Human activity and impact


Name	_____
Class	_____
Teacher	_____

L1 Cycling in ecosystems.

An ecosystem is a community of living organisms (plants, animals, and microbes) interacting with their non-living environment (weather, earth, sun, soil, climate, and atmosphere). In an ecosystem, materials like carbon and water are constantly being cycled through both the living (biotic) and non-living (abiotic) components. This cycling is essential for the survival of all organisms.

The Carbon Cycle

1. **Photosynthesis:** Plants absorb carbon dioxide (CO_2) from the atmosphere and, using sunlight, convert it into oxygen (O_2) and glucose (a type of sugar) during photosynthesis.

2. **Consumption:** Animals eat plants (and other animals) and use the carbon in their bodies to build tissues and generate energy.

3. **Respiration:** Both plants and animals release CO_2 back into the atmosphere through respiration, a process that breaks down glucose for energy.

4. **Decomposition:** When organisms die, decomposers like bacteria and fungi break down their bodies. This process returns carbon to the soil and releases CO_2 into the atmosphere.

5. **Fossil Fuels:** Over millions of years, some dead organisms become fossil fuels (coal, oil, natural gas). When humans burn these fuels, CO_2 is released back into the atmosphere.
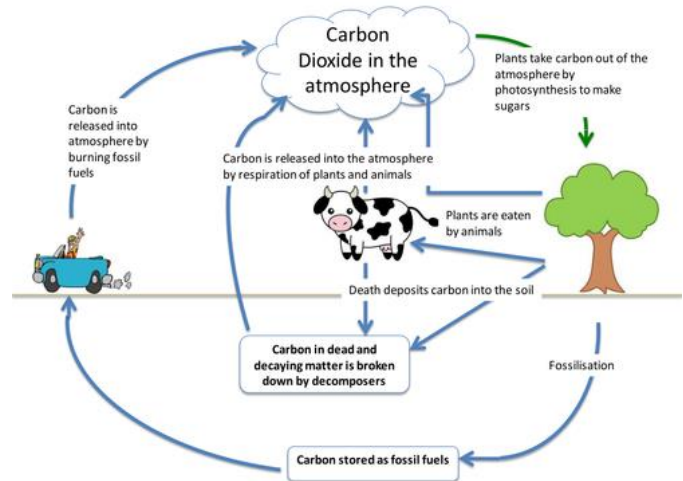
The Water Cycle

Water is continuously cycled through the environment in the water cycle, which consists of several key processes:
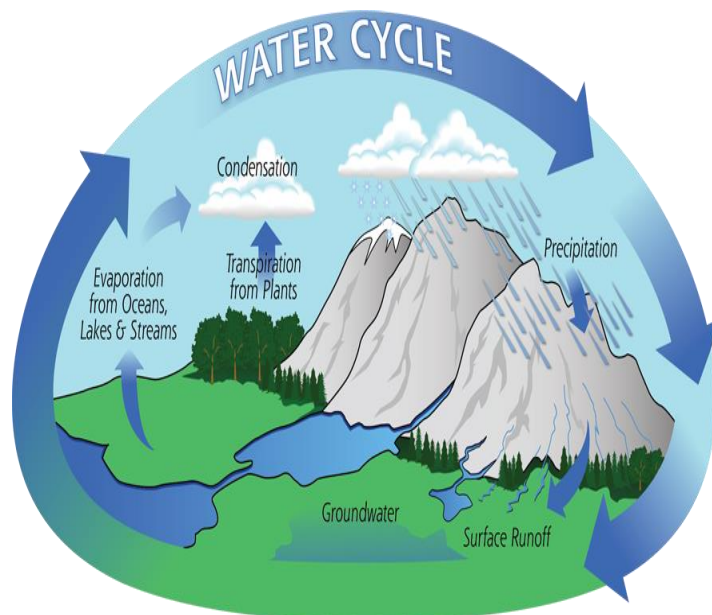
1. **Evaporation:** Water from oceans, lakes, rivers, and soil evaporates into the atmosphere due to the sun's heat.

2. **Transpiration:** Plants also release water vapor into the air through a process called transpiration.

3. **Condensation:** As the water vapor rises, it cools and condenses to form clouds.

4. **Precipitation:** When the clouds become heavy, water falls back to Earth as rain, snow, sleet, or hail.

