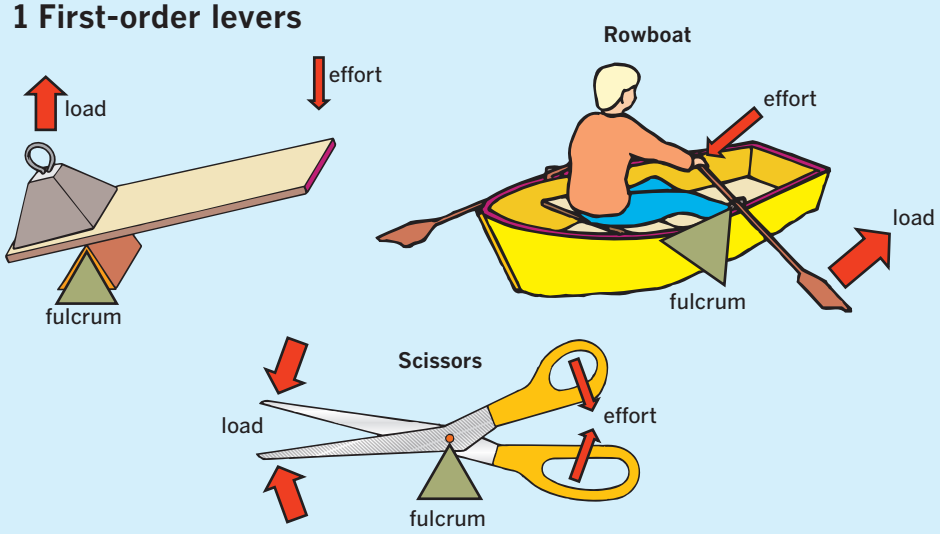
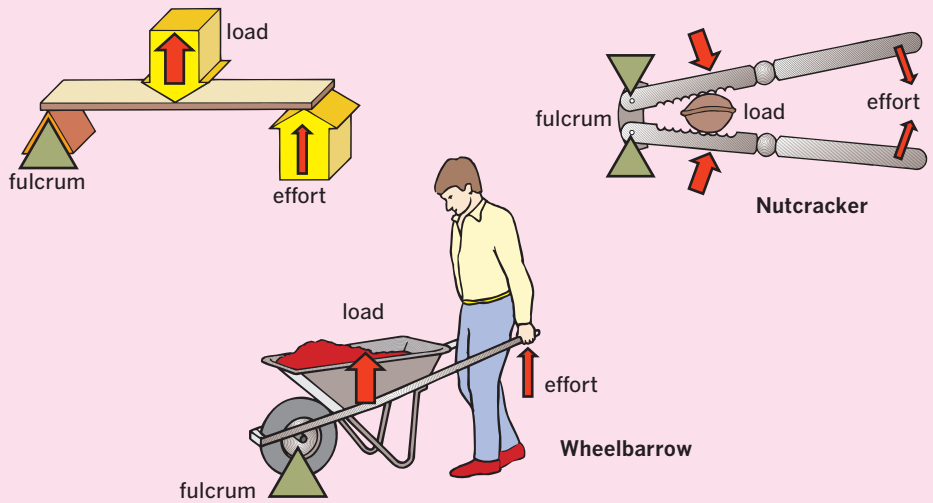
Simple machines 1

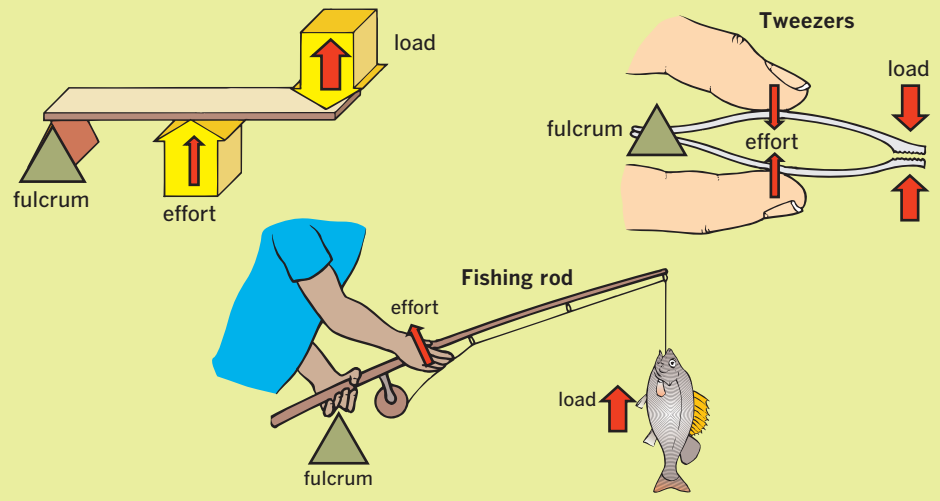
1 First-order levers



2 Second-order levers



3 Third-order levers



Key words

force
lever
mechanical advantage
moment
work

Simple machines

- A machine is a device in which a *force* applied at one point gives an output force elsewhere.
- The *work* done by a machine, **E**, equals the force applied multiplied by the distance moved, **E = F x d**.
- The force ratio (*mechanical advantage*) of a machine is the ratio of the load to the effort.
  force ratio = load/effort
- The distance ratio (velocity ratio) of a machine is the ratio of the distance moved by the effort to the distance moved by the load.
  distance ratio = distance moved by effort/distance moved by load
- Force multipliers have both a high force ratio and a high distance ratio.
- Distance multipliers have both a low force ratio and a low distance ratio.

Levers

- These simple machines are all based on *levers*. Their action is based on the law of *moments*. A lever may act as a force multiplier or a distance multiplier.
- Crowbars, wheelbarrows, and nutcrackers are force multipliers. A small effort force is applied over a large distance to exert a large force on the load over a small distance.
- The forearm is a distance multiplier. A large effort force is applied over a small distance to exert a small force on the load over a large distance.

1 First-order levers

- A first order lever has the fulcrum between the effort and load.

2 Second-order levers

- A second order lever has the load between the effort and fulcrum.

3 Third-order levers

- A third order lever has the effort between the fulcrum and load.