Biomedical Admissions Test (BMAT)

Section 2: Biology

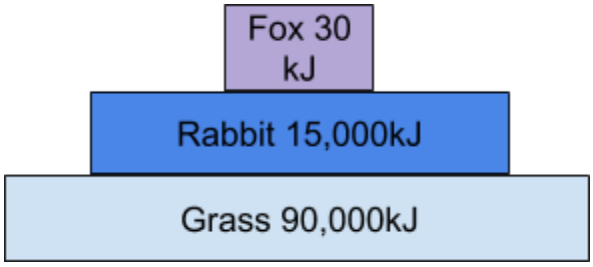
Questions by Topic

B10 - Ecosystems

B10: Ecosystems - Questions by Topic

(Mark Scheme and explanations at the end)

1 Calculate the efficiency of the following energy transfer between the primary and secondary consumer of this trophic diagram.



A 0.02%
B 0.2%
C 2%
D 20%
E 0.5%

2 Which of the following statements are true of the interactions between organisms?

1 Interspecific and Intraspecific have the same effect on population size.
2 Environmental factors can alter populations in 3 main ways.
3 An increase in the amount of grass would mean an increase in the number of foxes in a typical food chain.
4 Predator-prey cycles are sometimes out of phase with each other as one population takes time to respond to changes in the other population.

A 1 and 2
B 3 and 4
C 2 and 3
D 1 and 4
E 1 only
F 2 only
G 3 only
H 4 only

3 Barnacles can root on a male crab. The barnacle changes the crab's reproductive behaviour and leads to the crab looking after the barnacle as if it was a brood of eggs. Male crabs do not normally look after eggs.

What is the best description of the relationship between the barnacle and the crab?

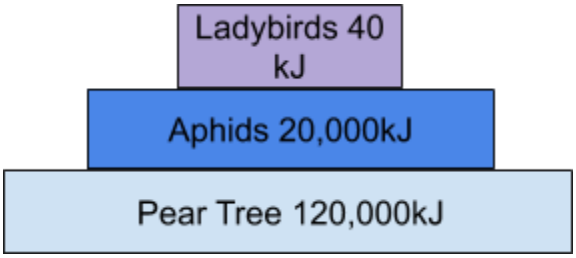
A Mutualistic
B Predator-Prey
C Parasitic
D Interspecific Competition
E Intraspecific Competition

4 Which of the following are true of pyramids of biomass?

1 The number of organisms in each trophic level tends to increase as you move up.
2 Mass is lost through each trophic level due to inedible material.
3 The base of a biomass pyramid always represents a producer.
4 Pyramids can sometimes be 'top heavy'.

A 1 and 2
B 2 and 3
C 3 and 4
D 1 and 4
E 1 only
F 2 only
G 3 only
H 4 only

5 Calculate the efficiency of the following energy transfer between the producer and primary consumer of this trophic diagram.



A 0.17%
B 1.7%
C 17%
D 0.2%
E 0.002%

6 Which of the following carbon cycle processes takes carbon dioxide from the atmosphere?

A Plant respiration
B Animal respiration
C Decay
D Photosynthesis
E Death and waste

7 Nitrogen fixing bacteria are found in the root nodules of leguminous plants. Using your knowledge of the nitrogen cycle, what term best describes the relationship between these 2 organisms?

A Parasitism
B Mutualism
C Predator-prey
D Interspecific Competition
E Intraspecific Competition

8 Which of the following best describes the process of nitrification?

A Nitrogen gas is converted into nitrites, and then further into nitrates
B Nitrogen gas is converted into nitrates, and then further into nitrites
C Nitrites are converted into nitrates
D Nitrates are converted to nitrites
E Ammonium compounds are converted to nitrites
F Ammonium compounds are converted to nitrates
G Ammonium compounds are converted to nitrites, and then further into nitrates

9 An artificial environment is set up for a science experiment. The concentration of nitrogenous compounds have been measured.

Which process is responsible for a decrease of ammonium compounds **and** an increase in nitrite concentration?

A Denitrification and decomposition
B Nitrogen fixation and decomposition
C Nitrogen fixation
D Decomposition
E Nitrification
F Denitrification

Answers and Explanations

1 **The answer is B**

B is correct - here, you must know which bar represents the **primary consumer** and which represents the **secondary consumer**. The rabbit is the primary consumer, as it is the bar present immediately after the **producer**. The secondary consumer is the fox as it consumes the primary consumer.

The equation needed here is:

Efficiency = (energy available to next level)/(energy from previous level) x100

A is incorrect
C is incorrect
D is incorrect
E is incorrect

2 **The answer is C**

1 is incorrect - **Intraspecific competition** has a far greater effect on population size than **interspecific competition** as organisms of the same species have the same needs, rather than just similar needs.

