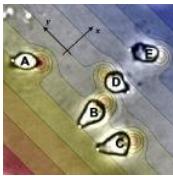


# Physics 131-Physics for Biologists I

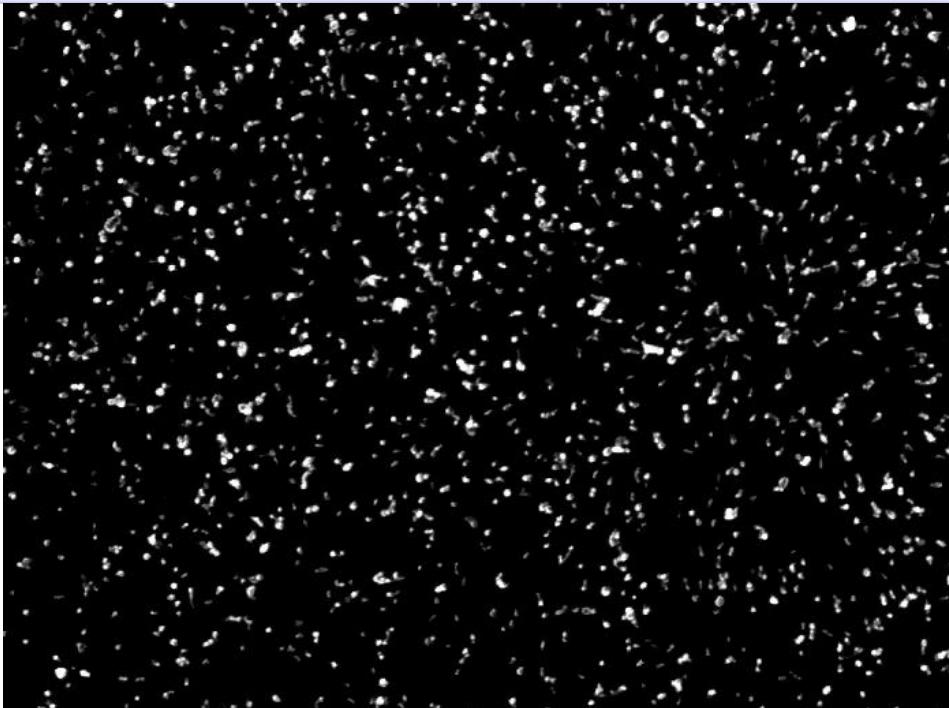


**Professor: Wolfgang Losert**  
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*I did not realize how relevant the topics from 132 were- entropy was the very first thing I learned in Biochemistry this semester, and some of our problems looked like the **recitations** we did.*

**Momentum  
Conservation**

**Emergence**



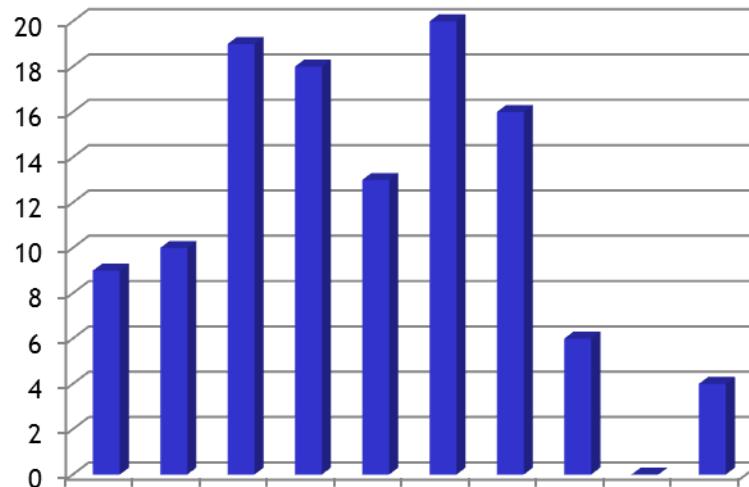
# National Science Foundation / Alfred P. Sloan Foundation Study Wants to Hear from Students in This Course

- Talking About Leaving Revisited (TALR): Study aims to understand students' motivations & experiences in courses required for a degree in science, technology, engineering, and math
- Findings will be used to influence nation-wide efforts to improve the education of future scientists, engineers, and computer scientists
- Receive \$20 cash for participating in a 60-90 minute focus group interview. Email invitation forwarded from instructor with the subject heading **“Volunteer your experiences for a national study, receive \$20”**
- Look for end of semester survey: Student Assessment of their Learning Gains (SALG)

