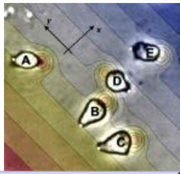
Physics 131-Physics for Biologists I



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HW: Link under “HW” tab on webpage to a page that shows how to submit numerical answers in webassign. Note that roughly half the points are for correct reasoning.

Final exam Date now listed on our website

MIDTERM 1: October 4 (Sample exam available now)

I suggest you review all readings (including the ones for which you did not have to do a summary) and go over HW and Quizzes and in class activities.

Exam questions may also be based on lab and recitation activities.

EXTRA office hours (in course center: **Monday 11am-noon**
Wednesday noon-1pm

Questions about Midterm?

Sample midterm posted!

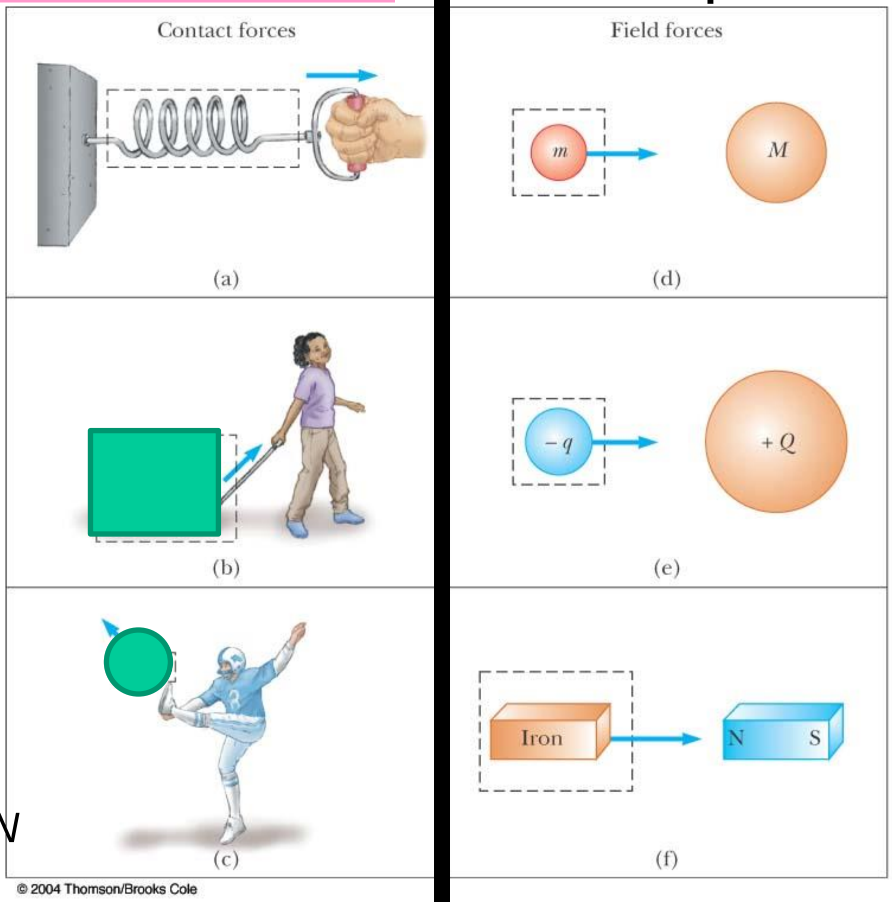
Wed next week Review

Contact forces - due to physical contact between two objects

Tension F^T

Resistive F^f

Normal F^N



How does one add/subtract vectors of different types of forces?

Non-touching force

Objects can interact through empty space over long distance

Gravity F^G

Electrical F^E

Magnetic F^M

Why are electric forces and magnetic forces considered different? What is different about them on a microscopic or subatomic level?

