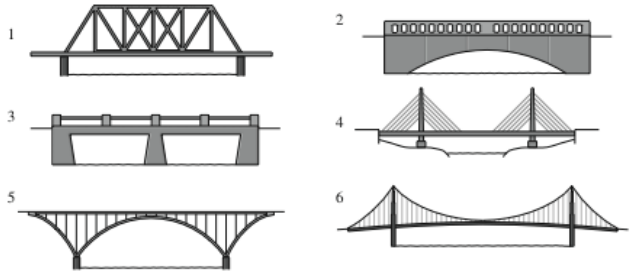
Name _____ Class _____ Date _____

MCAS ENGINEERING STUDY GUIDE

Units Covered this year:

- Communications
- Transportation
- Flight
- Universal systems model
- Manufacturing/ Construction
- Bridges/forces/ structures, adaptive/assistive devices
- Bioengineered products/Fossil fuels/ Bio-fuels

Questions:



Name the type bridges:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

7. Fill in how a arch bridge is different from a suspension bridge:

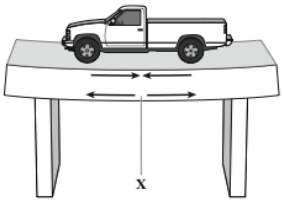
   a. A suspension bridge has _____ that hold up the roadway. An arch bridge's arch shape gives it _____.

8. Circle the answer Steel is used for cables in suspension bridges because of its capacity for:
   a. tension.
   b. torsion.
   c. compression.
   d. contraction.

9. Circle the answer An engineer designing a suspension bridge discovers it will need to carry twice the load that was initially estimated. One change the engineer must make to her original design to maintain safety is to increase the:

   a. length of wires in tension.
   b. diameter of wires in tension.
   c. height of support towers.
   d. length of the bridge.

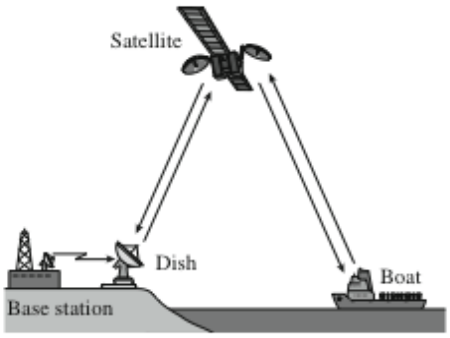
10. A beam bridge supporting a toy truck is shown in the diagram below.



When an object pushes down on this bridge, the bottom edge experiences a force that tends to pull it apart as shown. What is the type of force labeled X?

   a. compression
   b. shear
   c. tension
   d. torsion

11. A communication link between a Coast Guard patrol boat and its base station is shown below.



(not to scale)

The boat uses the satellite to communicate its position to the base station.

a. What does a decoder in a communication system do?

_____

b. What does encoding mean?

_____

c. Explain the purpose of a transmitter in a communication system.

_____

d. What is a transceiver?

_____

12. A scientist working for a company is testing a new medicine that they think will help heal damaged tissue. In which part of the company are the scientists working?

a. distribution
b. mass marketing
c. public relations
d. research

13. Advertising staff working for a company is selling a new medicine that they think will help heal damaged tissue. In which part of the company are these people working?

a. distribution
b. mass marketing
c. public relations
d. research

14. Delivery personnel working for a company are delivering a new medicine to pharmacies throughout the country. In which part of the company are the people working?

a. distribution
b. mass marketing
c. public relations
d. research

15. A manufacturer wants to produce a container for food storage that does not break easily and is airtight, inexpensive, and microwave-safe. Which of the following is the best material to use to make the container?

a. glass
b. metal
c. paper
d. plastic

Name _____ Class _____ Date _____

16. Which of the following best describes an advantage of using a mass production manufacturing system instead of a custom manufacturing system?

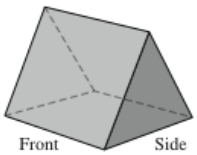
    a. Customers can provide specific feedback to workers.
    b. Workers become skilled in all aspects of assembly.
    c. Goods can be easily modified for customers.
    d. Products can be made at a lower cost.

17. The drawing below represents a bit used in a power drill.

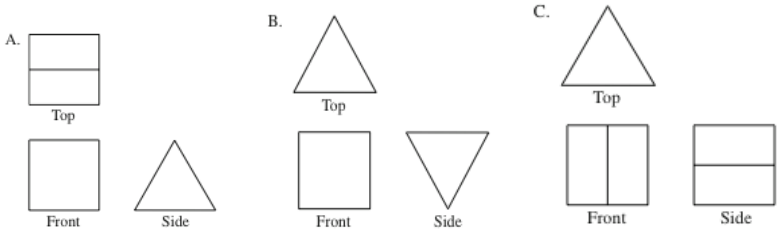
Which of the following metals is most suitable for making this drill bit?

    a. aluminum
    b. copper
    c. gold
    d. steel

18. The diagram below shows a three-dimensional object.



Which of the following diagrams correctly shows an orthographic projection of this three-dimensional object?



