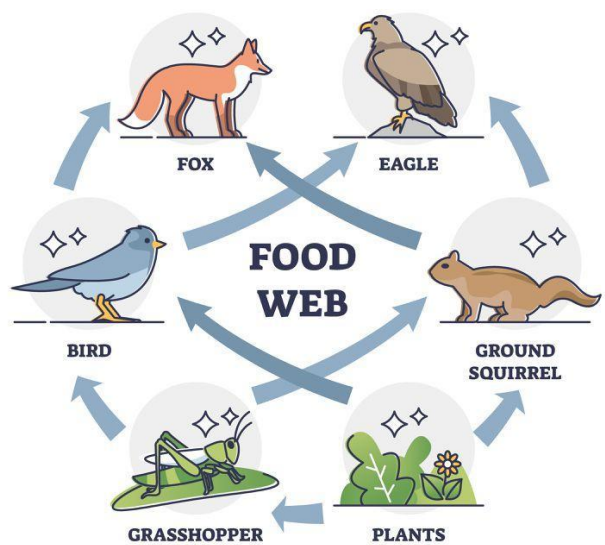
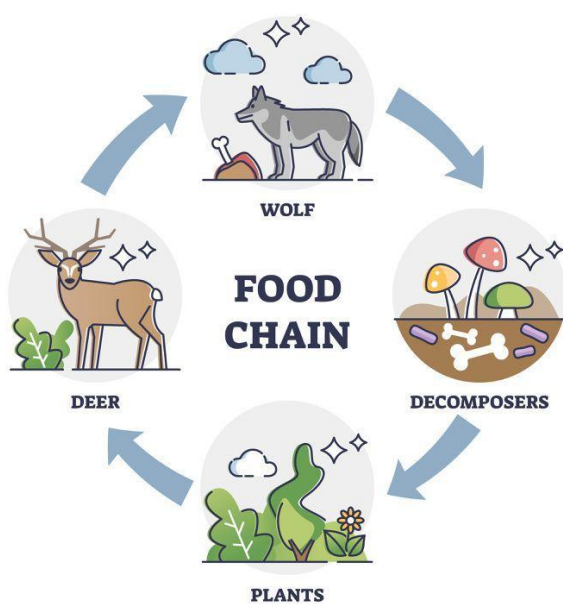


IB Biology

Revision

Topic 4 Ecology



Name:

Teacher: Mr Trent

1. [1 mark]

What is a community?

- A. A group of individuals of the same species in a given area
- B. A group of animals that interact socially
- C. A group of organisms interacting with the abiotic environment
- D. A group of populations interacting with each other within a given area

2. [1 mark]

What is a potential consequence of the rise in global temperatures?

- A. Increased exposure to UV light due to ozone depletion
- B. Increase in ocean pH threatening the survival of marine organisms that require calcium carbonate
- C. Decrease in the number and severity of storms due to the increased evaporation
- D. Changes to circulating ocean currents

3. [1 mark]

Which process contributes to the formation of limestone?

- A. Partial decomposition of biomass in waterlogged soils
- B. Fossilization of biomass in anaerobic conditions in waterlogged soils
- C. Decomposition of soft tissues of marine animals in sea beds
- D. Fossilization of hard parts from marine animals in sea beds

4. [1 mark]

The table shows features of greenhouse gases in the atmosphere.

Greenhouse gas	Concentration / ppm	Average lifespan / years
Carbon dioxide	397.00	50–200
Methane	1.79	12
Nitrous oxides	0.30	114
CFCs	0.00	100

According to the data in the table, which greenhouse gas contributes the most to climate change?

- A. Carbon dioxide because it is the most abundant greenhouse gas
- B. Methane because it has the shortest lifespan
- C. Nitrous oxides because they absorb the greatest amount of shortwave radiation
- D. CFCs because they destroy the ozone layer

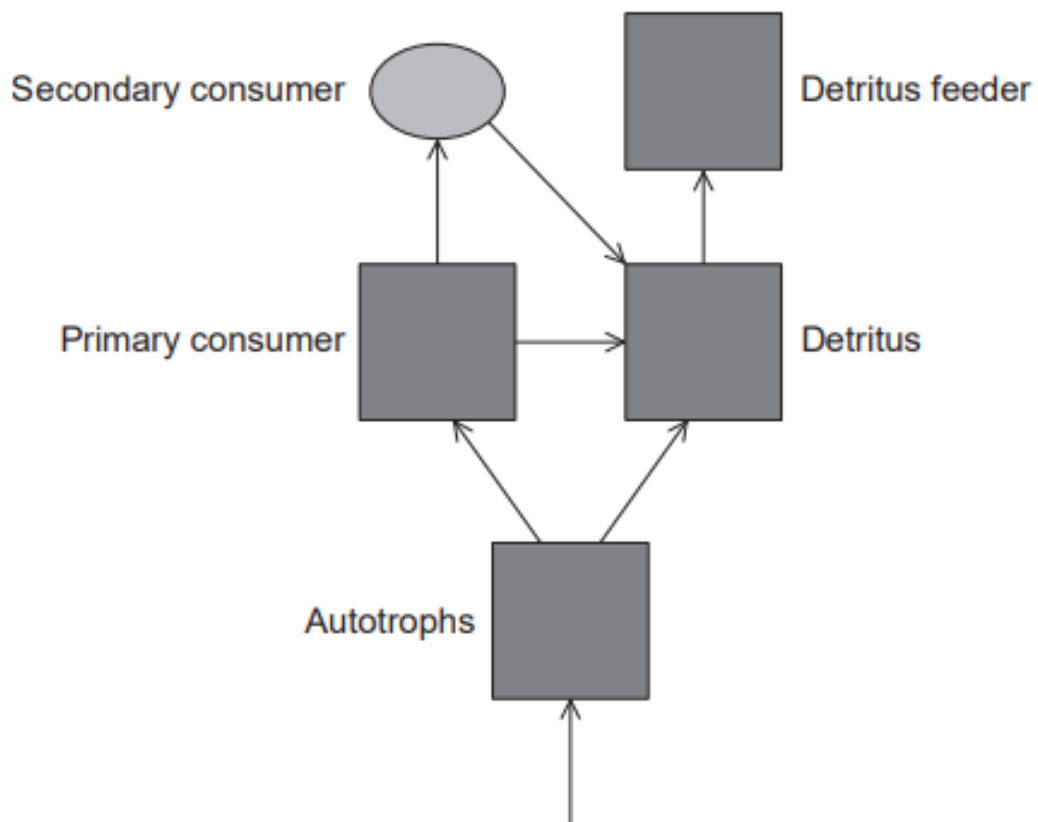
5. [1 mark]

