Modelling Greenhouse Effect

Introduction

Greenhouse gases (such as carbon dioxide and water vapour) are gases within the atmosphere that trap and retain heat. This heat retention is known as the greenhouse effect and is a naturally occurring process. Greenhouse gases ensure that Earth maintains the moderate temperatures that is needed by organisms to survive. Human activity is increasing the concentration of certain greenhouse gases, which is creating an enhanced greenhouse effect and causing climate change (e.g. global warming).

Alka seltzer tablets contain sodium bicarbonate (base) and citric acid. When the tablet is dissolved in water, the two ingredients react to produce water, a salt (sodium citrate) and carbon dioxide as a gas.

$$3NaHCO_3 + C_6H_8O_7 \rightarrow Na_3C_6H_5O_7 + 3H_2O + \mathbf{3CO_2}$$

Aim

To use Alka seltzer tablets to model temperature changes caused by an enhanced greenhouse effect

Method

1. Set up four conical flasks and fill each one with 50 – 100 ml of tap water (depending on flask size)
2. To three of the flasks, add a different quantity of Alka seltzer tablets (½ tablet, 1 tablet, 2 tablets)
3. Cover the opening of the four flasks with a lump of clay and insert a thermometer into each flask (make sure the clay forms a seal around the neck and the thermometer hangs above the water)
4. Place each flask in front of a heat lamp (each flask should be equidistant from the source of heat)
5. Record the air temperature (ºC) in each flask at 2-minute intervals for a period of 20 minutes

Results

Tablet number	Air temperature (ºC)										
	0’	2’	4’	6’	8’	10’	12’	14’	16’	18’	20’
0											
½											
1											
2											

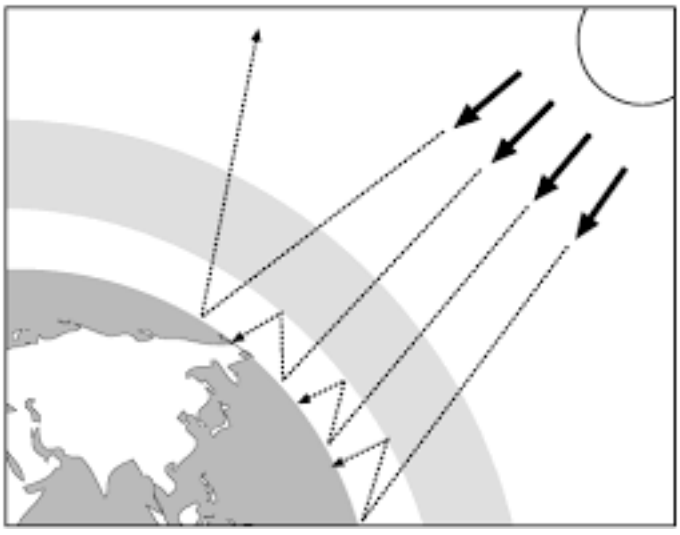
Discussion

1. Describe the trend seen in the data table (change in air temperature over time)

2. Identify a limitation in the experiment design that functions to invalidate the following conclusion:
   "Higher carbon dioxide concentrations result in higher air temperatures within the conical flasks"

3. Suggest an improvement to the design that would act to hasten changes in the dependent variable

4. Label the following picture and provide a brief explanation of the greenhouse effect



5. Research online to find the current level of atmospheric CO_2 and the level in the year you were born