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Level: SL IB in Biology
Subject: Biology
Topic: IB SL Biology
Type: Topic Question

All International Baccalaureate IB Topic Questions SL Biology

BIOLOGY

SL - IB

Key skills

Mark Scheme

Answer 1

The correct answer is C.

The only incorrect statement is IV. There is no reason why adding antibiotics to animal feed makes the feed less nutritious in other ways.

Statement I is correct because continuous feeding of antibiotics to farm animals has been used by some farms as an excuse to keep animals in less hygienic conditions, where disease microorganisms can thrive.

Statement II is correct because by flooding farm animals with antibiotics, humans exert a selective pressure on the bacteria, which supports the evolution of antibiotic resistance.

Statement III is correct because antibiotics are synthetic drugs so would always increase the manufacturing cost of animal feed products.

Answer 2

The correct answer is B.

Because the effectiveness of the antibiotic is best measured as the area of the zone of inhibition, not the diameter, we should use some pencil-and-paper maths here.

The linear scale factor between the diameter of X and the diameter of Y is 3; (because 6cm ÷ 2cm = 3).

Therefore the area scale factor is the square of that; $3^2 = 9$ (Answer B).

There is no need to get stuck in trying to work out πr^2 (a question like this would be in a non-calculator paper); you're being asked to work out a ratio, so the value of π cancels itself out (see model answer below).

After growth, the following results were obtained.

Antibiotic	Diameter of zone of inhibition / cm
X	2.0 (radius = 1.0)
Y	6.0 (radius = 3.0)

How many times more effective was antibiotic **Y** versus antibiotic **X** in this study?

Two alternative ways to calculate:

The ratio of the area of Y to the area of X is what the question needs you to calculate:

(1) $\frac{\text{Area of Y}}{\text{Area of X}} = \frac{\pi r^2}{\pi r^2} = \frac{\pi \times 3^2}{\pi \times 1^2}$

π cancels out $= \frac{3^2}{1^2} = \frac{9}{1} = 9$

[1 mark]

(2) Linear scale factor $= \frac{6}{2} = 3$

Area scale factor $= 3^2 = 9$

[1 mark]

Answer: B

Answer 3

The correct answer is C.

Penicillium mould grows on dead biomass including rotting food (as you'll know if you've left bread for too long) so it feeds naturally as a decomposer. Many other microorganisms feed in this way too, including some species of bacteria. *Penicillium* evolved to produce a bactericidal (bacteria-killing) compound that we know today as an antibiotic.

A is incorrect because bacteria do not feed on *Penicillium*.

B is incorrect because it implies that *Penicillium* requires a host organism, it does not.

D is clearly incorrect because antibiotics are not effective against viruses.

Answer 4

The correct answer is A.

By clumping together, bacterial cells can form a physical barrier to antibiotic drugs, meaning that those cells on the inside of the biofilm are unaffected.

B, C and D, whilst sometimes true, are not a major factor in biofilm production.

Answer 5

The correct answer is A.

The clue is in the information provided, where a part of the ribosome is targeted by the new antibiotic. Ribosomes are the site of protein synthesis, so that is the most likely mode of action.

B, C and D all are plausible ways in which some antibiotics work, although not in this case.

Answer 6

The correct answer is B because:

Blood type A has type A antigens (surface proteins) on the exterior of the red blood cells and blood type B has type B antigens. When blood type A is mixed with anti-A or anti-A+B serum, an agglutination reaction occurs, producing the dense dots seen in the diagram (these are clumps of red blood cells). Blood type B shows the same reaction with anti-B serum and anti-A+B serum. Blood type AB agglutinates in all three anti-serums. Blood type O has neither the A nor B antigen, so it does not react to the serums.

Answer 7

The correct answer is B because endocytosis is the process of engulfing a pathogen that is either attached to the surface of the cell or marked by an antibody. A vacuole is then formed around the bacteria and digestive enzymes are released from lysosomes into the vacuole. Finally, the products of digestion are excreted from the cell by exocytosis. The whole process described above is ‘phagocytosis’.

Answer 8

The correct answer is B; while increased antibiotic use provides a selection pressure that selects for resistance alleles in bacteria and increases rates of infection, a reduction in antibiotic use prevents this from happening and so reduces rates of infection. If antibiotic use is reduced (which it will be once people are vaccinated) then bacteria with resistance alleles have no advantage so the rate at which resistance alleles are passed on is no faster than for any other neutral allele.

Vaccines do not function by killing pathogens, instead activating the immune system to allow a specific immune response and develop long-term immunity. This vaccine will not kill the bacteria but will reduce the spread of the bacterial infection over time, so reducing the use of antibiotics.

Beware of any answers that suggest that organisms respond directly to changes in their environment by adapting. The mutations that lead to adaptation occur randomly and allow natural selection to occur rather than being a direct response to change.

The loss of antibiotics as a selection pressure won't prevent the passing on of resistance alleles but it will reduce the rate at which these alleles are passed on.