5. **Surface run off/Ground water flow :** Water collects in bodies of water like rivers, lakes, and oceans. Some of it infiltrates into the ground and becomes groundwater, which plants and animals can use.

The Role of Microorganisms

Microorganisms, such as bacteria and fungi, play a crucial role in cycling materials in ecosystems:

- **Decomposers:** These tiny organisms break down dead plants and animals. In doing so, they return carbon to the atmosphere as CO_2 and release mineral ions back into the soil, which plants use to grow.

- **Nutrient Recycling:** Microorganisms help recycle nutrients, making them available for use by living organisms again. Without them, dead matter would accumulate, and essential nutrients would be locked away, unavailable for new life.

Importance to Living Organisms

- **Carbon Cycle:** The carbon cycle is essential for the production of energy in living organisms. Plants use CO_2 for photosynthesis, which is the foundation of the food chain. Animals, including humans, rely on plants and other animals for food, making the carbon cycle critical for survival.

- **Water Cycle:** The water cycle provides fresh water, which is necessary for all living organisms. It ensures that water is available in different parts of the ecosystem, allowing plants to grow and animals to hydrate.

Independent practice – Answer questions in book in full sentences

1. State what process absorbs Carbon dioxide from the atmosphere?
2. Give the word equation for photosynthesis.
3. State what animals use carbon for.
4. Define transpiration.
5. What are decomposers?

Finish the sentences

6. In the water cycle clouds…..
7. In the water cycle water……
8. The water cycle is…..

This question is about carbon.
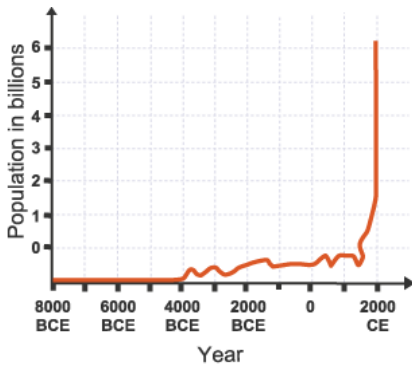
9. The diagram shows part of a carbon cycle in a habitat.
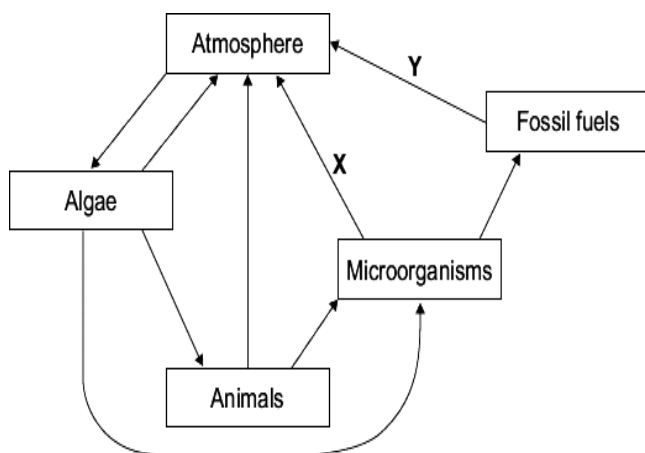
(a)   Name the processes shown by arrows **X** and **Y**.

(b)   Describe the part played by algae in this carbon cycle.

(c)   In tropical rainforests process **X** is much faster than in most other habitats. Suggest why

L2 Pollution and land use

The Impact of Human Population Growth

There are many reasons why our population increases:

- better health care so people are living longer
- new medicines are being developed so people don't die of previously fatal diseases
- farmers can produce more food using new breeds and equipment
- some religions do not permit the use of *contraception*

As the human population grows rapidly and living standards rise, we use more resources and produce more waste. If we don't handle this waste properly, it leads to pollution, which harms the environment.

Types of Pollution

Pollution can affect our planet in various ways:

- **Water Pollution**: This occurs when sewage, fertilizers, or toxic chemicals enter water bodies like rivers, lakes, and oceans. This contamination harms aquatic life and can make water unsafe for drinking and recreation.
- **Air Pollution**: Smoke and acidic gases released from factories, vehicles, and other sources pollute the air. This can cause health problems for humans and animals, and damage plants.
- **Land Pollution**: Dumping waste in landfills and using toxic chemicals can contaminate the soil. This affects plants' ability to grow and can harm animals that live in or use the soil.

