SL Paper 1

Which gas will enhance the greenhouse effect if released into the atmosphere?

A. Hydrogen
B. Oxide of nitrogen
C. Oxygen
D. Nitrogen

Markscheme

B

Examiners report

This turned out to be a very good discriminator. Some candidates believed nitrogen was a greenhouse gas.

Which of the following trophic groups include fungi?

A. Detritivores
B. Autotrophs
C. Saprotrophs
D. Producers

Markscheme

C

Examiners report

N/A

Which category of organisms is correctly described by its method of nutrition and site of digestion?

	Category of organism	Method of nutrition	Site of digestion
A.	consumer	heterotrophic	internal
B.	saprotroph	autotrophic	external
C.	producer	autotrophic	internal
D.	detritivore	heterotrophic	external

Markscheme

A

Examiners report

Although most candidates got the right answer, many candidates wrongly believed that autotrophs have internal digestion.

What term can be used to describe clams that eat decaying plant matter?

A. Detritivores
B. Tertiary consumers
C. Saprotrophs
D. Decomposers

Markscheme

A

Examiners report

A number of teachers expressed concern over this question, primarily concerned about an expectation of knowledge of clams. However, from the context of the question, students should have been able to determine that eating decaying matter rather than rotting decaying matter indicates that the clam is a detritivore.

What is lost between trophic levels in ecosystems and cannot be recycled?

A. Heat

B. Nitrogen

C. Carbon compounds

D. Biomass

Markscheme

A

Examiners report

[N/A]

What is the classification of an organism that is able to make organic compounds from inorganic nutrients?

A. Autotroph
B. Consumer
C. Detritivore
D. Saprotroph

Markscheme

A

Examiners report

[N/A]

Why do food chains in an ecosystem rarely contain more than five organisms?

A. Nutrients are recycled by the decomposers back to the producers.
B. Nutrients are lost from the ecosystem when organisms die.
C. The conversion of food into growth by an organism is not very efficient.
D. Energy is recycled by the decomposers back to the producers.

Markscheme

C

Examiners report

This question had a very high discrimination index, showing that good candidates were able to distinguish the correct answer.

What is recycled in an ecosystem?

A. Nitrogen, carbon and energy are all recycled.
B. Nitrogen and carbon are recycled but not energy.
C. Nitrogen is recycled but not carbon or energy.
D. Nitrogen, carbon and energy are not recycled.

Markscheme

B

Examiners report

N/A

Global warming threatens the survival of Arctic foxes. Which of the following factors could be involved?

I. Competition with other fox species spreading north
II. Reduction in numbers of prey species of Arctic foxes
III. Decrease in oxygen availability to Arctic foxes

A. I only
B. I and II only
C. II and III only
D. I, II and III

Markscheme

B

Examiners report

[N/A]

In a pond, two species of fish feed on insects and worms. The insects feed on the green plants that live in the water. What constitutes a population in this ecosystem?

A. All the living organisms
B. All the animals
C. All the fish
D. All the fish of one species

Markscheme

D

Examiners report

N/A

What is an ecosystem?

A. An environment in which an organism normally lives
B. A group of organisms of the same species inhabiting an area
C. A group of populations living and interacting with each other in an area
D. A community and its abiotic environment

Markscheme

D

Examiners report

N/A

The following statements refer to a pyramid of energy.

I. Some material is not assimilated by each trophic level.
II. Energy transformations are never 100 % efficient.
III. Heat is lost during photosynthesis.

Which of the statements give the reason why a pyramid of energy is narrower at the top than at the bottom?
A. I only
B. I and II only
C. II and III only
D. I, II and III

Markscheme

B

Examiners report

Some candidates wrongly believed that the process of photosynthesis produces heat.

What is a community?

A. A group of organisms living and interacting in the same trophic level
B. A group of populations living and interacting in a food chain
C. A group of organisms of the same species living and interacting in an ecosystem
D. A group of populations living and interacting in an area

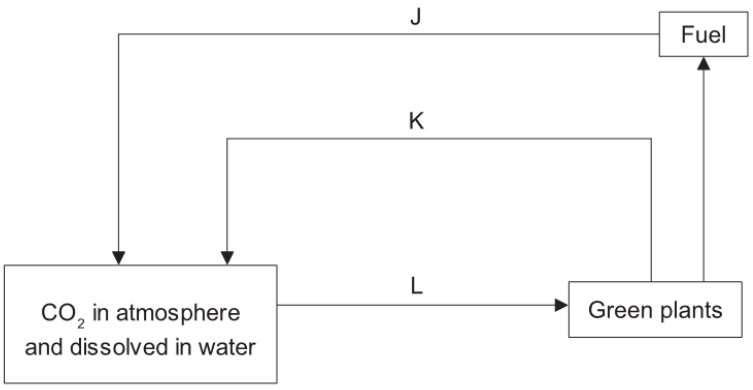
Markscheme

D

Examiners report

N/A

The diagram shows the carbon cycle.



