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Level: HL IB in Biology
Subject: Biology
Topic: IB HL Biology
Type: Mark Scheme

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All International Baccalaureate IB Topic Questions HL Biology

BIOLOGY HL - IB

Key skills

Answer 1

The correct answer is B, I. and II., this is because in example III. although a mutation has occurred that causes the two populations to become reproductively isolated, they can still be part of the same species. They can just be called variants rather than different species. An example of a plant species with both diploid and tetraploid variants is *Arabidopsis arenosa.* Over time these two variants can become new species.

I. is an example of speciation because the two populations are reproductively isolated and mutations have occurred causing the two populations to become genetically distinct. Over time this may mean that the two species can no longer interbreed successfully.

II. is an example of speciation because the new population is exposed to different selection pressures and is reproductively isolated from the original population. Any new mutations in the new population will not exist in the original population and could be favourably selected for, leading to the formation of a new species over time. This is an example of punctuated equilibrium called the Founder Effect.

Answer 2

The correct answer is A; the bones in the ear and jaw of mammals and reptiles are an example of a homologous trait, meaning that they look and function differently while sharing structural similarities. A good explanation for the existence of homologous traits is that they evolved from a common ancestor by adaptive radiation.

The image alone does not provide enough information to say whether the reptiles were ancestors of the mammals (B) or the mammals were ancestors of the reptiles (C); a comparison of fossils from different time periods would be needed to demonstrate this.

D describes an analogous trait rather than a homologous trait; such characteristics arise as a result of convergent evolution as organisms adapt to similar environments. While it can be difficult to tell the difference between homologous and analogous characteristics, it is unlikely that all mammals and all reptiles evolved to suit similar environmental conditions, and the structural similarities in the bone groupings and positions suggest homology rather than analogy.

Answer 3

The correct answer is C; the small differences between mating displays of lizards on neighbouring islands means that the displays show continuous variation which, when present across populations in the same geographical location, suggests that gradual divergence from a common ancestor has occurred.

Most of the species on the map show only one form of mating display, but there are very small differences between the displays of *M. albemarlensis* on Isabela and Fernandina and larger differences between the displays of *M. indefatigabilis* on Santa Cruz and Santa Fe. It is likely that these differences will limit gene flow between these populations and could eventually lead to speciation.

While it should theoretically be possible to find examples of all stages of species divergence the map only shows a selection of some of the male lava lizard species, and also only shows currently living species; this information is provided in the question stem. For the map to show all stages of divergence it would need to show all currently living species as well as all extinct species.

Answer 4

The correct answer is C.

The pelvic bones of whales are found in the equivalent position to land mammal hip bones, though they do not connect to the skeleton; this fits well with the idea that homologous traits have structural similarities but are different in appearance and function.

The graph showing rib size against testis size shows no correlation, so there is no relationship between the size of these structures; a larger whale might have smaller testes than a smaller whale.

While rib size and testis size are not related, pelvic bone size and testis size show a positive correlation. As the testes are involved with sexual reproduction this is a strong indication that the pelvic bones of whales are involved with reproduction.

The discovery that whale testes (and also whale penises) are connected to whale pelvic bones is a change in scientific thinking that has until recently said that whale pelvic bones are nothing but an evolutionary leftover. If having large pelvic bones increases reproductive success then natural selection will be acting on the pelvic bones in a way that it would not act on a vestigial structure.