Pollution kills plants and animals, reducing biodiversity, which is the variety of life in an area. This loss of biodiversity makes ecosystems less stable and resilient.

Land Use and Its Effects

Humans use land for various purposes, which reduces the space available for other species:

- **Building**: Constructing homes, roads, and cities takes up land that was once habitats for plants and animals.
- **Quarrying**: Extracting resources like stone and minerals changes the landscape and destroys habitats.
- **Farming**: Large areas of land are cleared for agriculture, which often involves using chemicals that can harm the environment.
- **Dumping Waste**: Landfills take up space and can pollute the land and water nearby.

One specific example of harmful land use is the destruction of peat bogs. Peat bogs are unique wetlands that support diverse species of plants, animals, and microorganisms. When peat is harvested for garden compost, these habitats are destroyed, reducing biodiversity. Additionally, when peat decays or is burned, it releases carbon dioxide (CO_2) into the atmosphere, contributing to global warming.

4

Independent practice – Answer questions in book in full sentences

1. How has healthcare impacted human growth?
2. What can contaminate rivers?
3. How do land fills affect plant growth?
4. What are peatbogs?
5. Describe the different ways that humans use the land, and how this impacts wildlife.

Exam questions

6. Human activities have many effects on our ecosystem. The graph shows the volume of peat compost and peat-free compost used in gardening from 1999 to 2009.
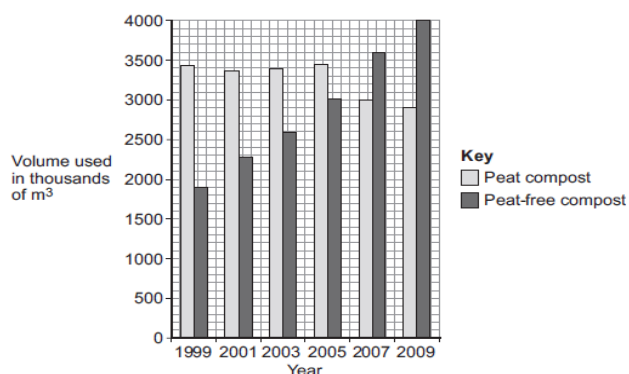
(a) Describe the trends shown in the graph. (2)

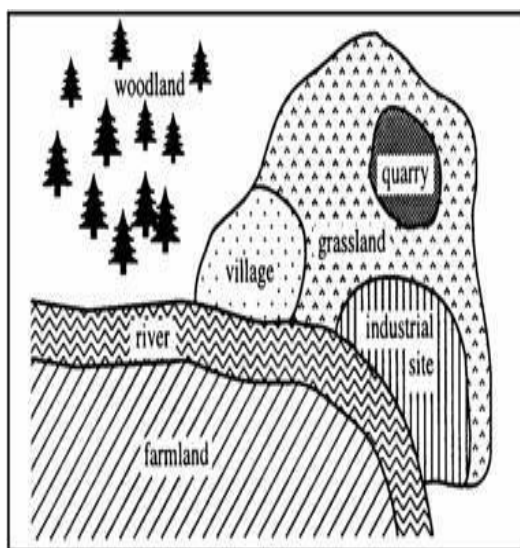(b) What effect does the destruction of peat bogs have on the gases in the atmosphere? (1)

7. The pie diagram shows the quality of river water in England and Wales in 1985.
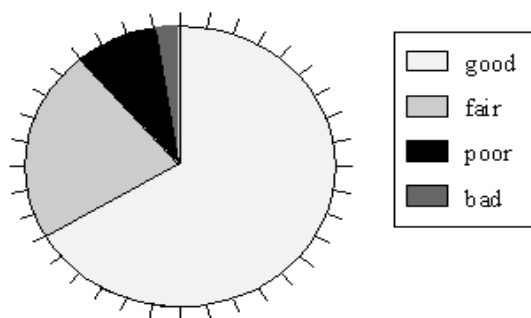
(a) What proportion of the rivers had good quality water?

(b) Give **two** ways in which rivers may become polluted.

