5.1 Evolution & Natural Selection

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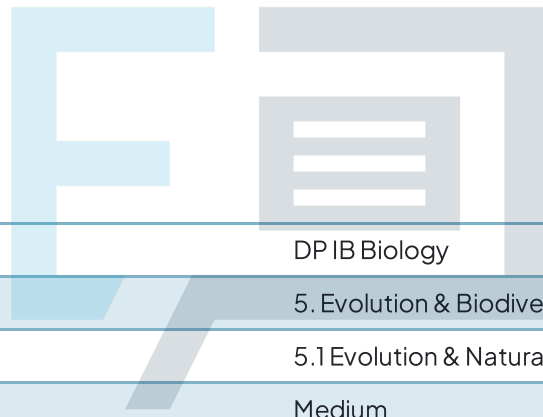
Course	DP IB Biology
Section	5. Evolution & Biodiversity
Topic	5.1 Evolution & Natural Selection
Difficulty	Medium

To be used by all students preparing for DP IB Biology HL
Students of other boards may also find this useful

Exam Papers Practice

1

The correct answer is **C** because only changes in **heritable** characteristics are passed on to subsequent generations.

A implies that evolution has a purpose, where it is in fact the result of **random** mutation.

B and **D** do not refer to the heritable nature of the changes in the organisms' bodies or the advantageous characteristics, so there is no guarantee that these would lead to evolution. E.g. An organism having put on weight ahead of the winter is an advantageous characteristic, but it is not heritable, so will not lead to evolution.

2

The correct answer is **B** because a lack of gene exchange between two populations allows genetic differences to accumulate.

A, **C** and **D** are incorrect because they all contain incorrect statements I, III, or both.

- Speciation **can** result from geographical separation by a mountain range or water, but these are not the only ways that gene exchange can be prevented.
- Differences in physical characteristics may develop between two separate populations, but only once they can no longer interbreed to produce fertile offspring will speciation have occurred.

3

The correct answer is **C** because this set of fossils forms part of a growing fossil record. No one set of fossils alone can **prove** that evolution has occurred, but the more fossils there are, the stronger the evidence for evolution over time.

A is incorrect because while this set of fossils does contain several transitional fossils, it is not complete; fossilisation events are too rare for this to ever be the case.

B is incorrect because it implies that evolution has a purpose, where it is in fact the result of **random** mutation. In addition to this, the fossils in this image do not tell us anything about the environment in which the animals evolved.

D is an incorrect statement; neither limbs or fins are always advantageous, but rather it depends on the environment in which they are used.

4

The correct answer is **A** because this is an accurate description of the selective breeding process.

B involves allowing the plants to reproduce asexually and would just produce clones.

C describes the process of genetic modification.

D suggests that the process of selective breeding only takes two generations, while in reality it takes many generations for the desired characteristics to become widespread in the population of crop plants.

5

The correct answer is **C** because these processes all generate genetic variation:

- Random assortment means that alleles are allocated to gametes in many different combinations during meiosis
- Mutations occur due to copying errors during DNA replication; this generates new alleles
- Random fertilisation means that different zygotes will receive different combinations of alleles

D contains incorrect statement II; mitosis gives rise to genetically identical daughter cells.

6

The correct answer is **B** because genetic variation is passed from one generation to the next. Only advantageous characteristics that result from changes in the alleles of an organism will be passed to offspring.

A does generate genetic variation, and so natural selection may be more likely to occur in a sexually reproducing population. Mutations do arise in asexually reproducing populations such as bacteria, so natural selection can still take place in these populations.

C is an example of a selection pressure. Selection pressures can drive natural selection, but they are not essential, and there are many other examples beyond this one.

D does not specify that the advantageous characteristics result from changes to the alleles; if the characteristics are not heritable, they will not lead to natural selection.

7

The correct answer is **D**; darkened wings from soot particles in the air may well help with escape from predators, but this is an example of an **acquired** characteristic and is therefore **not heritable**, so will not be passed to future generations.

The presence of a **selection pressure** is essential for natural selection to take place, because it means that some individuals will have an **advantage** over others; in this case predation, combined with darkened tree trunks from air pollution, acts as a selection pressure. The camouflaged moths have a survival advantage and therefore an increased chance of reproducing and passing on their melanistic alleles.

There must be variation in **heritable** characteristics (here given as genes) for natural selection to take place.

8

The correct answer is **D** because this is an explanation of how natural selection causes an increase in beak size during drought years.

A implies that natural selection has a purpose, and that finches respond to the change in food source by adapting, where in reality natural selection takes place due to allele changes from **random** mutation.

B contains conclusions, and **C** is a description that can be gained from the graph. Neither offer any explanation, which is what the question asks for.

9

The correct answer is **B**

- Antibiotics act as a **selection pressure**, effectively selecting resistant bacteria which then reproduce and pass on their resistant alleles. If antibiotics are not used, then there will be no advantage to having the alleles for resistance, and these alleles will be no more likely to be passed on.
- Reducing the spread of infection will reduce the need to use antibiotics.

Researching new antibiotics will provide essential alternative treatment options in the future, and while they may eventually lead to reduced reliance on current antibiotics (leading to a reduction in their use and a resulting reduction in resistance to them), this benefit will not occur until after they have been tested and approved for use. Note that bacteria will also eventually evolve resistance to these new antibiotics and alternative antibacterial technologies will be needed in the future.

10

The correct answer is **A**. Resistance can be seen to increase to any antibiotic that is in regular use. Cefixime resistance increases while it is recommended and then decreases again, azithromycin resistance increases while it is recommended, and ciprofloxacin and tetracycline resistance increases throughout due to their use in treating various infections.

B is incorrect; ceftriaxone resistance doesn't appear to increase in this study, but that doesn't mean that it won't evolve elsewhere, and not all antibiotics are suitable for use against all bacteria.

C is incorrect; infection X needs to be treated, and resistance rates to most antibiotics in the study appear to remain low. There may also be other antibiotic options beyond those in this study.

D is incorrect; tetracycline is frequently used against mild conditions, and is therefore not relied on for use in serious infections. The development of resistance to it is not likely to be critical to anyone's health.