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**Passage I (Data Representation)**

The decay of uranium-238 (238U) to lead-206 (206Pb) is often used for radiometric dating of rocks. 238U is a radioactive substance that decays at a unique rate until it becomes stable in the form of 206Pb. The concentration of 206Pb in the rock can be used to determine the age of the rocks. The half-life (t1/2) of 238U is 4468 million years; thus, it takes 4468 million years for the concentration of 238Uin the sample to decrease by half (and for 206Pb to increase by the same amount). Figure 1 shows the half-life of the radioactive 238U decay. Samples were collected from two different regions in both the Rocky Mountains in Colorado and the Appalachian Mountains in Georgia and the percent of 238U was determined at different depths. The regional 238U % values in the Rocky Mountains and Appalachian Mountains are shown in Figure 2. The average 238U % values in the Rocky Mountains and Appalachian Mountains are shown in Figure 3.

1. According to Figure 1, what is the percent of 238U in the sample after two half-lives?
   1. 50%
   2. 25%
   3. 75%
   4. 12.5%
2. According to Figure 1, how old is a rock with 50% 238U concentration?
   1. 4468 million years old
   2. 8936 million years old
   3. 17,872 million years old
   4. 35,744 million years old
3. According to Figure 2, which rock contains the least amount of lead-206 (206Pb)?
   1. Region 2 Rocky Mountains at 0 inches
   2. Region 1 Rocky Mountains at 350 inches
   3. Region 2 Appalachian Mountains at 350 inches
   4. Region 1 Appalachian Mountains at 0 inches
4. According to Figure 2, the % of 238U in the sample was greater in Region 1 of the Rocky Mountains compared to Region 2 of the Rocky Mountains at which of the following depths?
   1. 100 in, 200 in, and 300 in
   2. 0 in, 200 in, and 350 in
   3. 0 in , 100 in, and 200 in
   4. 50 in, 150 in, and 250 in
5. Based on the information provided in Figure 3, which rock was the oldest?
   1. 0 inches in the Rocky Mountains
   2. 0 inches in the Appalachian Mountains
   3. 350 inches in the Rocky Mountains
   4. 350 inches in the Appalachian Mountains
6. According to the passage, which of the following is the most stable?
   1. 238-uranium
   2. 234-uranium
   3. 207-lead
   4. 206-lead

**Answers and Explanations to Passage I Questions**

1. **B**. Half-life was defined in the passage as the amount of time it takes for the concentration in the sample to decrease by half. Therefore, after one half-life, the sample will have 50% of what it previously had. After two half-lives, the sample will have half of what it had at one half-life, so half of 50% is 25%.
2. **A**. The half-life, which was defined as the amount of time it takes for the concentration in the sample to decrease by half, is 4468 million years old. Therefore, after 4468 million years old, the concentration of 238U in the sample will be 50%.
3. **D**. The rock with the least amount of lead-206 is the rock with the most amount of uranium-238, since uranium-238 turns into lead-206. The correct answer, according to Figure 2, is D, since the bar graph at the rock at 0 inches in the Appalachian Mountains is the highest in the graph.
4. **C**. The only depths at which Region 1 is greater than Region 2 for the Rocky Mountains are 0 in, 100 in, and 200 in, according to Figure 2. Check at which depths the blue bar graph is taller than the orange bar graph, since these pertain to Regions 1 and 2 of the Rocky Mountains, respectively.
5. **C**. The rock is older as there is less 238U in the sample. The rock at 350 inches in the Rocky Mountains had the lowest 238U %, as indicated in Figure 3.
6. **D**. Only 238 uranium and 206-lead were mentioned in the passage. Of the two, 206-lead is more stable. The passage indicates that 238-uranium is *radioactive* and it *decays* to form the more *stable* 206-lead.