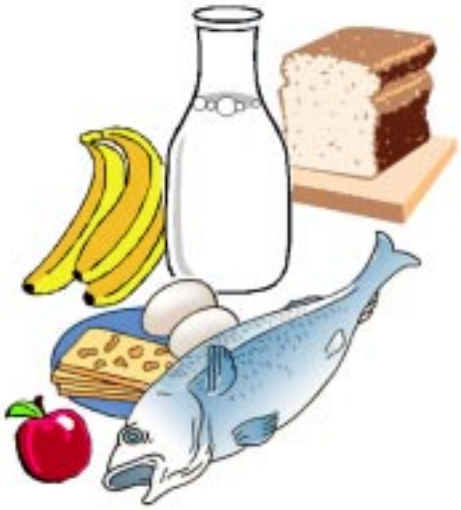
Answer Key

Internal Exposure from Radioactivity in Food and Beverages

All of the foods that we eat and beverages we drink contribute to some extent to our internal exposure to radiation. These foods are naturally radioactive. They contain elements like potassium and carbon that are essential for good health and cannot be eliminated from our diets, but also trace quantities of uranium, thorium, and other elements.



Potassium-40

Potassium-40 is a radioisotope of naturally occurring potassium. Potassium-40 contributes 18 millirem to our average annual radiation dose.

Directions: Use the chart entitled "Potassium Content and Potassium-40 Activity in Some Selected Foods" to answer the following questions.

1. List four foods you have eaten this week that contain potassium.

   (Answers will vary.)

2. If the radioactivity of 1 gram of natural potassium is 30 disintegrations per second (d/sec) and a small banana contains about 0.4 grams of natural potassium, what is the number of disintegrations per second of this banana? ("Disintegrations per second" is a standard measurement of the intensity of the radiation emitted by any radioactive substance.)

   $$\frac{1 \text{ gram}}{30 \text{ d/sec}} = \frac{0.4 \text{ grams}}{x \text{ d/sec}}$$

   $$\frac{(1 \text{ gram})(x \text{ d/sec})}{1 \text{ gram}} = \frac{(0.4 \text{ grams})(30 \text{ d/sec})}{1 \text{ gram}}$$

   $$x = 12 \text{ d/sec}$$

3. The activity of the radioactive potassium-40 in your body is about 60 disintegrations per second per kilogram (d/sec/kg) of body weight.

   a. How much do you weigh? (in pounds) ___ *(Answers will vary.)*

   b. If 1 kilogram (kg) = 2.2 lbs., how much do you weigh in kilograms? *(Answers will vary.)*

   $$\frac{1\ kg}{2.2 lbs} = \frac{\text{weight of student in kg}}{\text{weight of student in lbs}}$$

   Example: 160 lb student $* \frac{1kg}{2.2\ lbs} =$ *73 kg student*

   c. Given the activity of potassium-40 above, what is the activity of potassium-40 in your body in disintegrations per second (d/sec)? *(Answers will vary.)*

   $$\frac{60\ d/sec}{1\ kg} = \frac{\text{activity of potassium-40 (d/sec)}}{\text{weight of student in kg}}$$

   Example: 73 kg student $* \frac{60\ d/sec}{1\ kg} =$ *4,380 d/sec from potassium-40*

Carbon-14

The second largest contributor to our annual internal exposure is carbon-14, a naturally occurring radioactive isotope of carbon. It contributes about 1.2 millirem to our average annual radiation dose.

4. Our bodies are about 23 percent carbon by weight. Because it contains some carbon-14, the carbon in your body has an activity of 227 disintegrations per second per kilogram.

   a. Based on your weight in kilograms (from question 3b), how much of your body is carbon? Express your answer in kilograms of carbon. *(Answers will vary.)*

   $$\frac{23}{100} = \frac{\text{kg carbon}}{\text{weight of student in kg}}$$

   Example: 73 kg student $* \frac{23\ kg\ carbon}{100\ kg} =$ *17 kg carbon*

   b. Given the activity of carbon-14 in the carbon of your body, and your carbon weight in kilograms, what is the total activity (disintegrations per second) of the carbon in your body? *(Answers will vary.)*

   $$\frac{227\ d/sec}{1\ kg} = \frac{\text{activity of carbon (d/sec)}}{\text{weight of carbon in kg}}$$

Example: 17 kg carbon $\times \frac{227 \text{ d/sec}}{1 \text{ kg carbon}}$ *= 3,859 d/sec from carbon*

Radioactivity in Water

5. Your local city or town's water supply must be tested regularly for many pollutants, including alpha and beta emmitters as well as radium and uranium. Obtain test results from your nearest municipal water supply organization. (The results may be available online via the Web.) Note how far from EPA limits your water supply may be. Then compare them with results for the same contaminants for the Las Vegas Valley Water District for the year 2004. The Las Vegas results can be found at http://www.lvwd.com/assets/pdf/wqr2004_complete pdf. Is there cause for alarm? Why or why not? *(Answers will vary.)*

Your Health and Radioactivity in Food and Beverages

6. Should you try to eliminate all potassium or carbon or water from your diet in an effort to reduce your annual internal exposure to ionizing radiation? Why or why not? _____

   (No, you should not. Potassium is important for maintaining the proper pressure and balance within the cells of your body. Potassium is also important for your nerves, muscles, and heart to function properly. Carbon is important in providing the heat and energy necessary for our bodies to function. Water is essential to every cell, tissue, and organ in your body. Without water, no life would exist. But your water supply should be tested to be sure its radioactivity is within the standards considered safe.)