1. In which type of lever are the resistance and effort moving in opposite directions? __________

2. In which type of lever is the effort between the fulcrum and the resistance? __________

3. Identify these machines as first, second, or third-class levers by writing 1, 2, or 3 in the spaces provided.
   a. crowbar __________ e. pliers __________ i. snow shovel __________
   b. bottle opener __________ f. broom __________ j. seesaw __________
   c. rowboat oars __________ g. wheelbarrow __________ k. nut cracker __________
   d. fishing pole __________ h. lifting weight __________ l. skull pivoting on vertebra __________

4. Why is the position of the fulcrum important, particularly in first-class levers?
   ____________________________
   ____________________________

5. Why are pliers considered a first-class lever?
   ____________________________
1. What are the three elements of a lever?

2. By each number above, write F for fulcrum, R for resistance, or E for effort.

3. Write definitions for each of the following:
   a. resistance
   b. fulcrum
   c. effort

4. Write the word or words that will make each sentence a true statement.
   a. ___________ have two connected levers that can be used to ___________

   b. A ___________ is a simple machine that needs two hands as the ___________

   c. In second-class levers, the ___________ is between the effort and ___________

   d. When the fulcrum is closer to the effort than to the resistance, there is a loss in

   e. A seesaw is a common example of a ___________ -class lever.
The Inclined Plane, Wedge, and Screw

Using an inclined plane requires less effort over a longer distance.

The wedge is an inclined plane that tapers to a sharp edge.

The screw is an inclined plane wound around a central cylinder.

1. Describe how the inclined plane in the top illustration assists the person moving the barrel?

2. What are two inclined planes you have seen or used?

3. Next to the wedges named, write whether they are used to split, cut, or fasten.
   a. chisel
   b. scalpel
   c. tack
   d. spike
   e. hatchet
   f. doorstop

4. Write the word or words that will make each sentence a true statement.
   a. Using an inclined plane to lift a barrel requires less effort over a greater distance.
   b. Lifting the barrel from the ground to a platform requires effort over a ________________ distance.
   c. A ________________ is an inclined plane wound around a cylinder.

5. Name two examples of screws other than the ones shown above.
The Gear

Gears increase speed and force or change direction.

Small gear turns twice as fast as large gear, but with less force.  

Force on axle turns gear.  

Large gear turns half as fast as small gear, but with greater force.

Types of Gear Arrangements

- spur
- bevel
- worm
- planetary

Gear Uses

bicycle

watch

electric mixer

1. In the pictures of gear arrangements, a single arrow on one gear shows the direction in which it moves. Circle arrow A or B on the second gear to show the direction in which it will move.

2. List three machines, other than the ones pictured, that use gears. 

3. Write the word or words that will make each sentence a true statement.
   a. Gears are wheels with _______________ that can be used to ____________________ force or speed or to change _______________
   b. Two factors that determine the kind of work a gear can do are the ____________________ and ____________________ of its teeth.
   c. A motor turning the axle of a small gear will turn the connected large gear ____________________ (faster or slower) but with greater ____________________.
   d. Gears transfer ____________________ to different parts of a machine.

4. If the second gear turns because it is connected to the first gear, why does the first gear turn? 

4b
1. Label the types of pulleys in boxes I through III above.
2. Label the fulcrum, resistance, and effort on lines A through C.
3. Write the word or words that will make each sentence a true statement.

   a. Three parts of a pulley are the grooved ____________, the ____________, and the rope.
   b. A fixed pulley is like a turning ________________-class lever because the ________________ is between the ________________ and the resistance.
   c. A movable pulley is like a turning ________________-class lever because the ________________ is between the fulcrum and the ________________.
   d. The ________________ pulley is used primarily to change the direction of force.

4. Name the kind of pulley used for the following.
   a. raising sails on a boat ________________
   b. window blinds ________________
   c. lifting very heavy weights ________________
   d. painter's scaffold ________________

5. What prevents the rope from slipping off the wheel of a pulley? ________________

6. What is the function of a movable pulley? ________________
The Block and Tackle

A block and tackle is a combination of fixed and movable pulleys.

**single block and tackle**

effort needed = ________ the resistance

effort needed: about 45 kg

**double block and tackle**

fixed pulley: *changes the direction of force*

effort needed = ________ the resistance

effort needed: about ________ kg

**resistance**

**movable pulley: *changes the amount of force***

1. For the single block and tackle above, write the fraction that tells how much effort is needed to lift the resistance: 1/2, 1/3, or 1/4.

2. For the double block and tackle above, write the number of kilograms of effort needed to lift the motor.

3. Write the word or words that will make each sentence a true statement.
   a. A block and tackle is also known as a _______________ pulley.
   b. The two kinds of pulleys that make up a block and tackle are _______________ and _______________ pulleys.
   c. A block and tackle changes the _______________ and increases _______________.
   d. The more strands of rope or wire required by a block and tackle, the greater the amount of _______________ generated.
   e. In practice, nothing is gained by more than _______________ pulleys.
The Wheel and Axle

The wheel and axle is a wheel connected to a rigid pole.

A handle can be thought of as a section of a wheel.

1. Why does using a wheel and axle make work easier? ____________________________________________

2. How did early people make a wheel and axle for their carts? ____________________________________

3. A conveyor belt, used to load or unload a truck, is made of which two simple machines? ____________

4. The handle of a pencil sharpener is like the ____________ of a ____________.
Simple Machines

A. 

B. 

C. 

D. 

E. 

F. 

1. Label the simple machines on lines A-F above.
2. On the second line give an example of the machine other than the one pictured.
3. Identify the following simple machines.
   a. sloping surface 
   b. rope over a wheel 
   c. bar pivoting on a fixed point 
   d. spiral inclined plane 
   e. wheel connected to a shaft 
   f. slope tapering to a sharp edge
4. Name the simple machine used to do the following.
   a. chop wood 
   b. load railroad cars 
   c. remove tacks 
   d. fasten pieces of wood 
   e. reduce friction on rolling objects 
   f. raise and lower a sail
5. Write the word or words that will make each sentence a true statement.
   a. A machine can never do more work than the amount of ____________ put into it.
   b. No matter how complex machines seem, they are all forms of six ______________ machines.
   c. Simple machines help us make better use of our ______________.