Over time, the hull of a sunken ship may become colonized by a wide range of marine organisms. What term is used to describe all of the organisms living in and on a sunken ship?

- A. A community
- B. An ecological niche
- C. A population
- D. An ecosystem

6. [1 mark]

The diagram shows the energy flow between five “sinks” in a terrestrial ecosystem.



In a typical terrestrial ecosystem, which trophic level would have the highest biomass?

- A. Autotrophs
- B. Primary consumers
- C. Secondary consumers
- D. Detritus feeders

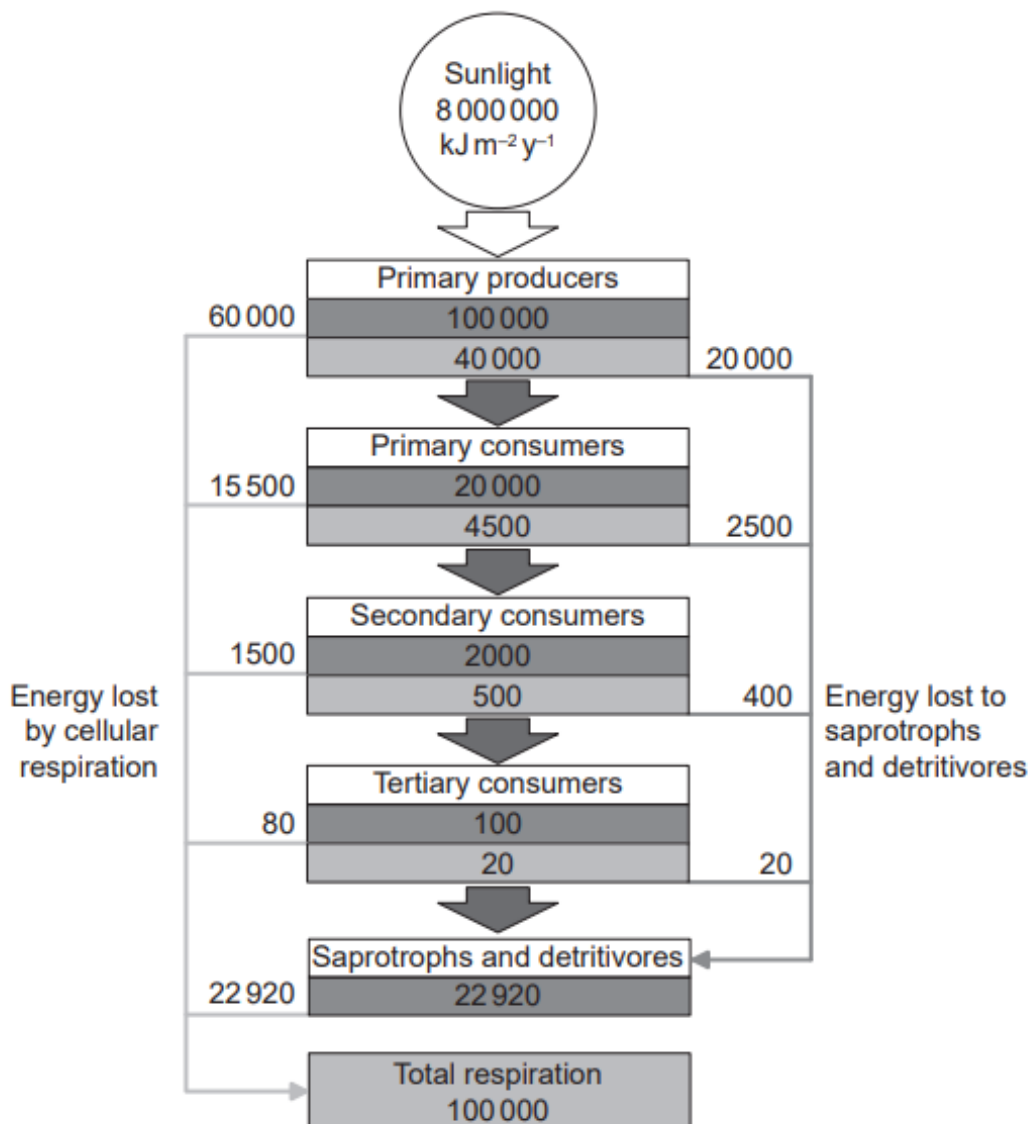
7. [1 mark]

Which organism would be classified as a saprotroph?