Newton's Laws

1. 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]
2. 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]

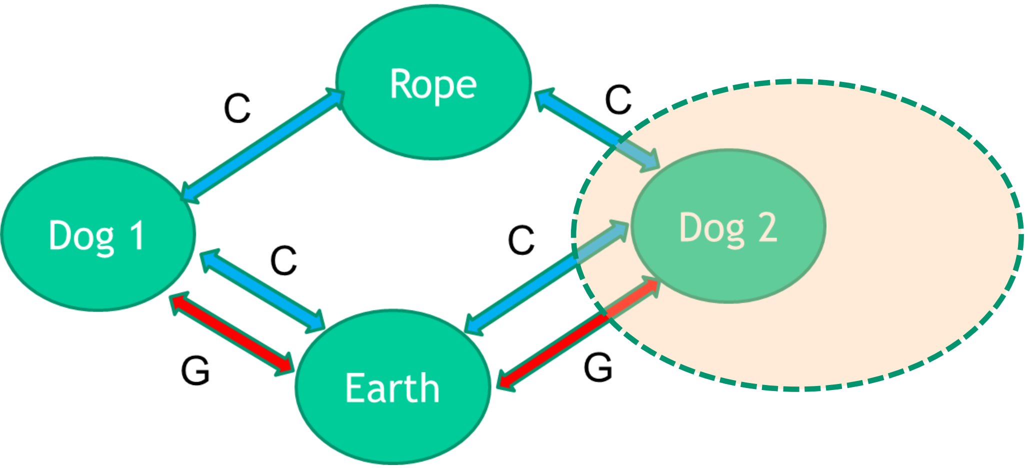
$$\vec{a} = \vec{F}^{net} / m$$

3. Whenever two objects interact, the forces they exert on each other are equal in magnitude and opposite in direction. (Reciprocity) [Newton 3]

$$\vec{F}^{type}_{A \to B} = -\vec{F}^{type}_{B \to A}$$

Is it possible to include all the forces in schema? Since there are so many things going around on Earth, it can't right?

