# Mechanical Engineering in Nature

Mechanical Engineering · Answer Key · 12 Questions

**1. The drag reduction observed in the skin of the shortfin mako shark, which inspires surface engineering for fluid transport, is primarily attributed to which mechanical feature?**

A) Superhydrophobic wax coatings
**B) Micro-riblets on dermal denticles**
C) Active mucus secretion channels
D) Electrostatic repulsion of boundary layer particles

**2. In the study of insect flight, which mechanical phenomenon allows the Manduca sexta moth to maintain stable hovering despite turbulent gust conditions?**

**A) Passive aeroelasticity of the wing membrane**
B) Active cavitation of wing tip vortices
C) Hysteresis in thoracic muscle contraction
D) Variable-stiffness hydraulic actuator control

**3. What mechanical property of the dactyl club in the peacock mantis shrimp allows it to withstand high-velocity impacts against gastropod shells without fracturing?**

A) A ceramic-metal matrix gradient
**B) The Bouligand structure of chitin fibers**
C) A self-healing polymer resin
D) Piezoelectric crystalline lattice arrays

**4. Which mechanical system explains the extreme energy storage efficiency of the flea's jump, involving the deformation of resilin?**

A) Hydraulic fluid displacement
B) Pneumatic pressure release
**C) Elastic strain energy storage in a protein spring**
D) Centrifugal force amplification

**5. The attachment mechanism of the gecko foot, used as a model for synthetic adhesives, relies primarily on which physical principle?**

A) Capillary adhesion
**B) Van der Waals forces**
C) Vacuum suction chambers
D) Chemical covalent bonding

Quixly | This material was auto-generated. Quixly is not liable for errors or omissions. Visit quixlylearn.com to report corrections.

**6. Woodpeckers utilize which mechanical strategy to prevent brain injury during repetitive high-deceleration drilling?**

A) Cerebrospinal fluid compressibility
B) Asymmetric beak geometry for kinetic energy dissipation
C) High-frequency vibration dampening via the hyoid apparatus
**D) Elastic deformation of the cranial cancellous bone**

**7. What is the primary mechanical function of the 'bulla' bone in the ear of a baleen whale regarding underwater acoustics?**

**A) Impedance matching for low-frequency vibration transmission**
B) Thermal regulation of auditory nerves
C) Elastic recoil for rapid signal processing
D) Pressure compensation at depth

**8. The lotus effect, utilized in surface engineering to create self-cleaning materials, is defined by which mechanical surface characteristic?**

A) Surface energy reduction through chemical grafting
**B) Micro-scale roughness combined with epicuticular waxes**
C) High-frequency electrostatic repulsion
D) Hydrophilic pore-based capillary suction

**9. How do the wing surfaces of owls suppress the mechanical noise of aeroacoustic turbulence during flight?**

**A) Comb-like leading-edge serrations**
B) Elastic membrane wing trailing edges
C) Porous wing-surface coating
D) Active boundary layer suction

**10. In botanical mechanics, the opening of pine cones in response to humidity is driven by which phenomenon?**

A) Osmotic pressure fluctuations
**B) Differential swelling of bilayered tissue structures**
C) Hydraulic capillary action
D) Thermal expansion coefficients

**11. The structural integrity of deep-sea glass sponges is attributed to which engineering geometry of their spicule arrays?**

A) Triangular space-frame lattices
B) Hexagonal prism hierarchies
**C) Concentric cylindrical reinforcements**
D) Icosahedral mineral stacking

Quixly | This material was auto-generated. Quixly is not liable for errors or omissions. Visit quixlylearn.com to report corrections.

**12. The rapid tongue projection in chameleons is governed by which mechanical energy conversion process?**

A) Pneumatic inflation of the hyoid bone

**B) Elastic recoil of pre-loaded collagen tissues**

C) Hydraulic pressure amplification

D) Rapid muscle twitch activation

Quixly | This material was auto-generated. Quixly is not liable for errors or omissions. Visit quixlylearn.com to report corrections.