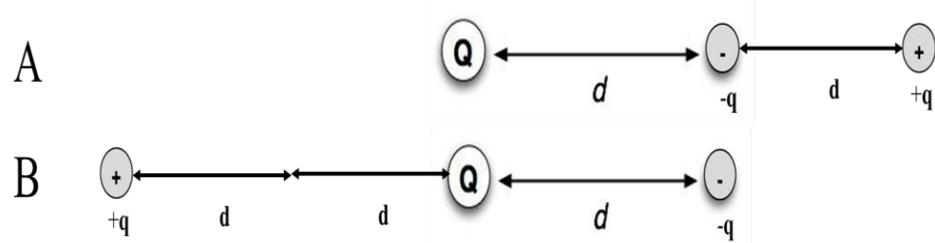


# Quiz 6

Average: 4



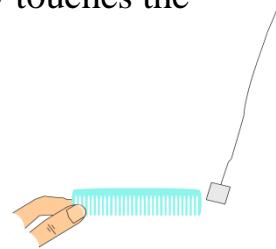
(2 pts) Two charges  $+q$  and  $-q$  are brought near a test charge  $Q$  in two different ways (A) and (B). In which case is the force larger **Indicate AB if the force is the same, D if it depends on the magnitude of q or Q**



A student suspends a small piece of aluminum foil by a light insulating thread, holds the foil between her fingers for a moment, then releases it.

2a (2 pts) The aluminum foil is then attracted towards a charged comb. Before it actually touches the comb, the foil most likely \_\_\_\_\_.

- A. is neutral
- B. is polarized
- C. has the same charge as the comb
- D. has a charge opposite to the comb

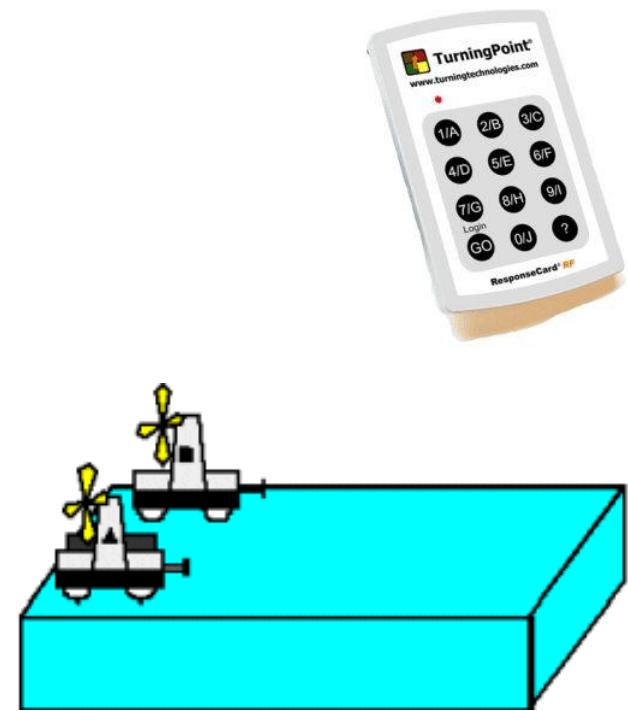


2b (2 pts) Suppose that instead of the comb you used a glass rod, which is charged oppositely to the comb. In this case, the aluminum foil would \_\_\_\_\_.

- E. be attracted towards the glass rod
- F. be repelled by the glass rod
- G. do neither

Two fan carts are on opposite sides of a table with their fans pointed in the same direction. Cart A is twice as heavy as cart B. When the fans are on, they cause the air to exert a constant force of the cart independent of its mass. Assume friction can be neglected.

The fans are set with a timer so that after they are switched on, **they stay on for a fixed length of time,  $\Delta t$ , and then are turned off.**

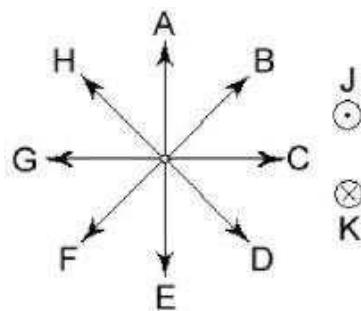
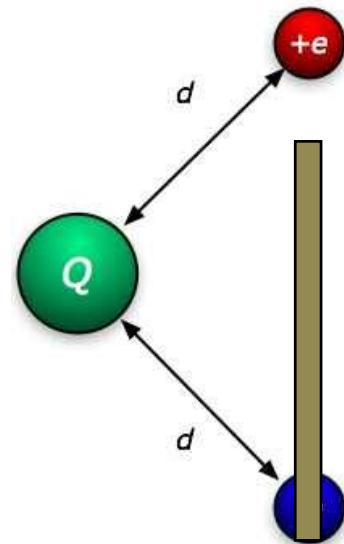


**Just after the fans are turned off, which is true about the momenta of the two carts?**

- (A)  $p_A > p_B$
- (B)  $p_A < p_B$
- (C)  $p_A = p_B$

3. (4 pts) Consider a charge  $Q$  near a pair of charges which we will call a  $+e/-e$  pair. Choose the letter corresponding to the **direction** of the following forces for the situation shown at the right. Use the compass rose below the figure to provide a letter associated with a direction. (J points out of the page, K points into the page.)


- A. The net electric force on  $Q$  from the  $+e/-e$  pair if  $Q$  is positive.
- B. The net electric force on  $Q$  from the  $+e/-e$  pair if  $Q$  is negative.
- C. The net electric force on the  $+e/-e$  pair if  $Q$  is negative (note that both  $+e$  and  $-e$  are part of the same object).
- D. The net electric force on the  $+e/-e$  pair if  $Q$  is positive (note that both  $+e$  and  $-e$  are part of the same object).