[Source: © International Baccalaureate Organization 2017]

Which two processes correspond to the labelled arrows?

A. K is combustion and L is catabolism.

B. J is anabolism and K is respiration.

C. J is combustion and K is respiration.

D. J is anabolism and L is catabolism.

Markscheme

C

Examiners report

[N/A]

Which group of organisms in the carbon cycle converts carbon into a form that is available to primary consumers?

A. Decomposers
B. Saprotrophs
C. Detritus feeders
D. Producers

Markscheme

D

Examiners report

N/A

Which of the following is the best definition of a population?

A. A group of individuals that can interbreed and produce fertile offspring
B. The number of individuals of the same species in a given area
C. A group of species living and interacting with each other in a given area
D. The total number of individuals in a given area

Markscheme

B

Examiners report

This did not discriminate very well, with quite a number of candidates choosing C (a community) instead of B (a population). It was thought that this may be language difficulty for ESL students, and also the definitions are often associated with a time factor.

What best describes the mode of nutrition of a heterotroph?

A. It ingests only non-living organic matter.
B. It obtains organic molecules from other organisms.
C. It synthesizes its organic molecules from inorganic substances.
D. It produces its organic molecules from chemical reactions using light.

Markscheme

B

Examiners report

N/A

Euglena is a unicellular organism that feeds on bacteria and uses CO_2 as a carbon source. Which describes the nutrition of this organism?

A. Autotrophic only

B. Heterotrophic only

C. Saprotrophic only

D. Autotrophic and heterotrophic

Markscheme

D

Examiners report

[N/A]

What term refers to organisms of the same species, living in a specified area and time?

A. Population
B. Community
C. Family
D. Genus

Markscheme

A

Examiners report

N/A

Which of the following ecological units includes abiotic factors?

A. A community
B. An ecosystem
C. A population
D. A trophic level

Markscheme

B

Examiners report

N/A

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

A. Increased exposure to UV light
B. Increased rate of decomposition of detritus
C. Decreased success of pest species
D. Increase in the ice habitat available to polar bears

Markscheme

B

Examiners report

N/A

What contributes to the enhanced greenhouse effect?

A. Ozone from violent thunderstorms

B. Carbon particles in diesel engine exhaust

C. Methane from agricultural sources

D. Carbon dioxide from active volcanoes around the world

Markscheme

C

Examiners report

Most candidates were able to realize that methane from agriculture is a greater contributor to the greenhouse effect than carbon dioxide from volcanoes. Many good candidates did believe it was the carbon particles from engines, failing to realize this is not a gas.

What are the units of a pyramid of energy?

A. kJ m^{-2} yr^{-1}
B. kJ m^{-1} yr^{-1}
C. J m^{-3} s^{-1}
D. J m^{2} s^{-1}

Markscheme

A

Examiners report

N/A

Zoophobas morio is an insect. Its larvae feed on bat feces in caves in Guatemala. What type of organism is a *Zoophobas morio* larva?

A. Autotroph

B. Consumer

C. Detritivore

D. Saprotroph

Markscheme

C

Examiners report

[N/A]

At each trophic level energy is lost. How is this energy regained by the ecosystem?

A. Heat
B. Nutrients
C. Photosynthesis
D. Recycling

Markscheme

C

Examiners report

Five teachers expressed concern over this question, primarily over the use of the term ‘regained’. Answer C is the only reasonable answer to the question of how an ecosystem maintains energy supply for food chains.

What are examples of greenhouse gases?

A. Ethane and ozone

B. Methane and nitrogen

C. Methane and carbon dioxide

D. Ethane and oxygen

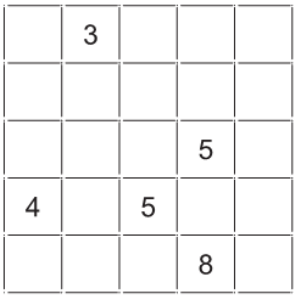
Markscheme

C

Examiners report

[N/A]

In an area of forest measuring 100 m by 100 m, samples were taken to estimate the number of silver maple (Acer saccharinum) trees in the forest. The number of trees counted in each of five areas of 400 m^2 was recorded.



Approximately how many silver maple trees are in the 10000m^2 area of forest?

A. 5

B. 25

C. 125

D. 625

Markscheme

C

Examiners report

[N/A]

What do records from the twentieth and twenty-first century show about the concentration of carbon dioxide in the atmosphere?

A. An upward trend with annual fluctuations
B. An upward trend with no annual fluctuations
C. Annual fluctuations but no overall trend
D. Random fluctuations and no overall trend

Markscheme

A

Examiners report

N/A

What limits the length of food chains in an ecosystem?

A. The size of individual organisms
B. Competition between organisms
C. The loss of energy between trophic levels
D. Natural selection

Markscheme

C

Examiners report

This question was a very good discriminator.

