

Galileo Galilei and The Leaning Tower of Pisa

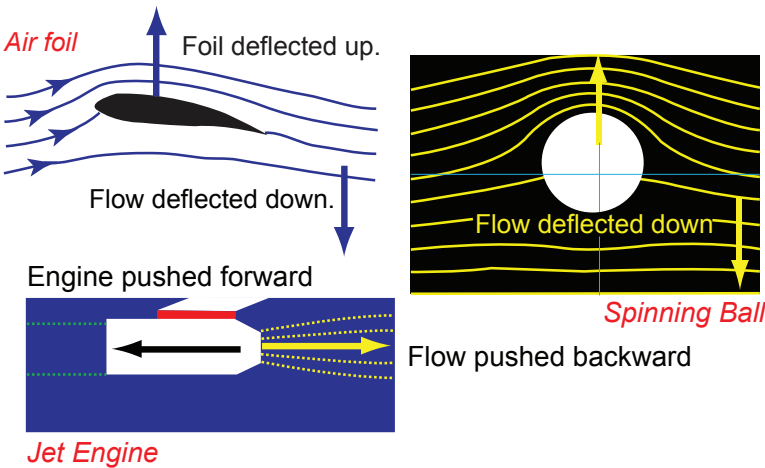
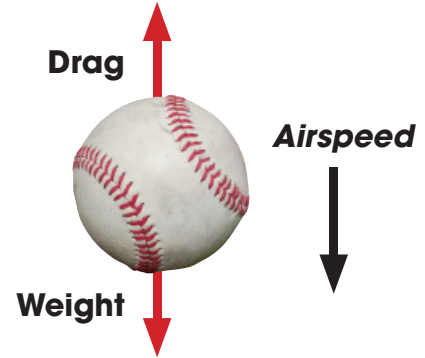


It has been said Galileo discovered how objects fall by dropping balls of different masses from the Leaning Tower of Pisa. Actually he rolled balls down a ramp.

Isaac Newton

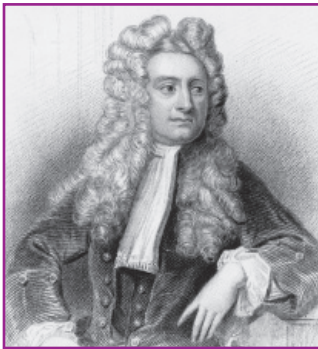
First law of motion:

An object at rest remains at rest, and an object in motion continues to move in a straight line with a constant speed unless an unbalanced force acts upon it.



Second law of motion:

The acceleration of an object equals the net force on that object divided by its mass.
 $a = F/m$ or $F = ma$

