabatic wind over the Adriatic
(b) warm anabatic wind blowing from the Med
(c) northerly wind blowing from the Med
(d) warm katabatic wind blowing over the Adriatic

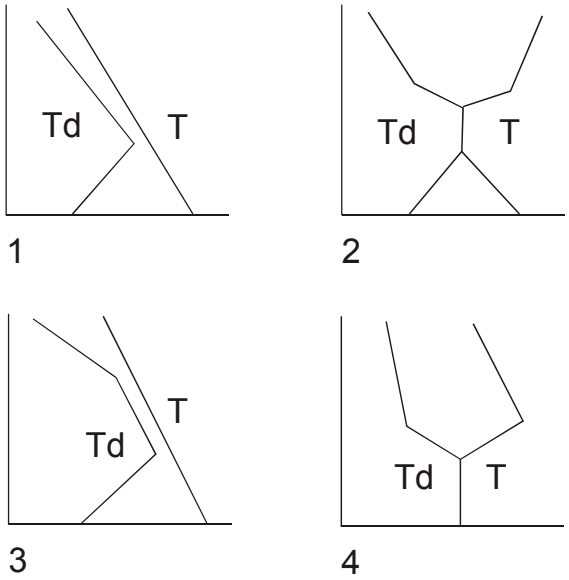
159. When are tropical cyclones most likely?

(a) spring
(b) summer
(c) autumn
(d) winter

160. The Geostrophic wind is affected by which combination of factors?

1. rotation of the earth,
2. centripetal force,
3. latitude,
4. Coriolis force,
5. height

(a) 1, 3, 4,
(b) 1, 2, 3,
(c) 3, 4, 5,
(d) 1, 4, 5,



161. Which of the above radiosonde diagrams shows fog?

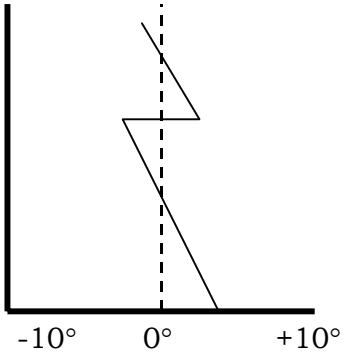
(a) 1
(b) 2
(c) 3
(d) 4

162. Which of the above radiosonde diagrams shows low stratus?

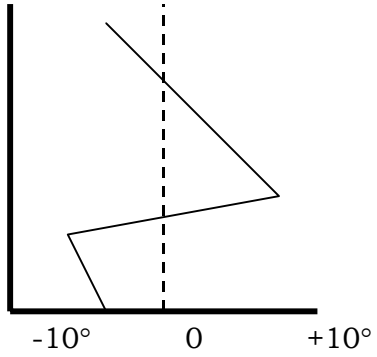
(a) 1
(b) 2
(c) 3
(d) 4

163. What is a microburst?

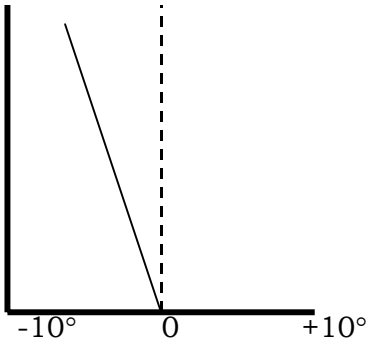
(a) Air descending at high speed, colder than the surrounding air
(b) Air descending at high speed, warmer than the surrounding air
(c) A small TRS
(d) A small depression with strong wind speeds



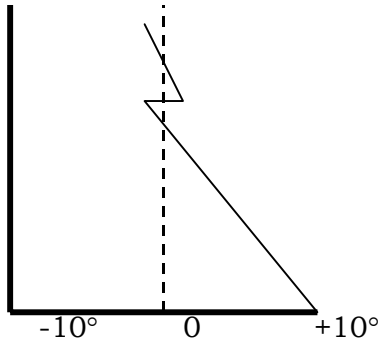
A



B



C



D

164. Which of the above temperature plots show freezing rain?

(a) A
(b) B
(c) C
(d) D

165. What is freezing rain?

(a) rain hitting the ground and freezing on impact
(b) rain falling into warmer air
(c) rain falling from an inversion into an area below 0°c
(d) rain falling into colder air and freezing into pellets

166. What gives freezing rain over Central Europe?

(a) a warm occlusion
(b) a cold occlusion
(c) a warm front
(d) a cold front

167. In which cloud would you encounter the most intensive rain?

(a) Ci
(b) Ns
(c) St
(d) Sc

168. TRSs in the Indian Ocean would be:

(a) Tornados
(b) Hurricanes
(c) Typhoons
(d) Severe Cyclones

169. In the northern hemisphere, the point of occlusion moves mainly in which direction?

(a) along the front to the west
(b) across the front to the north
(c) across the front to the south
(d) along the front to the east

170. At what height is the 300hPa level?

(a) 10,000 ft
(b) 18,000 ft
(c) 30,000 ft
(d) 38,000 ft

171. Flying in an atmosphere warmer than ISA, you might expect the:

(a) true altitude to be the same as indicated
(b) true altitude to be lower than indicated
(c) true altitude to be higher than indicated
(d) true altitude to be decreasing

172. With a QNH of 1030hPa, you set the standard pressure setting at the transition level, what happens to indicated altitude?

(a) It drops by 510 ft
(b) It rises by 510 ft
(c) It rises by 840 ft
(d) It drops by 840 ft

173. An airfield 100m below sea level has a QFF of 1025 hPa and a temperature of ISA -10°C, what is the QNH?

(a) higher than 1025hpa
(b) less than 1025hpa
(c) 1025hpa
(d) it is impossible to say

174. Where is the ozone layer?

(a) In the stratosphere
(b) At the tropopause
(c) In the troposphere
(d) In the ionosphere

175. Where is the ITCZ during the year?

(a) It doesn't move
(b) It is always south of the equator
(c) It is always north of the equator
(d) It moves in accordance with the heat equator

176. Which of the following would cause your true altitude to decrease?

(a) cold air/low pressure
(b) cold air/high pressure
(c) warm air/high pressure
(d) warm air/low pressure

177. Flying from Bankok to Bombay, why does the wind at 30,000 ft change from a 15kt headwind in winter to a 20kt tailwind in summer?

(a) freak weather conditions experienced on route
(b) the subtropical jet changes direction by 180°
(c) the equatorial jet changes direction by 180°
(d) the local changes in upper winds are due to movement of the ITCZ

178. A plain in western Europe at 500m amsl is covered with a uniform layer of altocumulus cloud during the summer months, at what height above the ground would the base of this cloud be expected?

(a) 100 - 1500 ft
(b) 1500 - 7000 ft
(c) 7000 - 15000 ft
(d) 15000 - 25000 ft

179. Why is the geostrophic wind round a low stronger than the gradient wind?

(a) The centrifugal force adds to the gradient force
(b) The centrifugal force opposes the gradient force
(c) The Coriolis force adds to the gradient force
(d) The Coriolis force opposes the gradient force

180. ITCZ weather is:

(a) clear weather
(b) showers
(c) light winds
(d) thundery, with strong convergence

181. The ITCZ is best described as the area:

(a) where the trade winds of the northern and southern hemisphere meet
(b) where the west winds meet the sub tropical high pressure belt
(c) where cold fronts are formed in the tropics
(d) where the harmattan meets the NE trades in Africa

182. If you see Ns, As, Cs and then Ci, whilst flying at FL50, what would you expect to happen?

(a) The temperature to increase
(b) The temperature to decrease
(c) To encounter downdrafts
(d) To encounter windshear

183. With the passage of a polar front depression, what would be most likely?

(a) There will be continuous snow and rain, which stops to be followed by showers of rain and snow
(b) There will be showers for two hours, drizzle for 12 hours, then rain and snow
(c) There will be heavy showers of rain and possibly hail, followed by drizzle and light rain
(d) There will be continual backing of the wind

184. At a point on a 300 hPa chart the temperature is -48°C, the tropopause is shown at FL330, what is the most likely temperature at FL350?

(a) -50°C
(b) -56.5°C
(c) -54°C
(d) -58°C

185. If the temperature was -0.5°C and the dewpoint -1.5°C, how would this be shown in a METAR?

(a) M01/M02
(b) M0.5/M1.5
(c) M00/M01
(d) M01/M01

186. A METAR for Zurich gives the surface wind as 260/20, which would be the most likely wind at 2000 ft?

(a) 260/15
(b) 220/25
(c) 290/40
(d) 185/20

187. What is the movement of air in a ridge?

(a) ascending and diverging
(b) descending and diverging
(c) ascending and converging
(d) descending and converging

188. At a coastal airfield in the Mediterranean, with the runway parallel to the coastline, you are downwind over the sea with the runway to your right. On a warm summer afternoon, what wind would you expect on final?

