Welcome to Physics First I Cycle 7
Lesson 3

OBJECTIVE: Use Hooke’s Law to describe and predict the action of springs. Define friction in terms of systems and equilibrium.

VOCAB: Hooke’s Law, spring constant, friction, sliding friction, static friction, lubricant

CLASSWORK:

p. 130 “Understanding Vocabulary” #8, #10-12
p. 130 “Reviewing Concepts” #10-12, #14, #15
p. 131 “Solving Problems” #7
p. 131 “Solving Problems” #8-9

Chapter 5
5.2: Forces and Equilibrium
5.3: Friction
Springs are used in many devices to keep systems in equilibrium. Springs can also store potential energy when compressed or stretched.

The normal force of a surface works like a spring. How does a surface ‘know’ how much reaction force to exert on an object? Because it is slightly compressed until it reaches equilibrium – normal force is the ‘spring’ pushing back.

The normal force exerted by a surface is similar to that of a compressed spring.
The relationship between a spring’s change in length and the force it exerts is called Hooke’s Law.

Some springs are very flexible, while others are very stiff. We say that a spring which is more stiff has a higher spring constant.

**Hooke’s Law**

\[ F = -kx \]

- **Force** (newtons)
- **Spring constant** (newtons/meters)
- **Extension or compression** (meters)

The change in length of a spring is often used in the operation of a scale. Measuring the change in length of the spring allows calculation of the force measured.
Friction is a force which resists the motion of objects or surfaces. It is caused by microscopic ‘hills’ and ‘valleys’ on surfaces of objects.

Because friction exists in many different situations, it is classified into multiple types.

**Sliding Friction** is present when 2 objects or surfaces slide across each other.

**Static Friction** is present when forces are acting to cause an object to move, but friction prevents the object from moving. **Static Friction** is often present at equilibrium.
Friction is caused by surface roughness. A greater normal force between 2 surfaces will cause increased friction by pushing the microscopic hills & valleys together.
A fluid used to reduce friction between surfaces is called a **lubricant**. A lubricant works by preventing the hills & valleys from contacting each other. This is **good** in a machine. This is **bad** when it involves a tire on wet pavement. This is why tires have grooves.

A ball bearing reduces mechanical friction. **Magnetic levitation** is used in bullet trains. Grooves in tires allow water to not be trapped, so that it will not act as a lubricant.
Static Friction > Sliding Friction

Static Friction is generally higher than Sliding Friction – it takes a larger push to start an object moving.