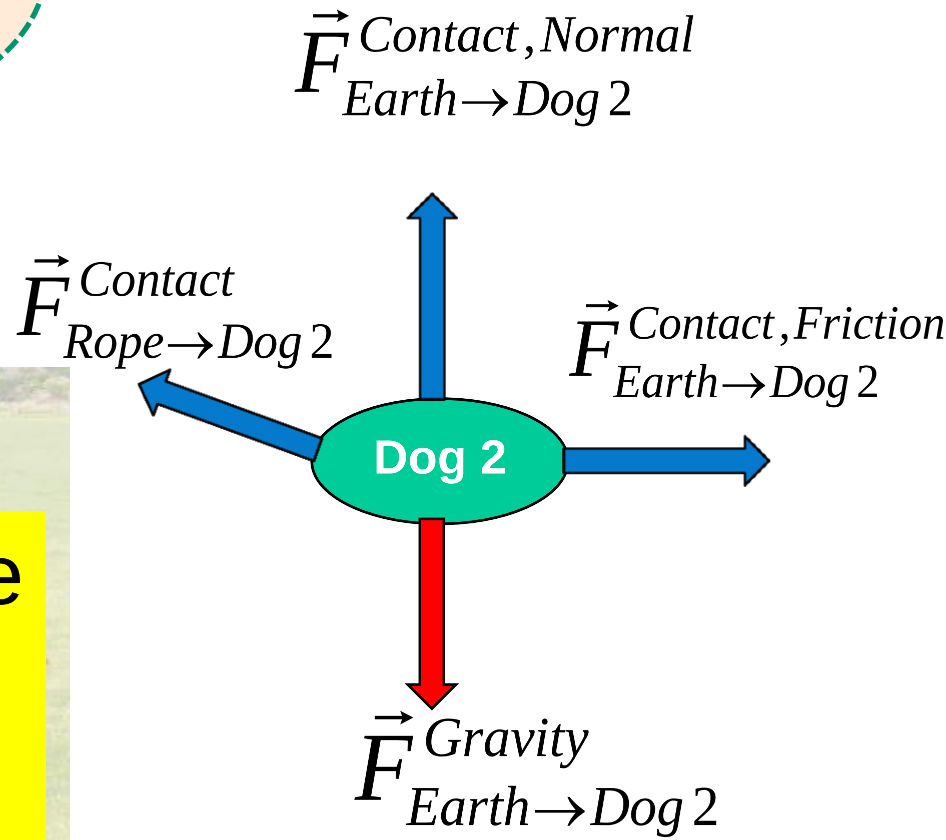
System Schema

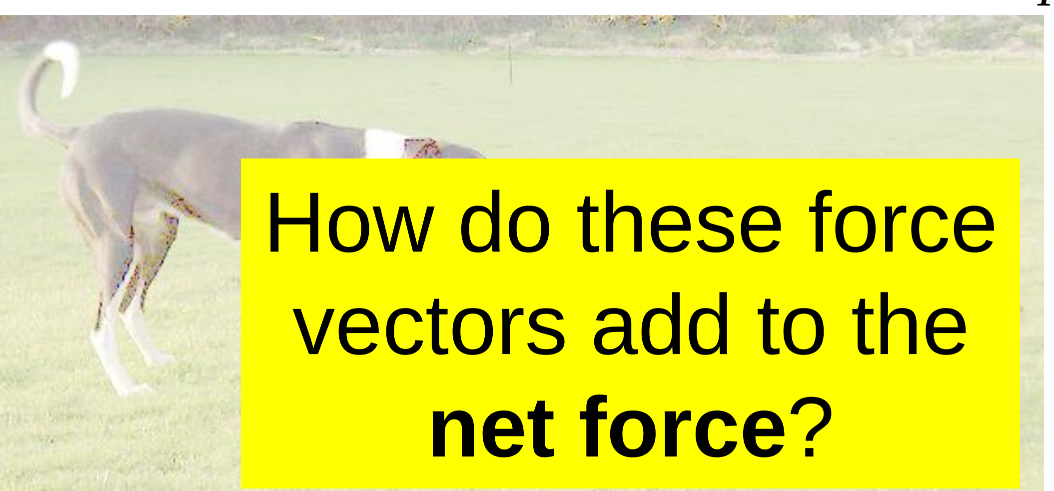


Free body diagram: dog 2

Provides information about:

- All forces exerted on the dashed circle (here: Dog 2)
- Magnitude of the forces
- Direction of the forces





How do these force vectors add to the **net force**?

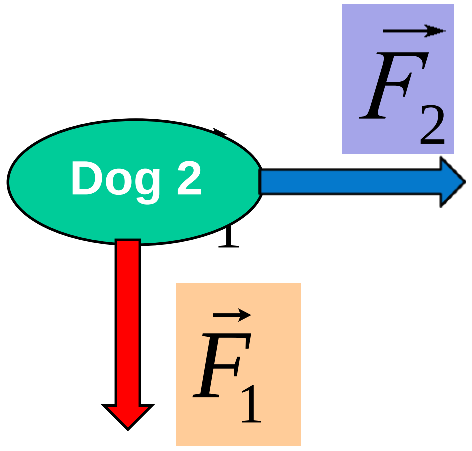
Review of Vectors (2-dimensional coordinates)

- We have 2 directions to specify. We must
  - Choose a reference point (origin)
  - Pick 2 perpendicular axes (x and y)
  - Choose a scale
- We specify our x and y directions by drawing little arrows of unit length in their positive direction. $\hat{i}, \hat{j}$
- A force vector is written

$$\vec{F} = F_x \hat{i} + F_y \hat{j}$$

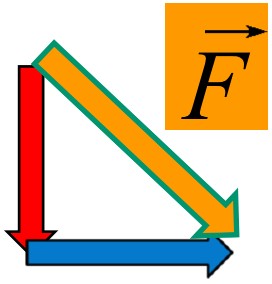
Adding Forces

$$\vec{F} = \vec{F}_1 + \vec{F}_2$$



We define the sum of two vectors as if they were successive displacements.

Adding Vectors Head to Tail



Draw Vector for $\vec{F} = \vec{F}_1 - \vec{F}_2$

(Whiteboard, TA & LA)

1. Same direction
2. Same magnitude
3. Same direction and magnitude
4. Same magnitude, opposite direction
5. Same magnitude, perpendicular direction
6. Neither same magnitude nor same direction

Compare the vector sums $\vec{C} = \vec{A} + \vec{B}$ and $\vec{D} = \vec{A} - \vec{B}$. In general, $\vec{C}$ and $\vec{D}$ have the

(Whiteboard, TA & LA)

1. Same direction
2. Same magnitude
3. Same direction and magnitude
4. Same magnitude, opposite direction
5. Same magnitude, perpendicular direction
6. Neither same magnitude nor same direction

Now we want to consider **both dogs together** as our object of interest.

1. Draw free body diagram for the new “two dogs” object
2. Write equations for 3rd law force pairs

Do 1&2 with whiteboard (TA &LA)

Will normal force always be equal to the force you apply to it? If it is, how does an object move at all?

The System Schema for the two-dog tug-of-war