Laboratory 1: Critical Thinking and the Scientific Method / Unit Conversions

Name: _____

Introduction:

The Radiation and Life laboratory course introduces students to ionizing radiation and how to quantitatively measure it, as well as its uses in research. Before performing any experiments, however, it will be necessary to review the Scientific Method and how to perform unit conversions.

Critical Thinking and the Scientific Method:

Science is more than just a collection of facts- it's a way of thinking about the world around us. In particular science requires critical thinking. You probably apply critical thinking every day without realizing it.

For instance, consider the claims of TV and radio advertisements. Does one brand of stereo sound better than another? You can accept the claim of the manufacturer at face value and buy that brand without comparison-shopping, but you will more likely compare the sound quality of a number of brands at the store before making your purchase. In the end, you will try both brands to verify the claim.

The Scientific Method formalizes the process of critical thinking, and contains a number of steps that must be followed. For the first part of today's lab, you will watch a video about critical thinking and the Scientific Method. Answer the questions below and submit this handout either today or at the start of next week's lab period.

Unit Conversions:

When performing lab experiments, you'll collect data and will often want to present the results in different units than what you initially measured. Some everyday examples of unit conversions include the following.

1. You measure a length with a metric ruler, but need to convert to US Customary units because you're doing carpentry. The length is 5.08 cm. How many inches is this?

2. You're driving 55 mph on a winding back road in Canada. The speed limit sign reads 80 km/hr. Are you driving too fast?

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Unit Conversions, cont:

The second part of this lab is a review of unit conversions because it will be necessary to perform simple calculations in the subsequent experiments. Answer the questions and submit this handout either today or at the start of next week's lab period.

Questions:

1. What is the Scientific Method? (20 points)

_____
_____
_____
_____
_____

2. What is a hypothesis? (10 points)

_____
_____
_____

3. Data must be reproducible (T / F). (10 points)

4. What is the placebo effect? (20 points)

_____
_____
_____
_____

5. What is a "double-blind" test/experiment? (20 points)

_____
_____
_____
_____

6. In a given experiment, how many factors differ between the control and the experimental group? _____(10 points)

7. When sampling, the samples should be drawn randomly (T / F). (10 points)

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Additional Questions-Extra Credit (numbers 8-10 are worth 10 points apiece, no partial credit allowed):

8. The radius of a hydrogen atom is 37.1 picometers. Convert this to each to the following units of measure:
a. centimeters _____
b. inches _____
c. feet _____

9. One curie represents 37 billion radioactive decays per second (DPS). One millicurie
represents:
a. _____radioactive decays per second (DPS).
b. _____radioactive decays per minute (DPM).

10. The half-life of Co-60 is roughly 5.27 years. 5.27 years = _____ seconds.