(a) Crosswind from the right
(b) Crosswind from the left
(c) Headwind
(d) Tailwind

189. With a surface temperature of +18°C and a temperature at 1000m of +14°C, the atmosphere is:

(a) Unstable
(b) Stable
(c) Conditionally unstable
(d) Conditionally stable

190. What is the movement of air in a trough?

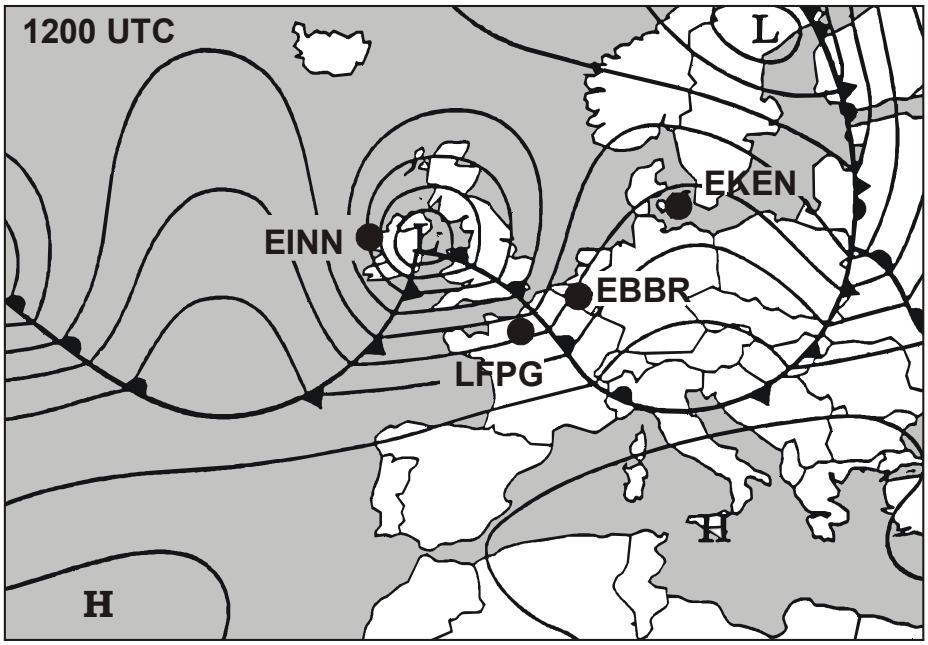
(a) ascending and diverging
(b) descending and diverging
(c) ascending and converging
(d) descending and converging

191. At what approximate height is the 250hPa level?

(a) 34,000ft
(b) 38,000ft
(c) 30,000ft
(d) 32,000ft

192. The validity of a TAF is:

(a) 3hrs
(b) 6hrs
(c) 12hrs
(d) specified in the TAF



193. From the synoptic chart above, select the station that would be reporting the following METAR:

    24015KT 4000 DZ OVC005 10/09 Q1014=

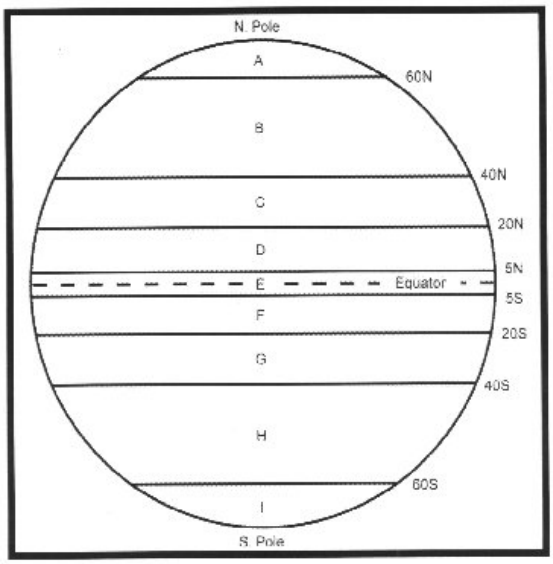
    (a) EINN
    (b) LFPG
    (c) EKEN
    (d) EBBR

194. With respect to the above chart, which statement best describes the diagram?

    (a) An easterly wave
    (b) A westerly wave
    (c) Biting winds
    (d) A uniform pressure gradient

195. With respect to station EKEN on the above chart, which of the following describes the pressure system?

    (a) A trough of low pressure
    (b) A ridge of high pressure
    (c) A depression
    (d) A col



196. On the idealised globe above, select the region of travelling depressions.

(a) E
(b) D
(c) B
(d) C

197. On the idealised globe above, select the region of north easterly trade winds.

(a) E
(b) D
(c) B
(d) C

198. On the idealised globe above, select the region where the sub tropical jet would be located.

(a) E
(b) D
(c) B
(d) G

199. Which of the above clouds best shows Altocumulus Lenticularis?

(a) A
(b) B
(c) C
(d) D

200. Which of the above clouds best shows Altocumulus Castellanus?

(a) A
(b) B
(c) C
(d) D

201. Which of the above clouds best shows Cumulus Capillatus?

(a) A
(b) B
(c) C
(d) D

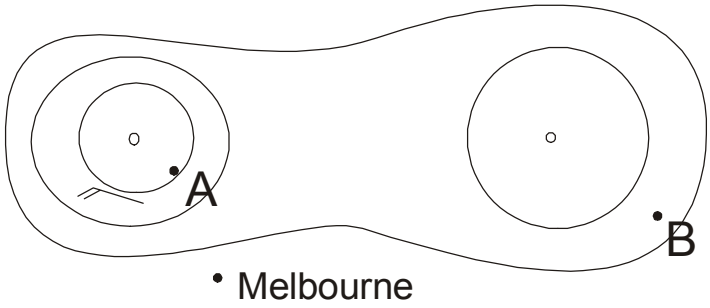
202. The QNH at an airfield 200m AMSL is 1010 hPa, If the temperature is ISA -10°C, what is the QFF?

(a) less than 1010
(b) more than 1010
(c) 1010
(d) it cannot be determined

203. The QFF at an airfield 150m below MSL is 1006 hPa temperature is higher than ISA, what is the QNH?

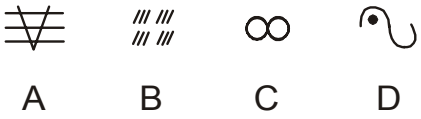
(a) less than 1006 hPa
(b) more than 1006 hPa
(c) 1006
(d) it cannot be determined

204. On the diagram below on a flight from A to B at 1500 ft, which statement is true?



(a) The true altitude at A is greater than B
(b) The true altitude at B is greater than A
(c) The true altitude is the same at both points
(d) The relative true altitudes cannot be determined

205. Which of the symbols below represents widespread haze?



A B C D

(a) A
(b) B
(c) C
(d) D

206. Which of the above symbols represents freezing precipitation?

(a) A
(b) B
(c) C
(d) D

207. What is the approximate speed of a 40kt wind expressed in metres a second?

(a) 20 m/s
(b) 40 m/s
(c) 80 m/s
(d) 60 m/s

208. What is (i) the diameter and (ii) the duration of a typical microburst?

	(i)	(ii)
(a)	4 km	1 - 4 mins
(b)	5 km	5 - 8 mins
(c)	5 nm	more than 10 mins
(d)	100m	less than 60 seconds

209. What is the Chinook?

(a) a warm dry wind on the lee of the Rockies
(b) a warm dry wind of the Swiss Alps
(c) a cold wind that blows across Argentina
(d) a wind that blows into the Mediterranean

210. What is the maximum height of radiation fog?

(a) 150ft
(b) 1500ft
(c) 5000ft
(d) 10,000ft

211. A METAR contains the following groups:

……271020…R26R/1500NR26L/1500N….NOSIG =

this means:

(a) Runway 26R, 1500m RVR, no recording on runway 26L, visibility 1500m to the north
(b) Both runways, 26R and 26L, RVR 1500m, no change forecast and no significant weather.
(c) Both runways, 26R and 26L, RVR 1500m, no change in the last few minutes before 1020Z and no significant change forecast until 1220Z
(d) Runway 26R and 26L, 1500m RVR, visibility 1500m to the north and no significant change forecast

Answers

1. Hoar frost on aircraft comes from a cold aircraft moving to a warm airmass, descending in normal conditions but climbing through a temperature inversion. In practice, hoar frost in flight is a transient effect, for the aircraft skin temperature rapidly rises to ambient. Hoar frost on the ground, before takeoff, is the major hazard. Answer c.

