1) Had life never evolved on Earth, the current atmospheric composition would be vastly different today. The photosynthesis reaction released enormous amounts of $O_2$ (oxygen) into the atmosphere—so much so that it now represents nearly 22% of every breath you take. The presence of so much $O_2$ resulted in the creation of the ozone layer ($O_3$). Once the ozone shield was in place, much of the deadly ultra-violet radiation from the sun was prevented from penetrating to the surface of the Earth. The presence of these two oxygen species in our atmosphere is a *direct* result of the presence of life on Earth.

2) This problem involves consideration of the kinetic energy. Recall that kinetic energy is product of the MASS of an object and its VELOCITY squared (divided by 2). If both ball A and ball B are moving at the same speed, then their kinetic energies will differ based only upon their different masses. The more massive ball will have more kinetic energy (i.e. more ability to do work on some form of matter). When the balls strike one another, the amount of work done by each ball can be related to the recoil distance of its partner since it takes work to make either ball recoil from the point of impact. Since ball B recoils farther from the point of impact than ball A, we know that ball A has done more work than ball B. Thus, ball A must have a greater mass and thus it has the greater density.

3) a) The temperature of the air inside the basketball drops.

b) Temperature is the average kinetic energy of the molecules, so a drop in temperature is equivalent to a slowing down of the molecules.

c) Since the molecules move more slowly they impact the inside wall of the basketball with less force. Since the ball keeps its original shape, there is no change in the interior surface area of the ball. Combining these two facts, results in the conclusion that the pressure exerted by the air in the basketball drops as well.

d) The ball’s ability to bounce is directly related to the force the molecules of air inside the ball exert on the ground when the ball hits the ground. That force is exactly the same as the upward directed force exerted on the ball by the ground. It is that upward directed force that compels the ball to bounce off the ground. Since a decrease in the air pressure inside the ball is as consequence of the decrease in the force exerted by the molecules of air inside the ball, the ball will not bounce as well when it is cold.