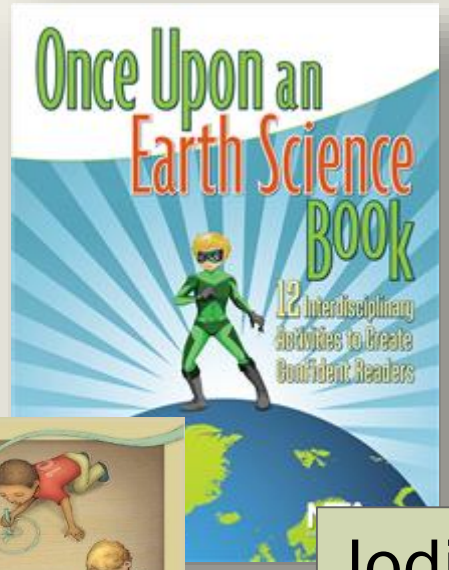

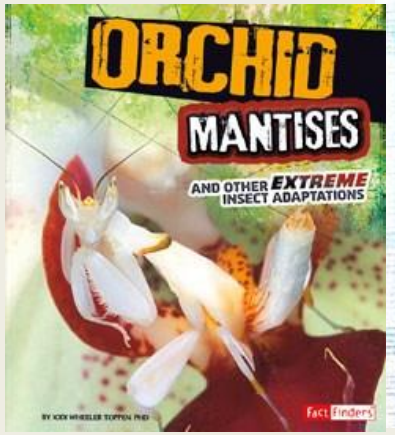

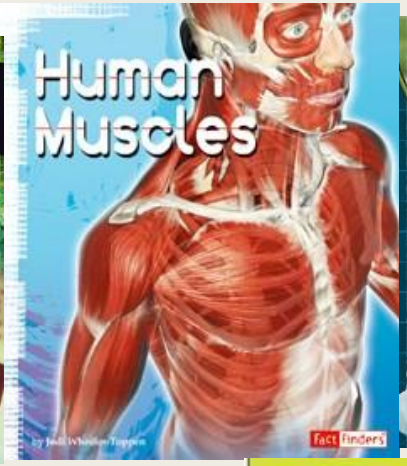

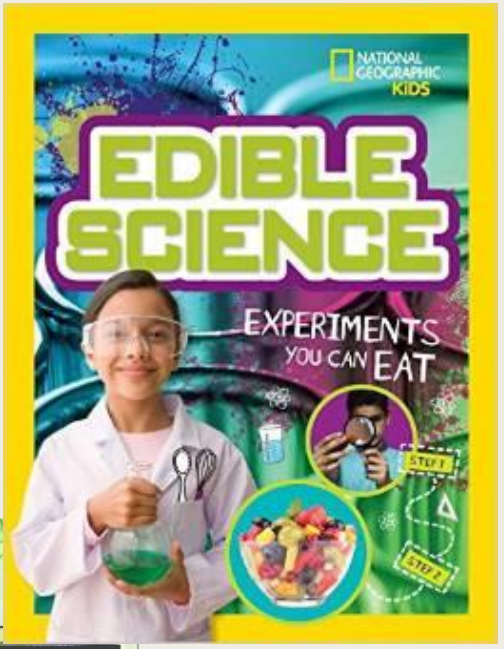

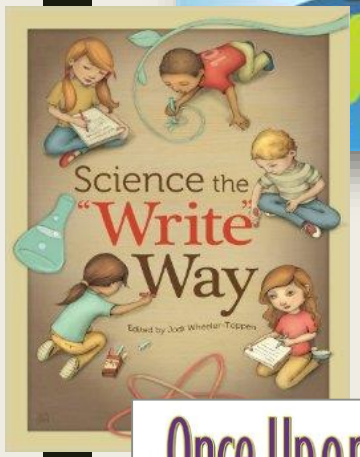

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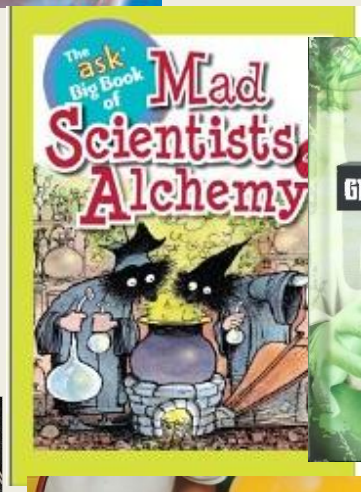
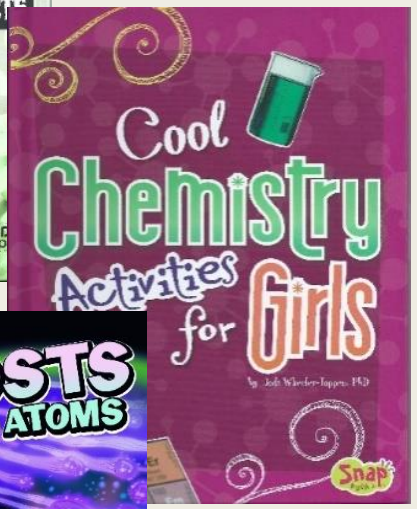
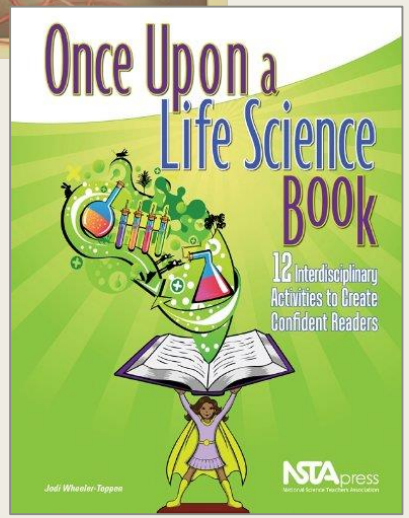
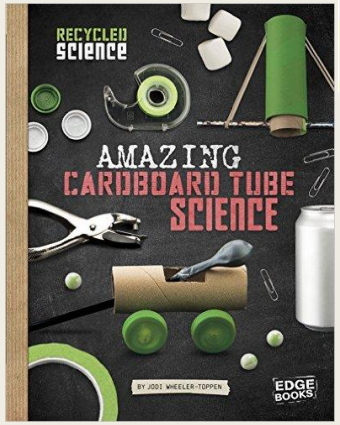
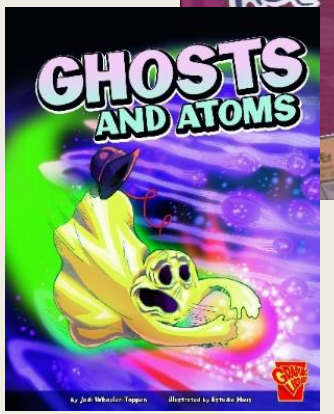










So, we got some new standards…

- Standards come and standards go
- But these are coupled with a significant change in the world
- That provides us an opportunity to make meaningful changes in teaching
- And it might even be fun (!?)

We do *not* want our students to just learn the facts and vocabulary of science;

We want them to be able to draw from

their prior experiences,

texts,

conversations,

labs,

lecture,

media, and video

Piece a'cake, right?

evaluate those sources and to *assemble* it all into an understanding of the topic that they can