2. The formation of radiation fog and advection fog is essentially the same process. Moist air is cooled to below dewpoint by contact with a cold surface. In advection fog the air is moving over the cold surface – 15kt is thought to be the minimum windspeed for the formation of widespread advection fog – while in radiation fog the air is nearly stationary. Answer a.

3. In winter, Continental Europe is cold, and you will only get thunderstorms associated with depressions and frontal systems or when very cold maritime type air masses come in from the North. Frontal systems come at any time. The question is referring to air mass thunderstorms and the effect of rising surface temperatures in daytime heating. These reach a maximum in mid afternoon. Answer c.

4. Thunderstorms are driven by the medium level wind, taken to be the wind at the 700mb (10,000ft) level. The name “air mass thunderstorm” normally applies to thermally triggered storms that arise randomly in a wide area, and thermal triggering depends on relatively light winds, that allow high surface temperatures to develop. Orographic thunderstorms are triggered by stationary land features and their subsequent movement depends on the 700mb wind. Active frontal systems trigger line squalls of thunderstorms, and active fronts are, by definition, moving relatively rapidly and taking their thunderstorms with them. Answer b.

5. Bankok (now Krung Thep) is at Lat 14N and Karachi at Lat 25N. The northern boundary of the tropical easterlies in this area moves from about 10N in January to 20n in July. North of these boundaries the winds are westerlies, light at first but increasing in strength as you go north. Thus in July on the route described you would be in the (light) easterlies until the end of the leg but in January you would be in westerlies all the way. This agrees with the winds given in the question setting. Answer a.

6. In an occlusion the warmest air, the remnant of the old warm sector, is aloft in the “V”. At the surface, in a warm occlusion, it looks like a warm front, with cold air from behind the occlusion overriding the colder air in front. Answer b.

7. Three quarters of the atmosphere by weight lies in the troposphere, below the tropopause. Half lies below 16,000ft. Answer d.

8. The point of having an airfield QNH is that your altimeter should read station elevation - actual height amsl – when you touch down. Your altimeter reads from a datum pressure, set in the baro window, on the assumption that ISA temperatures apply at all heights. To find this datum pressure the met man reads the station pressure – QFE – and calculates down to msl

using ISA temperatures for the heights involved. If ISA temperatures actually apply in real life then this calculated datum will accurately reflect the pressure at msl and indicated height will be true height. If not, then the actual pressure at msl will be different and all indicated heights not at airfield elevation will have a built-in temperature error. However, whatever the temperature, the altimeter will be accurate on touchdown. Another cunning way of finding QNH is to sit in your aircraft on the airfield, wind the baro knob until the altimeter reads airfield elevation and then read off the baro setting

In order to get a more realistic value for the pressure at msl to use in the low level pressure charts met men make a second calculation using the actual ambient temperature. This is QFF. Both QNH and QFF are calculated approximations to the pressure at msl, and while QFF gives a better result than QNH neither can be classified as in options c and d in the question as "the pressure at msl". Answer a.

9 Minimum temperatures occur just after dawn, so this is why you will get fog at this time even if it has been too warm all through the night. Additionally, the slight turbulence and mixing that occurs at dawn in near zero wind conditions as the sun appears is often enough to stir up a fog from what was just a heavy dew. Answer d.

10. In the northern hemisphere the cold air will be on your left, as you stand with your back to the wind looking downstream. The jet core is in the warm air, so on your left is the most rapid change in temperature as you move away from the core, hence the most rapid change of windspeed and maximum CAT. Answer c.

11. The fundamental cause of wind is a horizontal pressure gradient. It is true that for high level winds the pressure gradient at height is generated by the air mass thermal gradient, but that is one step back. Earth rotation affects where the wind blows to, after the pressure gradient takes effect, but that is one step forward. The fundamental link is that a horizontal pressure gradient or differential causes winds. Answer c.

12. Land breezes blow from the land to the sea at surface level and they are a night-time effect. Answer d.

13. In a year-on-year average the tropopause goes from about 55,000ft at the equator to 25,000ft at the poles. Heights are also quoted as 16km at the equator and 8km at the poles, although these are not accurate conversions of the figures in feet. There are breaks – discontinuities – in the tropopause at the main air mass dividing lines, especially at the polar front. However, the general condition is that the tropopause height in the northern hemisphere decreases as you go north. Answer a.

14. An air mass will be conditionally unstable to rising air if the environmental lapse rate, ELR, is between the wet and dry adiabatic lapse rates, the SALR and the DALR. The DALR in metric numbers is 1°C/100m and the SALR, although variable, is taken to be 0.6°C/100m. Only the value of 0.75°C/100m fits into the required band. Note the conversion factor of 3 from the figures in thousands of feet. Answer a.

15. The tropopause is the place where the troposphere stops, or pauses. It is the boundary between the troposphere and the stratosphere. It is the measured point where temperature ceases to fall with increasing height – ignoring low level effects. Answer c.

16. It is worth while repeating the explanation given in Question 8. The point of having an airfield QNH is that your altimeter should read station elevation - actual height amsl – when you touch down. Your altimeter reads from a datum pressure, set in the baro window, on the assumption that ISA temperatures apply at all heights. To find this datum pressure the met man reads the station pressure – QFE – and calculates down to msl using ISA temperatures for the heights involved. If ISA temperatures actually apply in real life then this calculated datum will accurately reflect the pressure at msl and indicated height with QNH set will be true height. If not, then the actual pressure at msl will be different and all indicated heights not at airfield elevation will have a built-in temperature error. However, whatever the temperature, the altimeter will be accurate on touchdown. Another cunning way of finding QNH is to sit in your aircraft on the airfield, wind the baro knob until the altimeter reads airfield elevation and then read off the baro setting. Answer c.

17. Lenticular cloud – lens shaped or almond shaped – is characteristic of standing waves, otherwise known as mountain waves. The airmass has to be stable and the wind generally constant, so convective cloud should not be a problem. Flying at medium level through the standing waves can give marked windshear and the resulting sudden changes in IAS, but in this question the logic is that lenticular clouds indicate standing waves and then standing waves imply windshear. Look out for turbulence at all levels, even above the tropopause, and severe turbulence at low level. Answer d.

18. The ICAO definitions of turbulence levels are:

Light — Conditions less than moderate turbulence. Changes in accelerometer readings less than 0.5 g at the aircraft's centre of gravity'

Moderate — Conditions in which moderate changes in aircraft attitude and/or attitude may occur but the aircraft remains in positive control at all times. Usually, small variations in air speed. Changes in accelerometer readings of 0.5 g to I .0 g at the aircraft's centre of gravity. Difficulty in walking. Occupants feel strain against seat belts. Loose objects move about.

Severe — Conditions in which abrupt changes in aircraft attitude and/or altitude occur; aircraft may be out of control for short periods. Usually, large variations in air speed. Changes in accelerometer readings greater than 1.0 g at the aircraft's centre of gravity. Occupants are forced violently against seat belts. Loose objects are tossed about.

From the list, Answer a.

19. The direction of circulation around highs and lows in the southern hemisphere is opposite to those in the northern hemisphere, clockwise around a low, anti-clockwise around a high. For starboard drift – wind from the left – you could be flying toward a surface high or away from a low. For high level winds air mass temperature is dominant and flying away from low temperature would be correct. As there is only one choice of flying away from low anything it has to be a high level situation. Answer d.

20. All stationary anticyclonic systems – highs – have subsidence, an inversion and surface divergence. Air subsiding means no cloud. Note that underneath the inversion the air is not subsiding, so stratus or stratocumulus can form at low level. Answer c.

21. The adiabatic processes are reversible. This means that as long as nothing gets out of or into the air parcel it will revert to its original state at its original height. In the question "condensation level" means cloudbase and "position" means height. Height means pressure in a standard atmosphere. Note that in a Fohn effect, as an example, something does get out – the rain on the hillside – so the process is no longer reversible and cloud bases on the lee side of the hill are higher than on the windward side. Answer c.

22. Blunt airfoil surfaces send strong pressure waves ahead at the local speed of sound. These have the effect of diverting the airflow away from leading edges and reducing the rate of icing. Sharp airfoil surfaces also send pressure waves ahead, at the same speed, but a lesser amplitude. These do not divert the airflow as much and so the rate of accretion of ice is higher. Answer c.

23. The ITCZ does not move down into the South Atlantic in January because the water is relatively cool. This is the residual effect of the cold Benguela current coming up the western coast of South Africa and Namibia. Rather as in the central Pacific, the ITCZ in the Atlantic will always be found just north of the geographic equator. Answer a.

