Key points from Lecture 6 of ASTR 350

1. Special relativity considers only inertial frames. General relativity adds gravity and, more generally, gives us a way to handle accelerated frames..
2. Gravitational redshift: as locally measured, the energy of a photon diminishes as it climbs out of a gravitational well. If this were not so, we could generate unlimited energy (Einstein tower thought experiment).
3. A consequence of this is that if you look at the clock of someone deeper in a gravitational well than you are, you see their clock running slowly. This is called gravitational time dilation. Unlike with special relativity, this situation is asymmetric: they would see your clock running fast. Like with special relativity, however, both of you see your own clocks running normally.
4. This has practical importance: GPS would not operate correctly if we ignored gravitational time dilation.
5. Strong equivalence principle: there is a complete physical equivalence of a gravitational field and a corresponding acceleration of the reference system, locally. If you go to large enough scales there are differences. But the idea is that, locally, if you are inside a freely-falling elevator you can't distinguish between that and being in deep space far from any gravitating bodies.
6. Light also falls; that is, the path of light is deflected by gravitating bodies. This leads to *gravitational lensing*, which has been observed from many galaxies.
7. Overall, gravity affects space and time.