Which statement describes the term species?

A. Members of the same ecological community

B. Organisms that reproduce together to produce fertile offspring

C. Organisms of the same type in a population

D. The first word in the binomial name of an organism

Markscheme

B

Examiners report

A better wording for this question would have been to say in the correct answer that in species organisms can potentially breed (as in many cases they do not).

What is a population?

A. Organisms of the same genus living in an ecosystem

B. Organisms living together and interacting in the same habitat

C. Organisms of a species living together in the same area

D. Organisms that can breed together

Markscheme

C

Examiners report

[N/A]

What favours the production of peat?

I. Presence of organic matter

II. Anaerobic conditions

III. Acidic conditions

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

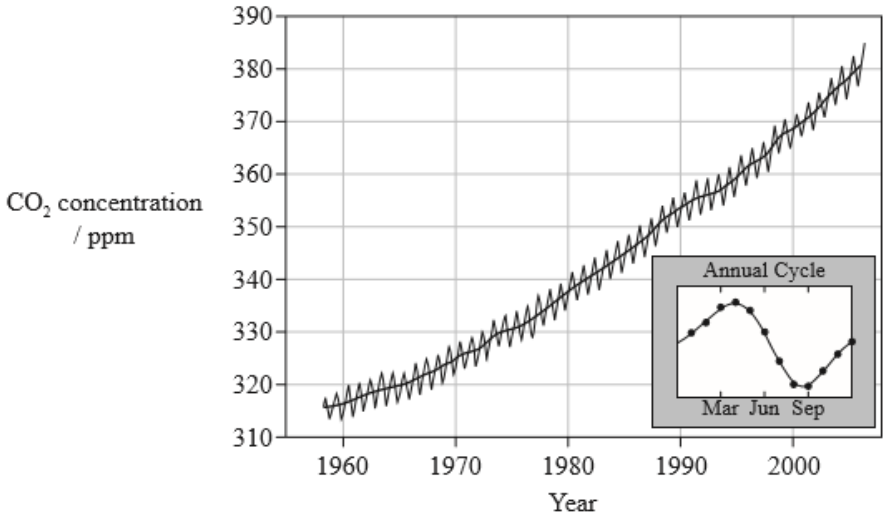
Markscheme

D

Examiners report

[N/A]

The graph below shows variation in the concentration of CO_2 in the atmosphere as measured at Mauna Loa in Hawai'i. The small inset graph shows the variations in CO_2 during a one year period.



[Source: adapted from Dr P Tans, NOAA Earth System Research Laboratory]

Why does the amount of CO_2 fall between April and August?

A. Seasonal increase in the rate of photosynthesis in northern hemisphere forests
B. Seasonal decrease in the rate of photosynthesis in northern hemisphere forests
C. Seasonal decrease in the rate of fossil fuel consumption
D. Seasonal increase in the amount of CO_2 taken up by the oceans

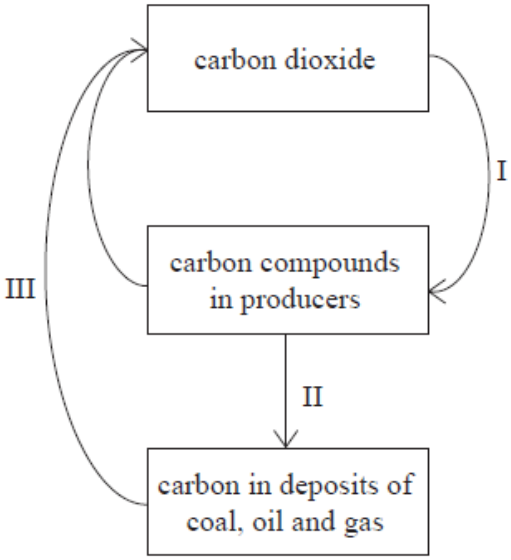
Markscheme

A

Examiners report

Assessment statement 5.2.2 says to analyze the changes in concentration of atmospheric carbon dioxide using historical records. This means candidates should have used the data provided, or data of a very similar nature. Most candidates found the questions easy.

The diagram below shows some of the links in the carbon cycle.



What processes are taking place at I, II and III?

	I	II	III
A.	photosynthesis	fossilization	combustion
B.	cell respiration	fossilization	greenhouse effect
C.	photosynthesis	decomposition	combustion
D.	cell respiration	decomposition	greenhouse effect

Markscheme

A

Examiners report

[N/A]

By which mechanism do greenhouse gases contribute to global warming?

A. Their higher concentration absorbs more long wave radiation coming from the Sun.

B. Short wave radiation emitted from the Earth's surface increases with their concentration.

C. They absorb higher amounts of long wave radiation emitted from the Earth's surface as their concentration increases.

D. They absorb higher amounts of short wave radiation caused by increased combustion of fossilized organic matter.

Markscheme

C

Examiners report

[N/A]

Which characteristic of water vapour classifies it as a greenhouse gas?

