

## Tissue Mechanics Worksheet **Answers**

1. As the concentration of collagen cross-links in our tissues increases, does the tissue stiffness increase or decrease?

Tissue stiffness increases with increasing collagen cross-linking.

2. What function does collagen provide in our tissues?  
Give an example of a tissue that uses collagen to function correctly.

Collagen provides strength in tension. Tendons are composed mainly of collagen so that they do not break when pulled during the movement of muscles and bones.

3. What function does elastin provide in our tissues?  
Give an example of a tissue that uses elastin to function correctly.

Elastin gives tissues elastic properties, similar to springs. Arteries contain large concentrations of elastin so enabling them to expand and contract with the varying pressure of blood as it is pumped through the circulatory system.

4. What function do proteoglycans provide in our tissues?  
Give an example of a tissue that uses proteoglycans to function correctly.

Proteoglycans attract water molecules in our tissues, causing them to retain water. This allows tissues to provide lubrication throughout the body. Cartilage is an example of a tissue with a lot of proteoglycans. Cartilage uses proteoglycans to lubricate our joints.

5. List three examples of what engineers might design or study that would require them to use tissue mechanics. For each example, explain *why* engineers would need to understand tissue mechanics. (If needed, use the back of this sheet.)

*Artificial heart valve:* Engineers must understand tissue mechanics when designing artificial heart valves to ensure the valves will not harm surrounding tissues.

*Tissue disease:* Engineers use tissue mechanics when studying tissue diseases and how the tissue and its function is altered by the disease. They use this knowledge to design devices to restore function to the tissue or to detect that disease in the tissue.

*Prosthetics:* Engineers apply their understanding of tissue mechanics when designing prosthetics in order to understand the forces that prosthetics may experience during use, and ensure that the functions and ranges of motion of the natural limbs are restored to patients.

*NOTE:* For questions 2-5, students may provide several different examples. Accuracy of these examples can be determined with a quick Internet search.