

Hypothesis Cubes – Nature of Science Lesson #STEMAZingVirtualAdaptation

Directions:

Observing the five visible sides, determine what is on missing face on the bottom of the cube. Make a claim about what you think is on the missing face (which number and what color is the face). Support your claim with as many lines of evidence (patterns) as you can find. (There are at least eight lines of evidence to support most claims made for what is on the missing face of this cube. Some lines of evidence or patterns can be quite simple but still used to support your claim.)

Method:

- 1) First, place students in breakout rooms of 2-3 students each and give them the link to the first cube (<https://stemazing.org/hypothesis-cube-1/>).
- 2) Give them 5 minutes to determine what is on the bottom and write down their lines of evidence – the patterns they see that support both the color and number they determine should be on the bottom.
- 3) Bring students back together as a whole group.
- 4) Share patterns found on Cube 1 to support the number and color they think is on the bottom of Cube 1.
- 5) Put students back into breakout rooms and give them the link to Cube 2 (<https://stemazing.org/hypothesis-cube-2/>). The directions remain the same though the task for this cube will generally take a bit longer. NOTE: You can either put them in groups of 2-3 students which you later combine into groups of 4-6 to share ideas after 5 minutes or so or you can put them in new groups of 4-5 students each.
- 6) Give them 15 minutes to determine what is on the bottom and write down their lines of evidence – the patterns they see that support the color, numbers, and name they determine should be on the bottom.
- 7) With a few minutes left, instruct them to come up with their final evidence supported claim as to exactly what is on the bottom of Cube 2. They can draw this using your program of choice from Google Slides to Google Draw and so on.
- 8) Bring students back together as a whole group. Have each group screen share their final answer for what the bottom of the cube looks like and share patterns found on Cube 2 to support their claim. Subsequent groups can add any additional patterns not called out or differences in their claims and patterns to support their ideas.
- 9) When done, explain to students that this is how science works. The “answer” will not be revealed because in science you do not get to call up someone and ask if you have figured out how the natural world works. You are either more or less certain about your claim based on the evidence and based on other ways of interpreting the same evidence to support a different claim. For older students, this would be a brilliant time to assign watching the documentary Particle Fever – a humanized view of real scientists using mathematics to predict the mass of a subatomic particle and then finding out which mass the experimental data supports.

Hints, Tips and Variations:

- You can require students to stay on mute for a certain amount of time initially so they can establish some patterns on their own before everyone starts to share. This will protect the thinking space of students who need more time to make sense of the patterns.
- It is helpful to tell them that there are about 10 lines of evidence or patterns they can find for Cube 1.
- You might need to give them a hint about opposite side connections but generally at least one group will figure this out.
- You can give them the strategy of drawing all the sides on a piece of paper so they can see them all at once if they don't come up with this strategy on their own.
- You can have them list the "variables" they are trying to support with patterns of evidence – color, name, gender, top number, bottom number, etc.
- Sometimes for Cube 2, you might want to give a hint about the names and numbers being connected. Depends on the time you have and if students catch this on their own.
- Some groups will write the name they guess without using block letters. Good discussion about paying attention to detail!
- You want at least one group to come up with a competing hypothesis for Cube 2, so artfully give hints as you pop into breakout rooms that push some of them in a different direction if necessary.

Cube 1 Hypothesis and Patterns

Claim: It has the number 2 and it is shaded or grey in color.

Patterns:

- There is a series of numbers 1, 3, 4, 5, 6 and 2 is missing.
- Opposite sides are opposite colors, so if the top is green the bottom should be grey.
- Opposite sides add up to 7 like a normal die – $1+6$ and $3+4$ – so if 5 is on the top, then the bottom number should be 2.
- Opposite sides are odd and even. 5 is odd so the bottom number should be even.
- There are three green sides and only two grey sides, so the bottom should be grey.
- Even numbers are shaded grey. A 2 on the bottom means it should be shaded grey as well.

Cube 2 Hypotheses and Patterns

Claim 1: It is red, has the numbers 4 on the bottom and 8 on the top and the name is FRANCINE.

Claim 2: It is red, has the numbers 4 on the bottom and 5 on the top and the name is FRANN or FRANI or FRANY.

