

4.2 Carbon Cycling & Climate Change

Question Paper

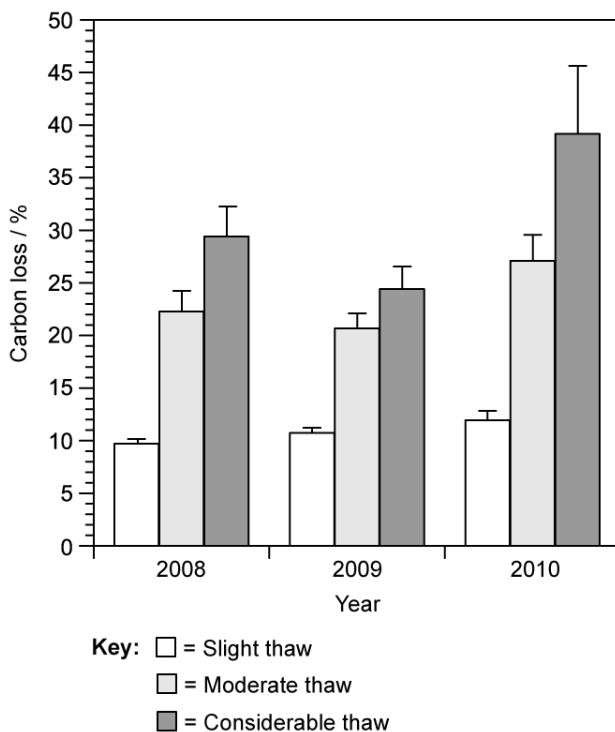
Course	DP IB Biology
Section	4. Ecology
Topic	4.2 Carbon Cycling & Climate Change
Difficulty	Hard

Time allowed: 60
Score: /42
Percentage: /100

Question 1a

a)

Tundra soils are mainly composed of peat that forms in the extreme cold conditions found within this ecosystem. Peat contains large amounts of carbon which is released when the tundra soils thaw during warmer seasons. Scientists investigated the amount of carbon released from tundra soils at one location, that were thawed to different extents over the course of three years. The results from this investigation can be seen in the graph below.



Explain why tundra soils act as a carbon store.

[2 marks]

[2 marks]

Question 1b

b)

Calculate the difference in the mean carbon loss that occurred in tundra soils that were thawed considerably and those that were thawed slightly. Show your working.

[2 marks]

[2 marks]

Question 1c

c)
Compare the rate of carbon release in moderately thawed soils with those in soils that were considerably thawed.

[2 marks]

[2 marks]

Question 1d

d)
Scientists concluded that the carbon released from the considerable thawing of tundra soils will lead to a further increase in global temperatures.

Evaluate this statement based on the investigation that was done.

[2 marks]

[2 marks]

Question 2a

a)

The following data show fluxes in carbon between different storage reserves in an ecosystem, measured in gigatonnes per year (GT yr^{-1}). A gigatonne equals 1 billion tonnes.

Process of carbon transfer	Flux / GT yr^{-1}
Release from the oceans	101
Ocean dissolving	104
Release from soil	62
Incomplete decomposition	52
Respiration of terrestrial organisms	53
Photosynthesis	117
Deforestation	2.0
Combustion of fossil fuels	4.9

i)

Calculate the net flux of carbon. Show your working.

[2 marks]

ii)

State the direction of this movement with regards to the atmosphere.

[1 mark]

[3 marks]

Question 2b

b)

Explain how the combustion of fossil fuels can affect the carbon balance in the atmosphere.

[2 marks]

[2 marks]

Question 2c

c)

Estimating global carbon fluxes are of great interest to scientists, even though it may be challenging to make accurate measurements.

