1. Which letter(s) labels absorption lines?  C, D
2. Which letter(s) labels the peak of infrared light?  E
3. Which letter(s) labels emission lines?  A
4. Which is hotter?
   c) A blue star (see Figure 5.10). “blue hot” is hotter than “red hot”
5. What happens if a rocket in deep space shuts off its engines?
   c) It keeps moving at the same speed (Newton’s 1st law)
6. Rank in order of strength of gravitational force (from strongest to weakest):
   a) two 1 kg objects separated by 1m
   b) a 1kg and 2 kg object separated by 1m
   c) two 1kg objects separated by 2m
   d) two 2kg objects separated by 3m
   The force due to gravity is proportional to the product of the masses divided by the square of the distance ($F=GM_1M_2/d^2$).
   Therefore the ratios of the forces are 1: 2: 1/4: 4/9
   And the order from strongest to weakest is therefore b:a:d:c
7. Rank the following in order of most energy (from highest to lowest):
   a) one kg of water ice
   b) one kg of liquid water
   c) one kg of steam

c), b), a) - you need to heat up ice to make it water and then add more heat to make it steam. Energy is conserved and the steam therefore contains more energy than water which contains more energy than ice.

8. New York winters can be brutal – the temperature might drop well below freezing. The water in the Hudson river is not frozen, however, because it is warmer than the air. Mad Professor X (on sabattical at Columbia) suggests that people should jump into the water to warm up. Why is this a bad idea?

Your body is warmer than both the air and the water and will try to heat them up. Since the water is much denser, this requires a lot more thermal energy, even though it is not as cold as the air. Consequently you will lose energy (and your body will drop in temperature) far more quickly in the water than in the air. The moral of the story is don’t jump into an icy lake – you would die in less than half an hour! (Think of the Titanic.)