

Exercise Science in the Natural World

Exercise Science · Answer Key · 10 Questions

1. Which terrestrial animal exhibits the highest peak ground reaction forces relative to its body mass during locomotion, a characteristic advantageous for rapid acceleration and shock absorption?

- A) African Elephant (*Loxodonta africana*)
- B) Cheetah (*Acinonyx jubatus*)
- C) Kangaroo (*Macropus giganteus*)**
- D) Giraffe (*Giraffa camelopardalis*)

2. The remarkable diving capacity of marine mammals like the sperm whale (*Physeter macrocephalus*) is partly due to adaptations that allow for extreme oxygen conservation. Which of the following is a key physiological mechanism employed?

- A) Increased heart rate during descent
- B) Peripheral vasoconstriction to shunt blood to vital organs**
- C) Elevated metabolic rate to generate heat
- D) Increased lung capacity relative to body size

3. The 'spring-loaded' tendons in the hindlimbs of the red kangaroo (*Macropus rufus*) function as elastic energy storage systems. At what phase of saltatorial locomotion are these tendons maximally stretched, contributing to efficient hopping?

- A) During the aerial phase of the jump
- B) Upon initial push-off from the ground**
- C) During mid-flight, prior to landing
- D) Just before full extension of the hindlimbs

4. The gliding locomotion of the sugar glider (*Petaurus breviceps*) is achieved through a membrane called a patagium. What primary biomechanical principle allows for controlled descent and maneuverability?

- A) Aerodynamic lift generated by wing flapping
- B) Thrust production from tail oscillations
- C) Increased drag and reduced lift, controlled by limb extension**
- D) Utilizing updrafts and thermal currents

5. Hummingbirds (family Trochilidae) possess an extraordinary flight capability, including hovering and backward flight. This is primarily facilitated by a unique wing articulation that allows for:

- A) Pronation and supination of the entire wing
- B) A figure-eight motion of the wingtip
- C) Rotation at the shoulder joint, generating lift on both the downstroke and upstroke**
- D) Flexion and extension of the elbow joint

6. The endurance running capabilities of prey animals like the pronghorn (*Antilocapra americana*) are supported by several physiological and anatomical adaptations. Which of the following is NOT a significant contributor to their sustained speed?

- A) Large lung capacity and a powerful diaphragm
- B) A flexible spine that enhances stride length
- C) Highly efficient oxygen utilization by muscles
- D) A high proportion of slow-twitch muscle fibers in the legs**

7. The extreme vertical leaps of fleas (order Siphonaptera) are achieved through a remarkable energy storage and release mechanism involving elastic proteins. What is the primary protein responsible for this rapid 'snap' action?

- A) Actin
- B) Myosin
- C) Resilin**
- D) Collagen

8. The burrowing locomotion of animals like the mole (family Talpidae) requires significant muscular force and specialized anatomical features. What adaptation allows for efficient excavation of soil?

- A) Elongated forelimbs for digging
- B) Broad, spade-like forepaws with strong claws**
- C) A streamlined body shape for pushing through soil
- D) High metabolic rate to generate heat for soil softening

9. The 'burst swimming' performance of cephalopods like the squid (order Teuthida) relies on jet propulsion. This mechanism involves the rapid expulsion of water from which anatomical structure?

- A) Ctenidia (gills)
- B) Siphon (funnel)**
- C) Mantle cavity
- D) Radula

10. Certain plant species, such as the Venus flytrap (*Dionaea muscipula*), exhibit rapid mechanical movements for prey capture. This 'snap' mechanism is driven by turgor pressure changes and is facilitated by:

- A) Rapid ATP hydrolysis in muscle-like cells
- B) Electrophysiological signals causing cellular swelling**
- C) Mechanical tension in specialized epidermal cells
- D) Hydrolysis of stored starch into sugars