8. The diagram shows a village and its surroundings.

a) Use words from the list to complete the sentences about pollution.

oxygen   pesticides   sewage   sulphur dioxide

The air might be polluted by _____ from the industrial site.

The river might be polluted by _____ from the village and

by _____ from the farmland.

(b) The owners of the quarry want to make it larger. Give **one** effect that this might have on wild plants and animals that live near the quarry.

L3 Deforestation and global warming

Deforestation is the process of clearing large areas of forests, and it has significant impacts on the environment. In tropical areas, deforestation happens for several reasons:

1. **Land for Cattle and Rice Fields**: Large forested areas are cleared to create land for cattle ranching and rice farming. These activities are important for providing food, but they can be harmful to the environment. When forests are cut down, the land is often used for agriculture, which can lead to soil degradation and loss of biodiversity.

2. **Crops for Biofuels**: Another reason for deforestation is to grow crops used in making biofuels. Biofuels are alternative sources of energy made from plant materials. While biofuels are considered more environmentally friendly than fossil fuels, the deforestation needed to grow these crops can negate some of the environmental benefits.

Global Warming

Global warming refers to the increase in Earth's average surface temperature due to rising levels of greenhouse gases in the atmosphere.

1. **Greenhouse Gases**:

   o **Carbon Dioxide (CO_2)**: Released from burning fossil fuels, deforestation, and various industrial processes. CO_2 is the most significant greenhouse gas contributing to global warming.

   o **Methane (CH_4)**: Emitted during the production and transport of coal, oil, and natural gas. It is also released by livestock and other agricultural practices.

   o **Water vapour**

The greenhouse effect is a natural process that warms the Earth's surface. It is crucial for making our planet habitable, but human activities have intensified this effect, leading to global warming. Here's how the greenhouse effect works and why it's important:

How the Greenhouse Effect Works

1. **Solar Radiation**: The sun emits energy in the form of light and heat. This solar radiation reaches the Earth, where some of it is absorbed by the surface, warming the planet.
2. **Heat Absorption and Emission**: The Earth's surface absorbs solar energy and then radiates it back into the atmosphere as infrared radiation (heat). However, not all of this heat escapes into space.
3. **Heat Retention**: When greenhouse gases absorb infrared radiation, they re-radiate the heat in all directions, including back towards the Earth's surface. This process keeps the planet warmer than it would be if all the heat escaped into space.
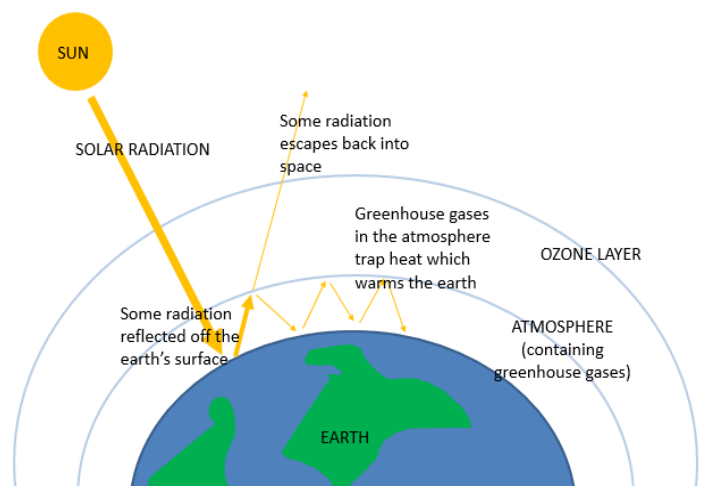
2. **Biological Consequences**:

- o **Habitat Destruction**: As temperatures rise, many species lose their natural habitats. For instance, polar bears are losing their ice habitats in the Arctic, and coral reefs are dying due to warmer ocean temperatures.

- o **Changes in Migration Patterns**: Many animals, like birds and fish, are changing their migration patterns in response to shifting climates. This can disrupt ecosystems and food chains.

- o **Extreme Weather Events**: Global warming is linked to more frequent and severe weather events, such as hurricanes, droughts, and floods. These events can destroy habitats and lead to loss of life.

- o **Impact on Agriculture**: Changes in temperature and precipitation patterns can affect crop yields. Some areas may experience reduced agricultural productivity, leading to food shortages and economic challenges.

