

Section 1 – Natural and Human-made Structures

- A student who was studying for a rest remembered the different models the teacher used in class to identify the different kinds of structures. When the teacher made a tent-like position with the hands, the student remembered it represented a ...

 - mass
 - shell
 - frame**
 - solid
- A frame structure like your skeleton is made of very strong materials so they can support the ...

 - ligaments
 - cartilage
 - joints
 - organs**
- Spider webs are examples of structures that can hold up to 4000 times the weight of the spider that made it. The spider web is a ...

 - solid frame structure
 - solid shell structure
 - natural shell structure
 - natural frame structure**
- All of the following structures can be classified as manufactured, EXCEPT a ...

 - jigsaw puzzle
 - spoon
 - feather**
 - fishing net

5.



Inukshuit is a unique symbol of Inuit culture, always pointing the way home. To anyone who encounters these manufactured structures (which come in many different forms and shapes) the greeting they convey is one of joy and happiness. Their purpose is to ...

- show danger
- guide travelers**
- reward hunters
- identify hazards

6.



The 5 glass-pyramids of the **Muttart Conservatory** in Edmonton house different types of plant cultures, including; tropical, arid and temperate. It is more than just a garden though, because it hosts many of Edmonton's premier floral shows, educational programs for school children, horticultural courses for adults and continues as a very popular site for weddings, banquets and business activities.

Because these structures are used for a variety of reasons, they have multiple

- designs
 - functions**
 - shapes
 - forms
- Roof types are designed for cover and also to serve a useful purpose in the environment in which they can be found. A very steep roof design in a mountainous area is designed to prevent ...

 - heavy rains
 - snow build-up**
 - climbing animals
 - wind damage

8. Michael Kelly, a Prairie rancher invented barbed wire to keep his livestock from wandering off. His idea came from a natural structure, a ...
- A. cactus
 - B. tumbleweed
 - C. prickly pear
 - D. thorny bush
9. When choosing the most suitable materials to build a structure, architects, engineers and designers should consider all of the following before making their final choice ...
- A. cost, appearance, environmental impact, energy efficiency
 - B. cost, color, life expectancy, impact strength
 - C. environmental appearance, type of symmetry, type of joints needed, cost effectiveness
 - D. flexibility, impact strength, energy efficiency, color

10. Each manufactured structure can be paired with a natural structure it is based on.



Only one of the pairings below is correct. Which one is it?

- A. 6 - 1
 - B. 3 - 6
 - C. 6 - 5
 - D. 2 - 6
11. One important criteria of good design - that is usually not written down in the specifications - is that the structure ...
- A. has a margin of safety
 - B. is esthetically pleasing
 - C. is cost effective
 - D. has a solid foundation

12. Sun-baked 'Adobe' brick houses are usually found in countries where the climate is ...



- A. Wet and cool
- B. Hot and dry
- C. Temperate
- D. Damp and cold

13. **Sod houses** were common on the prairies and were used by ...



- A. engineers
- B. settlers
- C. businessmen
- D. contractors

14. Both of these structures are houses for people in very specific environments. One advantage of structures such as these is that they ...



Igloo



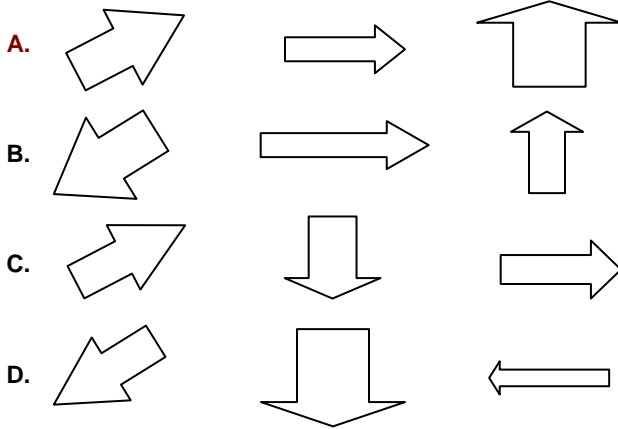
tent

- A. are portable
- B. protect from the cold nights
- C. keep out animals
- D. are fireproof

Section 2 – External and Internal Forces Act on Structures

15. The actual effect of a force depends on three things: the magnitude, or size of the force; the direction of the force; and ...
- A. how the force is applied
 - B. where the force is applied
 - C. why the force is applied
 - D. how long the force is applied

16. A large force is applied to a freezer to move it up a ramp to the second floor, where a smaller force is used to push it to the window, and a very large force is needed to lift it up, to put it off balance, so it falls out the window and is demolished on the sidewalk below.