- A. A single-celled eukaryote that obtains its carbon compounds by photosynthesis and ingestion of other single-celled organisms
- B. A jellyfish that uses the stinging cells in its tentacles to paralyse its prey, which is passed to an internal gastric cavity through a single opening
- C. A fungus that feeds by secretion of digestive enzymes onto its food and absorption of digested material
- D. A dung beetle that feeds on the fecal material left behind by other animals

8. [1 mark]

The diagram shows the flow of energy through an ecosystem in $\text{kJ m}^{-2} \text{y}^{-1}$.



Key: Gross productivity: the amount of chemical energy that is stored as biomass per unit time
 Net productivity: the amount of chemical energy that is stored as biomass per unit time after cellular respiration

What percentage of the energy passed from primary producers to primary consumers is lost to cellular respiration by tertiary consumers?

- A. 0.001%
- B. 0.08%
- C. 0.2%

D. 0.4%

9. [1 mark]

How can a chi-squared test be used in ecological research?

- A. To test the effect of an abiotic factor on one plant species
- B. To test whether two species tend to live together
- C. To test whether one population of plants is taller than another
- D. To test whether one species is more tolerant to heavy metals than another

10. [1 mark]

Under certain conditions, living organisms on Earth produce and release methane. What favours the production of methane?

- A. Forest fires
- B. High light intensity
- C. Anaerobic conditions
- D. Dry conditions

11. [1 mark]

What material is formed when organic matter is not fully decomposed in acidic waterlogged soils?

- A. Coal
- B. Hydrogen
- C. Oil
- D. Peat

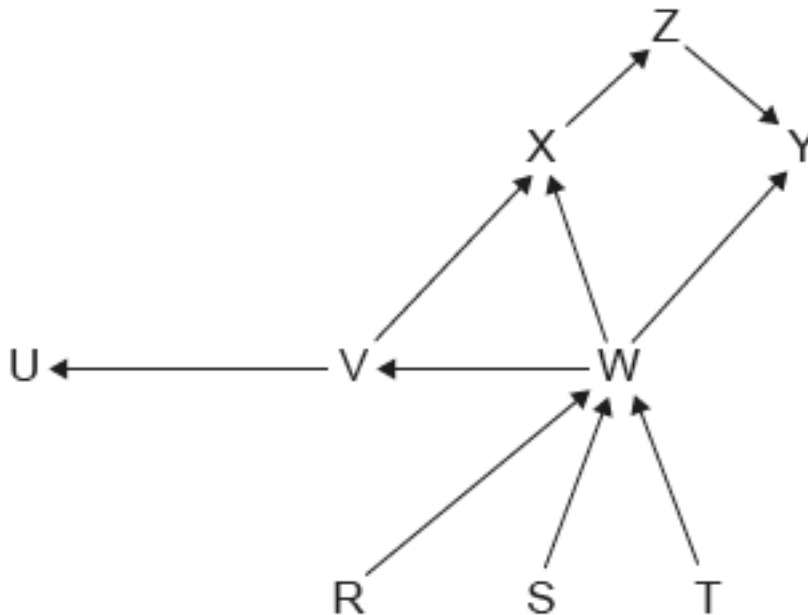
12. [1 mark]

Hummingbirds eat flower nectar and small insects. To which nutritional group do they belong?

- A. Autotrophs
- B. Consumers
- C. Detritivores
- D. Saprotrophs

13. [1 mark]

The diagram shows the food web for an aquatic ecosystem in which letters R–Z represent individual species.

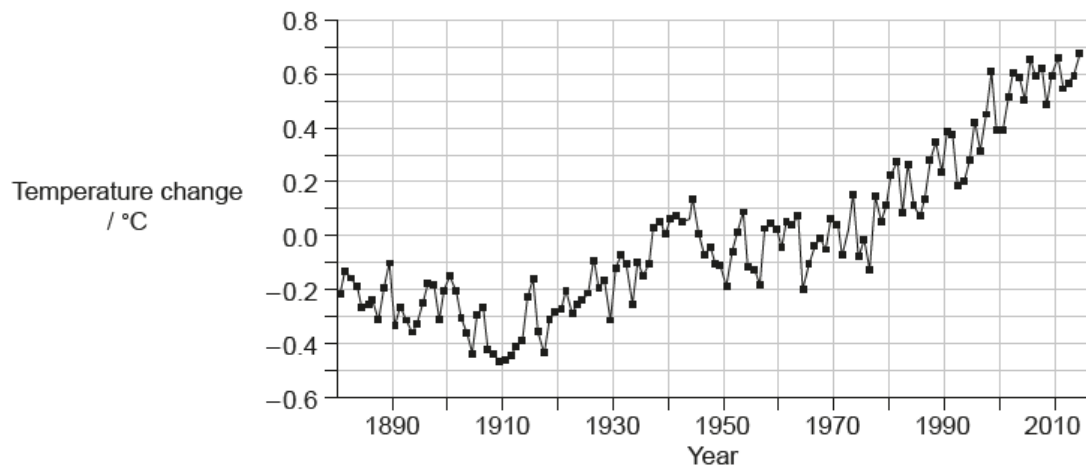


Which organism is a tertiary consumer?

