Name:_____

Biology 3820
Physical Principles in Biology
Fall Semester 2015

Quiz 1
4 September 2015

Please write your name on each page.
Be sure to show your work and include correct units in all of your answers!
25 points total.

1. Erythrocytes (red blood cells) are among the smallest cells of the human body. They are roughly disk shaped, with a diameter of about $7\,\mu$m and a thickness of about $2\,\mu$m. A healthy adult has about 20×10^{12} erythrocytes at a given time.

   (a) (6 pts.) Calculate the volume of a typical human erythrocyte, expressing your results in both units of μm^3 and mL.

(b) (4 pts.) Assuming that the erythrocytes have a density of 1 g/mL, estimate the total mass of erythrocytes in an adult human.

2. In addition to the conventional cubic (6-sided) dice, there are a variety of other kinds of dice that have been manufactured, including 4-sided dice with the numbers 1, 2, 3 and 4 marked on the side. Suppose that you were playing a game with two 4-sided dice.

   (a) (4 pts.) Define a sample set for a throw of two 4-sided dice. Assuming that the dice are fair, define this sample set so that the the probability of each outcome is equal and list all of the elements in the sample set.

   (b) (2 pts.) Calculate the common probability of the outcomes in the sample set you defined.

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(c) (3 pts.) Using the sample set you defined above, define three events, $E2$, $E5$ and $E7$, which represent the outcomes where the sum of the sides showing are 2, 5 and 7, respectively. Define each event in terms of the outcomes it includes.

(d) (3 pts.) Assuming that both dice are fair, calculate the probabilities of the events $E2$, $E5$ and $E7$.

(e) (3 pts.) Suppose that someone has managed to "load" *one* of the 4-sided dice in such a way that the probability of the four sides showing are:

1: $p = 0.2$
2: $p = 0.25$
3: $p = 0.25$
4: $p = 0.3$

Assuming that the other die is fair, calculate the new probabilities of the four events, $E2$, $E5$ and $E7$.