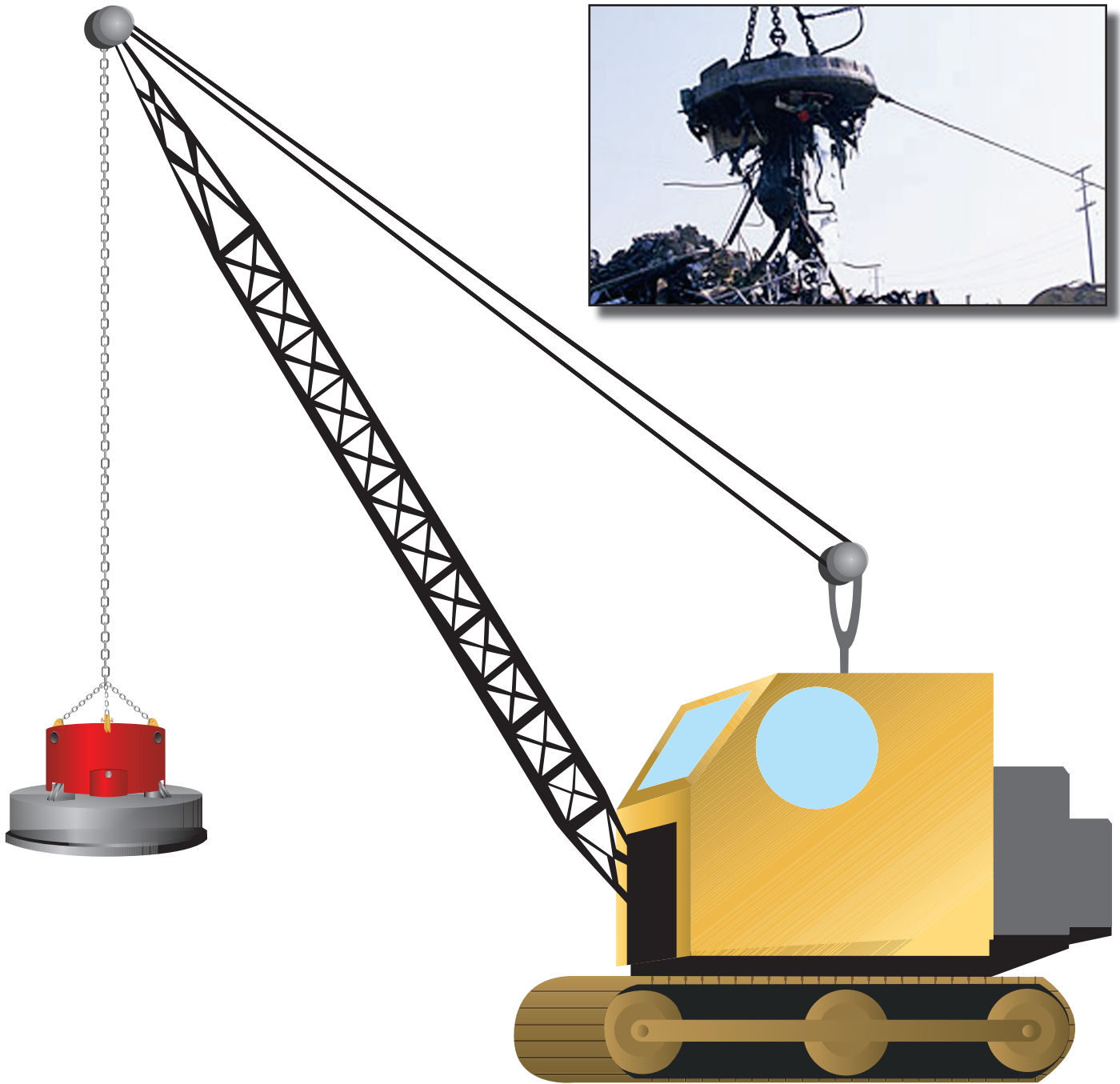


Third law of motion:

For every action force there is an equal reaction force in the opposite direction.



A Large Electromagnet



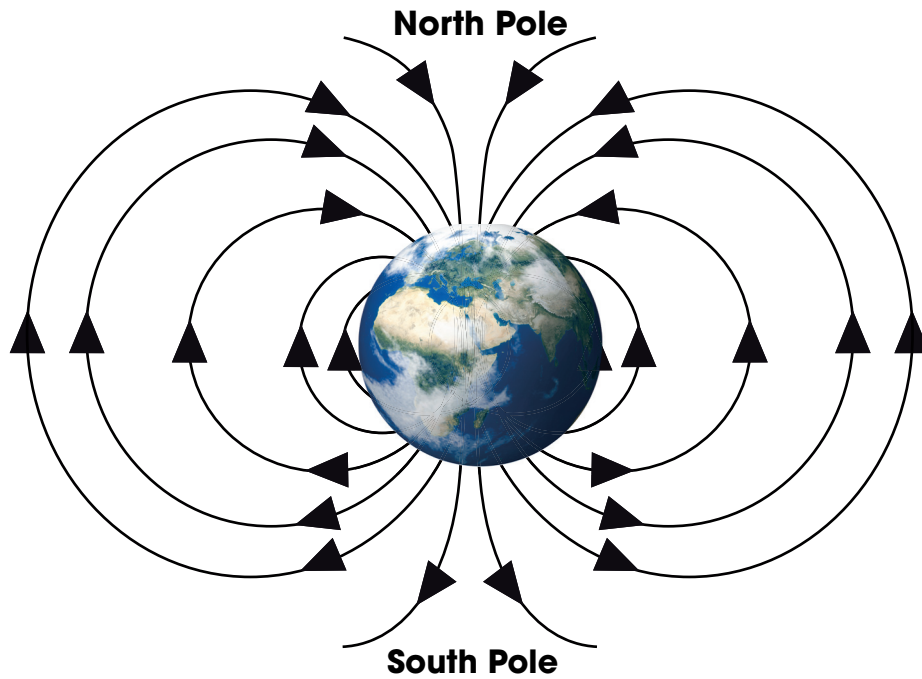
Large electromagnets are used to lift heavy objects made of iron or steel and to separate iron from other kinds of scrap metal.

