1. Describe the way in which energy flows through trophic levels and relate this to efficiency.

Answers should include concepts of waste up the trophic levels and how the potential chemical energy within a trophic level is converted up to the higher levels.

1. Americans use an equivalent of 6.7 tonnes of oil per year per person, what is this as an average power through the year in watts (joules per second)?

Student first has to convert tonnes of oil to Joules per year per person. This is done using the conversion in box 7.4, that is, 6.7 per year x 42GJ= 281GJ per year. To convert to seconds becomes 281/(60x60x24x365) = 8.9kW

1. What are the three major services of energy in personal consumption?

Heating and cooling, Car transportation, Jet flights

1. Describe the concept of power density when referring to energy generation. Relate this to the production of biofuels, and explain why it is hard solely rely on biofuels when transitioning towards renewable energy.

This explanation should include the idea that we can sum up all the area required for energy systems and compare the average power generated through the year by them. By dividing one by the other we can calculate the Watts generated per unit of land.

1. Why is land use change important when considering biofuels?

Any answer that includes an understanding that when the use of land changes there are large changes to the soil and existing plants which sometimes leads to large releases in GHGs and other pollutants. Answers should include the payback period of biofuels.