EAS270, "The Atmosphere" Quiz 3 15 Nov, 2004

Professor: J.D. Wilson Time available: 20 mins Value: 7%

Instructions: For all 14 questions, choose what you consider to be the best (or most logical) option, and use a pencil to mark that choice on the answer form. **Eqns/data given at back**.

1. Suppose in a certain layer of the atmosphere the environmental lapse rate ELR = +0.05 C m^{-1}, ie. for every 1m increase in height temperature increases by 0.05 C. This layer is ____

   (a) unconditionally unstable
   (b) conditionally unstable
   (c) conditionally stable
   (d) unconditionally stable ✓✓
   (e) well-mixed

2. An inversion layer of the atmosphere is defined as ____

   (a) An unconditionally-stable layer
   (b) A conditionally-unstable layer
   (c) A conditionally-stable layer
   (d) A layer within which temperature increases with increasing height ✓✓
   (e) A layer within which temperature decreases with increasing height

3. If air temperature in a certain layer decreases with increasing height by 0.9 C per 100 m, the layer is ____

   (a) hydrostatic
   (b) absolutely unstable
   (c) absolutely stable
   (d) adiabatic
   (e) conditionally unstable ✓✓

4. "Cirronimbulus" is ____

   (a) precipitating stratiform cloud below 2 km
   (b) precipitating cumuliform cloud below 2 km
   (c) precipitating stratiform cloud in the middle layer (2-5 km)
   (d) non-precipitating cumuliform cloud in the middle layer (2-5 km)
   (e) a non-existent cloud type ✓✓

5. Typically when the sun is viewed from beneath stratus, altostratus and cirrostratus its brightness or intensity would be ____

   (a) respectively highest, intermediate, lowest
   (b) respectively lowest, intermediate, highest ✓✓
   (c) about equal in all three cases
   (d) roughly 10 W m^{-2}
   (e) roughly 1 W m^{-2}

6. A thick, homogeneous low-layer cloud is called

   (a) lenticular
   (b) cirrus
   (c) cumulus
   (d) stratus ✓✓
   (e) droopulous

7. The 'wave-clouds' sometimes visible in the lee of a mountain occur in a/an ____ layer

   (a) absolutely unstable
   (b) conditionally unstable
   (c) conditionally stable
   (d) neutral
   (e) absolutely stable ✓✓

8. The 'warm cloud' process for forming precipitation particles entails the 'collision' and 'coalescence' (joining) efficiencies of cloud particles. The collision efficiency is small if

   (a) the 'collector' particle is much larger than the particles below it
   (b) the 'collector' particle is about the same size as the particles below it
   (c) the coalescence efficiency is small
   (d) the coalescence efficiency is large
   (e) both (a) and (b) ✓✓

9. According to the Bergeron theory, the coexistence of ____ and ____ is essential to the development of precipitation in most extra-tropical clouds.

   (a) ascending air; water vapour
   (b) ascending air; cloud condensation nuclei (CCN)
   (c) water vapour; cloud condensation nuclei
   (d) ice particles; supercooled water droplets ✓✓
   (e) frontal boundaries; riming and aggregation

10. The Canadian Meteorological Centre (CMC) analyses highlight the region where (potentially) freezing rain could occur by ____

    (a) stippling the region where $T - T_d < 2$ C on the 700 mb map

    (b) indicating in bold the 0 C isotherm on the 850 mb map

    (c) stippling the thickness range 534-540 dam on the 500 mb map ✓✓

    (d) stippling the height range 534-540 dam on the 500 mb map

    (e) inserting a "present weather" symbol for freezing rain (to the left of the station symbol)

For the remaining questions, please refer to the attached meteorological charts

11. The ground based layer ($p > 850$ mb) on the thermodynamic chart for the late afternoon of 22 Sept/04 is classified as ____

    (a) an inversion

    (b) neutral relative to moist adiabatic motion

    (c) isothermal

    (d) absolutely stable

    (e) absolutely unstable ✓✓

12. The 850-700 mb layer on the thermodynamic chart for 12Z on 23 Sept/04 is classified as ____

    (a) conditionally unstable

    (b) conditionally stable

    (c) neutral

    (d) well-mixed

    (e) both (a) and (b) apply ✓✓

13. Stability of the 700-600 mb layer on the thermodynamic chart for 12Z on 23 Sept/04 is classified as ____

    (a) absolutely stable ✓✓

    (b) conditionally stable

    (c) neutral

    (d) well-mixed

    (e) both (a) and (b) apply

14. The cloud symbol shown was plotted for 'middle cloud' (cloud in height range 2-6 km) at stations in Central Alberta at 12Z on 23 Sept/04, at which time Stony Plain 500 mb height was 562 dam ASL (ie. about 4900 m AGL, above ground level). Judging from the thermodynamic chart the reported middle cloud was most likely ____