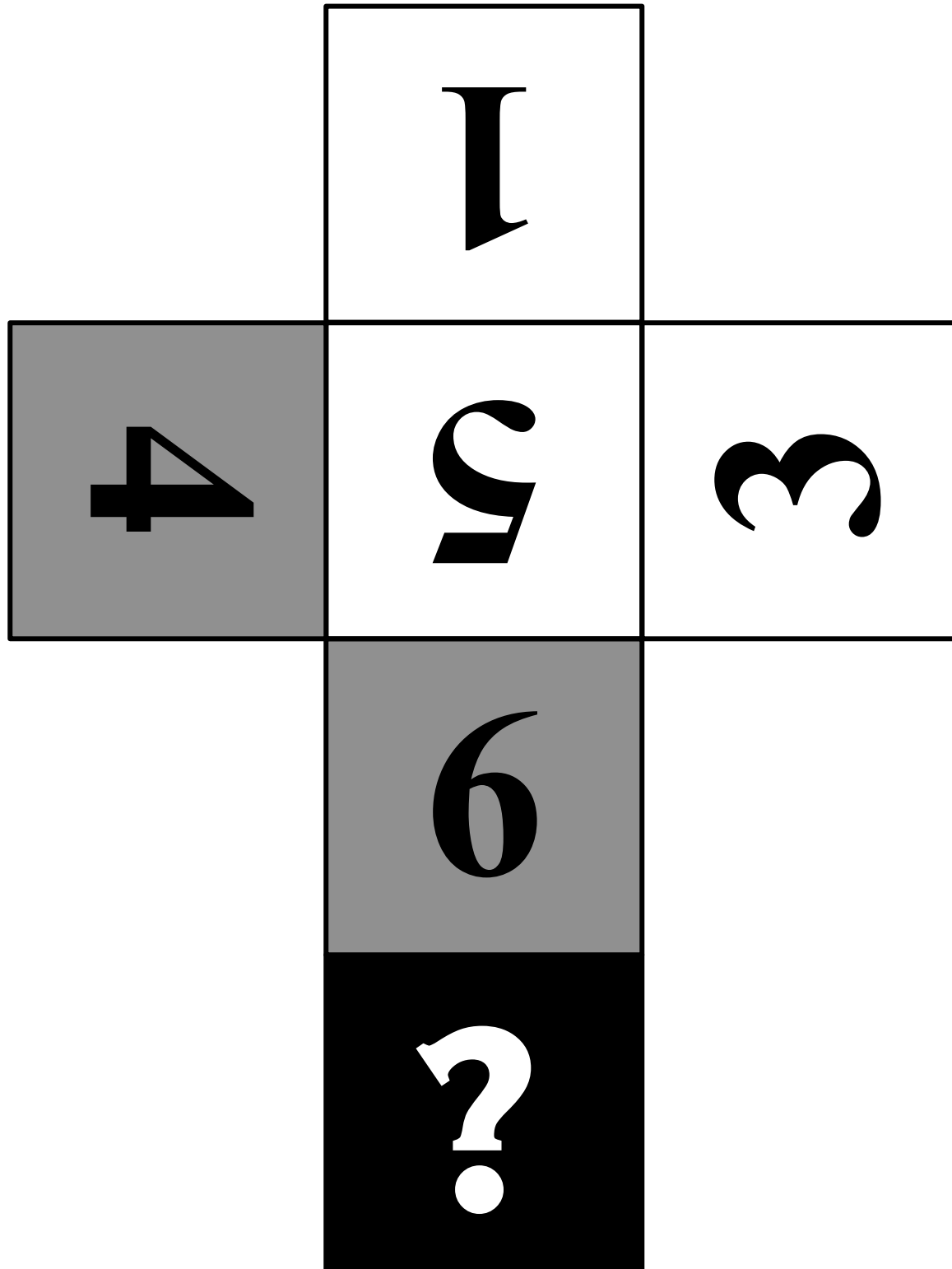
Claim 3: It is red, has the numbers 4 on the bottom and 7 on the top and the name is FRANCIS.

Patterns:

