Name _____ Date _____ Class _____

INTEGRATING TECHNOLOGY

Hydraulic Lift Force

When extra pressure is applied to a fluid enclosed in a container, the pressure is applied equally to all parts of the container. Engineers use this principle to create a hydraulic lift, shown in the diagram below.

In the diagram, when a force is applied to the small piston, the small piston pushes on the liquid with a certain pressure. The same pressure pushes against everything in the system, including the large piston.

Pressure is defined as the force exerted on a unit area of a surface. Mathematically, this definition can be written in the following way:

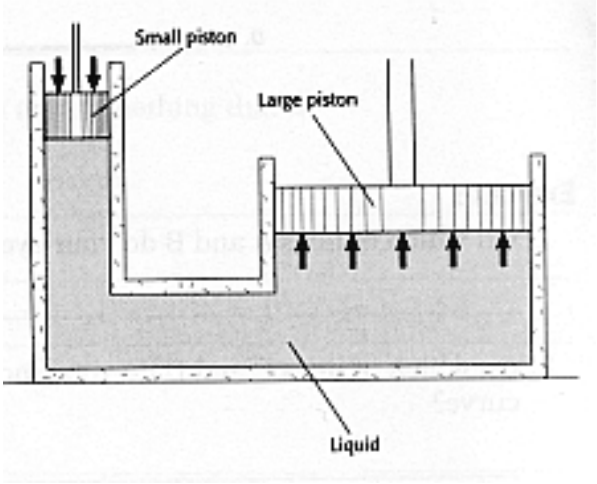
$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

To rearrange this equation so that force is alone on one side of the equation, multiply both sides by area, which will cancel on the right side:

$$\text{pressure} \times \text{area} = \frac{\text{force}}{\text{area}} \times \text{area} \qquad \text{pressure} \times \text{area} = \text{force}$$

In the example of the hydraulic lift, suppose that the area of the large piston is 100 times the area of the small piston. Because the pressure is the same everywhere in the liquid container, the upward force on the large piston will be 100 times as large as the downward force on the small piston.

Because force can be multiplied in this way, hydraulic force is used in devices like automobile lifts and barber chairs. It is hydraulic force that enables a driver to stop a car by pushing on the brake pedal.



Your Turn to Think

1. The areas of the pistons are 20 cm^2 and 100 cm^2. A force of 10 N is applied to the small piston. How much force is on the large piston?
2. The area of the small piston is 1,000 times the area of the large piston. How much is the force on the large piston compared with the force on the small piston?
3. The areas of the pistons are 5 cm^2 and 30 cm^2. A force of 1 N is applied to the small piston. How much force is on the large piston?