

Section 4 – Structures are designed, evaluated, and improved to meet human needs**4.1 Building Safe Structures in All Environments**

1. All structures are created to satisfy human needs (or wants). Although each structure is designed for a very specific function the one thing that they all have in common is ...
 - A. **cost**
 - B. **safety**
 - C. **durability**
 - D. **appearance**

2. Building components are designed to withstand more force than will normally occur or act on the structure. Unfortunately some structures fail in extreme situations because the forces acting on the structure have exceeded the structure's ...
 - A. **building code**
 - B. **stability parameters**
 - C. **margin of safety**
 - D. **deformation threshold**

3. Various tests on a structure's design are made before it is approved for use by the consumer. Consumer Product Tests ensure that a product is safe to use. The first step in the testing process is to test the product's ...
 - A. **components**
 - B. **performance**
 - C. **durability**
 - D. **design**

4. During the Ice Storm in Quebec in 1998, ice crystals formed on many structures. Some of these structures failed because the formation of ice crystals on the structure added to the structure's ...
 - A. **flexibility**
 - B. **overall mass**
 - C. **safety margin**
 - D. **tensile strength**

5. The most recent mudslides in North Vancouver (January, 2005) caused extreme damage and some loss of life. This occurred because of the ...
 - A. **unstable soil and steep terrain where these people lived**
 - B. **heavy rainfall this area received in a short period of time**
 - C. **poor construction practices and lack of appropriate safety margins**
 - D. **minor earthquake that occurred at the same time as the sudden rainfall**

6. Stability in a structure is dependant on a number of factors. One of these factors is whether or not a structure could fail if an extreme force was applied to the structure that was not in the original design specifications. The Empire State building is a steel frame building that survived the crash of a USAF Bomber hitting it between the 78th and the 79th floors. The design component that likely enabled the Empire State building to withstand this incredible force was its ...
 - A. **mass**
 - B. **reinforced concrete**
 - C. **central location**
 - D. **lack of glass materials used**

7. A firm foundation is necessary to support a structure. Solid ground is not always firm and stable. There are environmental and man-made conditions, which make the soil, loosen and become compact, which makes the soil relatively unstable. Three strategies are use to ensure a structure is built on a firm foundation. The three strategies include all of the following, EXCEPT ...
 - A. **find something solid**
 - B. **make a soil layer**
 - C. **spread the load**
 - D. **utilize pressure and density**

4.2 Strengthening Materials to Improve Function and Safety

1. Improving designs by using different materials or incorporating new technologies can help to make a structure perform its function more effectively. One way to solve a structural problem is to combine materials and components in new ...
 - A. **technologies**
 - B. **arrangements**
 - C. **adhesives**
 - D. **functions**

2. At birth a baby has 350 bones. As the baby grows, the total number of bones in the body is reduced to 206. Nature's way of strengthening the body is to use the 144 'missing' bones to reinforce the frame by this method ...
 - A. **adhesive**
 - B. **gluing**
 - C. **fusion**
 - D. **fastening**

3. The process of forming a material into wave-like ridges or folds is called corrugation. Common examples can be found in materials such as ...
 - A. **cardboard boxes**
 - B. **drywall sheets**
 - C. **aluminum foil**
 - D. **Reinforced concrete**

4. A stronger material, made by gluing layers of the same material together, is done through a process known as ...
 - A. **corrugation**
 - B. **reinforcement**
 - C. **lamination**
 - D. **papier-mâché**

5. Technological advancements have led to new composite materials being developed. One such material is used in such diverse products as tires, fibre optic cables, and sporting goods. This composite material is known as ...
 - A. **Spider silk**
 - B. **Kelvar®**
 - C. **Fibreglass**
 - D. **Titanium**

4.3 Evaluating Designs from an Overall Perspective

1. Any design can be evaluated from many different perspectives. The most common perspectives designers and engineers use include ...
 - A. **cost, benefits, safety, impact on the environment**
 - B. **materials, benefits, safety, waste production**
 - C. **cost, benefits, materials, aesthetics**
 - D. **impact on the consumer, aesthetics, safety, waste reduction**

2. Rocky Mountain bicycles modified a road bike and made this in 1982. The 'Sherpa' was the first one of these produced.
 - A. **racing bike**
 - B. **all-terrain bike**
 - C. **motocross bike**
 - D. **mountain bike**

3. Hollow triangle tubes are used as the traditional shapes for a bicycle. This is because they provide the best ...
 - A. **flexibility**
 - B. **ductility**
 - C. **strength**
 - D. **plasticity**

4. All departments within the bicycle company, such as marketing can have access to the bicycle specifications because the company uses this for all its bike designing and manufacturing ...
 - A. **engineering sketches**
 - B. **computer-aided systems**
 - C. **digital communication**
 - D. **audio-visual technologies**

5. A radio that operates by turning a crank in the back provides enough power to last about 30 minutes. The radio operates on mechanical energy, with no need for batteries or electricity. It could become very popular because one of its best advantages is its ...
 - A. **portability**
 - B. **design**
 - C. **cost**
 - D. **flexibility**