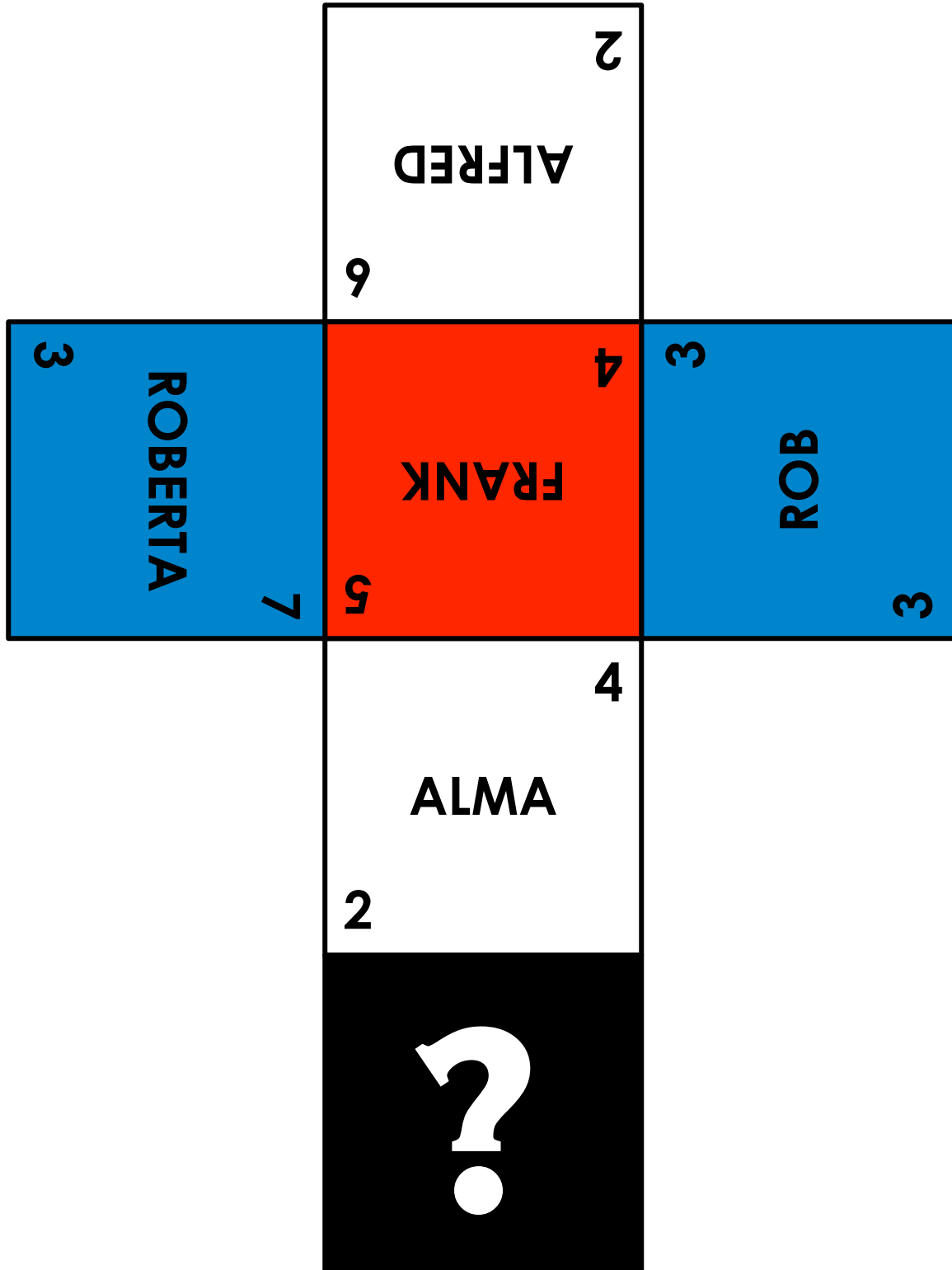
- Opposite sides are the same color so because the top is red, the bottom should also be red.
- Opposite sides have a male and then a female names so the name on the bottom should be a female name.
- Opposite sides have the same number on the bottom so the bottom number should be 4.
- The top right number is the number of letters in each name – 5 for FRANK, 3 for ROB, 7 for ROBERTA, 6 for ALBERT, 4 for ALMA.
- The bottom number is the number of letters opposite side names have in common – 3 for **ROB** and **ROBERTA**, 2 for **ALBERT** and **ALMA**. So we know with a 4 for **FRANK** that the bottom name should start with **FRAN**.
- The competing theories come from reasoning for the top right number. It could be 8 because there is a series of numbers – 3, 4, 5, 6, 7 – so 8 would be the next number and it can't be 2 because of the lower number giving the name at least four letters. OR It could be 5 because the top right numbers on opposite sides add up to 10 – 3+7 and 6+4 – so with a 5 on top it would also have to be a 5 for the top right number on the missing side. OR It could be 7 because ...
- There are all kinds of other crazy patterns, some with complicated algorithms, to support their claim.

National Academy of Sciences. 1998. Teaching About Evolution and the Nature of Science. <https://doi.org/10.17226/5787>.
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Cube 1



Cube 2



Design-Your-Own Cube