2 is correct - environmental factors can cause population size to **increase**, **decrease** or for population **distribution to change**.

3 is correct - an increase in the amount of grass would lead to an increase of other organisms including rabbits. Rabbits and other similar organisms are prey for foxes, and therefore would lead to an increase in the number of foxes as **more food is available for them.**

4 is incorrect - predator-prey cycles are **always** out of phase with each other as one population takes time to respond to changes in the other population.

3 **The answer is C**

A is incorrect - **mutualism** is present where both organisms benefit; the scenario describes gives no indication of the crab having any benefit from the barnacle.

B is incorrect - the crab does not eat the barnacle (or vice versa), and therefore cannot be a **predator-prey relationship**.

C is correct - the crab is supplying a benefit to the barnacle, but isn't receiving any benefit in return. This is an example of a **parasitic relationship**.

D is incorrect - the organisms are **not competing** for resources.

E is incorrect - these organisms are **not of the same species**, and are **not competing** for resources.

4 **The answer is B**

1 is incorrect - the **number of organisms tends to decrease, as biomass decreases**. There are exceptions, for example if flies eat a dead, large animal there will be many more flies than the large animal, but the biomass will still be reduced.

2 is correct - the biomass decreases as you move up the trophic levels as there is **inedible** material such as bone, and cellulose material that cannot be digested fully.

3 is correct - the **base of a biomass pyramid will always be the producer**. Bars above this will be the consumers, moving through primary to secondary etc.

4 is incorrect - increasing trophic levels on a biomass pyramid has decreasing mass. This is due to some mass being lost - organisms don't tend to eat more than their own bodyweight!

5 **The answer is C**

A is incorrect

B is incorrect

C is correct - here, you must know which bar represents the **producer** and which represents the **primary consumer**. The pear tree is the producer, as it is the bar present immediately after the **primary consumer**. The primary consumer is the aphid as it consumes the producer.

The equation needed here is:
Efficiency = (energy available to next level)/(energy from previous level) x100

D is incorrect

E is incorrect

6 **The answer is D**

A is incorrect - any form of (aerobic) respiration produces carbon dioxide, but does not take it in.

B is incorrect - as mentioned above, respiration is a producer of carbon dioxide.

C is incorrect - decay by microorganisms produces carbon dioxide through respiration.

D is correct - photosynthesis takes carbon dioxide and water from the atmosphere and produces glucose and oxygen.

E is incorrect - death and waste allos decay to take place - this allows microorganisms to respire, producing carbon dioxide.

Exam Tip - Photosynthesis produces glucose from carbon dioxide and water. This reaction is catalysed by sunlight.

7 **The answer is B**

A is incorrect - in parasitism, one organism benefits, but the host does not.

B is correct - the bacteria receive carbohydrates from the plant in return for nitrogen compounds. Here, both organisms are benefiting from the relationship.

C is incorrect - in the nitrogen cycle, the plant does not consume the bacteria (or vice versa).

D is incorrect - the organisms are not competing for any resources.

E is incorrect - the organisms are not of the same species, and are not competing for resources.

8 **The answer is G**

A is incorrect - nitrification does not include the conversion of nitrogen gas into other nitrogenous compounds.

B is incorrect - nitrification does not include the conversion of nitrogen gas into other nitrogenous compounds. Nitrification also includes the conversion of nitrites into nitrates, not the conversion of nitrates into nitrites.

C is incorrect - nitrification also includes the conversion of ammonium compounds into nitrates.

D is incorrect - nitrification also includes the conversion of ammonium compounds into nitrates.

E is incorrect - the nitrites produced are further converted into nitrates, not the other way around.

F is incorrect - in the process of converting ammonium compounds to nitrates, nitrites are produced as a precursor.

G is correct

9 **The answer is E**

A is incorrect - denitrification causes the conversion of nitrates into nitrogen gas, this would lead to an increase in nitrogen gas and a decrease in nitrate concentration. Decomposition causes the production of ammonium compounds - therefore causing an increase in ammonium rather than a decrease.

B is incorrect - nitrogen fixation decreases the amount of nitrogen gas. Decomposition causes the production of ammonium compounds - therefore causing an increase in ammonium rather than a decrease.

C is incorrect - nitrogen fixation decreases the amount of nitrogen gas, converting it into nitrates in the soil. This doesn't affect the concentration of ammonium.

D is incorrect - Decomposition causes the production of ammonium compounds - therefore causing an increase in ammonium rather than a decrease.

E is correct - nitrification causes the conversion of ammonium to nitrites, and then further into nitrates. This could therefore lead to a decrease in the concentration of ammonium, and an increase in the concentration of nitrite.

F is incorrect - denitrification causes the conversion of nitrates into nitrogen gas. This gas is then recycled into the atmosphere. This would lead to a decrease in the nitrate concentration, but an increase in nitrogen gas concentration.