

Q 3.A

- **Allen's rule states that mammals from colder climates generally have shorter ears and limbs to minimise heat loss. A smaller body surface area helps animals in colder regions stay warm by slowing down the loss of body heat.** It is named after American biologist Joel Asaph Allen who proposed it in his 1877 paper "The influence of physical conditions in the genesis of species".
- **Bergmann's rule** states that organisms at higher latitudes should be larger and thicker than those closer to the equator to better conserve heat.
- **Hence, option (a) is the correct answer.**

Q 4.B

- Photosynthetically active radiation designates the spectral range of solar radiation from 400 to 700 nanometers that photosynthetic organisms are able to use in the process of photosynthesis. This spectral region corresponds more or less with the range of light visible to the human eye.
- **Statement 1 is not correct:** Except for the deep sea hydro-thermal ecosystem, sun is the only source of energy for all ecosystems on Earth. **Of the incident solar radiation less than 50 per cent of it is photosynthetically active radiation (PAR).**
- **Statement 2 is correct:** Plants capture only 2-10 per cent of the PAR and this small amount of energy sustains the entire living world.

Q 5.C

- **Aquatic Ecosystem:** Lakes and ponds are divided into three different "zones" which are usually determined by depth and distance from the shoreline.
- **Littoral Zone:** The **topmost zone near the shore of a lake or pond is the Littoral zone.** This zone is the warmest since it is shallow and can absorb more of the sun's heat. It sustains a fairly diverse community, which can include several species of algae (like diatoms), rooted and floating aquatic plants, grazing snails, clams, insects, crustaceans, fishes, and amphibians. The vegetation and animals living in the littoral zone are food for other creatures such as turtles, snakes, and ducks.
- **Limnetic Zone:** The near-surface open water surrounded by the littoral zone is the limnetic zone. The limnetic zone is **well-lighted (like the littoral zone) and is dominated by plankton, both phytoplankton and zooplankton.** plankton are small organisms that play a crucial role in the food chain. Without aquatic plankton, there would be few living organisms in the world, and certainly no humans. A variety of freshwater fish also occupy this zone. **Hence statement 1 is correct.**
- **Profundal zone:** The deep-water part of the lake or pond is called the profundal zone. This zone is **much colder and denser than the other two.** Little light penetrates all the way through the limnetic zone into the profundal zone. The **fauna are heterotrophs**, meaning that they eat dead organisms and use oxygen for cellular respiration. **Hence statement 2 is correct.**

Q 6.C

- Ecologists and evolutionary biologists have proposed various hypotheses to account for the greater biological diversity in the Tropics.
 - Speciation is generally a function of time, unlike temperate regions subjected to frequent glaciations in the past, tropical latitudes have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification. **Hence statement 1 is not correct.**
 - Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialisation and lead to a greater species diversity. **Hence statement 2 is not correct.**
 - There is more solar energy available in the tropics, which contributes to higher productivity; this in turn might contribute indirectly to greater diversity. **Hence statement 3 is correct.**

Q 7.A

- Parasitism has evolved in so many taxonomic groups from plants to higher vertebrates. Many parasites have evolved to be host-specific (they can parasitise only a single species of host) in such a way that both host and the parasite tend to co-evolve; that is, if the host evolves special mechanisms for rejecting or resisting the parasite, the parasite has to evolve mechanisms to counteract and neutralise them, in order to be successful with the same host species.
- In accordance with their life styles, parasites evolved special adaptations such as the loss of unnecessary sense organs, presence of adhesive organs or suckers to cling on to the host, loss of digestive system and high reproductive capacity. The life cycles of parasites are often complex, involving one or two intermediate hosts or vectors to facilitate parasitisation of its primary host.