24. We have left this question in the form that it came to us so you can see some of the difficulties we have with feedback. As it stands, the answer is d, and it is just possible that this is what they intend. A more sensible interpretation is that this is a temperature error question. If this is so, the question can only be answered if there is no baro error, if the pilot has the correct QNH set on the altimeter. It does not matter what the QNH is, so long as it is set correctly. It means nothing to say either that there exists a QNH of 1011 or that the pilot has a QNH of 1011 set on the altimeter. The two have to be tied together. A phrase like "..with the QNH of 1011 correctly set.." would have been all right. Once we have established that the correct QNH is set on the altimeter then in temperatures below ISA the altimeter will overread, showing a height above the elevation of the "Alp". Answer b.

25. Snow, heavy freezing rain, freezing fog (which means supercooled fog, not ice fog) and hail. Which do you think? Answer b.

26. In an atmospheric layer outward horizontal movement of the air from a point – divergence – will be due to high pressure at that point. Think of the divergence at the surface in surface highs. The thickness of the layer – if the layer is defined by top and bottom pressure values – will be determined by the air temperature, as with thickness charts. In this case, high temperature air will give a thicker layer. Answer c.

27. Steaming fog, aka sea smoke or Arctic fog is caused by cold air over a warm wet surface. Typically, it occurs at the top of Greenland fjords, where cold, sub-zero, air from the glaciers runs down (katabatic effect) and over the open water. Answer a.

28. Vertical downward movement of air. Answer b.

29. The source region for tropical continental air is not a well-established high pressure system like the Azores high, but a transient and temporary high pressure region over the Balkans and Turkey. Tc is only present over Europe for about 5% of the year, and is restricted normally to late summer and autumn. Answer c.

30. You would not expect turbulence in any stratiform cloud. Cc is relatively insignificant, but in standing waves, in the Ac lenticularis, you might expect light or moderate turbulence. Do not select Cc because you expect CAT at high level, this is a different problem. Answer c.

31. Clear skies and a calm wind. Answer a.

32. ICAO icing classifications are:

Light – less than moderate icing.

Moderate – Conditions in which a change of heading and/or altitude may be considered desirable.

Severe - Conditions in which an immediate change of heading and/or altitude is considered essential.

These are as written in ICAO PANS-RAC Appendix 1, and, as you can see, say nothing about de-icing, which you would have on under any icing condition. Nor is a diversion to an alternate mentioned. We interpret the phrase “no diversion necessary” to mean “no diversion from your current heading or altitude necessary”. Answer a

33. In the absence of any suggestion of strong winds, which would give turbulence and an inversion, we go for stratiform cloud. Answer d.

34. Refer to question 9. Unless other factors, like fronts, intervene the lowest diurnal temperatures will be just after dawn. Answer d.

35. Given that jets are normally found in the warm air, just below the warm air tropopause, we would expect the arctic, polar and subtropical jets

to be at about 20/25,000ft, 30/35,000ft and 40/45,000ft respectively. The single tropical easterly jet would be at about 50,000ft. This does not help much with the options given, but we would go for 20,000ft for the arctic jet, for 30,000ft is too typical of the polar front jets to be allocated to the arctic jets. Answer a.

36. An air bubble rising into an area of lower pressure will expand. The expansion takes the form of the bubble skin moving out, pushed by the pressure inside. This is a force times a movement and is work done – energy used. The internal heat of the bubble supplies this energy, so the temperature goes down. Answer a.

37. The greater the difference between the OAT and dew point temperatures (called the dew point spread) the dryer the air. Answer a.

38. In the original warm sector depression, before the occlusion formed, the air on both sides of the warm sector was from the same polar maritime source, and conditions were the same. Now, later in the life of the depression, we have different temperatures in front of and behind the occlusion. The reason for this is that the air masses on the two sides have different recent histories, the leading air affected more by continental Europe and the trailing air by the Atlantic. In summer the land is relatively hot while the sea is cool. This makes the leading air warmer than the trailing air, producing a cold type occlusion. In winter the land is much colder than the sea, producing the reverse effect and a warm occlusion. Remember the paradox. Cold occlusions form in the warm season and warm occlusions in the cold season. Answer a.

39. When you ask for the "worst" icing there are two factors to consider. One is type of icing, the other is rate of accretion. The type of icing and to some extent the rate of accretion is affected by the temperature. The highest proportion of bad clear icing occurs at temperatures from freezing down to about –10°C. There is a steady change to mixed clear and rime icing as the temperature falls and by –25°C It is all rime icing. Not only that. At these lower temperatures more of the water drops abandon their supercooled state and freeze, so from –25°C to –45°C icing goes from rime to light rime to nil. Rate of accretion also depends on the type of cloud, aircraft speed and other factors not mentioned in the question, so we take this to be a straightforward temperature assessment. On that basis –2°C to –15°C will give the worst type of icing, clear down to mixed clear and rime. "near the freezing level" looks a superficially attractive answer, but it would have to say "near to but above the freezing level" to be valid. Answer a.

40. This is a description of a warm front. You see the high Ci giving the ring round the moon, and during the night the cloud thickens and descends to Ns with continuous moderate rain, and it gets warmer. Answer a.

41. "Alto" means medium level cloud, "stratus" means layer type, not heap type. Answer b.

42. TRSs do not from over cool water. For this reason they never form south of the equator in the Atlantic. The choice of South Pacific is ambiguous. TRSs do form south of the equator in the Pacific, but only in the

western Pacific, which you might call the Coral Sea or Solomons area. In the eastern South Pacific the cold Peru current blocks all TRS activity. Answer c.

43. Although you could get severe icing in Ns you will get little or no turbulence. However, all through the Met world you will see the statement "Cb or Ts imply moderate to severe icing and turbulence". Go with the flow. Answer b

44. The definitive textbook, The Handbook of Aviation Meteorology also known as the blue book, says "The heavy rain of tropical regions is associated with visibilities of 50 –500m". Therefore, visibilities can sometimes be less than 100m. Answer d.

45. The environmental lapse rate (ELR) is a variable. It varies both in time and in space. It can vary from temperature falls of over 3ºC/1000ft to temperature increases of 10ºC/1000ft. Answer c.

46. There is a traditional saying that the most dangerous place to be if a TRS is coming is in the front 90º sector, 45º either side of track. Too true. You would have to row very hard to get out of the path of the TRS from that position. For aviators, the worst flying conditions, in terms of turbulence, will be at the eye wall. Answer b.

47. Answer, low level cloud. There is only one listed, stratus. Answer a.

48. This question is not answerable in this form. The cloud description "nimbo" means rain bearing, as in both nimbostratus and cumulonimbus. Therefore we expect precipitation from both types, and if the temperatures are correct it will be snow. Snow from Cb will be snow showers, and from Ns continuous snow, but that does not help with the answer.

49. The movement of fronts and occlusions as described in the blue book are that the cold front moves at the geostrophic speed measured between isobars along the front and that the warm front moves at about 2/3 of the measured value. There is a general statement that occlusions tend to move slower than fronts and may be nearly stationary in areas well away from the centre of the depression. Answer c.

50. Supercooled water drops are found in cloud and in fog – which is only really cloud on the ground. They are also found in rain falling into a cold layer, which is rain ice. Note that FZ in a TAF or METAR means "supercooled", so FZFG is supercooled fog, not ice crystal fog. Answer b.

51. A polar front low. Do not confuse this with a polar low, another name for a cold low. These form in very cold air masses like arctic maritime, move with the general airflow and are small but very active. Answer a

52. Aircraft speed and airfoil shape only affect the rate of accretion. Relative humidity is 100% in cloud or freezing rain in all cases. "Freezing level" has a temperature implication, but means nothing on its own. Droplet size affects the rate of accretion, OAT the type of icing, so between them they cover mechanisms that are most likely to influence the probability that icing will occur. Answer c.

53. The cloud classifications into low, medium and high are complex, and are different for tropical and temperate zones. In a simplified form, for temperate zones, low cloud has a base from zero to 2000m, medium cloud from 2000m to 5000m, and high cloud above 5000m. These figures translate to 6500ft and 16,500ft. Answer c.

54. If we are dealing with temperate climates you can bet that Cb always contain water, ice and supercooled water drops (SCWD). So would Cb in the tropics once the tops pass about 15,000ft. We suppose Cb where surface temperatures were below zero might not have any liquid water. but you do not normally get Cb over very cold surfaces. Answer c.

55. This is not a question about the gradient wind – low round a low and so on – it is about what happens in real life. The dominant features of temperate zones are the travelling lows, with tight gradients and strong winds. Answer a.

56. High pressure areas bring subsidence, with little or no cloud, divergence at the surface and light winds. Although over land in summer the daytime heating may be sufficient to generate isolated thunderstorms this is not the case in winter. Light winds and clear skies tend toward the formation of radiation fog, possibly lifting to low stratus. Answer d.

