

You may have learnt about isotopes in physics. They also crop up time and again in biology and chemistry. For example, let's take a look at the Amazon:



Image Credit: NASA Earth Observatory



Image: NASA

## Task

Read the following extracts and information about rainfall in the Amazon and the effect of increasing CO<sub>2</sub> levels.

“The problem begins with the nature of rainfall over the Amazon. Recall the isotopes of oxygen: <sup>16</sup>O and <sup>18</sup>O. Of the two, <sup>16</sup>O is lighter, and because of that it is preferentially taken up by evaporation. When scientists examined the water falling in the western Amazon Basin, they discovered that it was very low in <sup>18</sup>O. That is because it had been recycled into the atmosphere so many times that most of the <sup>18</sup>O had been left behind far to the east. This tells us that the plants of the Amazon effectively create their own rainfall, for so vast is the volume of water transpired by them that it forms clouds that are blown ever westwards where the moisture falls as rain, only to be transpired again and again.”

“Plants will keep their stomata open only as long as required. Thus, as CO<sub>2</sub> levels increase, the plants in the Amazon will keep their stomata closed for longer, and transpiration will be reduced.”

*The Weather Makers* copyright © Tim Flannery/Penguin Books, 2007

The Met Office Hadley Centre predicts that, partly because of this, by 2100 rainfall will have fallen from 5 mm to 2 mm per day, with north-eastern Amazonia receiving virtually nothing.

## Questions

1. Use kinetic theory to explain, in terms of the motion of water molecules, why water with the heavier isotope of oxygen evaporates less easily.
2. Carefully explain the link between the principal cause of global warming and reduced rainfall in the Amazon.
3. Why does it matter if the amount of rain in the region is reduced so much?

## Answers

1. The more mass a molecule has, the slower its velocity on average at a specific temperature. This means that the lower mass water molecules will be moving faster, on average, so are much more likely to evaporate.
2. CO<sub>2</sub> is the gas widely accepted as the principal cause of man-made global warming. Since this is taken in by plants, as CO<sub>2</sub> levels rise, plants will need to open their stomata for less time. This results in less evaporation from their leaves, which in turn will lead to reduced rainfall.
3. Reduced rainfall in the Amazon rainforest will lead to less water in the rivers, which may dry up at certain times of year, devastating wildlife. Furthermore, trees and plants may die out without rain so some of the forest could start to turn to desert.