1. In 17.6(a) the lower pair is faster because it bends less in the same B field.

2. Photons do not produce ionization in a bubble chamber, because they are charge free. (Photons ionize, but more weakly.)

3. An electron moving upward would have a straighter track below the lead and a more curved track above the lead. Same curve direction, though.

4. Light speed: photon (by definition)
   \[ v_c, v, v_e \] (because nearly massless)

5. Electric force: \[ e^+,\mu^+,\tau^+,\mathcal{W}^\pm \]
   Exchange photons: \[ e^+,\mu^+\tau^+,\mathcal{W}^\pm \] (same thing)

6. \( W \) and \( Z \) are similar to \( \gamma \) in that they are all:
   - bosons = spin 1
   - mediate "electroweak" interactions
   - different in that:
     - photons don't interact with neutrinos
     - photons are massless

7. Elementary: neutrino, quark, muon, photon

8. Quarks are similar to electrons in that they are:
   - charged
   - experience electroweak interactions

   Different in that:
   - quarks aren't free
   - quarks experience strong
CH 17 C5.14 Remaining mass of proton comes from field energy; mostly strong force, but some electrostatic as well.

CH 17 P4 Power plant: 1000 MW = 1 GW output
Efficiency = 50% 
Input energy = 2 GW

1 year energy = \(2 \times 10^8 \text{ W} \times 365.25 \times 24 \times 3600 \text{ sec} \)
\[ E = 6.3 \times 10^{16} \text{ J} \]

Mass = \(E/c^2 = 0.70 \text{ kg} \)