57. The particular combination of strong up and down drafts that exist in Cb are necessary for the formation of hail. Answer b.

58. This is an example of a misunderstanding that seems to be creeping into the question bank. Rotor cloud is cloud associated with airflow rotors, which normally occur in strong winds over high ground, as in mountain wave conditions. Rotors are not normally associated with Cb, except that they might form if the cold gusts are strong enough and the necessary high ground is present. There is, however, a phenomenon associated with mature Cb and thunderstorms called a roll cloud or collar, which forms around the base of the main cloud. As its name suggests, it looks like a collar or ring. This has little significance except as a visual recognition point for a big mature Cb. Answer a.

59. Stratus. Answer a.

60. As given, this question is cannot be answered. The OED gives “constantly” as an adverb meaning “always” or “frequently”. Both the sub-tropical and polar front jets are always present in some form, in both hemispheres. Arctic front jets are not always present and the easterly equatorial jet is present only in the time of maximum heating in the northern hemisphere, July to October. The sub-tropical jets are by far the more consistent, maintaining direction position and speed over long periods. The polar front jets are a rat’s nest of smaller jets blowing at different speeds and in different directions and going where the polar front takes them. Perhaps they meant “which jet blows most consistently?” If so, the answer would be the sub-tropical jet.

61. The surface pressure gives some indication of atmospheric stability. High pressure systems are usually associated with stable conditions. This is

the effect, not the cause. Stability is determined by the environmental lapse rate, the ELR. Answer d.

62. Rain ice layers are usually at low level and are relatively thin – no more than one or two thousand feet on average. The Handbook of Aviation Meteorology says, "In low flight the best procedure for avoiding ice is to climb into the warm layer". This will be in the rain, and for good thermodynamic reasons the ice will melt faster there than anywhere else immediately available to you. Descent is an option, but requires both obstacle and air traffic clearance. Turning round is not a good idea. If you have been flying for, say, five minutes in rain ice and have accumulated sufficient ice to make a change in altitude or heading essential (Severe icing under the ICAO classification), then by the time you have executed a rate one turn through 180º and flown back out you will have had a further 6 minutes worth of severe icing to endure. One question has been seen giving "climb until clear of cloud" as an option at a warm front. This is nonsense. The cloud tops will be at around FL300 or higher. Answer b.

63. Assuming that you are holding a constant indicated altitude, your true altitude is increasing. Think of a contour chart for the 500mb level, about right for FL180. Upper winds blow along the contour lines. In the southern hemisphere if you stand with your back to the wind the low contours are on your right. This means that flying on the 500mb pressure surface with a wind from the left you are crossing contours at right angles, going from low contours to high contours. Since the contours give the true height of the pressure level amsl your true height is increasing. Answer b.

64. Cirrus will give either a trace of icing or none at all. It is too cold. Answer a.

65. An alternative word for a depression is a cyclone, though this has been hijacked by tropical revolving storms. This is because the air round a depression rotates in a cyclonic sense, in the same sense as the earth itself. Secondary depressions move around the parent depression blown by the circulating wind, which is cyclonic. Answer b.

66 The big figures are 8km and –45ºC at the poles, 16km and –75ºC at the equator. Answer b.

67. Fair weather cumulus (cumulus humilis) is caused by limited low level instability, not enough to produce Cb or thunderstorms. There will be some turbulence at low level and in or near the cloud, but usually none aloft. The instability at low level ensures good visibility. Notwithstanding that option c is a possibility at high altitude the most sensible choice is option d. Answer d.

68. We define it as upward vertical movement of air. Advection is horizontal movement of air. Answer b.

69. Assuming we are talking of the travelling lows that move west to east, then the wind direction, in an anti-clockwise sense, will be steadily backing. Contrast this to the usual question about the passage of a warm sector depression. In these, the observer is south of the depression centre and the wind direction veers. Answer b.

70. The dew point temperature is the temperature to which air must be cooled for dew to form, that is the saturation point, 100% relative humidity. Answer d.

71. If this question means anything at all, it refers to the International Standard Atmosphere. The ISA lapse rate is 1.98ºC/1000ft or 0.65ºC/100m. Note that in metric terms 1.0ºC/100m is the DALR and 0.6ºC/100m the SALR at ISA msl conditions. Answer c.

72. The highest recorded windspeed under any conditions has been "approaching 300kt" in the sub-tropical jet over north China in the winter. We take it that this means that windspeeds of 350kt are so unlikely as to be graded impossible. Answer b.

73. Contours on a contour chart record the height of the chosen pressure level amsl, usually in decametres. Decametres are 10m units, that is metres with the last digit chopped off. Answer b.

74. Clear ice is heavy and difficult to remove. It forms as the SCWD flow back over the surface, away from the de-icing systems. It can block static vents, cover aerials, jam undercarriage up-locks and control surfaces and cause all manner of grief. Answer c.

75. At the height of the jetstream, which is below the tropopause, flying from warm to cold air in the northern hemisphere means you are taking a jet from your left. Watch out for questions that talk about crossing above the jet, in the stratosphere, where a different temperature gradient applies. Answer c.

76. Looks as though you are overtaking a warm front and running out into the cold air ahead of the front. You should certainly see a drop in temperature. Whether you see a pressure increase will depend on you track relative to the isobars and whenever you overtake a front circulating round a northern hemisphere depression the wind will back. Answer b.

77. This question is about the little formula for working out height per mb. It is 96T/P in feet. T is the temperature in Kelvins. P is the pressure level in mb. 5500m (550decametres) in ISA is near the 500mb level. The temperature will be 15 - 0.65x55 in metric figures, -20.75ºC or 252K approximately. The formula is then 96x252/500 = 48ft. You could have guessed the answer. 27ft/mb is the well known sea level value, 100 and 150 ft/mb are for somewhere up at 50,000ft. Answer b.

78. The mechanism they are looking for here is radiation fog lifting to low stratus in a moderate wind. Answer b.

79. The Met rules say gusts will be written into METARs, and therefore quoted by ATC, if the gust speed exceeds the mean by 10kt. Answer c.

80. The only way to argue this is that at this height the general trend is from a hot equator to a cold pole. Answer (b)

81. Both Am and Pc have low temperatures and if the Pc is approaching the UK over the Baltic and the North Sea it is indistinguishable in effect from Am. However, Pc that has held a land track will be substantially drier and colder. Answer a.

82. The North Atlantic polar front certainly moves north in summer, and the front itself weakens, so the associated jets will also be weaker. This is not necessarily true at other points on the polar front, as, for example, over continental North America. Answer b.

83. It is conventional to show heights on contour charts as decametres, 10m units. These are metres with the last digit left off. Note that contour charts are not surface pressure charts and that they do not show "topography", which refers to surface detail, as in a topographic map. They show the height amsl of the chosen pressure surface. The contour lines are sometimes called isohypses, from the Greek iso (equal) and hypsos (height). Answer b.

84. Up and down drafts occur together and side by side in the mature stage, and this is the expected answer. Note, however, that in the dying stage there are still both gentle up and down drafts present, up in the high levels and down in the lower cloud. Answer c.

85. So far as Met is concerned, up to 32km, the lowest temperature quoted in ISA is from 11km to 20km altitude at –56.5°C. Answer b.

86. Katabatic winds are caused by cold air sliding down mountains, so cannot be warm, nor of maritime origin. In fact, the Bora comes down from the mountains behind Trieste in the northern Adriatic. It can be strong. Over 70kt has been recorded. Answer c.

87. All of these would be reflected at varying levels by radar of various wavelengths. The question is referring to airborne weather radar which is optimised to reflect rain and hail, although, to be technical, hail reflects less than rain because ice tends to attenuate the radar signals. Answer a.

88. If we are assessing the effect of temperature on humidity we have to assume a constant water vapour content. In choices a and d there is no statement about the water vapour content, so we ignore them. In a given overall pressure the statement "constant vapour pressure" implies a constant quantity of water vapour. Under these conditions lowering the temperature will increase the relative humidity. Answer c.

89. The Fohn effect occurs with stable air masses, so convective activity is out. We would not expect CAT but turbulence in cloud on the south side, perhaps. Nor would the winds be strong enough to produce gusting and direction changes. Overall, Answer a.

90. Not any of the high clouds, so Cc and Cs are out. Ac and As are possibilities if the temperature is right. However, Ns qualifies, and so does

Cb. Remember “Cb and Ts always imply moderate to severe icing and turbulence”. Answer c.

