

How is carbon cycled?

This resource accompanies the article **Where has all the CO₂ gone?** in *Education in Chemistry* which can be viewed at: <https://rsc.li/3DuWN30>

Learning objectives

- 1 Identify key processes in the carbon cycle.
- 2 Describe the carbon cycle.

Students successfully completing the questions will show understanding of the learning objectives.

'Identifying key processes' is assessed using questions 2 and 3 of the prior knowledge section and 1(c) of the carbon cycle section.

'Describe the carbon cycle' is assessed using questions 2 and 3 of the carbon cycle section. The other questions are useful to check for misconceptions, allow pupils to apply their knowledge and interpret data from a table.

Prior knowledge answers

1. Carbon dioxide
2. Photosynthesis
3. Aerobic respiration
4. Glucose + oxygen → carbon dioxide + water
Glucose and carbon dioxide should be circled
5. Carbon dioxide + water → glucose + oxygen
Carbon dioxide and glucose should be circled

Carbon cycle answers

- (a) $123 + 92 = 215$ gigatons per year

(b) $60 + 60 + 90 = 210$ gigatons per year

(c) Combustion (allow other acceptable answers, eg farming, deforestation etc. Don't allow aerobic respiration as it's included in the 'animal respiration' section)

(d) $210 + 9 = 219$ gigatons per year of carbon dioxide **entering** the atmosphere
215 gigatons per year of carbon dioxide **leaving** the atmosphere
 $219 - 215 = 4$ gigatons per year
- Sketch to include:
 - An arrow from the atmosphere to a land plant labelled 'photosynthesis'
 - An arrow from the atmosphere to an aquatic plant labelled 'photosynthesis'
 - An arrow from a plant/animal to the atmosphere labelled 'respiration'
 - An arrow from a decomposer/something decaying to the atmosphere labelled 'respiration'
 - An arrow from an aquatic animal/plant to atmosphere labelled 'respiration'
 - An arrow from a factory/example of combustion to the atmosphere labelled 'human activity'
 - Other possible arrows may show the transfer of carbon via feeding or formation of fossil fuels
- Carbon dioxide absorbed from the air by photosynthesis is released by aerobic respiration by the plant. Via the food chain, carbon dioxide released by aerobic respiration of animals has originally come from plants storing carbon in the form of glucose by photosynthesis. This balance of photosynthesis and aerobic respiration keeps the carbon dioxide concentration fairly constant.
- This is a very open ended question and would make a good whole-class discussion. Possible answers might include:
 - More births → more aerobic respiration
 - More deaths → more aerobic respiration via decay or less aerobic respiration
 - More farming → more animals → more aerobic respiration
 - More combustion (linked to time of year and heating)
 - Deforestation
 - Trees losing leaves in winter → affects photosynthesis and aerobic respiration
 - Trees growing leaves in summer → affects photosynthesis and aerobic respiration