A. It absorbs and then re-emits some of the long wave radiation emitted by the Earth's surface.

B. It prevents short wave radiation from reaching the Earth's surface.

C. It absorbs UV radiation but does not re-emit it.

D. It absorbs infra-red radiation but does not re-emit it.

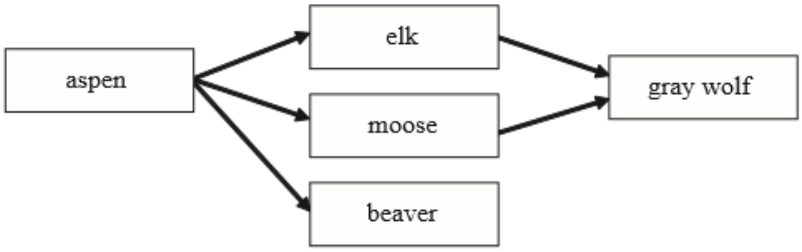
Markscheme

A

Examiners report

[N/A]

The following diagram shows part of a food web from Yellowstone Park.



What would be the short-term effects on the populations of the other species if the gray wolf were exterminated?

	Beaver	Moose	Elk	Aspen
A.	Increase	Decrease	Increase	Increase
B.	Decrease	Decrease	Decrease	Decrease
C.	Increase	Increase	Decrease	Increase
D.	Decrease	Increase	Increase	Decrease

Markscheme

D

Examiners report

N/A

Two populations of the same fish species were fed different diets to investigate the effect of differing nutrition on their growth. What is an appropriate method to determine the significance of a resulting difference?

A. Calculate the mean for each population

B. Calculate the standard deviation for each population

C. Graph the results

D. Perform a *t*-test

Markscheme

D

Examiners report

[N/A]

The table shows the monthly CO_2 concentrations in mg L^{-1} taken at two monitoring stations.

Station \ Month	Jul 2011	Aug 2011	Sept 2011	Oct 2011	Nov 2011	Dec 2011	Jan 2012	Feb 2012	Mar 2012	Apr 2012	May 2012	Jun 2012
Cape Grim, Australia	388	389	389	389	389	389	389	389	389	389	389	390
Mauna Loa, Hawaii, USA	392	390	389	389	390	392	393	394	394	396	397	396

What is directly indicated by the data?

A. CO_2 concentration in the atmosphere varies from place to place.

B. Cape Grim is less affected by global warming than Mauna Loa.

C. CO_2 creates a greenhouse effect at both locations.

D. The standard deviation for Cape Grim is higher than standard deviation for Mauna Loa.

Markscheme

A

Examiners report

This question had too much data to analyse for a multiple-choice question. Capable candidates however were able to answer this question well.

What restricts the length of a food chain?

A. Energy losses between the trophic levels
B. A greater biomass at the higher trophic levels
C. The number of species in the food web
D. The consumption of waste by detritivores

Markscheme

A

Examiners report

[N/A]

Which pair of statements is correct?

	Autotroph	Heterotroph
A.	obtains organic molecules from other organisms	synthesizes organic molecules from inorganic molecules
B.	synthesizes organic molecules from inorganic molecules	obtains organic molecules from other organisms
C.	synthesizes inorganic molecules from organic molecules	synthesizes organic molecules from inorganic molecules
D.	obtains inorganic molecules from other organisms	obtains inorganic molecules from other organisms

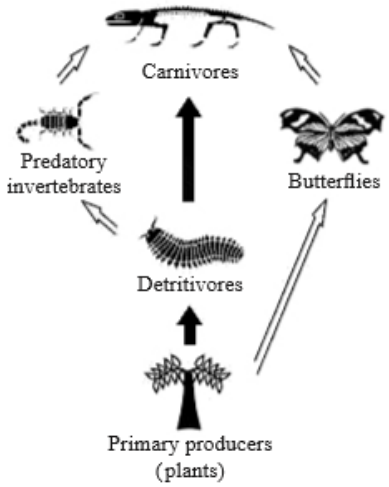
Markscheme

B

Examiners report

This was a very easy question with almost all candidates able to correctly distinguish between autotrophs and heterotrophs.

The energy passing from the detritivores to the predatory invertebrates in this food web is 14 000 kJ m^{-2} $year^{-1}$.



[Adapted with permission from http://jogginsfossilcliffs.net/cliffs/biodiversity/]

Approximately how much energy (in kJ m^{-2} $year^{-1}$) passes from the predatory invertebrates to the carnivores?