91. Answer b.

92. Water on the runway? Answer a.

93. The contour chart for the 500mb pressure level is, in all but name, an isobar chart for 18,000ft. The lines are all at the same pressure, but if you adjust the pressure on each line for its height above or below 18,000ft it will still look the same and the lines will now be isobars. Exactly as at low level, the winds blow along the contours/isobars. The geostrophic force acts always at right angles to the wind vector, opposite to the pressure gradient force (PGF). The geostrophic force is either equal to the PGF, in straight contours/isobars, less round a low or more round a high. This is covered by the phrase “more or less balances the PGF”. There is no friction effect at height. Answer a.

94. The question does not specify land or sea, an important difference. Over the cool sea you would certainly get calm winds and haze. Over the land in summer daytime heating might induce Cu, Cb or Ts, but it depends on the stability of the air mass aloft. Overall, as convection is a late development, that may or may not occur and calm winds are certain, we go for Answer d.

95. If your baro error is low-high, and your true altitude constant, then your temperature error is high-low. Paris is colder. Answer b.

96. In all warm highs, subsidence produces an inversion that stops descending at about 3-5000ft. This is typical of, for example, the Azores high. Answer b.

97. The equatorial easterly jet occurs from India to Africa in the time of maximum heating of the northern hemisphere, July, August and September. Answer a.

98. Refer to Question 42. The water is too cold. Answer a.

99. TEMPO, in TAFs, has the meaning that the given effect will not last for more than half the total time given, nor be present for more than one hour at a time. Note that TEMPO in a METAR Trend means “temporarily”, without qualification. Answer a.

100. The standard description is “a preferred region (for CAT) appears to be near or below the jet axis on the low pressure side”. The low pressure side is the cold air side, and as the jet is in the warm air this is the frontal side. Left or right of the core depends on which hemisphere you are in, so we assume that the phrase “between the boundaries of the cold and warm air” places the CAT directly in the frontal zone. This is acceptable, although we teach that the maximum CAT will probably be in the warm air rather than right in the front. Answer d.

101. In general, a front is a low pressure area and isobars at an active front kink toward the low pressure centre. As the front approaches pressure is falling so the altimeter reading will rise. However, note the special case of a warm sector passing a stationary observer. The pressure then remains roughly constant until the cold front passes, when it begins to rise steadily. Answer a.

102. TRS's do not run near the equator, and Darwin, Latitude 15S, is right on the inner limit for TRS's. Nevertheless, Darwin does get them, but not as often as, for example, Queensland at Latitudes 15-25S. Time for TRS's is the autumn of the hemisphere, January, February and March in the southern hemisphere. Stretch this to end of November to the beginning of April and Option c looks acceptable. Answer c.

103. For typical upper air temperatures, at FL400 you will be at –50ºC or below in the sub-tropical air. In the polar air you would be well above the tropopause at FL400, with an air temp of –45ºC. At this height, therefore, you would be going from warm to cold. Answer c.

104. Let us assume that if it is low pressure in the Mediterranean that it will be high pressure outside the region, with air blowing in toward the Med. A stable high to the north, air flowing toward the Med, would give a Fohn wind over the Alps. Answer c.

105. Stockholm is at a latitude where you might expect a polar front jet. Rio is not far enough south to be affected by a polar front jet in the southern hemisphere. That leaves you to cross the two sub-tropical jets in the northern and southern hemispheres. Answer b.

106 We don't want to appear picky, but the Gulf of Guinea is the bit where the west coast of Africa turns from N/S to E/W just above the equator. The gulf runs from zero latitude to about 05N, off the south coast of Ghana and Nigeria. 07N gets you out of the gulf, by Liberia and Sierra Leone. The expected answer is a, for there are no NW trades and no NE monsoon in this area. However, the description given for a is correct for the sea area off Senegal at latitude 00-10N, and not for the Gulf of Guinea. Trade winds blow toward the ITCZ, and the ITCZ goes south as far as the equator in the open sea, but does not often come south that far in the Gulf of Guinea in the winter. Winds in the Gulf of Guinea are usually SW all year. Answer a.

107. Primarily dust and sand, causing poor visibility up to 8-10,000ft. There is the anomaly of the sea fog forming offshore over the cold Canaries current, but this is a secondary effect. Answer c.

108. Refer to Question 106. Option a is too far south, options c and d too far north. Option b is correct for the open Atlantic, on this track. Answer b.

109. The main rains in North Africa occur in winter and spring. Over the western mountains there is a lot of spring and winter rain, with some autumn rain south of the Atlas mountains, but over the flat area from Tripoli eastward the rains come in autumn and winter only. Best fit is Answer b.

110. Sub-tropical highs form between the Hadley (tropical) and Ferrel (sub-tropical) cells, at about latitude 30. Answer b.

111. A refined version of Q87. Answer d.

112. A revised version of Question 100. This one gives the hemisphere, so the standard answer would be c. Note that combining the "in the boundary" phrase with "above the jet core" takes it out of play. Answer c

113. The condensation level – cloudbase – doesn't come into it. At the top of the friction layer, the boundary layer, during lots of turbulence, the wind speeds will be more or less the same in the friction layer and out of it. Not so with a stable layer on a cold night. Here the winds below the inversion will be light, and there will be a sharp change to stronger winds as you climb out. Cross refer to windshear warnings in strong (10°/1000ft) inversions. Answer d.

114. Let us assume they mean 1850UTC in the UK, not in Hong Kong. Option a has too much cloud, and a TREND of NOSIG. Option b has a dewpoint below zero, and will probably give a frost. Option c has too little wind, and will give a heavy dew. Option d is about right on wind, cloud cover and temperatures, and in any case has a TREND of BECMG 0700, which is fog! Answer d.

115. Contours will be in decametres. 18,250ft is 564Dm, to the nearest standard contour, on the 500mb chart. Answer c.

116. Repeat of Question 88. Answer c.

117. At 1000ft agl you will be in the boundary layer, affected by surface friction. Winds will not blow along the isobars, but will have an element toward the low pressure. If you are crossing the isobars at right angles as you fly toward the low centre the wind will be from your left and behind. Answer c.

118. Rain is falling, from warm air, into an area that is and has been very cold. This is probably the approach of a warm front. Answer b.

119. Repeat of Question 63, with the wind from starboard in the northern hemisphere. True altitude is increasing. Answer a.

120. Close isobars and a strong wind. Answer a.

121. On a stationary front there is no movement, and thus no wind across the front. The isobars run parallel to the front. The winds blow along the isobars. Answer a.

122. Surface conditions, including runway icing, can be attached to a METAR as an 8-figure group at the end of the METAR. Answer b.

123. Sublimation is the change of ice directly from solid to vapour. The opposite process – vapour to solid – is called deposition. Sometimes you will find people using sublimation, wrongly, for both processes. Answer a.

124. Runway 25, touchdown RVR Plus 1500m. Answer a.

125. RVR is usually greater than met vis, more properly known as MOR, meteorological optical range. The reason is the use of powerful lights to illuminate the runway. This is not always true, so do not make an automatic assumption about RVR. RVR is never given in a TAF. A ceilometer (ceilingometer?) is a CBR, cloud base recorder and RVR is not normally stated when it is below 1500m Answer b.

126. Cross refer to Question 35. The polar front jets will be at about 35,000ft, but in the context of this question 20,000ft is too low and 40,000ft too near the sub-tropical jets' height. Answer b.

127. Cross refer to Question 118. This is a similar setup. Rain falling into a sub-zero layer from 0 to 3000ft. Answer d.

128. The cold air will be on the left, east, and the cold air tropopause will probably be below the height of the jet core. The jet is in the warm air, near the higher warm air tropopause. Answer a.

129. Although TAFs can carry icing forecasts these are station forecasts, not route forecasts. Route icing can be read off the SIG WX chart, and if it is unusual enough (for example, severe icing, not associated with convective cloud), can be issued as a SIGMET. Answer c.

130. The very basic description of tropical weather is of a band of convection, Cb and Ts moving out to the transitional zones in the summers of the hemispheres and crossing the equator at the equinoxes. Options b, c and d are all wrong, but a does not look all that better. It could be a description of the weather in East Africa, the famous Nairobi double rains, with the worst in the spring, but it is not a valid world-wide answer. Answer a.

131. Clear skies for maximum radiation cooling, calm winds to prevent mixing and warming. Answer a.

132. Option a is a description of the formation of rime ice, not clear ice. Options b and d describe mixed clear and rime ice. Only c is a correct description of ice formation. Answer c.

133. Assuming we are talking height, 5500m, 550Dm, is about FL180. The strongest upper winds will be in the jets, at tropopause height, about FL350. Answer b.

134. Turbulence is a possibility for a SIGMET entry. A SPECI is a METAR raised for special met conditions, not a route forecast. Answer d.