The Force of the Moon's Gravity



“The Moon’s gravity pulls at the Earth so hard that it makes the water in the oceans slosh towards the moon! We see this when we see the ocean tides rising and falling.”

Earth's Magnetic Field

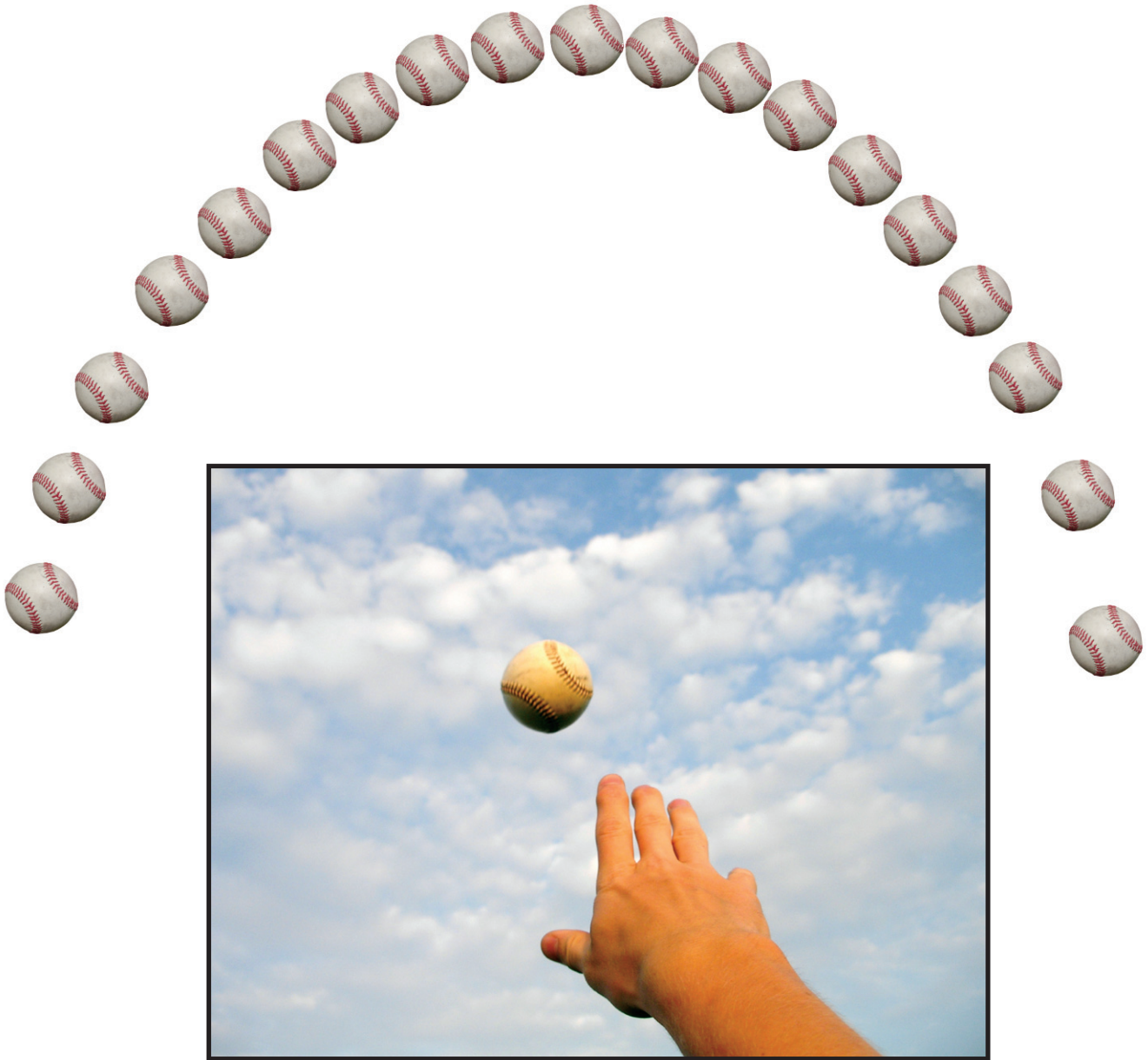


These are the magnetic lines of force of Earth's magnetic field.



Earth's magnetic field causes the aurora borealis, also called the northern lights.

A Projectile in Motion



“When you throw a ball it is decelerating on the way up and accelerating on the way down. The Ball is changing motion because it is acted on the unbalanced force of Gravity. Gravity is acting in the downward direction.”