A. 140
B. 1400
C. 14 000
D. 140 000

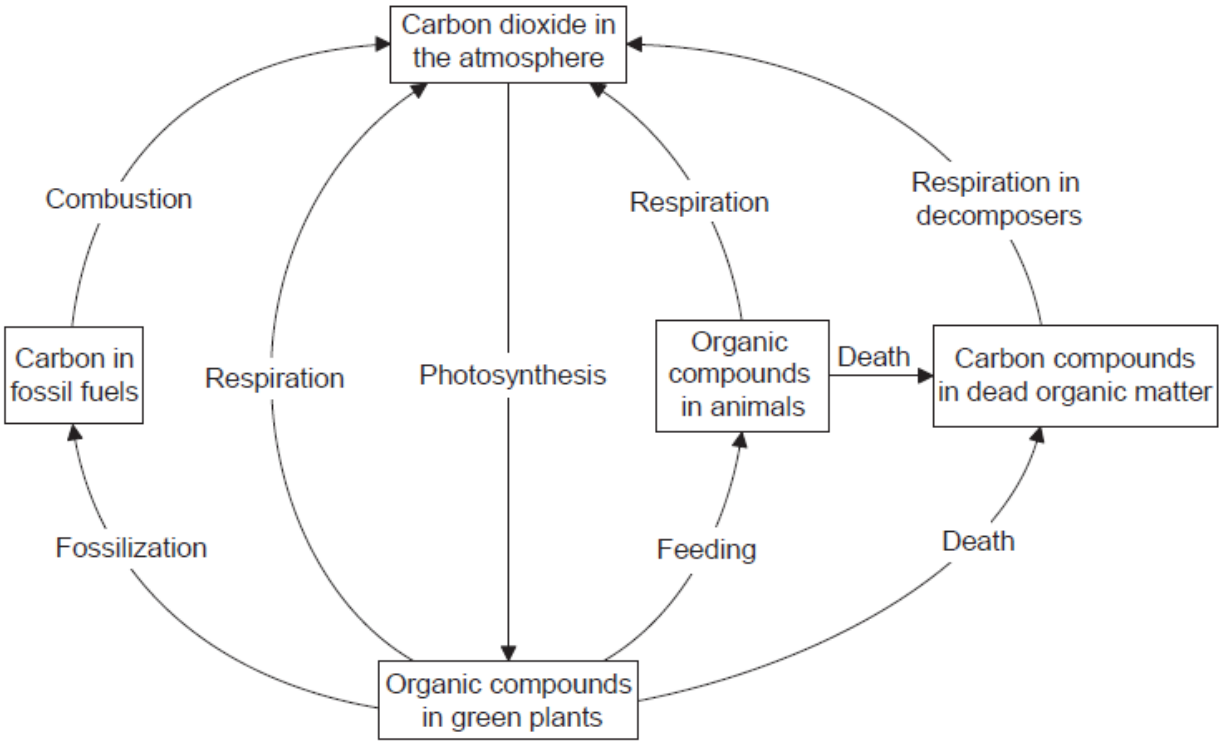
Markscheme

B

Examiners report

N/A

The diagram represents the carbon cycle.



[Source: adapted from http://content.answcdn.com]

Which process has the greatest relative role in transferring carbon?