135. Refer to the ICAO definitions given in Question 32. The same caveat applies here. The answer is severe icing, but it calls for an immediate change of height or heading, not a diversion to an alternate. Answer b

136. The Handbook of Aviation Meteorology says "from a few metres to some hundreds of metres". Less than 100m is too small. Distances measured in

km are too large. Television tells us that the book is about right, and that 100-150m is too restricted. It is, however, the nearest match. Answer c.

137. Veering or backing of the surface wind would depend on which hemisphere you are in, not specified here. The surface wind is always less than the free-stream wind, and blows across the isobars toward the low pressure area. Answer c.

138. Tm type weather, low stratus and drizzle. To get to fair weather Cu you need considerable daytime heating in a wide sector. Answer c.

139. Climb to avoid the clouds if you can, use weather radar to avoid turbulence and fly at V_{RA}, your rough air penetration speed. However, the wording of the question is difficult. Climb is correct, but do power changes refer to reducing speed to V_{RA} or to climbing and descending? We incline to the view that you are meant to take the height and power factors separately, that climb is the right action, then reduce power to slow down to V_{RA}. Answer a.

140. Answer d.

141. Clear ice is predominant in temperatures just below zero. By –20°C there will be mixed ice that is predominantly rime ice. As temperatures fall the icing changes to light rime ice and then to nil at about –45°C. Answer a.

142. The only sensible set of figures here is 55N to 75N for western Europe and the UK. The northern hemisphere polar front, on which the depressions are centred, is angled across the oceans. 35N to 55N would be correct for the eastern seaboard of North America, and we would prefer 50N to 65N for our side of the Atlantic. The figures are different again for the Pacific. However, best fit is Answer d.

143. All the “Altos”. Answer a.

144. The stability of an airmass is dictated by its Environmental Lapse Rate and to some degree by the amount of moisture present. Answer b.

145. The lowest or minimum flight level is a fixed clearance height above the equally fixed transition altitude, a true altitude. The calculation of the minimum flight level then depends on the pressure at msl, QNH, and on the air mass temperature. If QNH is above 1013mb you will be able to use a low flight level and if QNH is less than 1013mb you have to use a high flight level. If temperatures are above ISA your altimeter will be underreading, so you can use a lower indicated flight level. In temperatures below ISA you have to select a higher indicated flight level. To get the lowest indicated flight level to match the true altitude required for clearance you would need a high QNH and a high temperature, both above ISA conditions. Answer c.

146. Given the shape of a jetstream, and therefore the CAT – ordinary CAT, not max CAT – the best way out is vertically. Answer a.

147. In the cumulus or growing stage warm air is rising inside the cloud. Precipitation and downdrafts are associated with the mature stage. Answer a.

148. Another contour chart question. Flying a constant indicated altitude is holding a constant pressure level. If the wind is from the left in the northern hemisphere you are going downhill, true altitude decreasing. Answer a.

149. Refer to question 95. Baro error is low/high so temperature error is high/low. The air mass at A is warmer than at B. Answer a.

150. Cirrus. It is too cold and too thin. Answer a.

151. Density altitude is the altitude under ISA conditions that would have the same density of air as the actual conditions. It is best thought of as a takeoff thrust factor. Both pressure and temperature affect engine thrust and density altitude combines both to give a direct indication of thrust available – higher density altitude, less thrust and lower density altitude more thrust. To find density altitude at your airfield elevation you first find the airfield pressure altitude. This will be the indicated altitude with 1013mb set on the altimeter. It will be the same as true altitude if ISA conditions of temperature and pressure apply in the atmosphere. If msl pressure or air mass temperature differ from ISA the pressure altitude will not be your true altitude, but this does not matter in this question, which asks about the relationship between pressure altitude and density altitude, not between pressure altitude and true altitude. Once you have a pressure altitude the only factor that will make density altitude a different value will be an OAT on the airfield that is not ISA for the calculated pressure altitude. If the OAT is the same as ISA for the pressure altitude your density altitude will be the same as the pressure altitude. If the OAT is higher than ISA the density altitude will be higher, if the OAT is below ISA the density altitude will be lower than the pressure altitude. Repeat. The only factor affecting the relationship between pressure altitude and density altitude is **the OAT at the pressure altitude.** Answer a.

152. In occlusions the warmest air, the remnant of the warm sector, is always aloft. In a cold occlusion the overtaking air is the coldest, as in a cold front. If the overtaking air is coldest, the air in front of the occlusion is the less cold air. Answer b

153. The Icelandic Low is not a permanent low. Lows form and die fairly rapidly. The name refers to an area of mean low pressure that shows on the six monthly average plot for the winter. In the winter there is a greater thermal contrast between the cold polar air and the warm sea surface off the Newfoundland coast, accentuated by the fact that the cold polar air comes down over the very cold Labrador current before overrunning on to the warm Gulf Stream. This makes the frontal area more active, producing more and deeper lows. Option a is a rough description of this process. Options b and c are nonsense and we know from our practical experience that we get more continuous bad weather in the winter, so option d is out. Answer a.

154. Refer to Question 82, and link with Question 153 above. The southern hemisphere polar front moves toward the pole in summer, which is south. The weather gets better, for roughly the same reasons as given in Q153. Answer a.

155. Refer to Question 107. The Harmattan, as it leaves the Sahara, is a dry dusty wind. Answer c.

156. Cold pools are layers of cold air in the troposphere. Their presence is shown on charts that show the thickness between two pressure levels. Where the layer is cold it will be thin. Where lines of equal thickness (isopleths) are thin and form closed circles it is called a cold pool. Note, however, that this strict definition is largely ignored, and so far as the examination is concerned a cold pool is just a layer of cold air aloft. Again, so far as the examination goes, cold pools are assumed to have come from polar air aloft breaking away from the main polar air mass and penetrating into the sub-tropical air. This will produce cold air aloft and warm, moist air below, which is a recipe for instability and convective cloud. Answer b.

157. The blue book figures are "some thousands of km in length, a few hundred km wide and some 10,000ft deep". 10,000ft is 3km, so say 3 to 300, or 1 to 100 for the depth to width. Answer b.

158. Katabatic winds are cold and can reach high speeds. The Bora is a katabatic wind that blows down the mountains and out over Trieste into the northern Adriatic. Answer (a)

159. Tropical cyclones are heat driven, and occur normally in the time of maximum temperatures in the hemisphere. This is not midsummer, but the autumn of the hemisphere, July through October in the north and January through March in the south. Answer c.

160. The speed of the geostrophic wind is determined first and foremost by the pressure gradient. The pressure gradient generates the pressure gradient force (PGF) In any given pressure gradient the equation

$$PGF = 2\varpi\rho V \sin Lat$$

contains all the elements that determine V. The formula can be rewritten so that the geostrophic wind speed, V, equals

$$PGF \div (2\varpi\rho \sin Lat)$$

The factors that affect the wind speed are the PGF, the earth's angular rotation (ϖ), the air density (ρ), and the Latitude. Air density is affected by height, so height could be taken as a factor. On this basis the answer is 1, 3, & 5. This was not a listed option included in the feedback. We do not agree with the inclusion of Coriolis force as an option, for Coriolis or geostrophic force is, in fact, the whole expression $2\varpi\rho V \sin Lat$. Its amount exactly balances the PGF by varying V, the windspeed, and it is a **result** of the strength of the PGF. It may be that the combination of answers we have is wrong, we would appreciate more feedback on this one.

161. Td is dew point temperature, T is the OAT. Fog has 100% RH, and the dew point and outside air temperatures will be the same. Answer d.

162. Cloud has 100%RH, and the dew point and outside air temperatures will be the same. Answer b.

163. A microburst is a cold downdraft from a big Cb. Answer a.

164. The answer is that A, B and D all could give rise to freezing rain, but only B has freezing rain reaching the ground. As there has to be one selection only, it is clear that B is the intended choice. Answer b.

165. Refer to Question 164. The correct option here is c. Rain does not have to reach the ground to be called rain. Answer c.

166. The conditions necessary for freezing rain normally occur when a warm front takes over from a very cold air mass. A recently formed occlusion could also give rain falling into a sub-zero air mass, but this is less likely. Answer c.

167. From this list, continuous moderate rain from the Ns. The most intensive rain of all would come from Cb. Answer b

168. The feedback originally gave just 'Cyclone' as option d, but that would have left no strictly correct answer for mean winds over 64kt in this area. Cyclone is the name used by the World Met Organisation for TRSs in the western Pacific, south of the equator. In the Indian Ocean they are called Severe Cyclones north of the equator and Tropical Cyclones south of the equator. Answer d.

169. In the northern hemisphere the warm sector is normally south of the depression, which is itself moving east. As the occlusion forms the triple point where the occlusion and the two fronts merge moves east with the depression and out along the fronts at the same time. The options would have been clearer if they had read "along the front and to the east", for example. Answer d.