Animal Speeds



Killer Whale
34 mph



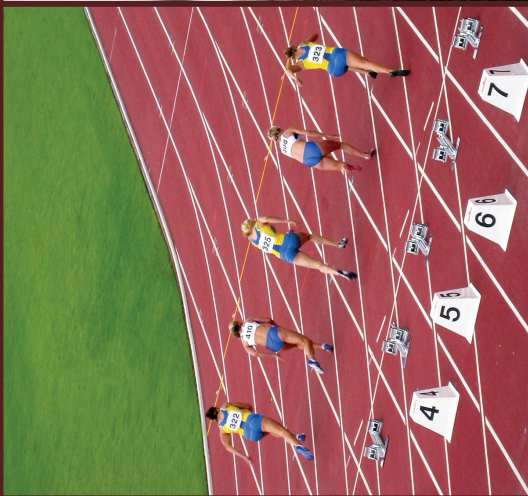
Cheetah
65 mph



Grizzly Bear
30 mph



Pronghorn Antelope
61 mph



Human
27 mph



Greyhound
39 mph

Acceleration of Machines and Animals



F16 Jet



Top Fuel Dragster



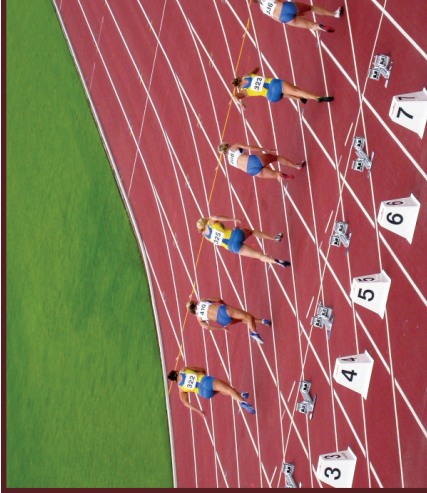
Formula 1 Race Car



Roller Coaster



Cheetah



Human

Type	Distance	Speed	Time	Acceleration Gs.
F16 Jet		1320 mph		9 G.
Top Fuel Dragster	1/4 mile	333 mph	4.4 Sec	3.3 G.
Formula 1 Race Car		60 mph	2.7 Sec	2.7 G.
Roller Coaster		120 mph		4 G.
Cheetah		50 mph	3 Sec	0.8 G.
Human	40 yds	27 mph	4.38 Sec	0.4 G.