A. Decomposition

B. Combustion

C. Photosynthesis

D. Cell respiration

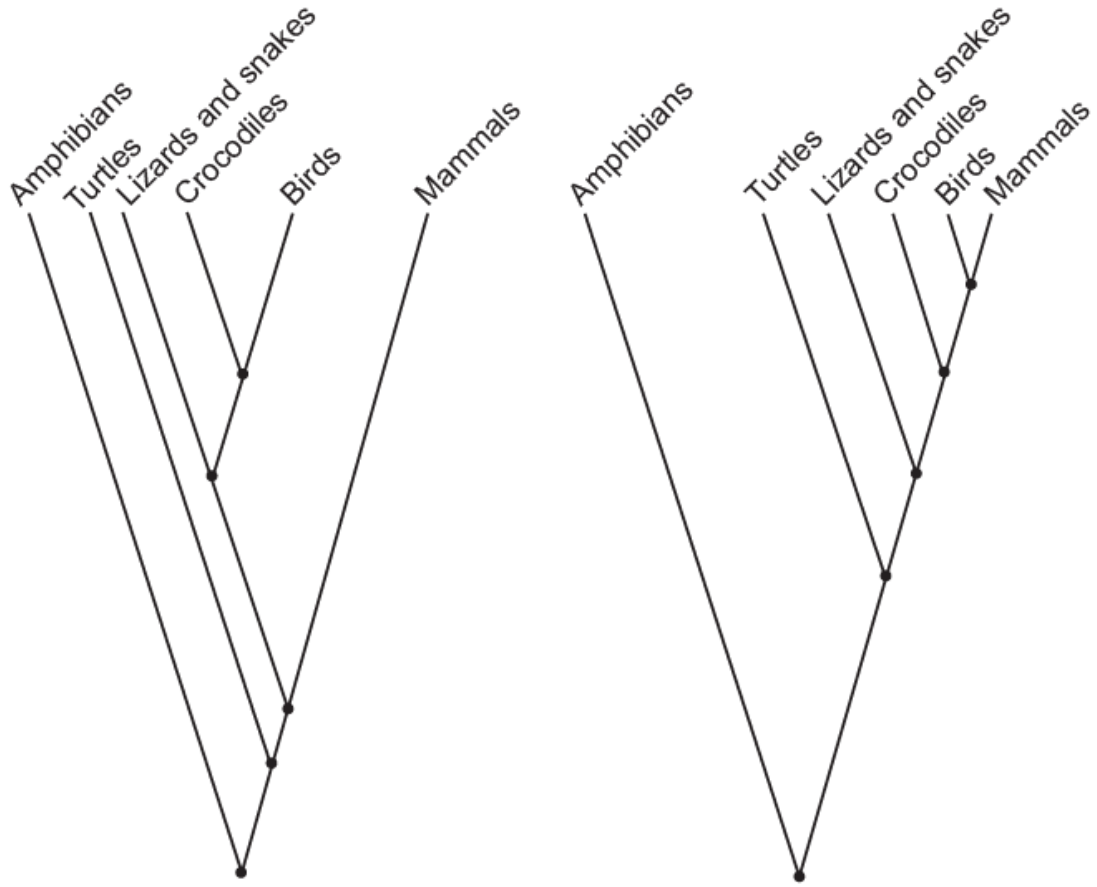
Markscheme

C

Examiners report

There have been some complaints about the use of the word "relative" before role. Although this word was not needed, it does not invalidate the answer to the question. This question had a very low discrimination index and only 40% of the candidates were able to answer this question correctly. The answer was quite easy, as one can see all arrows leaving from carbon dioxide in the atmosphere and the only arrow going back to carbon dioxide in atmosphere is the one coming from photosynthesis, therefore this must be the most important as it is equivalent to the addition of all the other arrows in order to balance the cycle.

Cladograms can be created by comparing DNA or protein sequences. The cladogram on the left is based on DNA sequences and the cladogram on the right is based on comparing protein sequences.



What is the reason that cladograms based on DNA sequences are more reliable predictors of the phylogenetic relationship of species than cladograms based on protein sequences?

A. Amino acids are not as chemically stable as DNA nucleotides.

B. DNA mutates but amino acids do not.

C. Several different triplets of bases can code for the same amino acid.

D. There are 20 different amino acids but only 4 nucleotides.

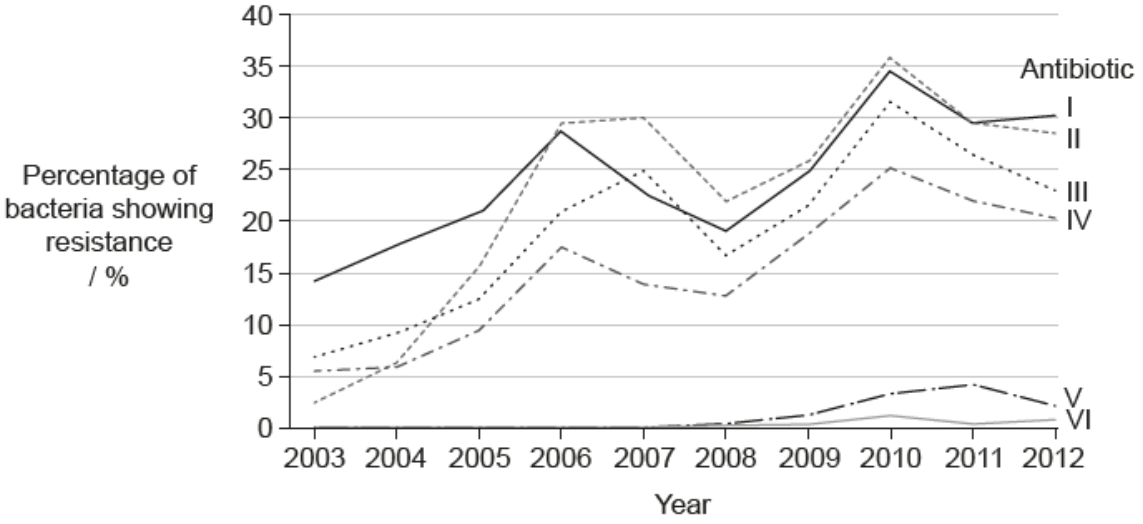
Markscheme

C

Examiners report

[N/A]

The bacterium *Neisseria gonorrhoeae* causes infections related to the human reproductive system. The graph shows the percentage of samples in which this bacterium showed resistance to six antibiotics over a period of ten years.



What is a possible explanation for the total percentage resistance being larger than 100% in 2010?

A. People do not take the antibiotics as prescribed.

B. More people have been sampled in that year.

C. There was an epidemic of *Neisseria gonorrhoeae* in that year.

D. Some bacteria are resistant to more than one antibiotic.

Markscheme

D

Examiners report

[N/A]

The image shows a female Golden Orb-weaving spider *(Nephila plumipes*). They can grow as large as 4 cm and build webs strong enough to trap small birds for food.

