HOW STRUCTURES FAIL
UNIT 4 TOPIC 5 Page 315

Name: _____ Class: _____ Date: _____

Levers Create Large Forces

A **lever** is _____

_____

A **fulcrum** is _____

Draw the lever the crowbar makes. Be sure to include the arrow (forces) and label the forces.

Draw an example of how an unintentional lever action can damage a structure. Be sure to include the arrow (forces) and label the forces.

How Materials Fail

External forces can cause _____ forces on a structure. Each type of _____ force can cause certain types of _____.

A. _____ - means to slide over another section along a weakness

Solid material always has _____ or _____. When compressed the crack can enlarge or _____ apart. One section may _____. The weight of the building can _____ the soil causing the soil to _____. The _____ beneath the building sinks and the building tilts or _____.

B. _____ or _____ - all thin panels tend to _____ and buckle (give way) when they are compressed. _____ forces cause material to bend on the _____ of the curve and _____ and _____ on the outside of the curve. Boats and _____ that use shell structures to support their entire _____ are reinforced to _____ buckling.

What are the three methods of reinforcement?

1.

2

3.

C. _____ - twisting forces can cause _____ failure too. Brittle _____ such as _____ and plastic cutlery often _____ when twisted. Sections of the structure _____ past each other, and the structure _____ or breaks in two. Flexible _____ such as rubber bands and electrical cords _____ less easily. Instead, _____ _____ make them fold up and _____ into tangles and knots. The loss of _____ is considered a form of _____.

Making Use of Stress

Buckle –

1. Describe how a car bumper is designed to make use of buckling. (1)

2. Describe how a blade of grass makes use of buckling (1)

Shear –

1. How is shearing made use of on a boat propeller? (2)

2. Describe how a clutch makes use of shearing. (1)

Twist –

1. How does a spinning wheel make use of twisting? (1)

2. List 3 other example of twisting. (3)

   a)

   b)

   c)

Metal Fatigue

Use the particle model to help explain what metal fatigue is. (2)

Topic 5 Review

1. a. Identify 3 dead loads and three live loads that are acting in your classroom.
   b. Explain your reasoning for deciding which loads are "dead" or "live" (6)

2. Name three ways materials fail and identify the type of internal force that causes each kind of failure. (6)

3. Which type of structure (mass, frame, or shell) is most likely to be damaged when its parts act as levers and create very strong forces?

4. Which type of material failure occurs when you
   a. Leave a trail of footprints in the carpet?

   b. Spain your ankle at a soccer game?

   c. Accidentally hit a baseball through a window?

   d. Crinkle a new $5 bill as you stuff it into your pocket?

   e. Twist the lid of a partly opened tin can back and forth until it breaks off?

Find Out Activity
Do the Activity on pg. 318 in your Science Focus 7 textbook. Answer the three questions on this page.