Remember to show all your work and always check your answer for correct sig figs and units.
Feel free to use your textbook or the internet to find any missing information or equations you may need.

Part A: Some energy and heat problems from old exams

1) Circle TRUE or FALSE for each question.
   a) A cup of boiling water has a higher temperature than a swimming pool of boiling water. TRUE FALSE
   b) A cup of boiling water has more heat than a swimming pool of boiling water. TRUE FALSE
   c) Energy can be changed from potential energy to kinetic energy. TRUE FALSE
   d) Melting ice is an endothermic process. TRUE FALSE
   e) Potential energy can be stored in chemical bonds. TRUE FALSE
   f) In an exothermic reaction, the products are higher in energy than the reactants. TRUE FALSE
   g) The Fahrenheit degree is the same size as the Celsius degree. TRUE FALSE
   h) The molecules in a sample of water at 85 °F are moving faster, on average, than the water molecules in a sample of water at 35 °F. TRUE FALSE

2) A small apple has approximately 55 Calories.
   a) Convert 55 Calories to calories:

   b) Convert 55 Calories to joules:

   c) Convert 55 Calories to kilojoules:

3) The boiling point of hydrogen gas, $H_2(g)$, is -253 °C.
   a) Convert -253 °C to °F:

   b) Convert -253 °C to K:

4) Back in question 1g, you should have answered "FALSE" because a Fahrenheit degree and a Celsius degree are not the same size. Let's prove that to ourselves now…

   a) Water freezes at 0 ° and boils at 100 ° on the Celsius scale. What is the difference between the boiling and freezing points of water on the Celsius scale?

   b) Convert 0 °C to °F:

   c) Convert 100 °C to °F:

   d) Using your answers to questions 4b and 4c, what is the difference on the Fahrenheit scales between the boiling and freezing points of water?

   e) Would you have gotten the same answer that you found in question 4d if you had just taken the temperature difference from question 4a and converted it directly to °F?

   f) Based on your answers to questions 4a and 4d, which is bigger, 1 °C or 1 °F? Briefly explain your answer.

5) Assuming 150 lbs of body weight, a leisurely bike ride (12-13 mph) will burn 2.28×10^6 J/hour. How many minutes of leisurely biking would be required to burn off a Snickers® bar (280. Cal)?

Part B: Fifty three miles per burrito?!

I found a website (www.zeropergallon.com) that sells t-shirts and stickers with the logo below, implying that it would be possible to bike for 53 miles on the energy from one burrito. Pretty impressive since my Prius gets about 50 mpg! Being a chemist, of course I wanted to check out their claim ☺.

53 mpb
fifty three miles per burrito

6) If riding a bicycle at 15 mph consumes about 35 Calories/mile, how many Calories would have to be in a burrito to allow you to bike for 53 miles? Does this number seem possible? (In other words, is their slogan reasonable? If you need to, check the Chipotle site online to see what a reasonable Calorie content is for a burrito.)

Now that we've addressed their slogan, let's do a comparison of driving and biking:

7) Gasoline provides 34.8 MJ/L. How many Calories/gallon is this?

8) If a typical car gets 30 mpg, how many Calories are consumed by driving 1 mile?

9) Compare the Calories/mile for bicycling (from question 8) and for driving (from question 10). Why do you think there is such a big difference in the number of Calories consumed by these two forms of transportation?