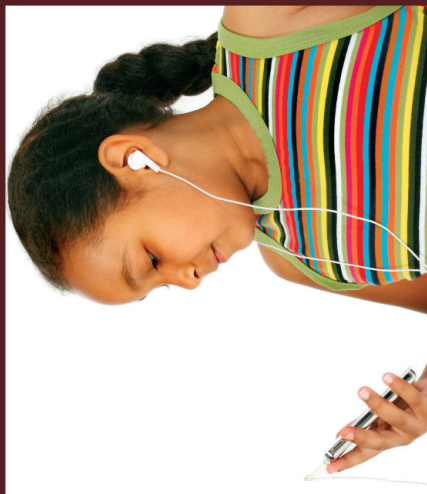
Ranges of Hearing



Mouse



Dog



Human



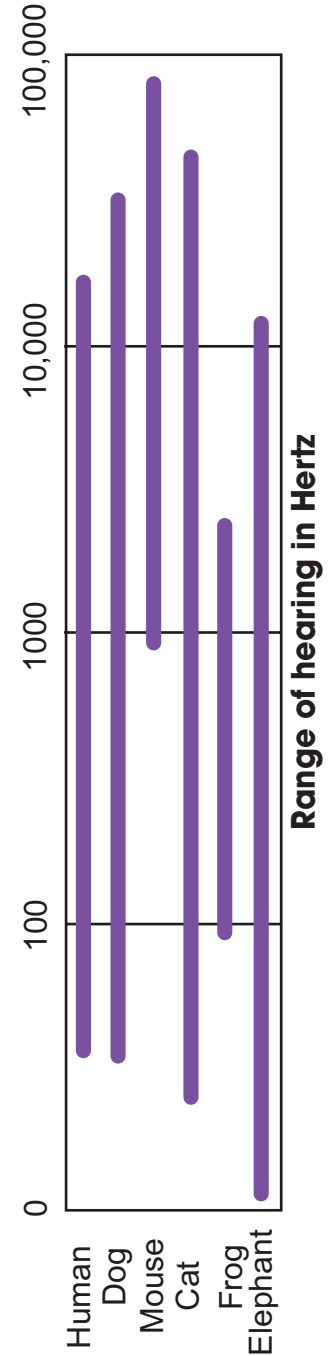
Elephant



Frog



Cat



Vibrating and Oscillating Motions



Harp
25-400
Vibrations
Per Second



Bee
Over 200
Wing-Beats
Per Second

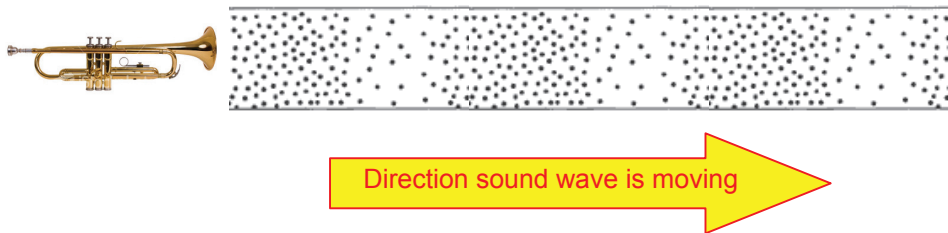
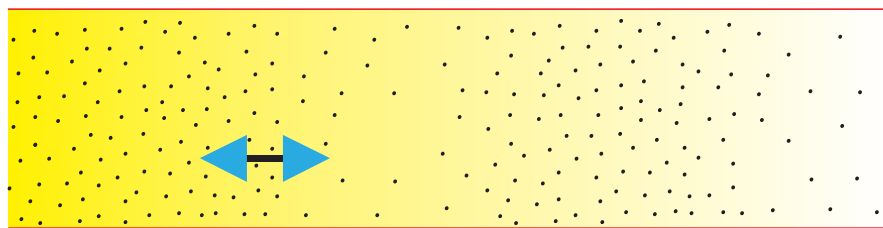
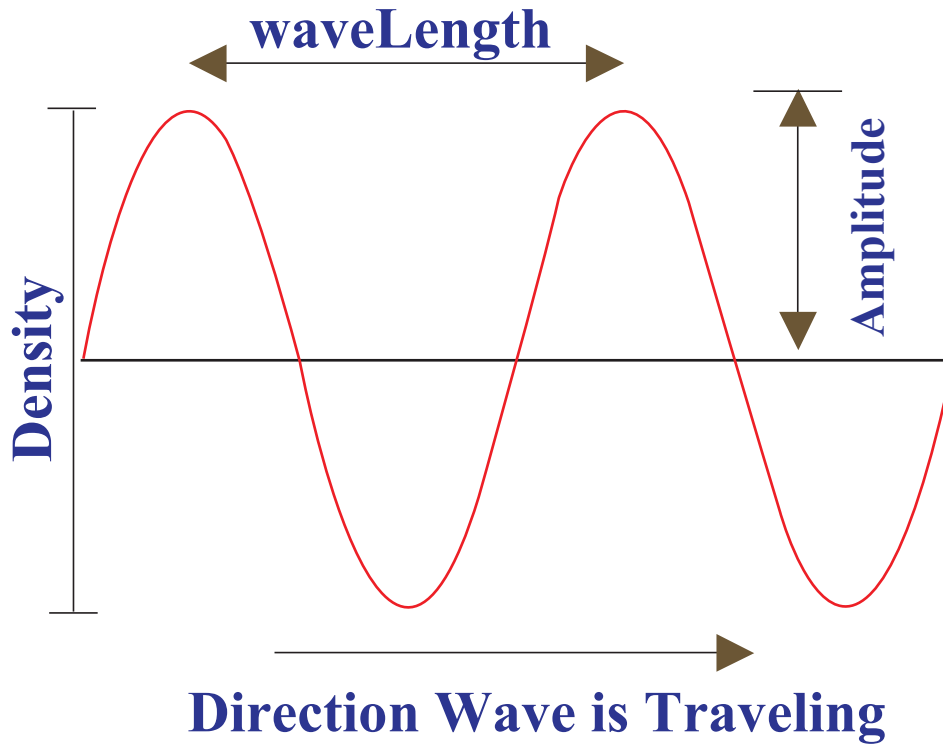