[Source: adapted from www.cli.nsw.edu.au]

Which of the following describe(s) this spider?

I. Primary consumer

II. Heterotroph

III. Arthropod

A. I only

B. I and II only

C. II and III only

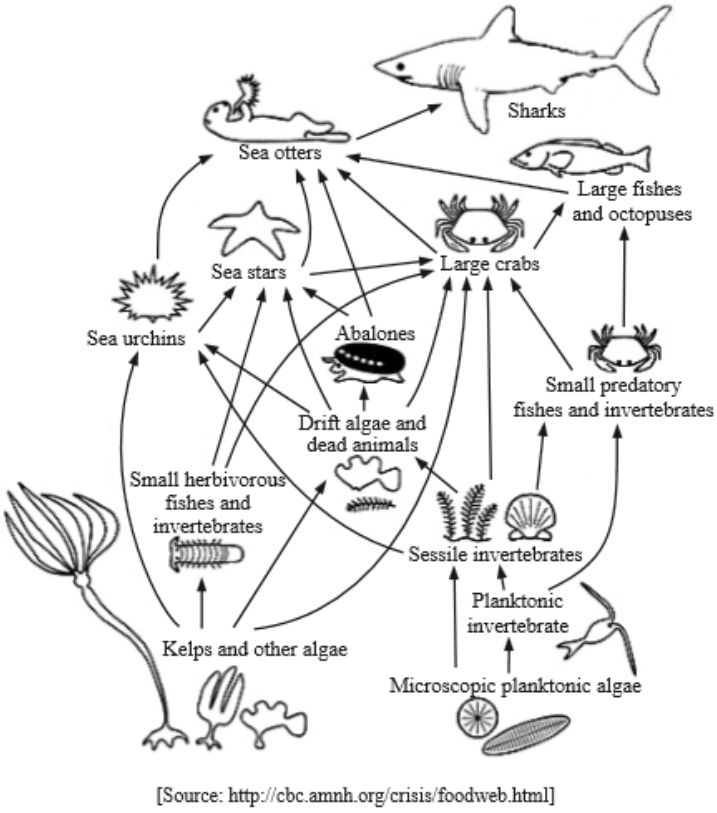
D. I, II and III

Markscheme

C

Examiners report

This question proved too easy.



[Source: http://cbc.amnh.org/crisis/foodweb.html]

What will happen to the food web above if the sea otter disappears?

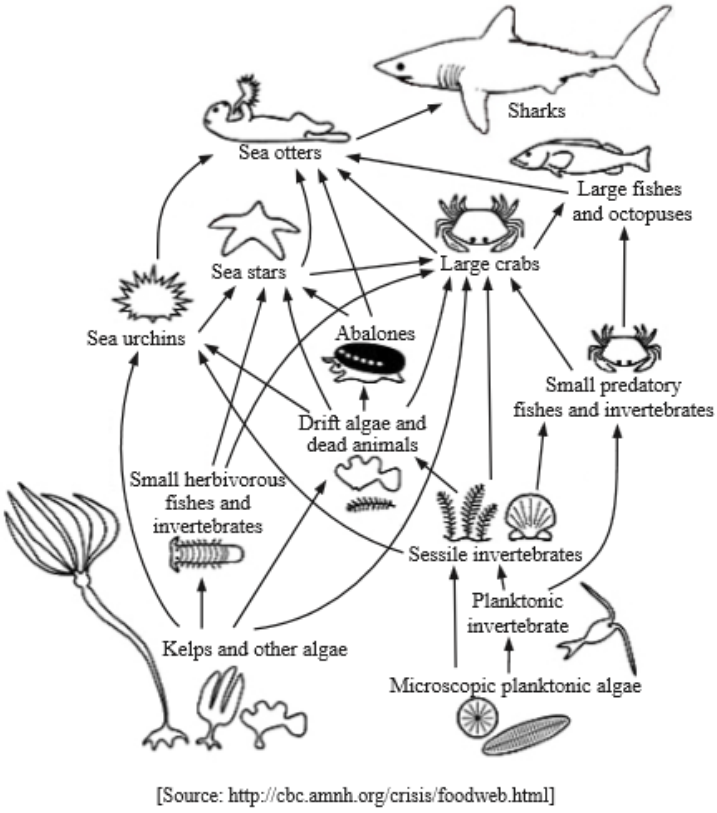
A. Large fish increase and sea urchins decrease.
B. Abalones increase and sharks increase.
C. Sea urchins increase and kelps decrease.
D. Sea stars decrease and sharks increase.

Markscheme

C

Examiners report

These were second and third easiest question of the exam. This means they were not good discriminators, as almost every candidate had the correct answer. In response to the G2 comments, obviously the candidates had no trouble with the food web.



[Source: http://cbc.amnh.org/crisis/foodweb.html]

Which organism in this food web is both a secondary and tertiary consumer?