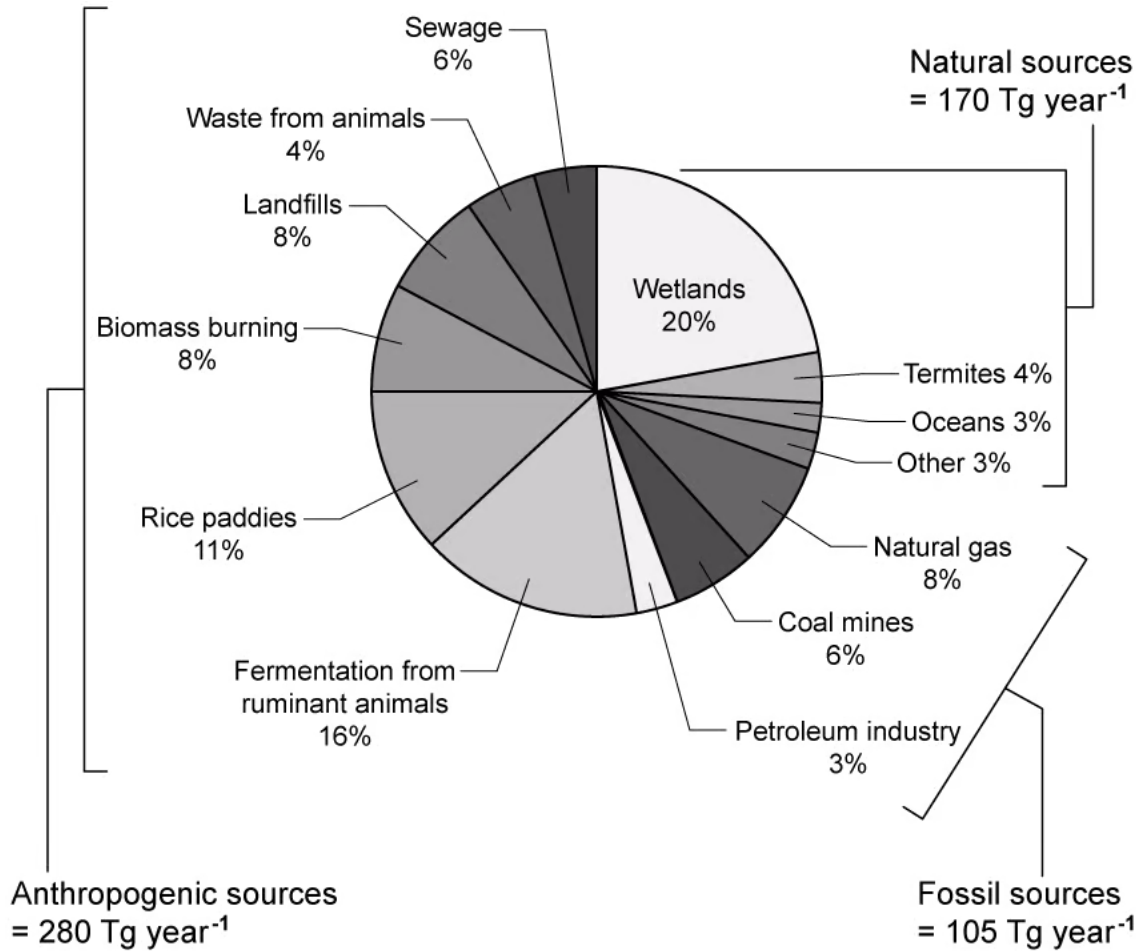
Discuss the scientific importance of estimating carbon fluxes.

[2 marks]**[2 marks]**

Question 3a

a)

Methane is an example of a greenhouse gas that commonly occurs in the atmosphere. The graph below shows the main sources of methane as well as the percentage contribution of the different components of each source. A teragram (Tg) equals 10^{12} grams and is equivalent to one megatonne (1 million tonnes).



Calculate the amount of methane, in Tg year⁻¹, that is released from wetlands. Show your working.

[2 marks]

[2 marks]

Question 3b

b)

Suggest a reason why wetlands would be the largest contributor of atmospheric methane, as shown in the graph above.

[2 marks]

[2 marks]

Question 3c

c)

Recent studies predict a decrease in levels of hydroxyl radicals in the atmosphere of between 10% and 16%. Hydroxyl radicals are often called the 'detergent of the atmosphere' and plays an important part in regulating atmospheric levels of gases such as methane.

i)

Predict the possible long-term effect these decreased levels of hydroxyl radicals could have on atmospheric concentrations of methane.