170. In ISA conditions, 30,000ft. Answer c.

171. Cold is dangerous. Warm is safe. Answer c.

172. You are changing your altimeter zero reference from 1030hPa(mb) to the higher altitude 1013mb level. Your altimeter indication will go down by (30 – 13) x 30 = 510ft. Note the use of 30ft/mb, recommended when a figure is not given in the question. 27ft/mb is correct for ISA msl conditions. Answer a.

173. If an airfield were 100m above sea level the calculated pressure increase down to msl, added to QFE, gives you QNH or QFF. If the temperatures are ISA, both will be the same. If the temperatures are less than ISA the QFF calculation will assume a larger pressure increase going down through the dense air to sea level. QFF will then be a higher mb value than QNH. If you think now of an airfield 100m below msl, the same logic applies. In temperatures below ISA the QFF calculation up to msl will assume a larger fall in pressure going up through the dense air. to sea level, and QFF will be a lower mb value than QNH. QNH is thus a higher value than QFF. Answer a.

174. The ozone layer is in the low stratosphere, around 50,000ft to 100,000ft. Answer a.

175. Although the ITCZ is literally a convergence zone, where tropical winds converge, the reason they do this is because the temperature is high and convection begins. The ITCZ is therefore more or less coincident with the line of maximum heating, the heat equator or thermal equator. Answer d.

176. High to low, look out below, applies to temperature and baro errors. Option c is totally wrong, b and d are indeterminate. Answer a.

177. Refer to Question 5. These are changes caused by the wind pattern shifting south in January, leaving the route in westerlies, then shifting north in July bringing up the easterlies. Answer d.

178. The ground height is a distraction. Medium level cloud has a base height between 6,500ft and 16,500ft, and only option c gets anywhere close. Cloud heights are given agl in station forecasts and reports like TAFs and METARs, but amsl or in flight levels in regional forecasts. Answer c.

179. The only way to get round a circle is to have a force pulling you in toward the centre, the centripetal force. Two forces act on the wind, the PGF and the Coriolis (Geostrophic) force. Round a low the PGF acts inwards and is fixed by the pressure gradient. The Coriolis force acts outwards, but can be changed by changing V, the windspeed. Solution: Reduce speed, reduce the Coriolis force, and there is your resultant force pulling you inward.
In effect, the unchanged PGF is balanced by some centrifugal force and this allows a reduced Coriolis force. Options a and c are wrong as to how the forces act. Options b and d are both correct, but d applies all the time, not just with curved isobars. We go for: Answer b

180. It is, after all, a convergence zone. Answer d.

181. Answer a.

182. You are flying from behind a warm front, overtaking it and passing out into the cold air. Answer b.

183. This is an extremely vague set of data. The only reasonable answer is that it rains or snows, according to the temperature and then you revert to Pm airmass weather as the depression passes. Note that an observer to the north of the depression centre will see a continual backing of the wind, from SE through N to NE. We do not select this answer, partly because the depression could pass either side, so it is a 50% probability at best, and partly because we suspect the examiner is mentally stuck with the standard diagram with a warm sector and winds that veer. Answer a.

184. The 300hPa chart is for FL300 in ISA conditions, which near enough apply here. At the standard lapse rate, if FL300 is at 48ºC then FL330 should be 6ºC lower, -54ºC. Above this tropopause height temperatures will remain constant. Answer c.

185. Temperatures in METARs are given to the nearest whole degree. If the recorded temperature is exactly on the half degree mark, it is rounded up to

the next full degree. This is to the next higher temperature full degree, so in negative temperatures it is to the next lower number. This means that -0.5ºC would round to M00 and –1.5ºC would round to M01. The M on the 00 value means that the actual exact temperature is below zero. 00 means below 0.5ºC but above zero. Answer c.

186. Here you have to apply the factors given for working out the surface wind, 50% of the free stream wind and backed 30º, but apply them backwards. This makes it 290/40. Answer c.

187. Like the parent high pressure system, air subsiding and then diverging at the surface. Answer b.

188. The setup described puts the sea to your right on finals, wind from starboard, port drift, in the sea breeze. Answer a.

189. The environmental lapse rate is 4ºC/1000m, 0.4ºC/100m. The SALR in metric figures is 0.6ºC/100m. The ELR is less than the SALR, the airmass is stable. Answer b.

190. Like the parent low pressure system, air ascending and diverging when it reaches the tropopause. We have to assume the order of the words is important, for troughs will have air converging at the bottom and then ascending, and if the order is not important then a and c are both right. Answer a.

191. The 300hPa level is at 30,000ft. The 200hPa level is at 38,000ft. The 250hPa level out to be somewhere in the middle, 34,000ft. Answer a.

192. Short TAFs (FC) are valid from 9 to 12 hours. Long TAFs (FT) can be valid from 12 to 24 hours. Each TAF, whatever the block, carries its own validity period written at the beginning. Answer d.

193. 4000m in drizzle, overcast at 500ft and very wet. Typical warm sector Tm weather. Answer b.

194. The only remotely acceptable answer is b. However, the correct description is a frontal wave depression (another name for a frontal depression) moving east. Westerly and easterly waves are phenomena of the mid to upper level winds. It is true that the development of westerly waves in the mid latitudes has an effect on the formation of polar front depressions, but the question asks “what is this” not “how is this formed”. Answer b.

195. EKEN is in a ridge of high pressure. Note that there are areas of high pressure both in front of and behind the depression – temporary cold highs. Answer b.

196. The disturbed temperate zones, B and H. Answer c.

197. The trade winds converge toward the ITCZ when it is near the geographic equator, in zones D and F. Answer b.

198. The sub-tropical jets run at 25N to 40N and around 35S, zones C and G. Answer d.

199. Lenticularis means shaped like a convex lens, or almond. This type of cloud is typical of standing waves. Answer a.

200. Castellanus means shaped like the battlements of an old castle. This is typical of unstable air aloft over stable air in the lower layers, as in returning polar maritime air masses. Answer c.

201. Think of capillatus as "with a cap", like Cb with an anvil. Answer d.

202. Refer to Question 173. If an airfield is 200m above sea level the calculated pressure increase down to msl, added to QFE, gives you QNH or QFF. If the temperatures are ISA, both will be the same. If the temperatures are less than ISA the QFF calculation will assume a larger pressure increase going down through the dense air to sea level. QFF will then be a higher mb value than QNH. Answer b.

203. Refer to Question 173 and 202 above. If an airfield is 150m above sea level the calculated pressure increase down to msl, added to QFE, gives you QNH or QFF. If the temperatures are ISA, both will be the same. If the temperatures are more than ISA the QFF calculation will assume a smaller pressure increase going down through the less dense air. QFF will then be a lower mb value than QNH. If you think now of an airfield 150m below msl, the same logic applies. In temperatures above ISA the QFF calculation up to msl will assume a smaller fall in pressure going up through the thin air to sea level, and QFF will be a higher mb value than QNH. QNH is thus a lower value than QFF. Answer a.

204. This is in the southern hemisphere, and the wind direction shows that these are areas of high pressure. From the isobars, A is at a higher pressure than B. Your altimeter is overreading at B, true altitude is lower than at A. Answer a.

205. Answer c.

206. D is showing light freezing rain. Answer d.

207. The value in m/s is roughly half the value in knots. Answer a.

208. The blue book says: "microbursts have a typical horizontal dimension of 1-3km and a lifetime of 5 to 15 minutes, with the period of most severe wind lasting 2 to 4 minutes". We therefore take the main hazard to last for 2-4mins. Best fit is Answer a.

209. The Chinook ("snow eater" in Blackfoot) is a warm drying wind that forms in the lee of the Rockies. Answer a.

210. The blue book says: "In general, [radiation] fog develops to occupy the whole of the friction layer. Although in average circumstances the depth of the friction layer is taken to be 1500ft or more it is much less in the light winds and stable lapse rate of foggy conditions. Most radiation fogs have a depth of only a few hundred feet". So, 150ft is too low and limiting. 1500ft is unlikely, but is a better answer. Answer b.

211. The NOSIG is the trend, the only piece of forecast you ever see in a METAR. It covers 2 hr from the METAR time, which is 1020Z on the 27th. NOSIG means no significant change is forecast. The code for no significant weather is NSW. The RVR is given for two runways. Both had 1500m touchdown RVR at 1020Z, and in the 10 minutes before then the RVR was not changing significantly. Trends and variations in the RVR are not normally given on UK METARs. An example would be …R25/0400V0500U…decoding as Runway 25, touchdown RVR Varying between 500m and 400m and observed to be going Up in the last 10 minutes before the METAR time. N is no change and D means down. Note that this is <u>not</u> forecast information, but past information. Answer c.