1. Which of the following is a notable failure of the ideal gas model?

   (a) the condensation of gases

   (b) the expansion of gases as they warm

   (c) the relationship between temperature and molecular kinetic energy

   (d) the proportionality of pressure and temperature

2. Two different solids of the same mass each are given the same amount of energy. Solid A is silver and has a specific heat of 230 J/(C·kg). The other is copper, which has a specific heat of 390 J/(C·kg). Which solid warms up more?

   (a) silver

   (b) copper

   (c) neither

3. What does it mean if two objects are in thermal equilibrium?

4. When water vapor condenses to make a cloud, the surrounding air

   (a) warms up.

   (b) cools off.

   (c) maintains its temperature.

5. Evaporation is

   (a) exothermic.

   (b) endothermic.

   (c) isothermic.

   (d) hypodermic.

6. Describe conduction, convection, and radiation.

7. Which has more energy, 20 g of ice at $0°C$ or 20 g of liquid water at $0°C$?

   (a) ice

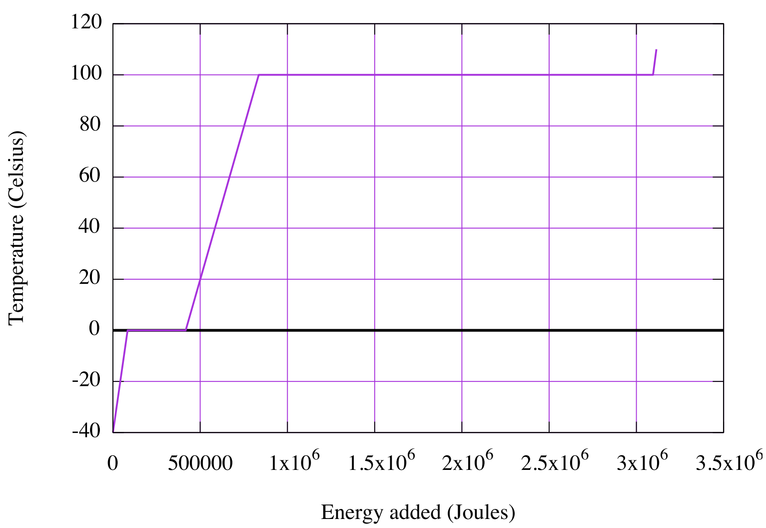
   (b) liquid water

   (c) neither

8. List a few successes and a few failures of the ideal gas model.

CONSTANTS: $c_{\text{water}} = 4186$ J/kgC°, $c_{\text{ice}} = 2100$ J/kgC° L_f,water $= 3.33 \times 10^5$ J/kg, L_v, water $= 2.26 \times 10^6$ J/kg, Boltzmann constant: $k = 1.38 \times 10^{-23}$ J/K Avogadro's number: $N_A = 6.02 \times 10 \times 23$ Universal gas constant: R = 0.0821 (L·atm) / (mol·K)

1. A cylinder of diameter 1.00000 cm at 30°C has to be inserted into a hole in a steel plate. The hole has a diameter of 0.99970 cm at 30°C. To what temperature must the plate be heated so that the cylinder will fit? [55°C]
2. You may have a steel measuring tape at home. Usually they are calibrated to be accurate at 20°C. On a 50°C day, a very hot day even in the Valley of the Sun, by what percent will your measurements be in error? (Optional hint: Make your life easier by considering a 100 inch (or 100 cm) length.) approx 0.036%
3. A glass is "filled to the mark" with 50.00 cm^3 of mercury at 18°C. If the flask and its contents are heated to 38°C, what will be the new measured volume? 50.15 cm^3
4. Find the increase in length of an aluminum power line when the temperature is 40°C, if it is 200.00 m at 20°C. 0.10 m
5. Find v_{rms} for N_2 gas at 20°C. 500 m/s
6. Find the ratio of v_{rms} for O_2 and He at the same temperature. 0.35
7. How much energy is lost by 1.0 kg of steam when it is condensed at 100°C and then cooled to 20°C? 2,260,000 J + 334,880 J = 2,594,880 J $\approx 2,595,000$ J
8. A 20 g piece of aluminum at 90°C is dropped into a hole in a large block of ice at 0°C. How much ice does the aluminum melt? 0.00486 kg
9. A 55 g copper calorimeter contains 250 g of water at 18.0°C. When 75 g of an alloy at 100°C is dropped into the calorimeter, the system warms to 20.4°C. What is the specific heat of the alloy? 429 J/(kg C)



10. (a) Describe and explain what is going on with the 1.00 kg sample of water in the graph shown above. First, the ice warms up to its melting point. The ice then melts to H_2O [ℓ] without a change in temperature. The liquid water then warms up to its boiling point. The water boils to steam, and finally the steam warms up further.

    (b) Just by looking at the plot, compare the specific heats for ice and for liquid water. Describe how you are able to determine which is greater. It takes less energy to warm the ice up a given number of degrees than it does liquid water as one can see from the slope of the line segments. Therefore, the specific heat capacity for liquid water is greater than that of the ice.

11. Explain why restaurants use misters here in the Valley of the Sun.
Air molecules bump into the tiny droplets of water that come from the misters. In these collisions, the air molecules tend to lose energy as they knock water molecules free from their neighbor H_2O molecules. In knocking attractive water molecules apart, there is an increase in electric potential energy around these H_2O's. As a result of all this, the air molecules lose energy, which means they cool down. That can be a good thing!

12. Describe the role of the condensation of water vapor in the formation of storms.
Water molecules attract each other. If they happen to collide with an air molecule and lose energy to the air molecule as a result, then they may not have enough energy to escape from each other, thus becoming bound together. As these collisions keep happening, droplets of water form, and the surrounding air warms. The warm air rises into cooler surroundings, which makes even more condensation occur, and so on. The amount of energy released by condensing water can be very large if there is a lot of water vapor. The rising air draws in even more surrounding air to replace it. Storms will therefore have water droplets and wind.