Humming Bird
15-80
Wing-Beats
Per Second



Wood Pecker
20-50
Pecks
Per Second

Wave Characteristics












Acceleration of a Falling Apple

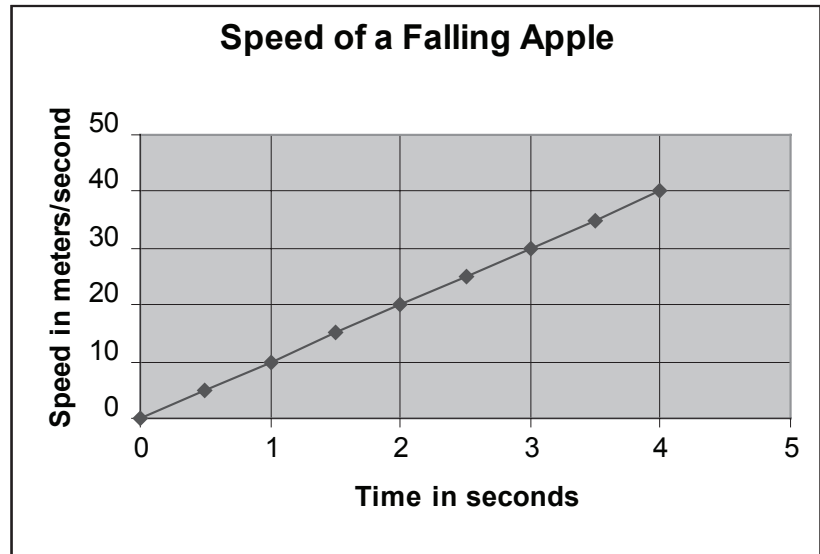
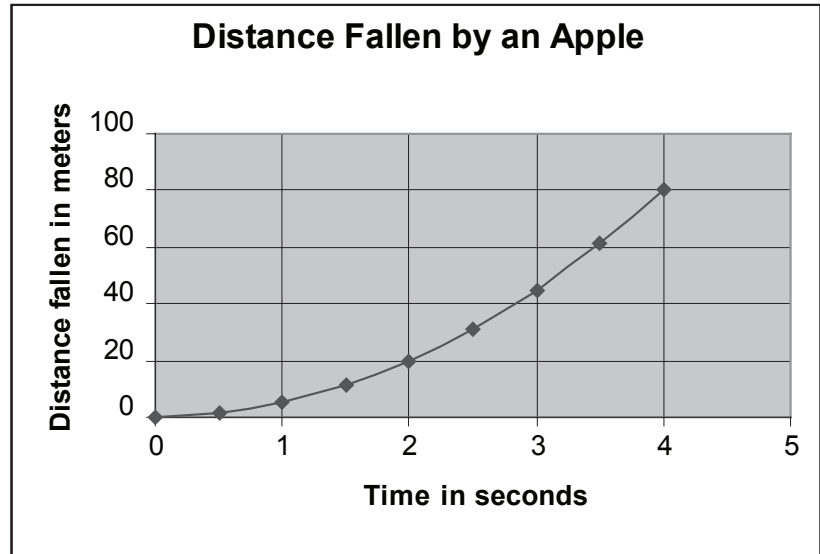


