1. What are the two most abundant permanent gasses, and roughly what fraction of the mass of the atmosphere does each make up?

2. Name three variable gases in the atmosphere, and discuss how each is significant.

3. What keeps all the air molecules in the atmosphere from falling to the ground due to the force of gravity?

4. Is a typical value of sea level pressure 1, 10, 100, or 1000 millibars?

5. Is the fraction of the mass in the atmosphere that lies below 15 km (10 miles) roughly 10%, 50%, 90% or 99%?

6. What four layers show up in the vertical profile of temperature in the atmosphere?

7. What is the tropopause?

8. Why does temperature increase with height in the stratosphere?

9. What is an inversion layer? Is it stably or unstably stratified?

10. In what layer of the atmosphere does weather occur?

11. Where is the ozone layer? Give a reason we should care about the ozone layer.

12. Is more of the mass of the atmosphere in the troposphere or in the stratosphere?

13. What are weather and climate? How do they differ?

14. What is kinetic energy? How is it related to air temperature?

15. What temperature scales do we use in meteorology?

16. What is heat capacity?

17. What is latent heat? Would it take more heat to bring a given amount of liquid water from freezing to boiling, or to evaporate it? To bring it from freezing to boiling, or to melt it from ice that is at 0°C?

18. In the Cascade Mountains, lakes may remain frozen until late summer. Explain the roles of heat capacity and latent heat in explaining this.

19. What are the three heat transfer mechanisms? Give an examples of each of these.
20. What kind of radiation does the sun emit? The earth?

21. Does the presence of an atmosphere lower or raise the average surface temperature of the earth?

22. Define albedo.

23. Why are visible satellite images only useful during daytime, but infrared satellite images are just as good at night?

24. Explain how an infrared satellite image can distinguish between regions covered by high cloud, low-lying cloud, and no cloud.

25. What does the "greenhouse effect" refer to?

26. Can you think of another planet beside Earth whose surface temperature is much more strongly affected by the greenhouse effect?

27. Do greenhouse gases warm the earth by absorbing sunlight?

28. What are the two most important greenhouse gases on Earth?

29. Why do we expect increasing concentrations of carbon dioxide should lead to "global warming"?

30. Explain why clouds tend to keep the surface temperature warmer at night but cooler during the day.

31. When is the earth closest and furthest from the sun? Is this the main cause of our seasons?

32. The earth's surface absorbs more energy from sunlight during summer than winter. We know that one reason is that days are longer than nights in summer. Give another reason of comparable importance.

33. About what fraction of sunlight hitting the top of the atmosphere is absorbed at the surface, 10%, 50%, 90%, or 99%?

34. Why do seasonal temperatures lag behind the astronomical seasons, especially over the oceans?

35. Near the equator, more sunlight is absorbed over the year than the energy emitted as longwave radiation. Where does this energy go? How is this related to weather?

36. At what time of day is the minimum temperature typically recorded? Name at least two factors that contribute to low nighttime temperatures.
37. On the slope of a valley, why does the wind typically blow downslope during the night? Why might things be different during the day?

38. Explain how the three forms of heat transfer combine to affect air temperature on a sunny day.

39. Why is temperature typically not measured at ground level, but typically 1.5 meters above the ground?

40. How is heat transferred to and away from the surface of the moon? (The moon has no atmosphere.)

41. Which would have the greatest effect on the earth's greenhouse effect: Removing all of the CO$_2$ from the atmosphere or removing all of the water vapour?

42. Explain why an increase in cloud cover would increase the greenhouse effect of the atmosphere, yet not necessarily lead to a lower earth surface temperature.

43. Consider two scenarios: (a) The tilt of the Earth decreased to 10°. (b) The tilt of the Earth increased to 40°. How would each of these change the summer and winter temperatures here at UW?

44. At what latitude would you expect to experience the smallest seasonal variation in temperature? Why?

45. Why does air expand and cool as it blows up a mountain?

46. What is the dry adiabatic lapse rate?

47. Why does the atmosphere not convect everywhere, even though it is much warmer near the surface than near the tropopause?

48. Why does the vertical pressure gradient not create a vertical wind?

49. Why does air pressure decrease with height?

50. Why does air density tend to decrease with height?

51. Why do meteorologists like to look at contour maps of horizontal pressure variations? On such maps what are 'isobars'?

52. What is "reduction to sea-level pressure" and why do we need to do it?

53. On a contour map of 500 mb geopotential height, why do the heights typically fall as you move north? Explain what we can infer from this about the pressure gradient force at this level.
54. Why do higher 500 mb heights tend to be associated with higher temperatures between the surface and 5 km elevation?

55. What three forces are most important in determining wind speed and direction?

56. What is the pressure gradient force? Given a contour map of sea-level pressure

57. What is the Coriolis force? What factors affect the Coriolis force?

58. Why is the earth's surface further from its center in low latitudes than in high latitudes?

59. Why do winds tend to blow along the isobars except near the surface, even though the pressure gradient force is directed down the isobars? What is the name of the force balance involved?

60. In what layer of the atmosphere is friction important in affecting the wind? Does friction cause air to spiral out of or into regions of low sea-level pressure?