Independent practice – Answer questions in full sentences in your book.

1. Define deforestation.
2. State the human activities that increase the amount of greenhouse gases in the atmosphere.
3. Correct this statement "Global warming is where the earth gets colder."
4. Explain how the greenhouse effect causes the Earth to get warmer.
5. How has the destruction of forests caused an increased Greenhouse effect?
6. It is suggested that the increased level of carbon dioxide in the air is causing the atmosphere to warm up (the "Greenhouse Effect"). Describe, as fully as you can, **two** major effects of global warming and how these may affect the human population.

The graph shows changes in temperature and in carbon dioxide concentration in the earth's atmosphere between 1860 and 1990.
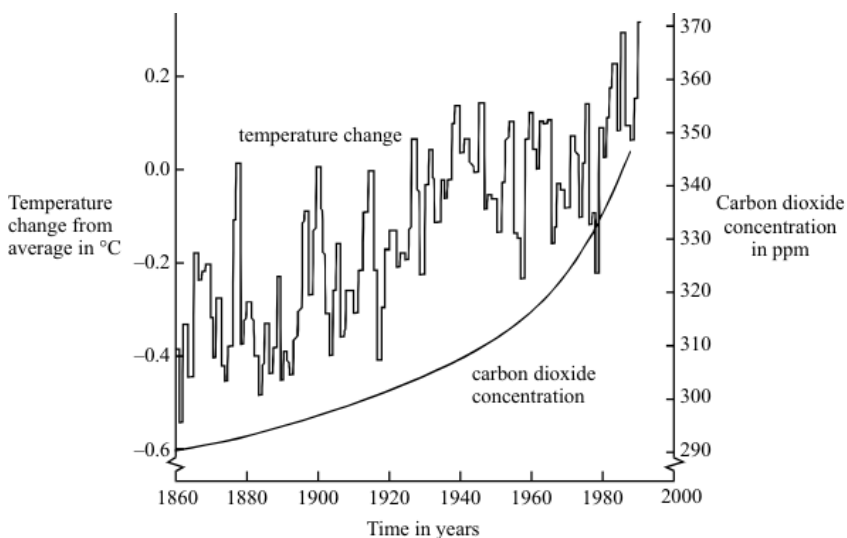
(a) Give two human activities which may have helped to increase the concentration of carbon dioxide in the atmosphere.

(b) (i) Describe the changes in temperature shown by the graph between 1860 and 1990.

(ii) Do the data in the graph prove that increased carbon dioxide concentrations in the atmosphere caused the changes in temperature you described in part (b)(i)? Give a reason for your answer.

Here's a set of data for the number of trees cut down each year in the UK over seven years:

Year	Trees Cut Down (in thousands)
2017	150
2018	170
2019	160
2020	180
2021	200
2022	220
2023	210

Plot the data as a line graph, and draw a line of best fit.

L4 Maintaining biodiversity

Biodiversity is the variety of all different species of organisms on Earth or within a specific ecosystem. It includes every living thing, from plants and animals to fungi and microorganisms. High biodiversity means there are many different species living together in one area.

Importance of Biodiversity

Biodiversity is crucial for the stability of ecosystems. Here's why:

- **Ecosystem Stability**: A diverse ecosystem is more resilient and stable. This means it can better withstand environmental changes and disruptions, like extreme weather or disease.

- **Interdependence**: In ecosystems with high biodiversity, species rely on each other less for food and shelter. If one species is affected, others can still survive because they have multiple sources of food and shelter.

- **Physical Environment Maintenance**: Biodiverse ecosystems help maintain the physical environment, like soil fertility and water quality, which are essential for all life forms.

Human Impact on Biodiversity

The future of the human species depends on maintaining a good level of biodiversity. However, many human activities are harming biodiversity:

- **Deforestation**: Cutting down forests for timber, agriculture, or urban development destroys habitats.

- **Pollution**: Chemicals, plastics, and other pollutants harm wildlife and their habitats.

- **Climate Change**: Burning fossil fuels increases greenhouse gases, leading to climate change that affects habitats and species.

- **Overfishing and Hunting**: Overexploitation of species can lead to their decline or extinction.

- **Urbanization**: Expanding cities can lead to habitat loss and fragmentation.

