**Practice Questions Solutions**

**Question 1**

The radiation emitted by the isotope Caesium-137 can be used to treat food to increase its shelf life. Calculate the amount of energy absorbed by 2.00 kg of meat when it is given a dose of 2500 Gy.  
**5000 J**

**Question 2**

A careless research student at a university accidentally swallowed a radioisotope with an activity of 10.0 kBq. The material swallowed has a very long effective half-life, so assume that the activity will not change appreciably during the student’s lifetime. Each decay of the isotope releases 1.55 × 10-13 J of energy into the body.Also assume that all of the energy is absorbed by the student’s body and that the radioisotope is not eliminated.

1. Calculate the amount of energy absorbed in one year (365 days).  
   1 Bq = 1 decay s-1.  
   **4.89 × 10-2 J y-1**
2. If the student has a mass 55.0 kg, determine the energy absorbed per kg in one year.  
   **8.89 × 10-4 J kg-1 y-1**
3. Calculate the absorbed radiation dose in grays per year.  
   **8.89 × 10-4 Gy y-1**
4. Assume that the ingested radioisotope is an alpha emitter.
   1. What is the equivalent absorbed radiation per year?  
      **1.78 × 10-2 Sv**
   2. Should the student be concerned about his yearly radiation exposure? Justify your answer.  
      **No. Symptoms of radiation sickness begin to appear in people who receive doses greater than ~0.5 Sv over a short period of time (usually a single exposure). This much smaller dose spread over an entire year is likely to be completely harmless.**

**Question 3**

The nuclear disaster at the Fukushima Daiichi nuclear plant in Japan produced fallout over a wide area of the country. A person close to the plant was accidently exposed to the fallout and absorbed 70.0 J of beta radiation. If the person had a mass of 65.0 kg:

1. determine the absorbed dose.  
   **1.08 Gy**
2. determine the dose equivalent.  
   **1.08 Sv**
3. determine the dose equivalent if the source had been an alpha source.  
   **21.5 Sv**

**Question 4**

A student nurse of mass 80 kg accidentally absorbs 60.0 J of energy from a beta radiation source.

1. Determine the absorbed dose.  
   **0.750 Gy**
2. Determine the dose equivalent.  
   **0.750 Sv**
3. Determine the change in dose equivalent if the source had been an alpha source.  
   **+14.3 Sv**