

Air pollution chapter homework answers

Q1. Radiation inversion gets broken by **solar heating during the day**.

Q2. Subsidence inversion persist for **days or weeks**.

Q3. When the earth's surface cools rapidly, such as between late night and early morning under clear skies, a **radiation inversion** is likely to occur.

Q4. The wind speed at 10 m altitude is 5m/s. Find the wind speed at 250 m altitude for the following stability conditions (The p-values are shown in Table 2).

1. Large lapse rate: **9.52**

2. Zero or small lapse rate: **11.18**

3. Moderate inversion: **14.46**

4. Large inversion: **25**

$$\frac{u}{u_1} = \left(\frac{z}{z_1} \right)^p$$

Q5. Explain the scientific basis of the following two proverbs:

The smoke from chimneys straight ascends, Then spreading back to earth it bends.

When the ditch and pond offend the nose, Then look for rain and stormy blows.

(1) This proverb reflects atmospheric stability and the occurrence of temperature inversions:

When smoke ascends vertically, it indicates stable atmospheric conditions.

In such cases, the air near the surface is cooler than the air above,

preventing vertical turbulence and allowing smoke to rise uniformly.

When smoke bends and descends, it signifies the presence of a temperature inversion, where a warmer air layer overlays cooler air near the ground. This stratification restricts vertical mixing and causes the smoke to spread horizontally and return to lower altitudes.

(2) This proverb is based on the relationship between humidity, pressure changes, and the olfactory perception of odors:

Before rainfall or storms, the atmospheric humidity typically increases due to moisture-laden air masses. Elevated humidity enhances the release of odoriferous compounds from stagnant water bodies, making the smells more detectable.

Furthermore, the development of low-pressure systems, which are often precursors to storms, promotes evaporation and the release of volatile organic compounds (VOCs) from ditches and ponds, intensifying their odors.

Q6. Figure 19.7 depicts the direction of an idealized sea breeze as perpendicular to the land mass. Consider the East Coast beaches of the United States. Assume that the pressure gradient is directly east to west at a beach that runs directly north to south. Considering friction and the Coriolis force, from which direction will the actual sea breeze be blowing (Label the coast and the east-west and north-south directions, diagram the circulation, and give the relevant analyses)?

Resultant Sea Breeze Direction

1. The pressure gradient force drives air westward from the ocean toward the land.
2. The Coriolis force acts to the right of this motion, deflecting the air northward.
3. Friction weakens the Coriolis deflection, so the resultant wind direction will be southeast (where the wind is coming from), blowing from the ocean (east) toward the land (west) but with a slight northerly component.

