Name_____ Date_____ Per_____

**Refuting Claims Using Models: Why did the spacecraft go so much faster than expected on Wednesday?**

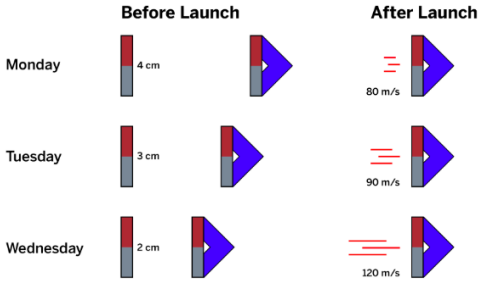
Between the Monday and Tuesday launches, the scientists at the USA moved the spacecraft 1 centimeter closer to the launcher, and it moved 10 meters per second faster. So on Wednesday, they moved the spacecraft another 1 cm closer to the launcher, and expected it to *increase* its speed by another 10 m/s. But the launch speed wasn't just 10 m/s faster than on Tuesday; it was 30 m/s faster! The increase in speed was much more than expected.

## Why did the spacecraft go so much faster than expected on Wednesday?

**Claim 1:** The magnets were misaligned on Tuesday.

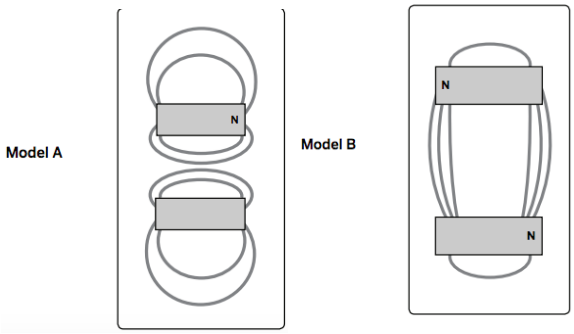
**Claim 2:** Much more energy was in the launcher system on Wednesday than on Tuesday.

**Claim 3:** The magnetic force was much stronger on Wednesday than on Tuesday.




The launcher relies on a powerful ***repulsive*** force between the magnets in the launcher and the magnets in the spacecraft. If the position of the magnets changed, and therefore the repulsive force between them changed, the spacecraft could go *slower* than expected. That could explain why the Wednesday launch was so much faster than the Tuesday launch even though the launch distance was changed by only 1 cm for each test.

Before we look at our magnetic field data from the launches, let's review what a repulsive magnetic field looks like.



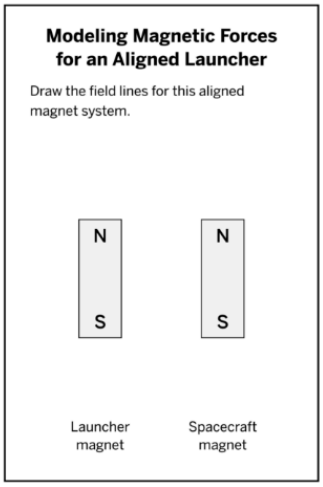

**1. Explain which model represents magnetic fields for magnets that are *repelling each other by using the description of the magnetic field as evidence..***

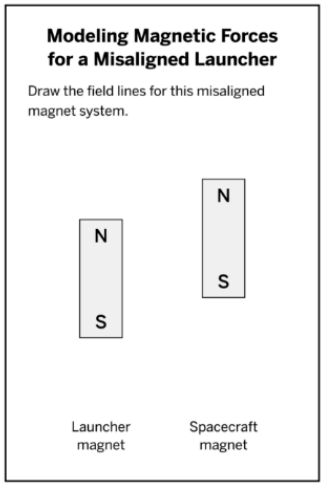
Model _____ represents magnetic fields for magnets that are repelling each other because_____

_____

_____

**2. Before we look at our data to see if the magnets were misaligned, let's DRAW them, AND then DESCRIBE what repelling magnetic fields should look like on magnets that are aligned, and what repelling magnetic fields should look like on magnets that are misaligned. Later, you will use these descriptions as your REASONING. (you may use the simulation on the blog to help)**




Descriptions:

**a) My description: Repelling magnets that are aligned have magnetic fields that**_____

_____

_____

**a) Revised description: Repelling magnets that are aligned have magnetic fields that**_____

_____

_____

**b)My description: Repelling magnets that are *misaligned* have magnetic fields that**_____

_____

_____

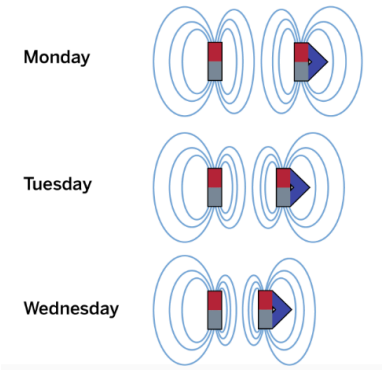
**b) Revised description: Repelling magnets that are *misaligned* have magnetic fields that**_____

_____

_____

Name_____ Date_____ Per_____

Let's look the magnetic field data from the test launches!




*Claim 1 states: The magnets were misaligned on Tuesday, which is why the spacecraft went so much faster on Wednesday*

**3. Look at the magnetic field data in the diagram. Do the magnetic fields pictured on tuesday match with magnetic fields between magnets that are misaligned? Why or why not?**

**(C)** The magnetic field from the launch on Tuesday **<u>does / does not</u>** match with magnetic fields that are misaligned because_____

_____

**We want to inform Dr. Shapiro that Claim 1 is not true. In order to convince Dr. Shapiro of this, it is important to write a clear explanation. We need to explain how the *evidence* shows the launcher and the spacecraft *were not* misaligned.**

**4. What things about the magnetic field line data from Tuesday should we point out to Dr. Shapiro? (evidence)**

**(E)** The magnetic field line data shows that on Tuesday, the magnetic fields were_____

_____

_____

**5. If the magnets were misaligned, what would the field line data look like? (reasoning)**

**(R)** If the magnets were misaligned, the field line data would look like_____

_____

_____

**6. Write your CERL below**

The Claim that the magnets were misaligned on Tuesday is incorrect because_____

_____

_____

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Vocabulary

- attract
- magnetic field lines
- poles
- refute
- repel
- system

Helpful words and phrases

- because
- if …, then …
- since
- therefore,

| Grade | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Argument | - The **Claim is correct, and includes a "because" statement**<br>**-** The Evidence from the diagram is **accurately and fully** described using vocabulary<br>- The Reasoning explains why claim 1 is incorrect by using the full description of the magnetic field<br>- Link fully explains why the evidence shows that claim 1 is incorrect | - The **Claim is correct,**<br>**-** The Evidence from the diagram is **accurately** described using vocabulary<br>- The Reasoning explains why claim 1 is incorrect by using the description of the magnetic field but may not be completely accurate, or described<br>- Link explains why the evidence shows that claim 1 is incorrect | - The **Claim is correct,**<br>**-** The Evidence from the diagram is described using vocabulary<br>- The Reasoning explains why claim 1 is incorrect, but may not use thel description of the magnetic field<br>- Link explains that claim 1 is incorrect, but may not mention evidence | - The **Claim is incorrect, or there is not claim**<br>**-** The Evidence from the diagram is **not described accurately**<br>- The Reasoning does not explain why claim 1 is incorrect by using thel description of the magnetic field or is not present<br>- Link is not present, or it is inaccurate |