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_2 with little or no $O_2(g)$
        - Volcanoes also produced nitrogen which gradually built up in the atmosphere & there may have been small proportions of methane (CH_4) and NH_3
    - Water vapour condensed to form the oceans
        - CO_2 dissolved in the water and carbonates were precipitated producing sediments, reducing the amount of CO_2 in the atmosphere

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

- Algae & plants produced the O_2 that is now in the atmosphere by photosynthesis

$$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$$

carbon dioxide + water –(light)-> glucose + oxygen

- 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_2 & CH_4
- 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 CO_2 & CH_4
- Examples include
    - Driving (CO_2)
    - Raising livestock (cows – 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 CO_2 and 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 CO_2 and 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