Speed
(m/sec)

Half-Second
Interval(sec)

0 ←		→ 0
5 ←		→ 1.25
10 ←		→ 5
15 ←		→ 11.25
20 ←		→ 20
25 ←		→ 31.25
30 ←		→ 45
35 ←		→ 61.25
40 ←		→ 80

Distance vs. Time



Speed vs. Time

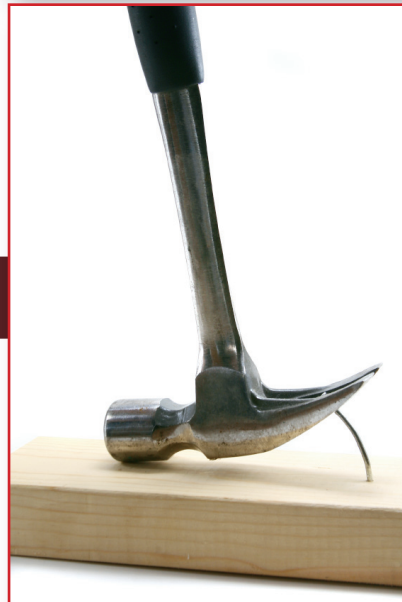
Levers



First-class lever



Second-class lever



Third-class lever

Pulleys and Wheel and Axles



Crane



Pulley



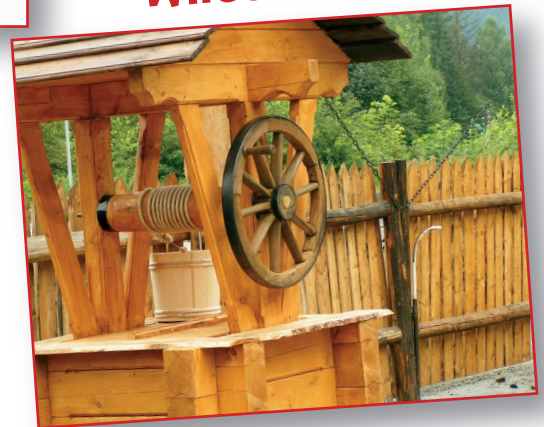
Pulley

Ships wheel



Steering wheel

