

Robotics in Nature and Environment: Advanced Knowledge

Robotics · Answer Key · 15 Questions

1. Which marine robot design is directly inspired by the efficient, silent propulsion of jellyfish and is utilized for discreet underwater observation?

- A) A hovercraft with articulated arms
- B) A bio-mimetic jellyfish robot (e.g., RoboJelly)**
- C) A towed sonar array
- D) A remotely operated vehicle (ROV) with thrusters

2. What is a primary environmental challenge that bio-inspired roboticists aim to address by studying the locomotion of insects like cockroaches or beetles for search and rescue operations in collapsed structures?

- A) Reducing plastic waste in oceans
- B) Improving the energy efficiency of industrial robots
- C) Navigating complex, unstable, and confined terrains inaccessible to wheeled or tracked robots**
- D) Developing autonomous drones for aerial surveillance

3. The 'Sea Glider' and 'Slocum Glider' are types of autonomous underwater vehicles (AUVs) that mimic the energy-efficient swimming of which aquatic animal to undertake long-duration oceanographic surveys?

- A) Sharks
- B) Dolphins
- C) Tuna**
- D) Whales

4. Robots designed to monitor coral reef health often employ what bio-inspired control mechanism to maintain position and stability in turbulent water currents, similar to how certain fish orient themselves?

- A) Gyroscopic stabilization systems
- B) Active fin-based propulsion and control**
- C) Ballast tank adjustments
- D) Tethered propulsion

5. Which type of robotic platform, often incorporating sensors for air quality and atmospheric data, is designed to mimic the flight patterns and maneuverability of birds for efficient, wide-area environmental monitoring?

- A) Ground-based sensor networks
- B) Autonomous surface vehicles (ASVs)
- C) Fixed-wing or multi-rotor drones**
- D) Submersible robots

6. The development of robotic grippers that can delicately handle delicate biological samples, such as insect specimens or plant leaves, often draws inspiration from the dexterous manipulation capabilities of:

- A) Octopuses' tentacles**
- B) Elephants' trunks
- C) Anteaters' tongues
- D) Chameleons' tongues

7. Robots designed for reforestation efforts, which can plant seeds or saplings, often utilize locomotion principles observed in:

- A) Snakes, for traversing uneven terrain**
- B) Cheetahs, for rapid deployment
- C) Elephants, for soil compaction
- D) Sloths, for slow and steady progress

8. What fundamental ecological role do robots designed to simulate the burrowing behavior of earthworms play in soil science research and agricultural applications?

- A) Pest control
- B) Nutrient cycling and soil aeration simulation**
- C) Pollination
- D) Herbicide application

9. The design of robotic systems for tracking wildlife migration patterns often employs algorithms that mimic the navigation strategies of:

- A) Ant colonies
- B) Arctic terns**
- C) Spiders
- D) Domesticated dogs

10. Robots that assist in waste management and recycling, particularly in identifying and sorting materials, can be partially inspired by the sensory and classification abilities of:

- A) Bats, through echolocation
- B) Butterflies, through chemical sensing
- C) Eagles, through visual acuity
- D) Sharks, through electroreception**

11. What is a key design principle in bio-inspired robots that aim to traverse dense forest undergrowth, mirroring the movement of animals like deer or wild boars?

- A) High-speed wheeled locomotion
- B) Articulated leg mechanisms with adaptive gait control**
- C) Continuous track systems
- D) Hovering capabilities

12. Robotic platforms designed for the study of bee colonies, such as micro-drones that can interact with bees, often take inspiration from the collective intelligence and communication methods of:

- A) Wolf packs
- B) Ant colonies**
- C) Penguin colonies
- D) Dolphin pods

13. The development of soft robotics for manipulating delicate biological specimens in laboratories or for environmental sampling is heavily influenced by the flexible and adaptable structures found in:

- A) Armored beetles
- B) Vertebrate skeletons
- C) Mollusks**
- D) Arthropod exoskeletons

14. Robotic swarms used for large-scale environmental monitoring, such as mapping deforestation or tracking invasive species, are often designed to exhibit emergent behaviors similar to:

- A) Solitary predators
- B) Herding mammals
- C) Flocking birds or schooling fish**
- D) Burrowing rodents

15. What environmental problem is directly addressed by the research and development of robots that can mimic the filter-feeding mechanisms of bivalves for water purification in aquatic ecosystems?

A) Ocean acidification

B) Plastic pollution

C) Sedimentation

D) Thermal pollution