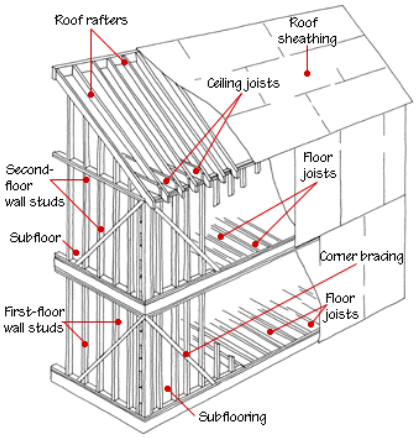
19. Which of the following tools is most useful for tightening a small mechanical fastener?
    a. chisel
    b. pliers
    c. sander
    d. saw

20. Several interchangeable parts are used in the manufacture of automobiles. Some examples of these parts are batteries, windshield wiper blades, spark plugs, and tires. Which of the following is an advantage of interchangeable parts over non-interchangeable parts on automobiles?
    a. Interchangeable parts are generally more expensive than custom-made parts for automobiles.
    b. Interchangeable parts break more often now than in years past on most automobiles.
    c. Interchangeable parts are plentiful for custom-made automobiles.
    d. Interchangeable parts can fit many kinds of automobiles.

Name _____ Class _____ Date _____

Tech Ed Lessons Review

1. **Parts of a structure:**



2. **Bridges:**
   a. **The beam bridge...**BEAM
   consists of a horizontal **beam** supported at each end by **piers**. The weight of the beam pushes straight down on the piers. The farther apart its piers, the weaker the beam becomes. This is why beam bridges rarely **span** more than 250 feet.
   b. **The truss bridge... has** TRIANGLES
   consists of an assembly of triangles. Truss bridges are commonly made from a series of straight, **steel** bars.
   c. **The arch bridge...** ARCH Shape
   has great natural strength. Thousands of years ago, Romans built arches out of stone. Today, most arch bridges are made of **steel** or **concrete**, and they can **span** up to 800 feet.
   d. **The suspension bridge...has** CABLES
   can span 2,000 to 7,000 feet -- way farther than any other type of bridge! Most suspension bridges have a **truss** system beneath the roadway to resist **bending** and twisting
3. **Forces: the real-life forces and actions that affect structures:**
   a. **Squeezing (Compression)**
   Compression is a force that squeezes a material together. When a material is in compression, it tends to become shorter.
   b. **Compression:**
   The lower columns of a skyscraper are squeezed by the heavy weight above them. This squeezing force is called compression.
   c. **Stretching (Tension)**
   Tension is a force that stretches a material apart. When a material is in tension, it tends to become longer.
   d. **Tension:**
   The weight of the roadway and all the cars traveling on it pull on the vertical cables in this suspension bridge. The cables are in tension.
   e. **Bending**
   When a straight material becomes curved, one side squeezes together and the other side stretches apart. This action is called bending.
   f. **Bending:**
   The top side of the metal bar is pulled apart in tension, and the bottom side is squeezed together in compression. This combination of opposite forces produces an action called bending.
   g. **Sliding (Shear)**
   Shear is a force that causes parts of a material to slide past one another in opposite directions.

h. **Shear:**
During an earthquake, parts of this roadway slid in opposite directions. This sliding action is called shear.

i. **Twisting (Torsion)**
Torsion is an action that twists a material. **RING A TOWEL**

j. **Torsion:**
In 1940, the Tacoma Narrows Bridge twisted violently in strong winds and collapsed. The twisting force that tore this bridge in half is called torsion.

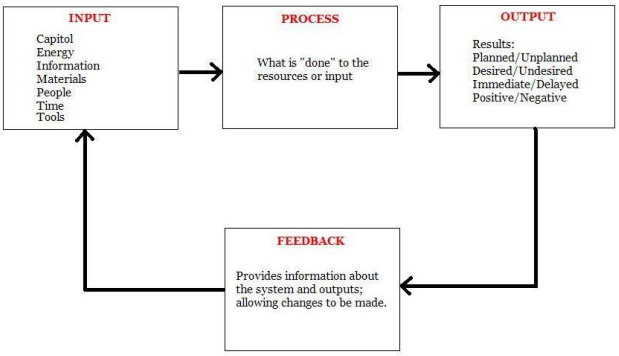
4. **Design Process:**
   a. Research the problem
   b. Identify constraints
   c. Brainstorm a list of ideas
   d. Choose the best idea
   e. Make plans of the solution
   f. Build and test a model of the solution
   g. Implement the solution

5. **CAD:**
   a. **Computer aided design.** A design drawing created on a computer
   b. **Floor plan** a drawing of a room or rooms showing the position of walls doors windows and all interior fixtures , which may include furniture
   c. **Materials**
      i. *Metals*: very hard, strong, somewhat inflexible
      ii. *Alloys*: metals mixed with other elements. Can be extremely strong (ex: steel, iron mixed with carbon)
      iii. *Plastics*: Strong and extremely flexible. Made out of long compounds called polymers.
      iv. *Wood*: Easy to get, strong, lightweight
      v. *Ceramics*: Hard, strong materials that resist heat and corrosion
      vi. *Adhesive*: fastens substances together

6. **COMMUNICATION**:
   a. Receiver- receives radio wave signals and decodes them into audio, video or both.
   b. Transmitter- sends encoded radio wave signals
   c. Transceiver- sends and receives radio wave signals (encodes and decodes)

7. **GPS**
   a. **Global positioning system. Receiver of** signals for the purpose of determining the present location, Using Geo synchronous satellites (minimum of 3).

8. **UNIVERSAL SYSTEM MODEL**



9. **Bio-Engineered products/Fossil fuels/ Bio-fuels**
   a. **Ethanol- is a Bio Fuel made from corn, renewable**
   b. **Gasoline -Fossil fuel made from crude oil, non renewable**

10. **Bio-Tech assistive device**
    a. **Ex. wheel chair, ramp, grab bar.**

11. **Bio-Tech Adaptive devise**
    a. **Ex. prosthetic arm, eyeglasses.**