- A. Organism T
- B. Organism U
- C. Organism W
- D. Organism Y

14a. [1 mark]

The graph shows the mean annual changes in global temperatures between 1880 and 2014. The mean temperature from 1951 to 1980 was used as the value of zero change in temperature.



Calculate the increase in mean global temperature between 1880 and 2010.

..... °C

14b. [1 mark]

Outline how changes in temperature over short time periods could give a misleading impression of changes to the Earth's climate.

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14c. [3 marks]

Explain how increased carbon dioxide in the air leads to the greenhouse effect.

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15. [2 marks]

Methane can be the product of anaerobic respiration in some organisms.

Explain the role of methane in climate change.

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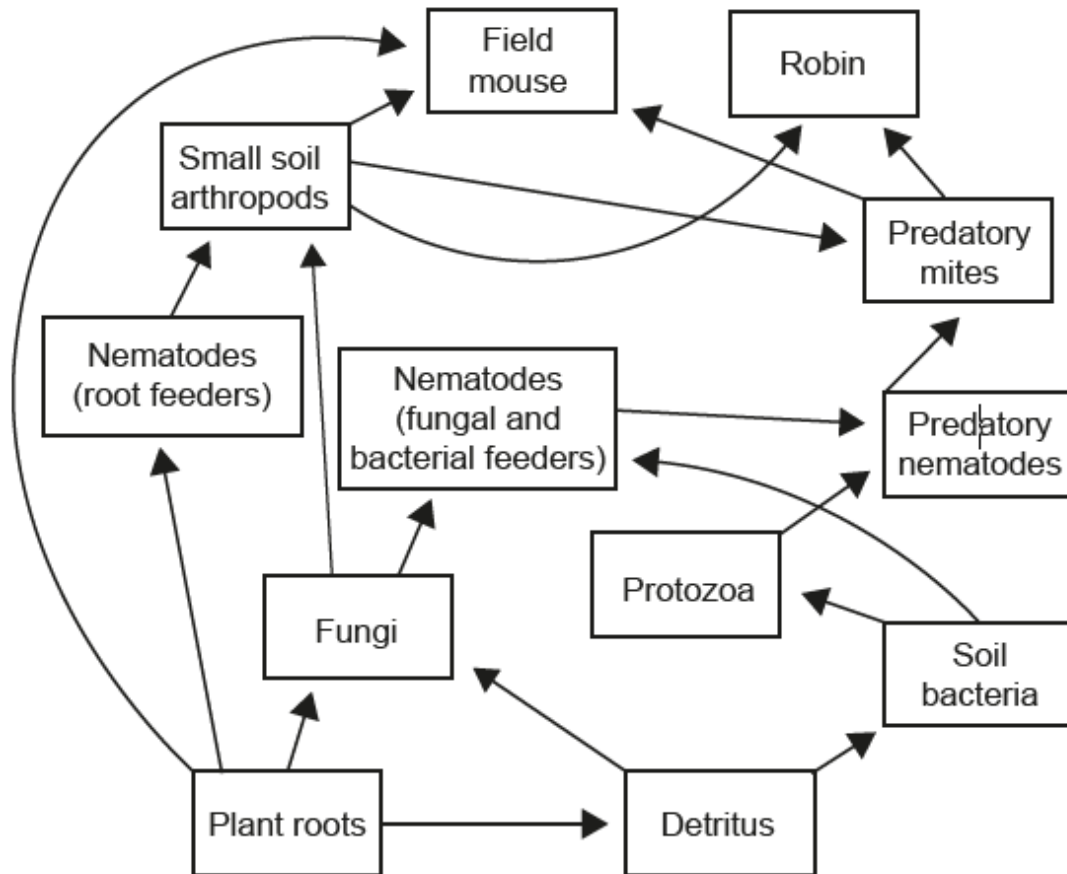
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16b. [1 mark]

The image shows an example of a soil food web.



Draw a food chain from this food web, showing at least three organisms.

16c. [3 marks]

Explain the reasons for food chains rarely containing more than four or five trophic levels.

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17. [2 marks]

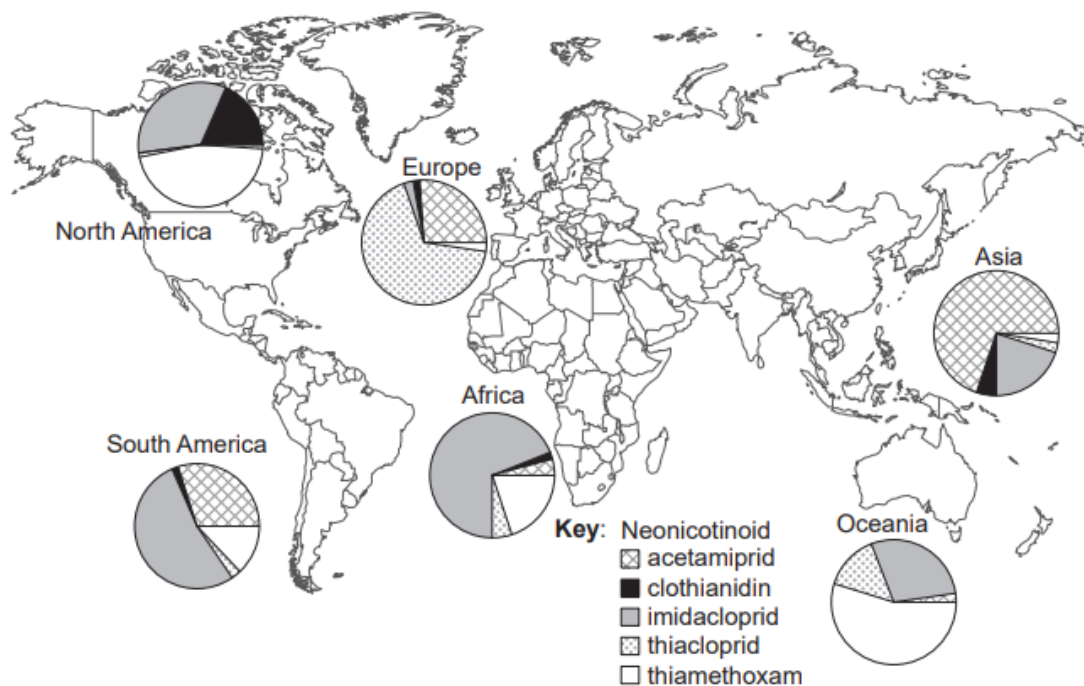
Compare and contrast the mode of nutrition of detritivores and saprotrophs.

