Week 7 Challenge Homework

1-D Conservation of Momentum

Submission Details | Submit a digital copy (PDF, jpg, etc.) to Canvas. Include solutions to the metacognitive exercise and each question. Please use the interface to associate each page of your submission with the assignment. It makes grading much easier. Please clearly indicate which question is being solved. If data is needed to complete a problem, be sure to cite the source you've acquired your data from. Typed work will not receive credit. See the course website for further details.

Group Submissions | You may submit a group collaboration to Canvas. Add each group member to the submission. Each group member should contribute to the work. Clearly indicate which part of the submission is written by each member (color or labels are preferable).

Sensemaking | You will be asked to apply sensemaking in some problems. More information about sense-making can be found on the BoxSand Sensemaking page, which is linked on the Canvas homepage.

Metacognitive Exercise

Each week will feature a metacognitive exercise, followed by one or two challenge problems to solve. The metacognitive exercise will usually ask you to reflect on your solution to the previous week's challenge problems.

Review your solution to the Week 6 Challenge Homework. If you do not have a copy of it anymore, you can find it on Canvas or Gradescope, under the Week 6 Challenge Homework assignment. Also, review the solution which has been posted to the BoxSand solutions archive (click here for a link) a few days after the assignment is due.

(a) Using the rubric and guidelines provided here and in the solutions archive (click here for link), grade your own solution to the Week 6 Challenge Homework submission. What areas of improvement do you see?

Category	None, developing, meets, or exceeds expectations	Reasoning (briefly)
Metacognition		
Clarity of Communication		
Earnest Attempt		
Physical Representation		
Sensemaking		

(b) Using the same rubric, grade your own solution to this week's challenge homework (after you have completed it, of course). Provide brief reasoning for each category. Are there any categories for which you are more uncertain?

Category	None, developing, meets, or exceeds expectations	Reasoning (briefly)
Metacognition		
Clarity of Communication		
Earnest Attempt		
Physical Representation		
Sensemaking		

Question 1:

You are a world-famous physicist-lawyer defending a client who has been charged with murder. It is alleged that your client, Mr. Lawton, shot the victim, Mr. Cray. The detective who investigated the scene of the crime, Mr. Dibny, found a second bullet, from a shot that missed Mr. Cray, that had embedded itself into a chair. You arise to cross-examine the detective.

> ***You:*** In what type of chair did you find the bullet?
> **Dibny:** A **wooden** chair.
> ***You:*** How massive was this chair?
> **Dibny:** It had a mass of 20 kg.
> ***You:*** How did the chair respond to being struck with a bullet?
> **Dibny:** It slid across the floor.
> ***You:*** How far?
> **Dibny:** Three centimeters. The slide marks on the dusty floor are quite distinct.
> ***You:*** What kind of floor was it?
> **Dibny:** A **wood** floor.
> ***You:*** What was the mass of the bullet you retrieved from the chair?
> **Dibny:** Its mass was 10 g.
> ***You:*** Have you tested the gun you found in Mr. Lawton's possession?
> **Dibny:** I have.
> ***You:*** What is the muzzle velocity of bullets fired from that gun?
> **Dibny:** The muzzle velocity is 450 m/s.

With only slight hesitation, you turn confidently to the jury and proclaim, "My client's gun did not fire those shots!"

(a) How are you going to convince the jury and judge?

(b) Choose one part of your solution and perform a sense-making analysis. Choose between *Sign*, *Units / Dimensionality*, *Related Quantities*, or *Proportionality / Covariation* sensemaking techniques. Clearly indicate which you are employing. You will likely want to make a clear prediction, explain the prediction, then compare the prediction to your found result.