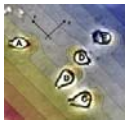
Physics 131- Fundamentals of Physics for Biologists I



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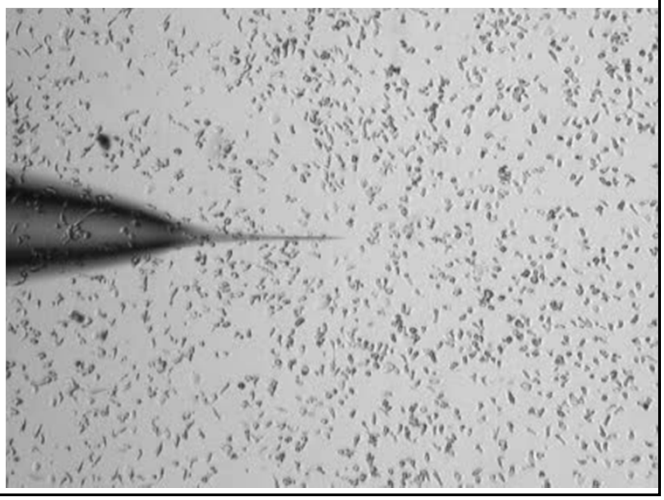
9/21/2012

-How can we describe motion (Kinematics)

- What is responsible for motion (Dynamics)

Movie of the Day
Chemically guided motion



Outline

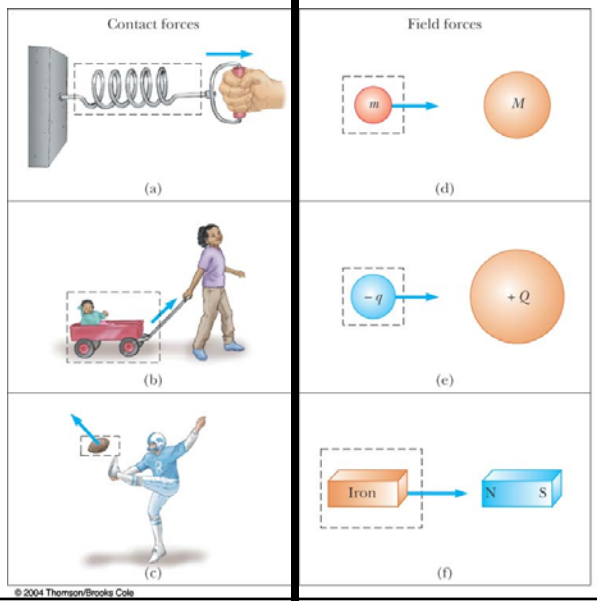
- Switched in office hours
  - Thu 10.30-12.15
- What is responsible for motion (Dynamics)
  - Newton's Laws

When does the juggler let go of the ball?

Converting this question into a physics question:

Let go of the ball

-> stop applying a force to the ball

Contact forces - due to physical contact with another object	Field forces – due to interaction FIELD which can act through empty space over long distance	
		
		Gravity
		Electrical
		Magnetic

Technical term alert: What's a "Force"?

- Although the technical term for this is "force" it is different from the common speech idea of force.
  - It is an interaction between two objects.
  - It occurs
    - » via contact or
    - » by the non-touching examples of gravity, electricity, and magnetism.
- Forces are connected to acceleration – Newtons 2nd law

$$\vec{a} = \vec{F}^{net} / m$$

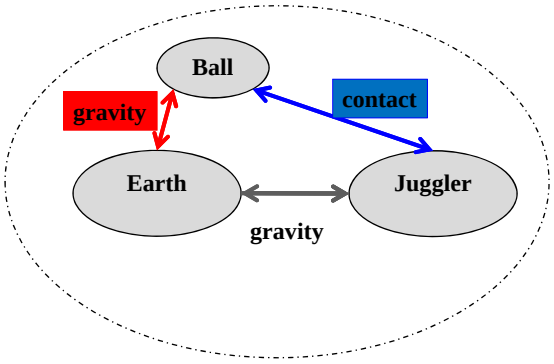
Conceptual ideas 1-3 underlying Newton's Laws

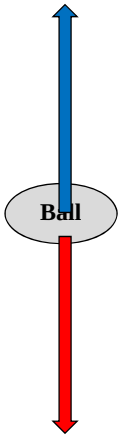
1. Every change in velocity an object experiences is caused by the object interacting with some other object – **forces**. (Interactions)
2. Objects respond only to forces ***acting upon them*** and they do so only at the instant that those forces act. (Object egotism) [Newton 0]
3. If there are a lot of different objects that are interacting with the object we are considering, the overall result is the same as if we add up all the forces as vectors and produce a single effective force -- the **net force**. (Superposition)

Conceptual ideas 4-7 underlying Newton's Laws

4. When one *solid* object exerts a force on another, that force is shared over all parts of the object. (Mass)
5. The acceleration felt by an object at a given instant is the net force on the object at that instant divided by the object's mass. [Newton 2]
6. All outside effects on an object canceling out (net force of zero), the object maintains its velocity (including direction). The velocity could be zero, which would mean the object is at rest. (Inertia) [Newton 1]
7. Whenever two objects interact, they exert forces on each other. (Reciprocity) [Newton 3]

System Schema and Force Diagram

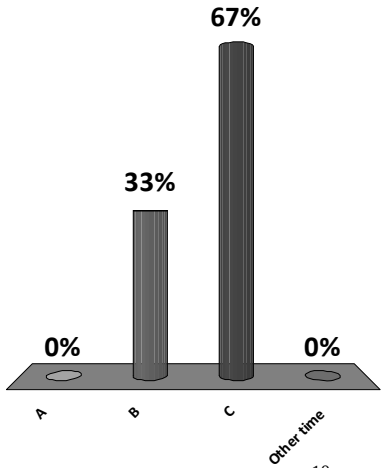




- The juggler gradually pushes less and less hard on the ball until the juggler lets go
- Draw a force vs time graph

Where on the force vs time diagram does the juggler let go of the ball?

1. A
2. B
3. C
4. Other time



- Draw acceleration vs time diagram

Where on the acceleration vs time diagram does the juggler let go of the ball?

1. A
2. B
3. C
4. Other time