Wheel & Axle



Inclined Planes & Wedges



Axe - Wedge



Ramp - Incline Plane



Inclined Plane



Knife - Wedge



Spike - Wedge



Road - Incline Plane

Screws



Bolt



Spiral Staircase



Drill Bit

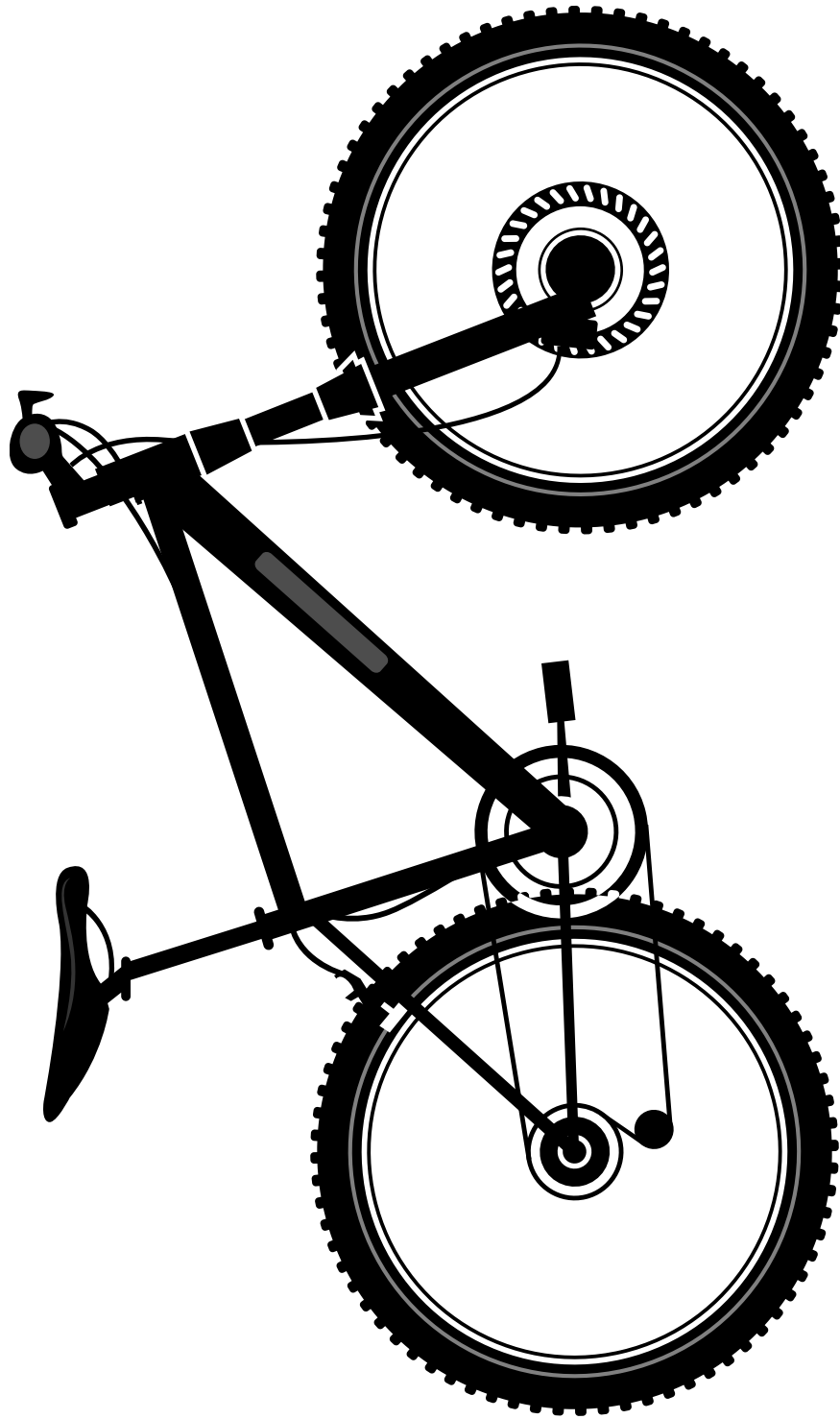


Cork screw



Screw

Bicycle - A Compound Machine

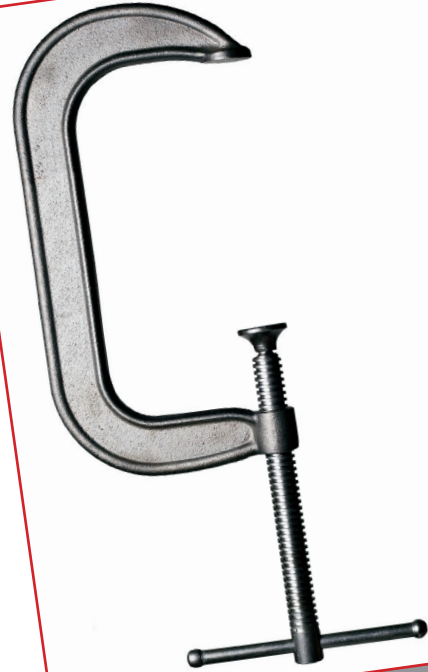


Mountain Bike

Compound Machines



Can Opener



Clamp



Wire Cutters



Swiss Army Knife