

# OCR A GCSE Chemistry

## Topic 6: Global challenges

### Interpreting and interacting with earth systems

#### Notes



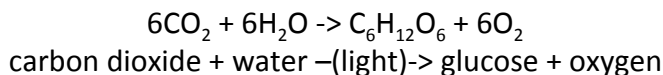


### *C6.3a interpret evidence for how it is thought the atmosphere was originally formed*

- Evidence is limited because of the time scale of 4.6 billion years
- One theory suggests that during the first billion years of the Earth's existence...
  - There was intense volcanic activity that released gases that formed the early atmosphere
    - At the start of this period, the atmosphere may have been like the atmospheres of Mars and Venus today, mainly CO<sub>2</sub> with little or no O<sub>2</sub>(g)
    - Volcanoes also produced nitrogen which gradually built up in the atmosphere & there may have been small proportions of methane (CH<sub>4</sub>) and NH<sub>3</sub>
  - Water vapour condensed to form the oceans
    - CO<sub>2</sub> dissolved in the water and carbonates were precipitated producing sediments, reducing the amount of CO<sub>2</sub> in the atmosphere

### *C6.3b describe how it is thought an oxygen-rich atmosphere developed over time*

- Algae & plants produced the O<sub>2</sub> that is now in the atmosphere by photosynthesis



- Algae first produced oxygen about 2.7 billion years ago and soon after this oxygen appeared in the atmosphere
- Over the next billion years plants evolved and the % oxygen gradually increased to a level that enabled animals to evolve

### *C6.3c describe the greenhouse effect in terms of the interaction of radiation with matter within the atmosphere*

- Greenhouse gases maintain temperatures on Earth high enough to support life
  - Include: water vapour, CO<sub>2</sub> & CH<sub>4</sub>
- Explanation of the greenhouse gas effect:
  - Electromagnetic radiation at most wavelengths from the sun passes through the Earth's atmosphere
  - The Earth absorbs some radiation and thus warms up (essential for life on Earth). But some heat is radiated from the Earth as infrared radiation.
  - Some of this IR radiation is absorbed by greenhouse gases in the atmosphere
  - Atmosphere warms up leading to the greenhouse effect and global warming





*C6.3d evaluate the evidence for additional anthropogenic (human activity) causes of climate change and describe the uncertainties in the evidence base*

- Human activities increase levels of  $\text{CO}_2$  &  $\text{CH}_4$
- Examples include
  - Driving ( $\text{CO}_2$ )
  - Raising livestock (cows –  $\text{CH}_4$ )
- Based on peer-reviewed evidence, many scientists believe that human activities will cause the temperature of the Earth's atmosphere to increase at the surface and that this will result in global climate change
  - But, it is difficult to model such complex systems as global climate change.
  - This leads to simplified models, speculation and opinions presented in the media that may be based on only parts of the evidence and which may be biased.
- However, graphs can show a correlation between change in atmospheric carbon dioxide concentration (a greenhouse gas) and the consumption of fossil fuels

*C6.3e describe the potential effects of increased levels of carbon dioxide and methane on the Earth's climate and how these effects may be mitigated*

- An increase in average global temperature is a major cause of climate change, this is due to increased levels of greenhouse gases – such as  $\text{CO}_2$  and  $\text{CH}_4$
- There are several potential effects of global climate change
  - Extinction of species
  - Raising sea levels due to the melting of polar ice caps
  - Increased risk of skin cancer due to more dangerous UV rays hitting the surface of the Earth
- Must consider the scale of increased levels of  $\text{CO}_2$  and  $\text{CH}_4$ , the risk they pose and environmental implications

*C6.3f describe the major sources of carbon monoxide, sulfur dioxide, oxides of nitrogen and particulates in the atmosphere and explain the problems caused by increased amounts of these substances*

- Most fuels, including coal, contain carbon and/or hydrogen and may also contain some sulfur. These gases are released into the atmosphere when a fuel burns may include carbon dioxide, water (vapour), carbon monoxide, and oxides of nitrogen (which are formed at high temperatures). Solid particles (particulates) may also be released.
- If there's not enough oxygen, some of the fuel doesn't burn – this is partial combustion. Here, solid particles of soot (carbons) and unburnt fuel are released. Carbon monoxide is also released.





problems with these substances:

- Carbon monoxide is toxic – causing breathing difficulties
- Sulfur dioxide and oxides of nitrogen cause acid rain, carbon dioxide causes global warming, and solid particles cause global dimming.

*C6.3g describe the principal methods for increasing the availability of potable water in terms of the separation techniques used*

- potable water: it is suitable for drinking so must have:
  - low levels of microbes
  - low levels of contaminating substances
  - it is not the same as pure water but is still safe
- making waste and ground water potable:
  1. sedimentation: large insoluble particles will sink to the bottom of the water
  2. filtration: water is filtered through beds of sand which removes small insoluble particles
  3. chlorination: chlorine gas is put through water to kill microbes
- making sea water potable using distillation:
  1. filter the seawater
  2. boil it
  3. water vapour is cooled and condensed
- water used in analysis:
  - must be pure because any dissolved salts could react with the substances you are analysing, leaving you with a false result

