

## Second Midterm Examination Study Questions

The questions below will help you focus on the most important concepts presented in class as you prepare for the second midterm exam. These questions don't necessarily cover all of the material on which you may be tested (nor will you necessarily be tested on all of the material noted below), but these questions are a good starting point for studying. As you prepare for the exam, I recommend that you **write down the answers** to these questions **in your own words** (not just copied from the textbook, and certainly not from Wikipedia!) to ensure that you understand the material completely.

1. Describe the general location and characteristics of the *jet streams* of the westerlies.
2. What are *Rossby waves*?
3. Briefly describe the location and general characteristics of the high-latitude components of the general circulation patterns: the *polar front*, the *polar easterlies*, and the *polar highs*.
4. Describe and explain the seasonal shifts of the general circulation patterns. Especially note the significance of seasonal shifts of the *intertropical convergence zone* (ITCZ) and the *subtropical highs* to regional precipitation patterns.
5. Describe and explain the South Asian *monsoon*.
6. Explain the origin of *land-sea breezes*.
7. Describe the conditions associated with relatively high rates of evaporation, and the conditions associated with relatively low rates of evaporation.
8. What is *absolute humidity*?
9. What is *relative humidity*?
10. What determines the water vapor “capacity” of air?
11. What happens to relative humidity when the temperature decreases? Why?
12. What happens to relative humidity when the temperature increases? Why?
13. What is meant by the *dew point* temperature of a parcel of air?
14. Which cooling process in the atmosphere is responsible for the formation of most clouds—and nearly all clouds that produce precipitation? (Hint: It was one of the ten basic warming and cooling processes discussed in Chapter 4.)
15. What happens to the relative humidity of an unsaturated parcel of air as it rises? Why?
16. What is the relationship of the dew point temperature of a parcel of air to its *lifting condensation level*?
17. What is *latent heat*?
18. Why is evaporation a “cooling” process and condensation a “warming” process?
19. Why does a parcel of *unsaturated* air cool more when it rises 1000 meters than a parcel of *saturated* air (in which condensation is taking place) when it rises 1000 meters? In other words, explain why there is a *dry adiabatic rate* and a *saturated adiabatic rate*.
20. Why can't descending air form clouds?
21. What is the difference between *stable air* and *unstable air*? What makes air unstable?
22. Describe the three main forms (shapes) of clouds.
23. Are *stratus* clouds associated with stable or unstable air? Are *cumulus* clouds associated with stable or unstable air?
24. Describe the four main lifting mechanisms of air.
25. What is a *rain shadow* and what causes one to form? In your answer, explain the role of adiabatic temperature changes, as well as changes in relative humidity and the actual water vapor content of the air in the formation of rain shadows. (Hint: The wind is not “blocked” by a mountain range.)
26. Using the global map of average annual precipitation (Figure 6-34 in the textbook), explain the causes of:
  - Wet regions within the tropics
  - Wet regions along the west coasts of continents in the midlatitudes (at about 40-60° N & S)
  - Dry regions along the west coasts of continents in the subtropics (at about 20-30° N & S)

- Dry areas within the midlatitudes

27. What is the relationship of *precipitation variability* to average annual precipitation?
28. What is an *air mass*, and what conditions are necessary for one to form?
29. Why is an air mass unlikely to form over California? (Hint: There are two reasons.)
30. What is a *cold front*? What is a *warm front*?
31. Explain *why* clouds develop along cold fronts and warm fronts.
32. Describe the pressure and wind patterns of a *midlatitude cyclone*. Describe the location of fronts and the surface sectors of a mature midlatitude cyclone.
33. Describe and explain the regions of cloud development and precipitation within a midlatitude cyclone.
34. Discuss the four components of movement of a midlatitude cyclone.
35. Explain the process of *occlusion*. Why does an *occluded front* usually indicate the death of a midlatitude cyclone?
36. Describe and explain the changes in wind direction, atmospheric pressure, sky conditions (such as clouds and precipitation) and temperature with the passing of a cold front.
37. Describe the pressure pattern, wind pattern, and general weather associated with a *midlatitude anticyclone*.
38. Why are there no fronts within a typical midlatitude anticyclone?
39. How are midlatitude anticyclones often associated with midlatitude cyclones?
40. Describe the pressure patterns, wind patterns and the *eye* of a *tropical cyclone (hurricane)*.
41. Why do hurricanes weaken when they move over land?
42. Why are there no fronts within a tropical cyclone?
43. Why are tropical cyclones common along the east coasts of continents in the midlatitudes, but not along the west coasts?
44. What is a hurricane *storm surge*, and what causes one?
45. What information is conveyed in a *climograph*?
46. In the *Köppen climate classification* letter code system, what information is given by the first letter, the second letter, and the third letter?
47. Briefly describe the major climate groups of the Köppen climate classification system: groups A, B, C, D, E, and H.
48. Describe the general location, temperature characteristics, precipitation characteristics, and main controls (the causes) of the following six climate types (you should also be able to recognize these climates from a climograph):
  - Af *Tropical wet*
  - Aw *Tropical savanna*
  - Am *Tropical monsoon*
  - BWh *Subtropical desert* (“hot” deserts)
  - BWk *Midlatitude desert* (“cold” deserts)
  - Cs *Mediterranean* (includes both Csa and Csb)
49. Why do Af (*tropical wet*) climates receive rain all year while Aw (*tropical savanna*) climates receive rain only in the summer?
50. What are the main differences in controls of BWh (*subtropical desert*) climates and BWk (*midlatitude desert*) climates?
51. Why do Cs (*mediterranean*) climates have dry summers and wet winters?
52. Although both cities are coastal and at roughly the same latitude, Boston, Massachusetts has a “severe” continental climate while Seattle, Washington has a “mild” maritime climate. Why?
53. Why are polar climates so dry?
54. Other than weather station data, describe and explain at least one way scientists can learn about climates of the past.
55. Other than variations in greenhouse gas concentration, describe and explain at least one cause of climate change.