[1 mark]

ii)

Explain your answer to part c) i).

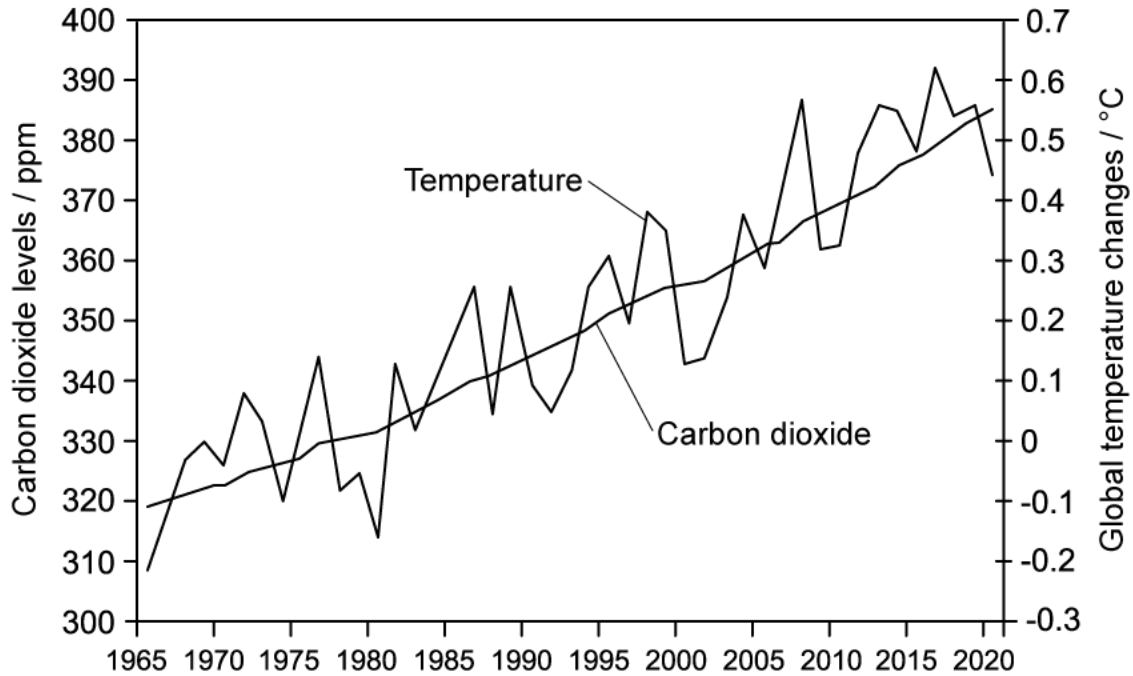
[1 mark]

[2 marks]

Question 4a

a)

Carbon dioxide is one of the main greenhouse gases in the atmosphere. The graph below shows the changes of carbon dioxide levels in the atmosphere, as well as the change in global temperatures over a period of time.



Describe the general trends in the data.

[3 marks]

[3 marks]

Question 4b

b)

Suggest possible causes of the trends in the data presented in part (a).

[2 marks]

[2 marks]

Question 4c

c)

Discuss the importance of greenhouse gases, such as carbon dioxide, in the atmosphere.

[2 marks]

[2 marks]

Question 5a

One mark is available for clarity of communication throughout this question.

a)

Coal, oil and natural gas are all examples of fossil fuels that can be utilised as an energy source.

Compare and contrast the formation of coal with that of oil and natural gas.

[5 marks]

[5 marks]

Question 5b

b)

The amount of carbon in the atmosphere is constantly changing over time. Carbon dioxide and methane gases contribute to carbon levels in the atmosphere and have important impacts on the planet.

Discuss the importance of obtaining reliable data on the atmospheric concentration of these gases over time.

[6 marks]

[6 marks]

Question 5c

c)

Suggest the possible impact that an increase in global temperatures would have on the polar regions, as well as the global consequences of this impact.

[3 marks]

[3 marks]

