1. The primary factor determining the temperature at which water boils is _____.

(A) the rate at which heat is added to the water
(B) atmospheric pressure
(C) atmospheric temperature
(D) water vapor pressure

Hint: Water boils when it finally has enough kinetic energy to form its own steam bubbles equal in pressure to atmospheric pressure.

2. Inside the bubbles in boiling water are _____.

(A) water molecules at a pressure greater than atmospheric pressure
(B) air molecules
(C) a mixture of air and water molecules
(D) water molecules at atmospheric pressure

Hint: The reason bubbles form in boiling water is that the water molecules finally have enough kinetic energy to overcome atmospheric pressure and form their own gas bubbles consisting of water molecules equal in pressure to atmospheric pressure.

3. Which statement is untrue? Air pressure is _____.

(A) measured in joules per cubic centimeter
(B) force per area
(C) the weight of air per area
(D) changes from day to day

Hint: Force is mass times acceleration. When the acceleration is the acceleration of gravity, the force is weight. Force per unit area is pressure. A force exerted over a distance is work or work-energy expressed in units of joules.

4. Which statement is untrue? Air pressure _____.

(A) pushes liquids up a drinking straw when you suck on the straw
(B) excludes the pressure exerted by water molecules in the air
(C) is the weight of all the air above a given area
(D) on an average day at sea level is 760mm mercury.

Hint: The weight of air is what provides air with its downward force.

A downward force of 14.7 pounds per square inch will push water up a straw but only if you remove the air in the straw by sucking out the air.

Air pressure will push water up to a height of 33.8 feet, or mercury up to a height of 760mm, 76cm (29.9 inches).

5. In a barometer, which measures air pressure, the area above the column of mercury contains _____.

(A) air molecules
(B) mercury molecules
(C) water molecules
(D) practically no molecules

Hint: In a barometer, the column of mercury is sitting in a puddle of mercury and being pushed up the glass tube by air pressure pushing down on the puddle of mercury.

If air molecules were present above the column of mercury, they would be exerting a downward pressure on the mercury column.

The height of the mercury column would then depend on the net force: atmospheric pressure minus the downward pressure exerted by the air molecules above the column of mercury.

6. The height of a mercury column in a barometer measures air pressure. Average air pressure is _____.

(A) 100mm Hg
(B) 500mm Hg
(C) 760mm Hg
(D) 1000mm Hg

Hint: The weight of atmosphere -- 14.7 pounds per square inch -- pushes down on a puddle of mercury with enough force to push the mercury up a completely empty tube (not even air inside) a distance of 29.9 inches, or 760mm, regardless of the diameter of the tube.

7. A pressure cooker _____.

(A) increases atmospheric pressure and allows food to cook slower
(B) releases excess atmospheric pressure and allows food to cook faster
(C) increases atmospheric pressure and allows food to cook faster
(D) releases excess atmospheric pressure and allows food to cook slower

Hint: By sealing a pressure cooker tight and increasing the air pressure inside the pressure cooker, water can be heated to more 100° Celsius before it boils, allowing food to cook faster.

8. The weight of air pressing down on a square inch of ground at sea level is about the weight of a _____.

(A) beach ball
(B) golf ball
(C) basketball
(D) bowling ball

Hint: The weight of a column of air 1 square inch in cross-sectional area extending from the earth to outer space is 14.7 pounds.

9. Which statement is true?

(A) At higher elevations, water boils at a lower temperature because it is colder at higher elevations.
(B) At higher elevations, water boils at a lower temperature because the air pressure is lower.
(C) An aneroid barometer uses low pressure mercury to push on a membrane and move the arrow indicator.
(D) An aneroid barometer measures elevation above the ground.

Hint: The main determinant of the boiling point is air pressure because air pressure is preventing water from creating its own bubbles equal in pressure to atmospheric pressure. Only when the water has enough energy (delivered in the form of heat, will the water have enough energy to form bubbles equal in pressure to atmospheric pressure.

10. Which statement is untrue? Air is colder at higher elevations because _____.

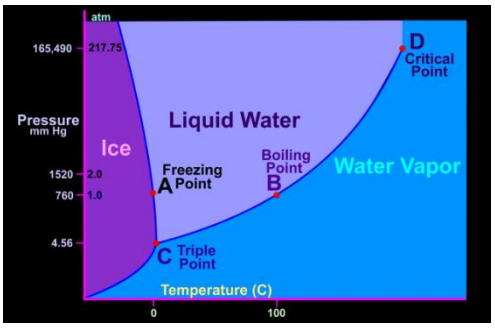
(A) air molecules used their kinetic energy to spread apart at higher elevations
B) there are fewer air molecules to transfer heat
(C) air is further away from the direct source of its heat
(D) there is less infrared radiation at higher elevations

Hint: Infrared radiation (heat) passes through the atmosphere without difficulty.

11. A phase diagram displays when the three phases of water occur as _____.

(A) the pressure and volume are changed
(B) the pressure and temperature are changed
(C) the volume and temperature are changed
(D) the triple point is varied

Hint: The X axis in a phase diagram is the temperature and the Y axis is the atmospheric pressure.



12. Increasing the air pressure over water _____.

(A) lowers the freezing point of water and raises the boiling point
(B) raises the freezing point of water and lowers the boiling point
(C) lowers the freezing point and the boiling point of water
(D) raises the freezing point and the boiling point of water

Hint: Increasing the air pressure over water means you begin on the Y axis at a point higher than 760mm Hg. As you move horizontally to the right, you encounter the blue line separating ice from liquid water. From that point on the blue line, looking down to the X axis, the temperature is less than zero degrees Celsius.

Continuing horizontally to the right from that point on the blue line, you encounter the blue line separating liquid water from water vapor. Looking down from that point, the temperature is greater than 100° Celsius.