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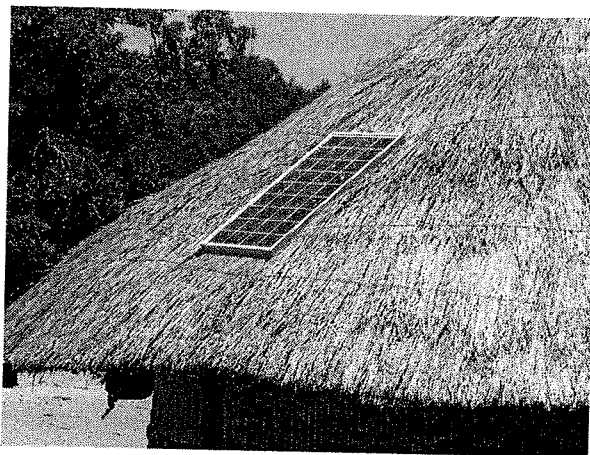
IB ESS

7.3 Climate Change – Mitigation and Adaptation

Significant ideas:

Mitigation attempts to reduce the causes of climate change.

Adaptation attempts to manage the impacts of climate change.



Mitigation

1. Describe what is meant by the term "mitigation":

The Intergovernmental Panel on Climate Change (2014) defines mitigation as 'A human intervention to reduce the sources or enhance the sinks of greenhouse gases (GHGs).'

2. Complete the sentences below about climate change mitigations.

emissions industrial revolution carbon dioxide immediately
greenhouse gas limit past emissions

Mitigation strategies to reduce the causes of climate change may involve reducing greenhouse gas emissions, or by using carbon dioxide reduction (CDR) techniques.

Limiting the amount of greenhouses gases in the atmosphere may help limit the extent of anthropogenic global climate

change, but this would not happen immediately. If we somehow

limit emissions to pre-1840s (pre industrial revolution) levels, the effects of climate changed will still be

observed for some time because past emissions will

continue to have an effect for years to come.



3. Mitigation strategies often involve attempts to reduce the release of greenhouse gases into the atmosphere.

The table below lists some of the ways that greenhouse gas levels could be reduced. For each one add at least two more suggestions as to how these ideas might be implemented.

| Strategy | Examples |
|--------------------------------------|--|
| Reduce energy consumption | <ol style="list-style-type: none"> 1. Use heating and air conditioning less at home. E.g. wear more layers to keep warm or use a fan instead of an air con. 2. <u>Switch off lights and TVs when not in use</u> 3. <u>Use less private transport or bike or walk instead.</u> |
| Reduce agriculture methane emissions | <ol style="list-style-type: none"> 1. Avoid wool products (as sheep produce methane). 2. <u>Change the diet of cows to reduce the amount of methane they produce.</u> 3. <u>Reduce the amount of dairy and meat consumption so there are fewer animals needed.</u> |
| Reduce oxides of nitrogen emissions | <ol style="list-style-type: none"> 1. "Congestion charges" in cities can be implemented by governments to reduce car use. 2. <u>Reduce the use of chemical fertilizer use organic instead.</u> 3. <u>Planting fallow fields with nitrogen-fixing legume crops.</u> |
| Use alternatives to fossil fuels | <ol style="list-style-type: none"> 1. Governments should invest in wind farms. 2. <u>Link several countries into a single grid - this could tap the strong solar + wind potential of some places.</u> 3. <u>Greater use of PV cells to convert light energy into electrical energy.</u> |
| Geo-engineering | <ol style="list-style-type: none"> 1. Release sulphur dioxide from planes as this may increase global dimming. 2. <u>Place giant mirrors in space in order to deflect incoming solar radiation</u> 3. <u>Scatter iron, nitrates or phosphates on oceans to increase algal blooms which act as carbon sinks.</u> |

Optional revision task: look at your examples above and decide which environmental value system is reflected in each one.



4. Carbon dioxide removal (CDR) is potentially a useful way to mitigate climate change causes. Summarise the following CDR techniques. Add examples where relevant:

Protecting/enhancing carbon sinks

Protecting and enhancing carbon sinks through land management
eg. United Nations - Reduction of Emissions from Deforestation and Forest Degradation in Developing Countries programme (UN-REDD)
Increasing photosynthesis by reforestation and restoring grasslands

Bio-fuels

Biomass can be used as a fuel source. There are many ways in which biomass can be grown and converted into fuels eg. biogas from Indian villages or on a larger scale in fermenters or biodiesel and ethanol from waste organic matter or waste vegetable oils or from planting crops such as sugarcane.