Positive and Negative Human Interactions

Humans interact with ecosystems in ways that can be both positive and negative:

Negative Interactions:

- **Habitat Destruction**: Clearing land for agriculture, roads, and buildings.

- **Pollution**: Releasing harmful substances into the air, water, and soil.

- **Overexploitation**: Excessive hunting, fishing, and harvesting of plants and animals.

Positive Interactions:

- **Conservation Efforts**: Setting aside protected areas like national parks and wildlife reserves.

- **Sustainable Practices**: Using resources in ways that do not deplete them, such as sustainable fishing and logging.

- **Rehabilitation**: Restoring damaged ecosystems, like replanting forests and cleaning up polluted areas.

Conservation Programs

Scientists and concerned citizens have created programs to help reduce the negative effects of humans on ecosystems and biodiversity. These include:

- **Breeding Programs for Endangered Species**: These programs help increase the populations of species at risk of extinction by breeding them in controlled environments and then reintroducing them into the wild.

- **Protection and Regeneration of Rare Habitats**: Efforts are made to protect and restore habitats that are rare or have been degraded, ensuring they can support diverse species.

- **Reintroduction of Field Margins and Hedgerows**: In agricultural areas where only one type of crop is grown, reintroducing field margins and hedgerows provides habitats for wildlife and increases biodiversity.

- **Reduction of Deforestation and CO_2 Emissions**: Some governments are implementing policies to reduce deforestation and lower carbon dioxide emissions to combat climate change.

- **Recycling Resources**: Encouraging recycling reduces the amount of waste sent to landfills and minimizes the extraction of new raw materials, helping to preserve natural habitats.

Independent practice – Answer questions in full sentences in book

1. Define biodiversity.
2. Explain why a desert has a lower biodiversity than a rainforest.
3. Explain the term interdependence.
4. Explain the negative impact of humans on biodiversity.
5. Explain the positive impacts of human impact on biodiversity.
6. Describe what conservation programs are and why they are important.
7. What is a potential risk of breeding programs?
8. Explain what actions an individual person can do to help reduce human impact on biodiversity.
9. The graph below shows the money spent on conserving biodiversity in the UK by the government.
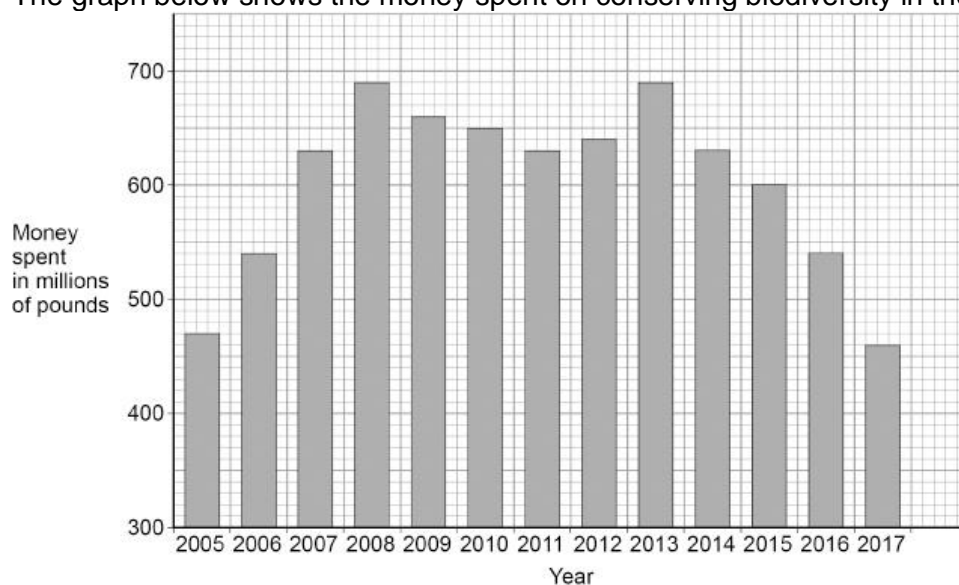
(a) Describe the trends in the money spent on conserving biodiversity from 2005 to 2011. Use data from the graph above in your answer. **(2)**

(b) Calculate the percentage decrease in the money spent on conserving biodiversity from 2013 to 2017. Use the equation:

$$\text{percentage decrease} = \frac{\text{change in money spent from 2013 to 2017}}{\text{money spent in 2013}} \times 100$$

Give your answer to 2 significant figures. **(3)**

L5 Sampling

There are multiple methods of sampling that can be done to investigate the population of species. The method used will vary depending on what the purpose of the investigation is. Random sampling is used if you want to investigate the population size in a specific area, while a belt/line transect is used to investigate how the population changes due to with a biotic or abiotic factor. Both types of sampling use a quadrat.