	Detritivores	Saprotrophs
Similarity		
Difference		

18a. [1 mark]

Honeybees (*Apis mellifera*) are key pollinators in most ecosystems. The worldwide use of neonicotinoid pesticides has caused concern because they may be contributing to the decline of honeybee populations.

Scientists measured the concentration of five neonicotinoids (acetamiprid, clothianidin, imidacloprid, thiacloprid and thiamethoxam) in honey samples from 198 different locations across the world. Each pie chart shows the relative frequency of neonicotinoids in honey samples from a continent.



Identify in which continent the fewest types of neonicotinoid were detected in honey samples.

18b. [1 mark]

Using the data, outline the different use of thiamethoxam in North and South America.

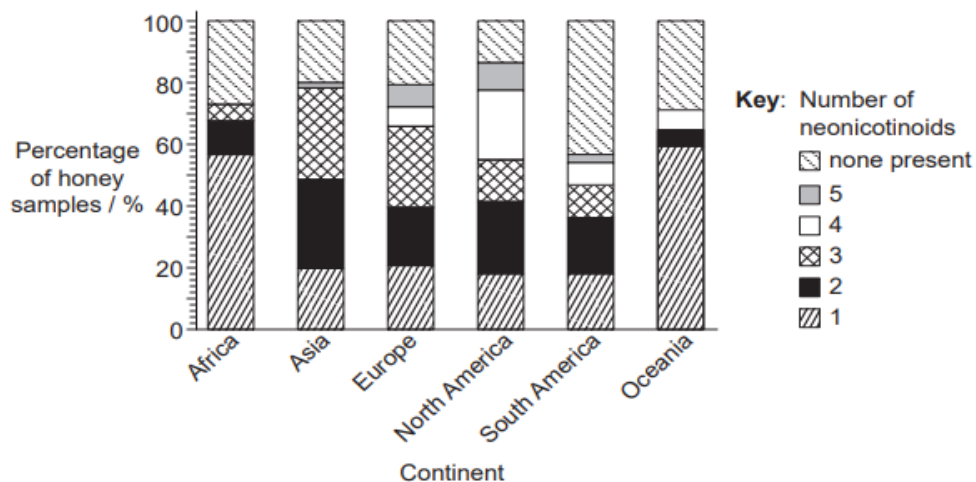
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18c. [1 mark]

The neonicotinoids can be used alone or together with other neonicotinoids. The percentage of honey samples with 0, 1, 2, 3, 4 or 5 different neonicotinoids in each continent are shown in the stacked bar chart.



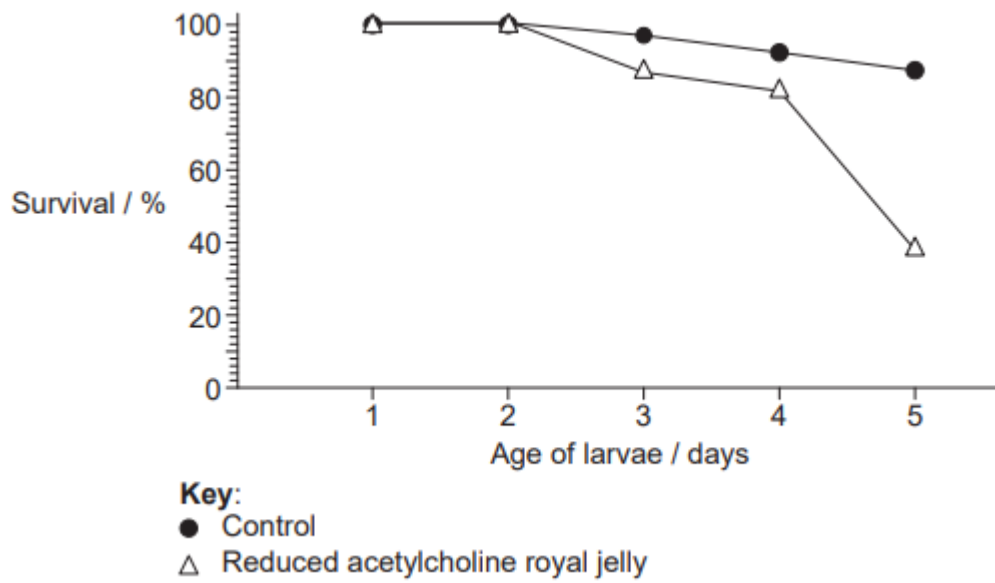
Identify the total percentage of honey samples contaminated with neonicotinoid pesticides in the continent with the lowest overall levels of contamination.