Carbon capture storage : capture the carbon dioxide before it is released into the atmosphere
- capture gas at the site where it is produced and then store it underground in a geological deposit (eg. abandoned oil reservoir)
- allow gas to enter the atmosphere but then remove it directly from the atmosphere using specially designed removal processes
eg. storing it in mineral carbonates.

Enhancing ocean absorption

Fertilizing the ocean with compounds of iron, nitrogen and phosphorus. This introduces nutrients to the upper layers of the oceans, increases marine food production and removes carbon dioxide from the atmosphere. In some cases it may trigger an algal bloom that will trap carbon dioxide and sink to the ocean floor.



Adaptation

1. Describe what is meant by the term "adaptation" with regards to climate change.

Adaptation aims to reduce adverse effects and maximise any positive effects. Adaptation initiatives and measures aim to reduce the vulnerability of natural and human systems against actual or expected climate change effects.

2. Describe possible strategies of adaptation to climate change. Use the headings to guide your answer

Vaccination programmes

These are vaccination against water-borne diseases such as typhoid which may become more common with increased flooding. Some diseases eg malaria will spread their geographical range.

Flood defense

Plan water catchment and run-off to minimize flooding.
Build houses on stilts or with garages that can be flooded underneath.

Desalinization

More desalinization plants will be required to cope with the change in the supply and the demand for water. These are expensive and some LEDC may struggle to meet the demand for fresh water.

New crop locations

As the biomes shift north and south away from the equator, crops will need to be planted accordingly. Some new areas may be added, others might disappear.

New crop types

Crop varieties must be made more resilient to higher temperatures and more frequent flooding or drought.

Weather control

The weather could be managed by seeding clouds to encourage rainfall and planting more trees to encourage rainfall.



Migrate

Move to areas less prone to flooding or draught.
move into formerly less hospitable biomes.

3.

a) Explain what is meant by the term "adaptive capacity".

the ability or potential of a system to respond successfully to climate variability and change, and include adjustments in both behaviour and in resources and technologies

From IPCC report 2007

b) In your opinion, does your home nation have relatively small, medium or large adaptive capacity? Justify your opinion.

Oman - has medium adaptive capacity

We have the financial and technological resources necessary
But with 3165 km of coastline flood defense is a challenge
and with an extremely hot and dry climate growing crops
would become even more challenging.



International Efforts Towards Tackling Climate Change

1. Explain why international efforts to tackle climate change are necessary.

Climate change is a global issue and results in an increase of global temperatures that will impact all countries regardless of their own level of emissions. Limits need to be set that are adhered to by all countries regardless of economic development.

2. Complete the table below to summarize the details and work of the IPCC.

| | |
|--|--|
| Full title for the IPCC: | Intergovernmental Panel on Climate Change |
| Established in the year... | 1988 |
| Established by... | United Nations Environmental Programme (UNEP) + World Meteorological Organization |
| Number of climatologists involved: | over 2000 |
| Main activity: | Provide at regular intervals an assessment of the state of knowledge on climate change |
| Years in which reports were published: | 1990, 1995, 2001, 2007, 2014 |



3. Describe the Kyoto protocol and evaluate its effectiveness.

In 1997 at an international and intergovernmental meeting in Kyoto, Japan 183 countries signed an agreement that called for the reduction of GHG emissions by 5% of their 1990 levels by 2012.

Countries were allocated amounts of CO₂ they were allowed to emit. These permitted levels were divided into units and countries with units to spare could sell them to other countries that might go over their allowance. (carbon market)

It was due to expire in 2012 but was extended.

The use of alternative energy sources is encouraged such as greater use of hydro-electric, solar and wind power.

The majority of carbon emission targets relate to MEDCs. In the future it will be essential that LEDCs are brought into the agreement as they will be responsible for an increasing proportion of CO₂ emissions.

Economic and social considerations make this difficult to negotiate as LEDC rightly say that development in the MEDCs was allowed without these restrictions.

- The success of these agreements depend on;
- the extent to which governments wish to sign up to the international agreement
 - whether governments are preventive or reactive

Because of this and the disparity of MEDCs and LEDCs a new approach to energy generation is needed.



4. In the space below, draw a timeline of major international commitments for tackling climate change.

