

## Chapter 5

### Reminders:

1. acceleration =  $\Delta v/\Delta t$
2. Force is a push or a pull
3. N1: If no net force acts, V is constant. (Inertia)

Well, what happens if a force does act?

$$F = ma$$

N2: A force causes an acceleration which is directly proportional to the force and inversely proportional to the mass.

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$$F = ma$$

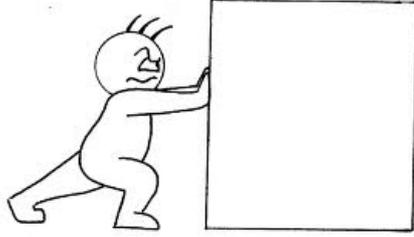
A Force of 1 N will cause 1 kg to accelerate at  $1\text{m/s}^2$

$$1\text{N}=1\text{kg m/s}^2$$

Let's say your mass is 80 kilograms. How much force would be needed to accelerate you at  $3\text{ m/s}^2$ ?



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The box has a mass of 2 kilograms. Our little friend is pushing it and it is accelerating at  $2 \text{ m/s}^2$  toward the right.

Assume there is NO friction and calculate the force which is being applied to the box.

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$$A = F/m$$



19.

Calculate the acceleration of a 2000 kg single-engine airplane just before takeoff assuming the thrust of its engine is 500 N.

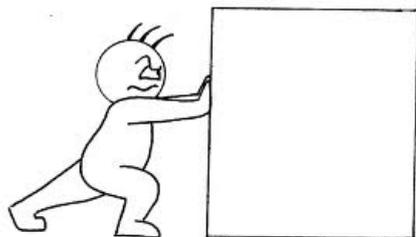
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## Friction

A force which acts between materials which are in contact with each other. It always acts in a direction to oppose the motion.



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The box has a mass of 2 kilograms. Our little friend is pushing it with a force of 10 N, but there is frictional force of 6 N.

(A) What is the direction of the force of friction?

(B) What is the total (resultant) force?

(C) What is the acceleration of the box?

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The force of friction depends upon  
the kinds of material in contact  
the force pushing the surfaces together.

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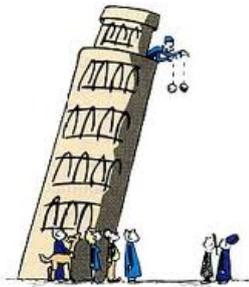
### Free Fall

The force of air friction on a falling object  
depends upon the cross-sectional area AND the  
speed.

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IF THERE IS NO FRICTION all things fall with the same acceleration.

WHY?????



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A football lineman often attempts to get his body under that of his opponent and push upward. Why?

What effect does this have on the friction force between the opposing lineman's feet on the ground?

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Clothes pin



Bag of 50 clothes pins

If dropped, which will hit the ground first AND WHY?

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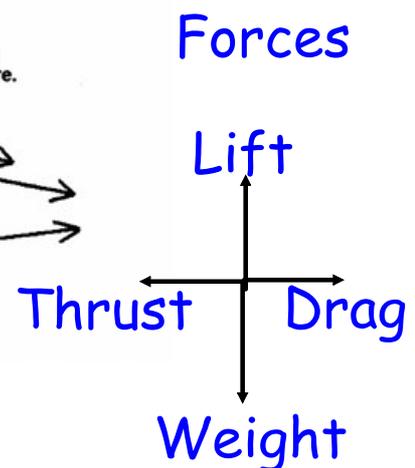
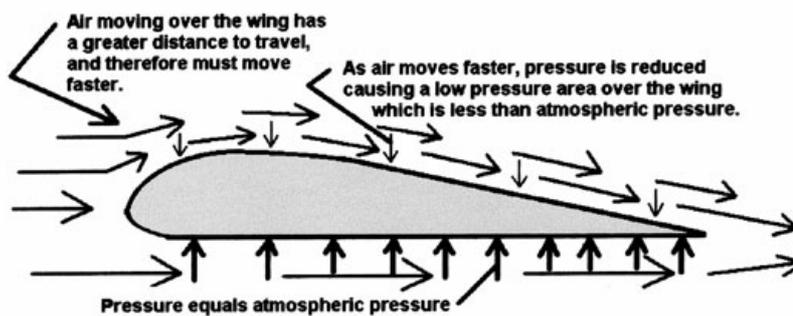
But what if we do not neglect friction in free fall?

The air friction on a falling body depends upon the cross-sectional area and also the speed of the body!



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How does an airplane fly?



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$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

**Earth's atmosphere is pressing against you with a force of 9.8 Newtons per square centimeter (14.7 pounds per square inch). The force on 1,000 square centimeters (a little larger than a square foot) is about a ton!**

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## Atmospheric Pressure

**Earth's atmosphere is pressing against each square inch of you with a force of 1 kilogram per square centimeter (14.7 pounds per square inch). The force on 1,000 square centimeters (a little larger than a square foot) is about a ton!**

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