..... %

18d. [2 marks]

In order to grow, honeybee larvae are fed royal jelly, a high energy food with very high acetylcholine concentrations.

In an experiment, larvae were bred artificially on a diet with reduced acetylcholine content in the royal jelly. The graph shows the mean survival rate of these larvae compared to control larvae fed on a normal diet.



Deduce the conclusions that can be drawn from the data in the graph.

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18e. [1 mark]

Suggest a reason for the effect of a diet reduced in acetylcholine on the larval survival rate.

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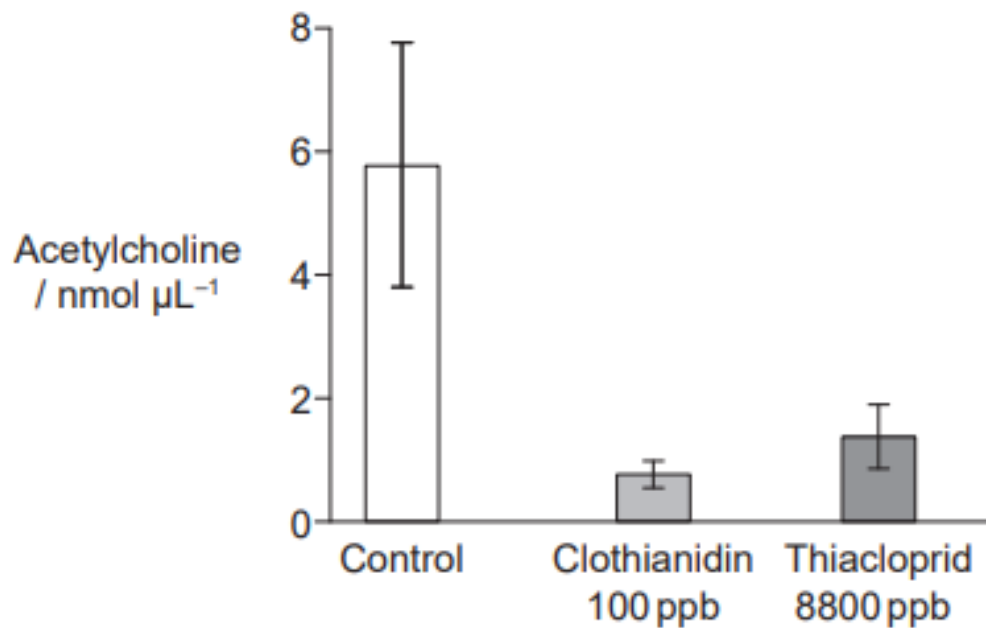
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18f. [2 marks]

The concentration of acetylcholine was measured in royal jelly produced by honeybees that had never been exposed to neonicotinoids (control) and honeybees that had been exposed for three weeks to two neonicotinoids; clothianidin and thiacloprid.



Compare and contrast the effect of clothianidin and thiacloprid treatments on the concentration of acetylcholine in royal jelly.

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18g. *[3 marks]*

Explain how neonicotinoids affect synaptic transmission in insects.

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18h. *[4 marks]*

Companies that manufacture neonicotinoid pesticides have argued that they do not cause significant harm to honeybees. Construct an argument, based on the data in this question, for serious concern about the manufacture and use of neonicotinoid pesticides.

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19a. [2 marks]

Distinguish between the transfers of energy and inorganic nutrients in ecosystems.

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19b. [2 marks]

Outline the role of methanogenic archaeans in the movement of carbon in ecosystems.

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19c. [3 marks]

Describe how autotrophs absorb light energy

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20. [5 marks]

The growing human population has an increasing demand for energy derived from crop plants. At the same time, increasing droughts that are part of climate change make it difficult to grow crops in some parts of the world.

Outline energy flow through a community in a natural ecosystem.

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21. [4 marks]

Discuss the relationship between atmospheric carbon dioxide concentration and global temperatures.

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22. [7 marks]

Life is based on carbon compounds.

Explain the transformations of carbon compounds in the carbon cycle.

23. [7 marks]

24. [4 marks]

Outline energy flow through a food chain.

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25a. [8 marks]

In ecosystems, energy is used to convert inorganic compounds into organic matter. Energy enters ecosystems through producers.

Explain the processes by which energy enters and flows through ecosystems.

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25b. [4 marks]

Draw a labelled diagram of a pyramid of energy.

1. [1 mark]

D

2. [1 mark]

D

3. [1 mark]

D

4. [1 mark]

A

5. [1 mark]

A

6. [1 mark]

A

7. [1 mark]

C

8. [1 mark]

D

9. [1 mark]

B

10. [1 mark]

C

11. [1 mark]

D

12. [1 mark]

B

13. [1 mark]

B

14a. [1 mark]

Markscheme

0.87; (accept values between 0.8 and 0.9)

14b. [1 mark]

Markscheme

short-term reading could show global temperatures falling while the trend is rising

OR

fluctuations from year to year may not show long-term trend;

14c. [3 marks]

Markscheme

- a. short wave radiation from sun passes through atmosphere / is not absorbed by CO₂;
- b. infrared/long wave (radiation) / heat emitted from/released from (surface of) Earth;
- c. CO₂ in the atmosphere absorbs infrared/long wave (radiation)/heat / cannot pass through the greenhouse gases;
- d. this results in warm/increased temperatures on Earth/global warming;

Do not accept "reflected" for mpb.