17. The standard unit of measuring force is named after a famous English scientist, who was the first to describe the 'law of gravitation', getting the idea for the law as he sat under an apple tree. This unit of measuring force is similar to the amount of force needed to hold an apple in your hand and is called a ...
- A. joule
 - B. kilogram
 - C. Newton
 - D. gram

18. Identify which structure would have the greatest stability, because of its centre of gravity.
- A. High centre of gravity and a narrow base
 - B. High centre of gravity and a wide base
 - C. Low centre of gravity and a narrow base
 - D. Low centre of gravity and a wide base

19. Weight is a force that is measured by the gravitational pull on the object. It is usually measured in ...
- A. Newtons
 - B. kilograms
 - C. grams
 - D. pounds

20. Symmetry is a balanced arrangement of mass that occurs on opposite sides of a line or plane, or around a centre or axis. The force of gravity acting on each side is the same. Which of the following illustrations is symmetrical?



21.




A dynamic load on this train bridge is the ...

- A. tracks
 - B. train**
 - C. cement pillars
 - D. wood beams
22. Designers generally use three key methods to help structures withstand forces. They include all of the methods below, EXCEPT for ...
- A. distribute the load evenly
 - B. direct the forces along angled components
 - C. shape the parts for the forces they are likely to face
 - D. place lighter materials above heavier materials**
23. When engineers build bridges, they take two conditions into account: what the bridge is crossing and what kinds of loads it will support, to decide which type of bridge will best suit the situation. Which type of bridge would engineers suggest to withstand very heavy loads?
- A. Beam Bridge
 - B. Truss Bridge
 - C. Arch Bridge**
 - D. Suspension Bridge
24. Performance requirements are the guiding principles that engineers use to design structures. Maximum weight that the structure can support is expressed as ...
- A. weight capacity
 - B. load performance**
 - C. static load mass
 - D. dynamic load mass
25. Complementary forces happen when different kinds of forces act on a structure at the same time. An example of a complementary force is ...
- A. bend**
 - B. buckle
 - C. shear
 - D. twist
26. When you put your hands on your desk and put all your weight on them - then try to move them forward your hand (much like a structure) resists movement forward because of ...
- A. static forces
 - B. kinetic forces
 - C. external forces
 - D. frictional forces**
27. The 7 wonders of the Ancient World took many years to complete, but they lasted a very long time. Why do you think that the Statue of Zeus at Olympia lasted so long?
- A. It was sheltered in a valley.
 - B. It was protected by the Greek Gods.
 - C. It was made of gold and ivory, which resist corrosion.**
 - D. It was made of reinforced concrete and sealed with epoxy.
28. The strongest structural shape is a ...
- A. square
 - B. circle
 - C. triangle**
 - D. rectangle

29. An arch, which is a common shape in bridges, can support large loads. This is possible because the force of the load is carried down through the arch to the foundation, from this point in the arch ...
- A. loadstone
 - B. keystone
 - C. column
 - D. cantilever
30. Structural stability requires that a variety of materials should to be utilized to avoid deformation and structural failure. In a hang-glider the way that helps to reduce internal forces, such as tension, compression and shear, on the component parts is to ...
- A. distribute the load evenly
 - B. direct the forces along angled components
 - C. shape the parts for the forces they are likely to face
 - D. place lighter materials above heavier materials

Section 3 – Structural Strength and Stability

31. The materials in structures can be evaluated according to many properties. The property that describes how easily a material can be shaped is called ...
- A. ductility
 - B. plasticity
 - C. brittleness
 - D. tensile strength
32.  This palm tree is demonstrating this property ...
- A. brittleness
 - B. ductility
 - C. plasticity
 - D. flexibility
33. A change of shape in a structure or a structural component, because the material is unable to resist the load acting on it is called ...
- A. deformation
 - B. resistance
 - C. ductility
 - D. brittleness
34. The force that resists another object when the surfaces of each are in contact is called ...
- A. fusion
 - B. force
 - C. friction
 - D. fissure
35. One way landscape architects join stones to make retaining walls and split-rail fences is to use this method ...
- A. rivets
 - B. welds
 - C. cement
 - D. mass
36. Adhesives are used to bind materials together. A type of adhesive that hardens when it cools is ...
- A. thermosetting glue
 - B. therapeutic glue
 - C. solvent-based glue
 - D. solvent-enriched glue

37. Moveable joints are used to secure materials together in a structure. All of the following joints are examples of moveable joints (allowing movement in a structure) EXCEPT ...
- A. a trailer hitch
 - B. photocopier lid
 - C. ball and socket joint (shoulder)
 - D. Lego
38. Joints are made to withstand forces acting on them for long periods of time. Wear and tear parts of moveable joints are caused by friction. Friction also generates ...
- A. deformation
 - B. fatigue
 - C. stability
 - D. heat
39. There are 656 muscles in your body. These muscles allow your skeletal frame to move. The contraction and relaxing of these muscles is possible because they are made of ...
- A. semi-solid fibrous tissue
 - B. solid fibrous tendon
 - C. solid fibrous cartilage
 - D. semi-fibrous ligament
40. The layer of material in a tree trunk that supports the rest of the structure, but does not function to conduct water and materials is the ...
- A. woody layer
 - B. heartwood
 - C. sapwood
 - D. vascular cambium

Section 4 – Structures are designed, evaluated, and improved to meet human needs

41. 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
42. 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
43. 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
44. 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 used 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

45. 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
46. 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
47. 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
48. 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
49. 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
50. 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**