A. Large crab
B. Small herbivorous fish
C. Shark
D. Microscopic planktonic algae

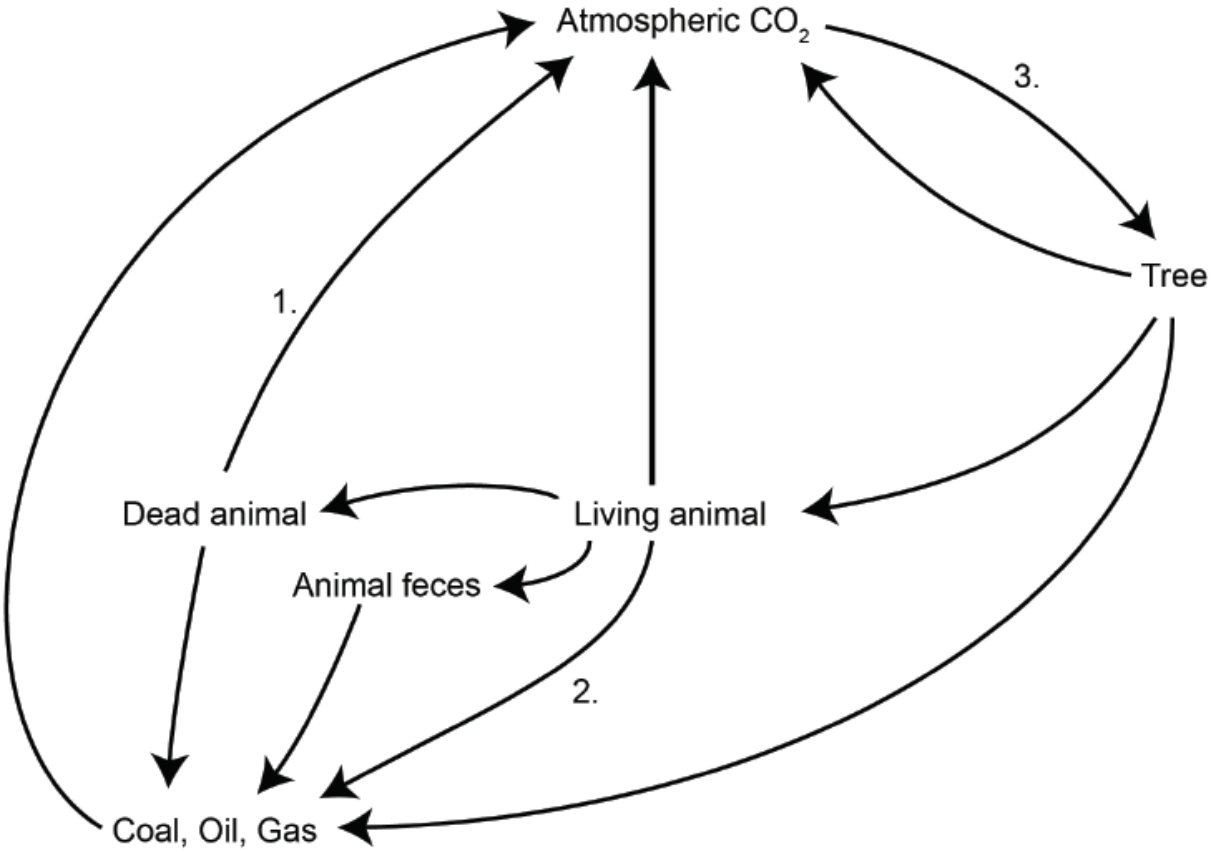
Markscheme

A

Examiners report

These were second and third easiest question of the exam. This means they were not good discriminators, as almost every candidate had the correct answer. In response to the G2 comments, obviously the candidates had no trouble with the food web.

The diagram shows a version of the carbon cycle. What is indicated by the numbers?



[Source : © International Baccalaureate Organization, 2017]

	1	2	3
A.	Death of consumers	Cell respiration in saprotrophs	Cell respiration in producers
B.	Death of consumers	Incomplete decomposition	Photosynthesis in producers
C.	Cell respiration in saprotrophs	Incomplete decomposition	Photosynthesis in producers
D.	Cell respiration in consumers	Cell respiration in saprotrophs	Cell respiration in producers

Markscheme

C

Examiners report

[N/A]

Image I shows a spotted hyena (Crocuta crocuta) and image II shows a leopard tortoise *(Geochelone pardalis*).

Image I

[Source: adapted from www.corbisimages.com]

Image II

[Source: adapted from http://mikeelliscb.edublogs.org]

Based on their diet, the feces of spotted hyenas appear white because of high calcium content. Leopard tortoises eat hyena feces. What would explain such tortoise behaviour?

A. They are saprotrophs.

B. They transform energy with 100 % efficiency.

C. They need to form bones and shell.

D. They only eat inorganic matter.

Markscheme

C

Examiners report

[N/A]