15. [2 marks]

Markscheme

- a. methane is a greenhouse gas
- OR**
- methane causes an increase in temperature of the atmosphere;
- b. methane is one of the most powerful greenhouse gases / more powerful than CO₂;
 - c. methane has a relatively short lifespan compared to CO₂/decomposes to CO₂;

Other verifiable sources.

16a. [2 marks]

Markscheme

	<i>Detritivores</i>	<i>Saprotrophs</i>
<i>Similarity</i>	heterotrophic OR feed on/obtain nutrients from dead organic matter/dead organisms;	
<i>Difference</i>	internal digestion/digestion in gut OR enzymes secreted into gut OR food ingested before digestion	external digestion OR enzymes secreted into surroundings OR food digested before being absorbed;

Accept not autotrophic/not photosynthetic instead of heterotrophic.

Do not accept that both groups are decomposers or consumers for the similarity.

16b. [1 mark]

Markscheme

food chain of three or more organisms starting with plants;

16c. [3 marks]

Markscheme

a. energy is lost between the trophic levels;

b. transfer between levels is only usually 10% efficient

OR

energy transformations take place in living organisms / the process is never 100% efficient;

c. energy is lost by the organism/used in respiration / released as heat/movement;

d. energy is lost as waste/feces/urine/undigested food/uneaten parts;

e. as energy is lost between trophic levels and so (higher ones) have less biomass / less biomass available for next level;

17. [2 marks]

Markscheme

	<i>Detritivores</i>	<i>Saprotrophs</i>
<i>Similarity</i>	heterotrophic OR feed on/obtain nutrients from dead organic matter/dead organisms;	
<i>Difference</i>	internal digestion/digestion in gut OR enzymes secreted into gut OR food ingested before digestion	external digestion OR enzymes secreted into surroundings OR food digested before being absorbed;

Accept not autotrophic/not photosynthetic instead of heterotrophic.

Do not accept that both groups are decomposers or consumers for the similarity.

18a. [1 mark]

Markscheme

Oceania ✓

18b. [1 mark]

Markscheme

thiamethoxam is the most used in North America (but not in South America) / CONVERSE

OR

in South America they use different neonicotinoids to thiamethoxam ✓

OWTTE.

Allow numerical comparison.

18c. [1 mark]

Markscheme

57 (%) ✓

Allow range 56 % to 58 %.

18d. [2 marks]

Markscheme

a. reduced acetylcholine does not affect larval survival in the first two days ✓

b. reduced acetylcholine causes increased mortality from day 3 onwards ✓

c. 90 % versus 40 % survival/other valid numerical comparison by day 5

OR

(much) greater decrease in survival occurs between days 4 and 5/by day 5 for the reduced group ✓

Do not accept answers without times/ days.

18e. [1 mark]

Markscheme

(larvae lacking acetylcholine/with reduced AcH cannot survive because) acetylcholine is a neurotransmitter taking message from one neuron to another in synapses of nervous tissues

OR

messages would not pass from one neuron to the other

OR

(larvae) unable to synthesise/produce ACh, so need it from their diet ✓

OWTTE.

18f. [2 marks]

Markscheme

a. both neonicotinoids reduce the concentration of acetylcholine in royal jelly (compared to control) ✓

b. clothianidin reduces the concentration of acetylcholine in royal jelly more than thiacloprid (but perhaps not statistically different) ✓

c. clothianidin is used in smaller concentrations (than thiacloprid) so no firm conclusion can be obtained ✓

Need one similarity and one difference.

18g. [3 marks]

Markscheme

a. neonicotinoids bind to the (acetylcholine) receptor (in insects) ✓

b. (binding happens) in (cholinergic) synapses/at motor end plate/between motor neuron and muscles ✓

c. neonicotinoids bind irreversibly (to receptors)

OR

(receptors are blocked so) acetylcholine is unable to bind ✓

d. acetylcholinesterase/enzymes cannot break down neonicotinoids ✓

e. (synaptic) transmission prevented ✓

f. (causing) insect paralysis/death ✓

18h. [4 marks]

Markscheme

a. neonicotinoids are used in every continent ✓

b. the choice of specific neonicotinoid varies considerably around the world ✓

c. neonicotinoids contaminate honey (so must get into honeybees) ✓

d. only a minority of honey samples from around the world contain no neonicotinoids ✓

e. neonicotinoids reduce the acetylcholine (content of royal jelly)

OR

only a small amount of clothianidin can reduce acetylcholine in royal jelly ✓

f. survival of honeybee larvae is lower if the acetylcholine is lower/content of royal jelly is reduced ✓

19a. [2 marks]

Markscheme

energy is lost (between trophic levels) / not all passed on / not reused / must be supplied;

nutrients are recycled/reused;

19b. [2 marks]

Markscheme

a. methane produced from organic matter;

b. in anaerobic conditions;

c. methane diffuses into atmosphere/accumulates in ground/soil;

d. oxidized/converted to carbon dioxide (in atmosphere);

19c. [3 marks]

Markscheme

a. light absorbed by (photosynthetic) pigments;

b. chlorophyll absorbs blue and red / drawing of absorption spectrum for chlorophyll;

c. photosystems are groups of pigment molecules/are light harvesting complexes;

d. photosystems are located in thylakoid membranes;

e. electrons excited/raised to higher energy level;

20. [5 marks]

