

MODELLING CLIMATE CHANGE: ENERGY BALANCE AS A LEAKY BOTTLE

In this activity your teacher will demonstrate how energy flows and temperature changes can be modelled with a 'leaky bottle'. This model can be used to represent solar radiation, terrestrial radiation and the Earth's temperature. When energy inflow equals energy outflow the Earth's temperature is steady.

Task A Exploring energy flow and energy balance

1. Your teacher will demonstrate how a 'leaky bottle' can be used as a model of heating and cooling. What represents energy? What represents temperature?
2. The bottle is now set up so that water can flow into and out of the bottle at the same time. What happens to the level of the water? What can you say about the inflow rate and outflow rate once the water is steady?
3. Your teacher will now increase the inflow of water. What do you predict will happen? What do you observe?
4. What do you predict will happen if the water outflow is reduced?

Task B Exploring changes in the Earth's energy balance

5. The bottle model can be used to represent the energy transfer between the Sun, the Earth and space. What represents the temperature of the Earth? What represents the flow of energy from the Sun? What represents energy emitted by the Earth?
6. With the water level steady, your teacher will decrease the outflow rate very slightly. What does this model? What do you observe? What can you say about the system now?
7. Use your observations of the model to explain what happens to the Earth's temperature if emission of terrestrial radiation decreases (e.g. because of an increase in greenhouse gases).