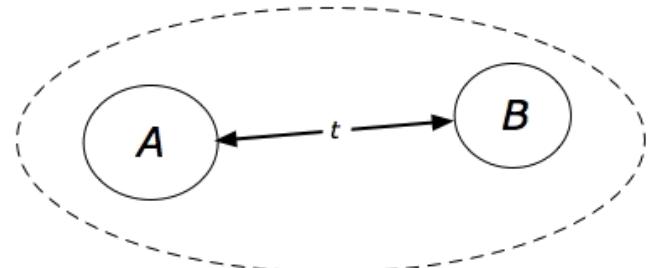


# Momentum Conservation

- 

$$m_A \Delta \vec{v}_A = \vec{F}_{B \rightarrow A} \Delta t$$

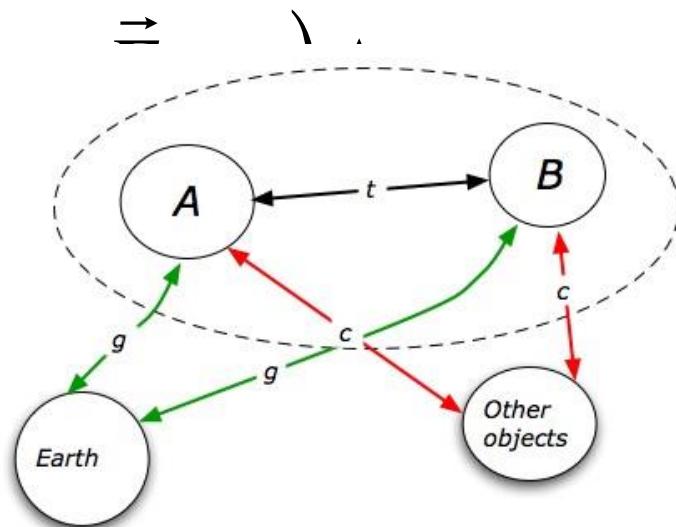
$$m_B \Delta \vec{v}_B = \vec{F}_{A \rightarrow B} \Delta t$$



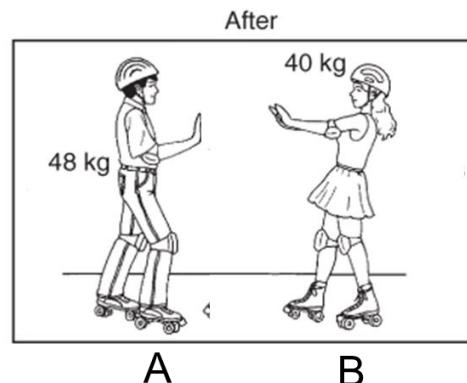
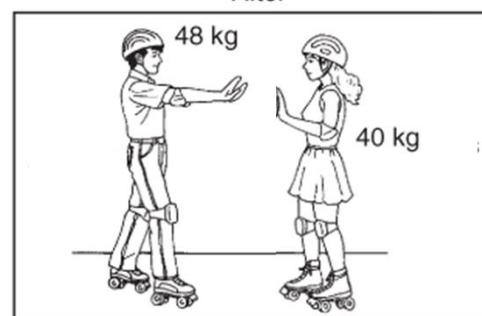
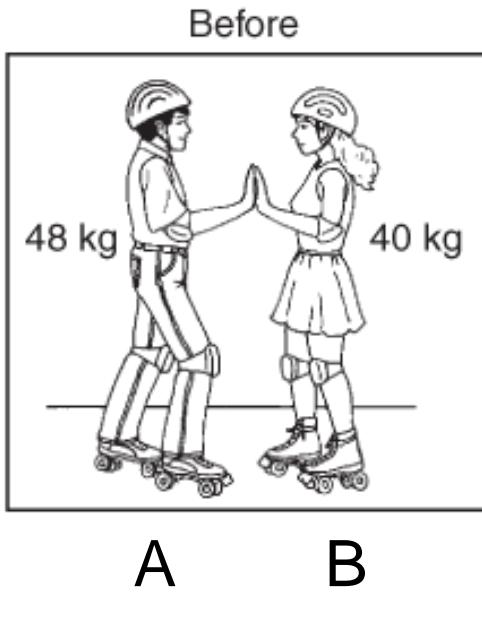
$$m_A \Delta \vec{v}_A + m_B \Delta \vec{v}_B = (\vec{F}_{A \rightarrow I}$$

$$\Delta(m_A \vec{v}_A + m_B \vec{v}_B) = 0$$

$$\Delta(m_B \vec{v}_B) = -\Delta(m_A \vec{v}_A)$$



# Whiteboard, TA & LA



1. Whoever gets pushed will reach a higher momentum (*magnitude*)
2. Whoever gets pushed will reach a higher speed
3. Whoever pushes will reach a higher momentum (*magnitude*)
4. Whoever pushes will reach a higher speed
5. Both A and B move with the same momentum (*magnitude*)
6. Both A and B move with the same speed