Weightlessness

When you step on a scale, gravity presses you down on the scale with a force equal to your weight. According to Newton's third law, the scale presses back. Suppose the floor beneath the scale suddenly gives way and you are falling together with the scale. Gravity is moving you and the scale together. The scale is not pushing up on you. According to Newton's third law, you are not pushing down on the scale. The scale measures your weight to be zero. You feel weightless because nothing is pushing up on you. Weightlessness in orbit is pretty much the same phenomenon. An object in orbit is falling towards the earth, but it is also moving away from the earth (at a right angle). All the objects in a space craft in orbit are also falling. As a result, they feel weightless. Keep in mind, however, that weight is the downward force due to gravity. Anything that is orbiting the earth is being pulled down by gravity, or it would take off into space instead of orbiting. As a result, technically, it still has weight regardless of how it feels.

Answer the questions below based on your reading above and on your understanding of physics.

1. What causes an object on earth to have weight? _____

2. An astronaut is in a satellite orbiting the earth. The astronaut feels weightless.
   a. Is the astronaut actually weightless, or does the astronaut have weight? Explain. _____
   b. Why does the astronaut feel weightless? _____

3. A "weightless" astronaut can jump and fly around in the space capsule as if there were no gravity. But even when the astronaut is jumping up in the space capsule (s)he is still falling under the influence of gravity. Explain. _____