Random sampling.

We can count the numbers of a species within small sections of the whole area. Then we can calculate a mean and multiply up to the whole area.

It is important to avoid bias when measuring the population, and to do this the samples must be done randomly. To do this draw a grid over a map of the area and then use a random number generator to determine where to place the quadrats. Throwing the quadrat IS NOT an acceptable method to achieve randomness.

The base method is consistent, and will only need minor adaptations based on the question.

1. Place the quadrat **randomly**
   - using a random number generator.
2. •Count and **record** the number of organisms
3. Only count organism that are 50% or more in the square
4. •Take at least 10 samples
5. •Work out the **mean number** of organisms in each quadrat
6. •Multiply by the area to estimate the total number in the site

You can use this method to compare the populations in two areas, for example if you wanted to compare the population in a field with higher soil acidity than another. You would carry out the same method, with an additional step to record the soil pH with a pH meter.

Belt/Line transect

This methodology is done to see how the population changes across an area.

1. **Lay Out a Transect Line**: Place a transect line across the study area. This line will guide your sampling.

2. **Place Quadrats Along the Transect**: At regular intervals (e.g., every 5 meters), place a quadrat next to the transect line.

3. **Count Individuals Within the Quadrat**: For each quadrat, count the number of individuals of the target species.

4. **Record Environmental Data**: Measure the environmental factor (e.g., light intensity using a light meter) at each quadrat location.

When you do a belt transect you only calculate a mean if you repeat the whole experiment along different transect lines in the area. For example if you did it 3 times in field for each distance from the starting point you would do the mean for those 3 quadrats.

Independent practice

1. Name the two types of sampling.
2. State when to use each type of sampling.
3. In which type of sampling will you always calculate a mean?
4. Describe a method to investigate the number of buttercups in the field.
5. Some students estimated the population of daisy plants in a field.

This is the method used.

1. Place a quadrat randomly on the field.
2. Count and record the number of daisy plants in the quadrat.
3. Repeat steps 1 and 2 another four times.

(a)   How could the students have made sure the quadrats were placed randomly? **(1)**

(b)   Describe the piece of equipment called a quadrat. **(1)**

The table shows the results.

Quadrat number	Number of daisy plants
1	8
2	11
3	4
4	6
5	16
Mean	**X**

(c)   Calculate mean value **X**.

(d)   The field is a rectangle 100 m wide and 150 m long.

Calculate the area of the field.

(e)   The quadrat used by the students had an area of 1.0 m²

Estimate the population of daisy plants in the field.

Use your answers to part **(c)** and part **(d)**.

6. Students were asked to investigate how the abundance and distribution of different organisms change as you move from the edge of the sea to the stony beach.
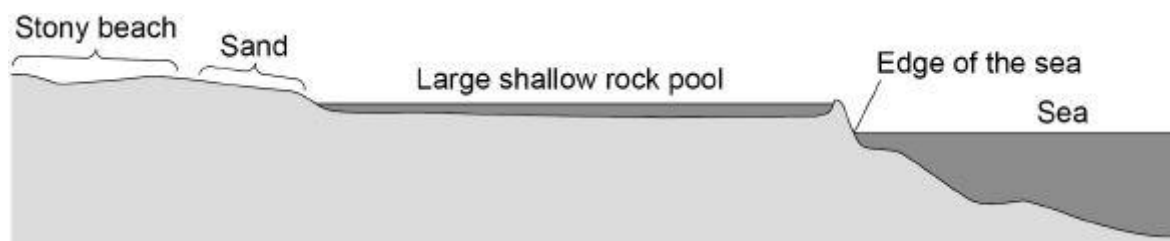
(a)   Describe a method the students could use.

(b) The shallow rock pool has a **higher biodiversity** than the sand or the stony beach. Suggest **three** reasons why.