Materials Science in Nature

Materials Science · Answer Key · 18 Questions

1. Which protein, found in spider silk, gives it a tensile strength comparable to high-grade steel?

A) Keratin
B) Fibroin
C) Collagen
D) Elastin

2. What substance makes up the exoskeleton of crustaceans, providing a durable and protective natural polymer composite?

A) Chitin
B) Cellulose
C) Lignin
D) Silica

3. Nacre, or mother-of-pearl, is a biological material that derives its extreme toughness from alternating layers of aragonite and which organic substance?

A) Lipids
B) Biopolymer chitin
C) Conchiolin
D) Glycogen

4. Which biological material, found in the teeth of limpets, is currently considered the strongest natural material known to science?

A) Goethite nanofibers
B) Calcium phosphate
C) Hydroxyapatite
D) Silica spicules

5. The hydrophobic effect that makes lotus leaves self-cleaning is primarily caused by which structural feature?

A) A layer of wax
B) Nanoscopic surface roughness
C) Ionic repulsion
D) High surface tension

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6. What mineral does the chiton use to reinforce its teeth, making them hard enough to scrape algae off rocks?

A) Magnetite
B) Calcite
C) Pyrite
D) Quartz

7. Which material do diatoms use to construct their intricate, glass-like cell walls?

A) Calcium carbonate
B) Silica
C) Magnesium oxide
D) Cellulose

8. The structural color found on butterfly wings, such as the Morpho butterfly, is caused by which physical phenomenon?

A) Chemical pigments
B) Bioluminescence
C) Light interference from microscopic scales
D) Absorption of ultraviolet light

9. What is the primary structural component of plant cell walls that provides high tensile strength?

A) Amylose
B) Cellulose
C) Pectin
D) Suberin

10. Which material do some species of sea sponges use to create a fiber-optic skeletal network?

A) Silica
B) Collagen
C) Chitin
D) Calcium phosphate

11. The extremely high impact resistance of the dactyl club in a peacock mantis shrimp is due to an internal structure made of what?

A) Mineralized hydroxyapatite
B) A complex arrangement of chitin fibers
C) Boron nitride
D) Liquid crystal polymers

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12. Which biomineral provides the hardness in the enamel of vertebrate teeth?

A) Hydroxyapatite
B) Fluorite
C) Dolomite
D) Gypsum

13. What substance, found in the beaks of giant squids, is a high-strength, lightweight protein-based material?

A) Beak-protein (squid beak protein)
B) Keratin
C) Silk
D) Elastin

14. The bark of the cork oak tree is an excellent insulator primarily because of its high content of what material?

A) Lignin
B) Suberin
C) Cellulose
D) Tannins

15. Which material is secreted by mussels to allow them to attach securely to rocks in turbulent intertidal zones?

A) Byssal threads (containing DOPA proteins)
B) Calcium carbonate
C) Silica
D) Wax

16. What protein provides the elasticity and structural integrity of the human dermis and animal connective tissues?

A) Collagen
B) Myosin
C) Tubulin
D) Actin

17. The high strength-to-weight ratio of bamboo is largely attributed to its composition of vascular bundles embedded in which matrix?

A) Lignin
B) Pectin
C) Starch
D) Glycogen

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18. What component gives bird feathers their structural durability and water-repellent properties?

A) Beta-keratin

B) Collagen

C) Chitin

D) Silica