1. (10 points) Since we deal a lot with units, let’s see how well you can match up the quantities on the left with the lettered choices of units on the right. The lettered choices may be used more than once on the left, but only one choice should be placed on each line.

___ frequency A. kelvins
___ power B. meters
___ gravitational potential energy C. watts
___ wavelength D. Hertz
___ work E. m/s
___ period F. decibels
___ wavespeed G. Joules
___ kinetic energy H. seconds
___ loudness
___ absolute temperature

2. (4 points) **Show your work.**
   a. A 1000-kg car is traveling at a speed of 25 m/s. What is its kinetic energy?

   b. How much work would be required to bring the car of part a to a complete stop?

   c. If the kinetic energy of the car changes to 150000 J, what is its new speed?
3. (10 points) **Show your work.**
   a. A 25.0 kg ball is held at a height of 20.0 m above the floor. Using the floor as the zero reference for height, what is the gravitational potential energy of the ball?

   b. If the ball is dropped from the height of 20.0 m, what is its gravitational potential energy at a height of 10.0 m?

   c. What is the ball’s kinetic energy at the height of 10.0 m after being dropped from a height of 20.0 m?

   d. How fast is the ball traveling at the height of 10.0 m after being dropped from a height of 20.0 m?

   e. How much work would be required to raise the ball from a height of 20.0 m to a height of 30.0 m?

4. (4 points) Make the following temperature conversions. **Show your work.**
   a. 392 °F = _____ °C

   b. 318 K = _____ °F
5. (6 points) Show your work.

a. A hot pack can sometimes be used in athletic situations where heat is needed to treat an injury on the field. Suppose a hot pack contains essentially 250 g of water, the specific heat of which is 4186 J/kg-°C. If the reaction that occurs in the hot pack produces 32000 J, how much does the temperature rise in the hot pack?

b. Sometimes when there is a freeze threat in a citrus grove, workers will spray water over the fruit. This has two effects, one of which is that when the water freezes around the fruit it releases heat which then warms the fruit. Suppose 0.025 kg of water freezes around an orange. How much heat would this amount of water release to the orange? The latent heat of fusion of water is 80 kcal/kg.

c. If the orange in part b has a mass of 0.150 kg and a specific heat of 0.60 kcal/kg-°C, by how much would the temperature of the orange increase due to the freezing of the water if all of the heat goes into the orange?

6. (2 points)

a. Give an example of a longitudinal wave.

b. Give an example of a transverse wave.
7. (6 points) **Show your work.**

   a. A sound wave has a speed of 340 m/s and a frequency of 15 kHz. Find its wavelength.

   b. Red light has a wavelength on the order of $7 \times 10^{-7}$ m. What is the frequency of light with that wavelength?

   c. The period of a wave is 15 s. What is its frequency?

8. (2 points) Circle the color of light with the largest frequency in each case below.
   
   a. orange or yellow
   
   b. violet or red

9. (2 points) A subway train generates a sound on the order of 90 decibels. City traffic generates sound of about 70 decibels. By what factor is a subway train louder than city traffic?

10. (2 points) The index of refraction of light in diamond is 2.42. What is the speed of light in diamond?

11. (4 points) For each of the diagrams below, identify each image as a concave mirror, a convex mirror, a convex lens, or a concave lens.
12. (8 points) Complete the following sketch to answer the questions about the image formed by the convex mirror.

Circle the correct choice.

a. The image is:  real  or  virtual

b. The image is:  upright  or  inverted

c. The image is:  larger than  or  smaller  than the object.
\[ W = Fd \quad E_k = \frac{1}{2}mv^2 \quad E_p = mgh \]

\[ P = \frac{W}{t} \quad T_k = T_c + 273 \quad T_F = \frac{9}{5}T_c + 32 \]

\[ T_c = \frac{5}{9}(T_F - 32) \quad H = m \times c \times \Delta T \quad H = m \times L \]

\[ f = \frac{1}{T} \quad v = \frac{\lambda}{T} \quad v = f\lambda \]

\[ c = 3.0 \times 10^8 \text{ m/s} \quad n = \frac{c}{c_m} \]