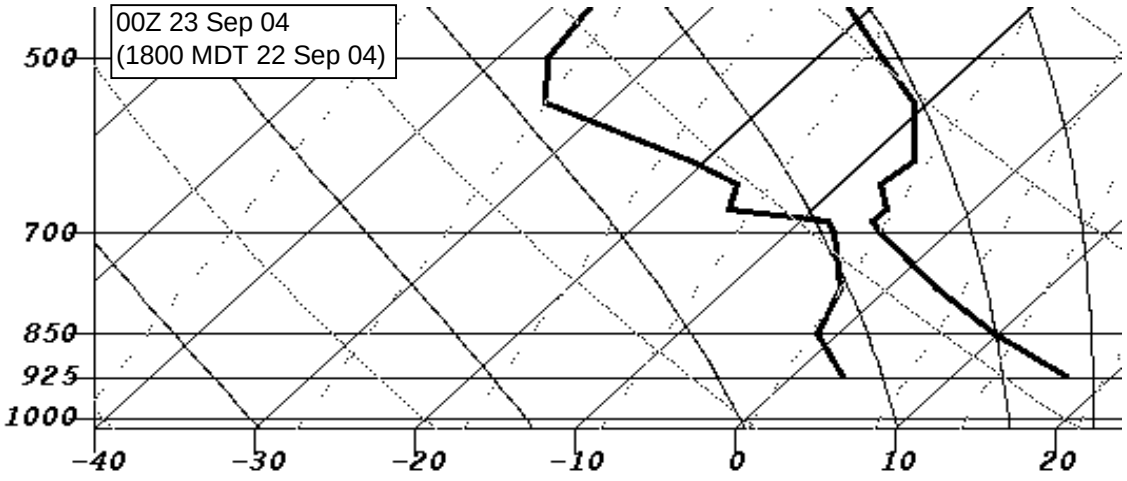
(a) in the 925-850 mb layer

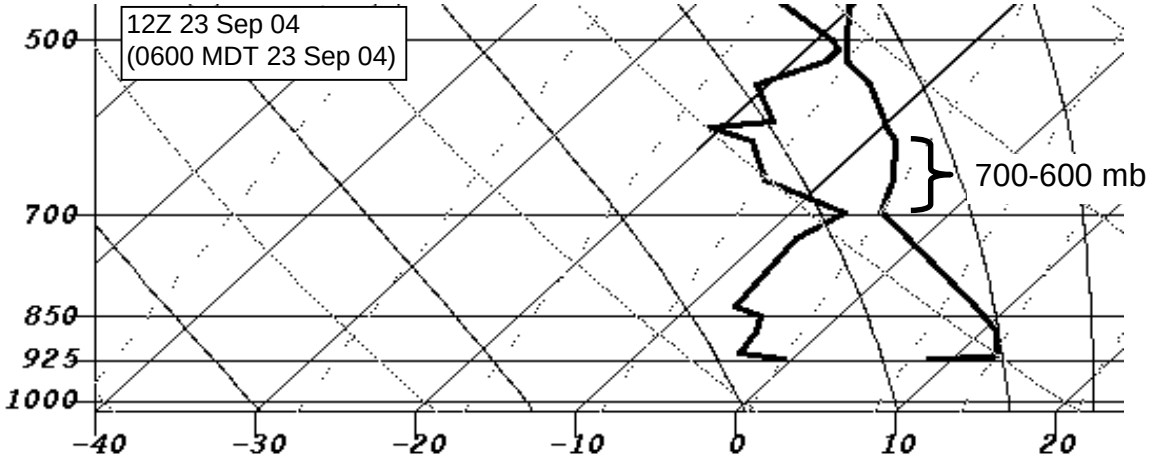
(b) in the ground-based inversion layer

(c) near the 500 mb level ✓✓

(d) near the 700 mb level

(e) unable to judge from the given data





Ac in two or more layers, usually opaque in places, and not progressively invading the sky; or opaque layer of Ac, not progressively invading the sky; or Ac together with As