Markscheme

a. communities are made up of populations of different species;

b. plants receive energy from the sun/light;

c. convert it to chemical energy through photosynthesis;

d. chemical energy is stored in organic/C-compounds;

e. the energy is passed to other organisms through feeding / reference to food chain;

f. respiration (of plants and animals) converts the chemical energy (of C-compounds) to other useful forms of energy;

g. eventually the chemical energy is lost as heat energy;

h. energy is non-recyclable/lost from a community/ecosystem;

i. energy losses between trophic levels limit food chains/mass of top trophic levels/only about 10 % of energy is transferred;

21. [4 marks]

Markscheme

- a. greenhouse effect keeps Earth warm ✓
- b. (over-time) earth's temperature has fluctuated naturally ✓
- c. changes in human activities have led to increases in CO₂ concentration ✓
- d. CO₂ absorbs infrared/long wave radiation / trapping heat ✓
- e. increase in atmospheric CO₂ (concentration) correlates with/causes increased global average temperature ✓
- f. use of fossil fuels increases atmospheric CO₂ ✓
- g. deforestation removes a carbon sink / less CO₂ absorbed ✓
- h. loss of polar ice causes less reflection of surface light/ more reradiation as heat contributing to (global) warming ✓
- i. CO₂ is not the only greenhouse gas/ there are other greenhouse gases ✓

22. [7 marks]

Markscheme

- a. autotrophs/producers convert carbon dioxide into carbohydrates/carbon compounds in photosynthesis;
- b. carbon dioxide diffuses/moves from the atmosphere /water into autotrophs/plants;
- c. carbon compounds are transferred through food chains/OWTTE;
- d. carbon dioxide produced by respiration diffuses out of organisms into water/atmosphere;
- e. decomposers release carbon dioxide during decay/putrefaction;
- f. methane is produced from organic matter in anaerobic conditions (by methanogens);
- g. some methane diffuses into the atmosphere/accumulates in the ground;
- h. methane is oxidized to carbon dioxide (and water) in the atmosphere;
- i. peat forms when organic matter is not fully decomposed because of acidic/anaerobic conditions in waterlogged soils;
- j. partially decomposed organic matter from past geological eras/fossils was converted into coal/oil/gas that accumulated in rocks;
- k. carbon dioxide is produced by the combustion of biomass/fossilized organic matter/fuels;
- l. hard parts of some animals/corals/molluscs are composed of calcium carbonate
- m. can become fossilized in limestone;

As this is an “explain” question, simply drawing a labelled diagram is not enough for [7].
Diagram would need sufficient annotations to meet the command term.

If carbon compounds are referred to instead of carbon dioxide, penalise once then ecf.

23. [7 marks]

Markscheme

- a. autotrophs/producers/plants obtain inorganic nutrients from the «abiotic» environment ✓
- b. energy provided «mainly» by sunlight ✓
- c. light energy converted «to chemical energy» through photosynthesis ✓
- d. photosynthesis/producers/autotrophs convert inorganic carbon/carbon dioxide and water into carbon/organic compounds ✓
- e. «these» carbon compounds/foods contain/are a source of «useable» energy «for life» ✓
- f. carbon compounds/energy are transferred along food chains when eaten by consumers/heterotrophs ✓ Allow OWTTE for mpf for passed up trophic levels.
- g. respiration returns carbon «dioxide» to the environment ✓
- h. respiration releases stored/chemical energy as ATP/heat ✓
- i. energy/ATP is used to carry out life functions/synthesis/growth/movement ✓
- j. energy is lost/not recycled ✓
- k. nutrients are recycled / example of recycled nutrient e.g. carbon ✓
- l. decomposers recycle minerals/inorganic nutrients ✓

24. [4 marks]

Markscheme

- a. energy from the sun/light energy is converted to chemical energy by photosynthesis ✓
- b. «chemical» energy flows through the food chains by feeding ✓
- c. energy is released «from carbon compounds» by respiration
OR
energy from respiration is used by living organisms and converted to heat ✓
- d. heat is not recyclable / heat is lost from food chains
OR
heat cannot be converted to other forms of energy ✓
- e. energy is lost in excretion/uneaten material/egestion/feces ✓

f. energy losses between trophic levels limits the length of food chains

OR

energy transfer is only 10 % between trophic levels ✓

25a. [8 marks]

Markscheme

a. light energy is the initial energy source for (all) organisms

b. producers/autotrophs change light/radiant energy into chemical energy

OR

producers/autotrophs convert/trap light/radiant energy by photosynthesis

c. producing $C_6H_{12}O_6$ /sugars/carbohydrates

d. carbon/organic compounds used for energy/growth/repair/storage

e. compounds/energy pass as food along food chains/trophic levels WTTE

f. cellular respiration releases energy as ATP from food

g. energy is lost as heat (during cellular respiration)

h. loss of energy at each trophic level

OR

only approximately 10% of energy is passed to the next trophic level / 90% is lost at each trophic level

i. energy lost in bones/hair when they die/not fully eaten by the next trophic level

j. energy lost in feces/urine

k. decomposers/saprotrophs remove energy from wastes/bodies

l. energy is not recycled

25b. [4 marks]

Markscheme

a. drawn in steps rather than triangle

b. drawn to scale (should be at least 1/5 of the box below it)

OR

annotated with appropriate numeric values

c. producer

d. primary consumer

e. secondary consumer

Award no marks if a drawing has not been made.

“Appropriate numeric values” should indicate scale so accept percentage or numbers.