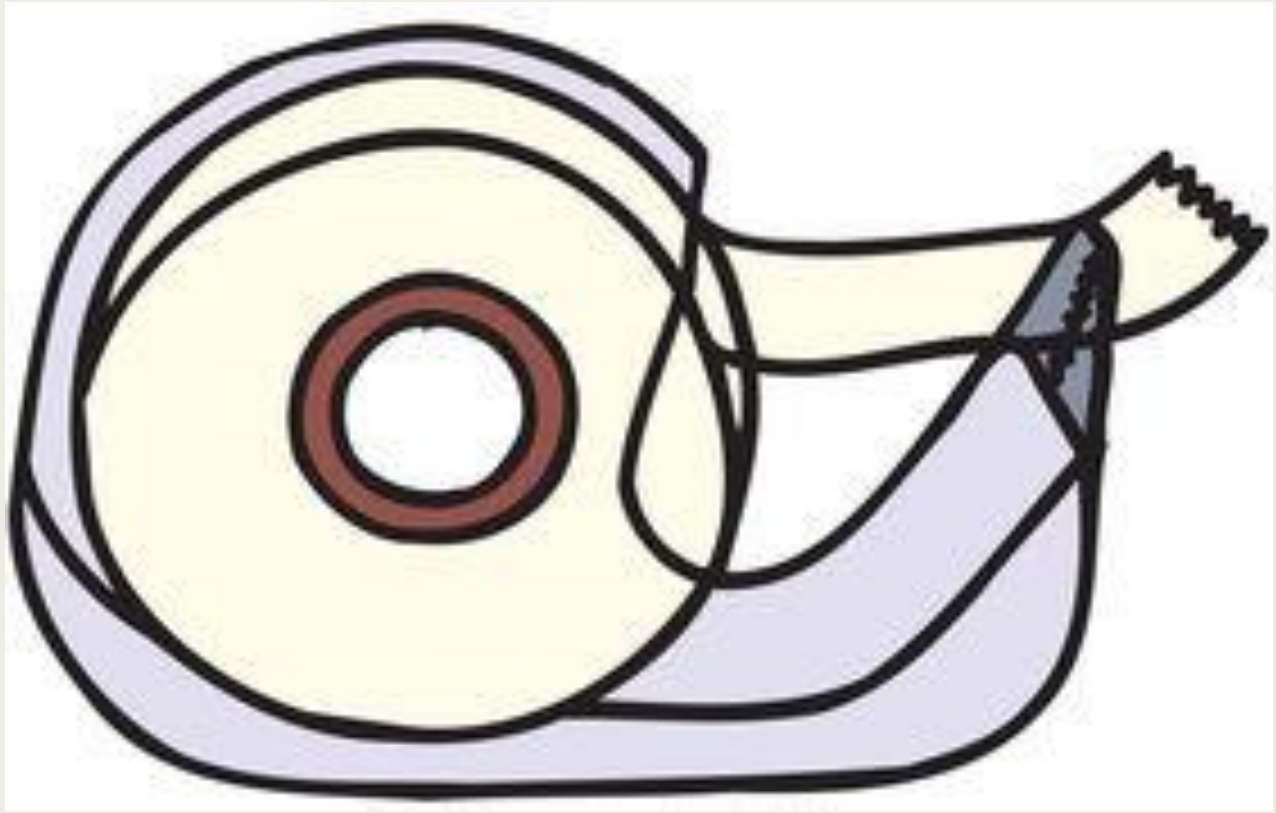
USE

to solve problems in the world.

How The New Standards Help

- Develop a model to…
- Analyze and interpret data on…
- Construct and present arguments using evidence to…
- Construct an explanation that predicts…
- Use mathematical representations to…
- Apply scientific principles to design a method for…

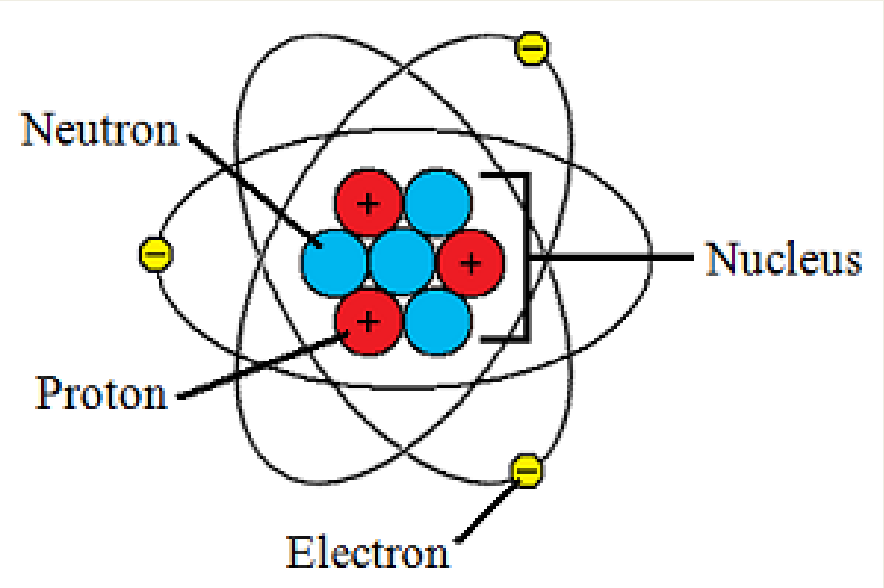
Sticky Tape Lab

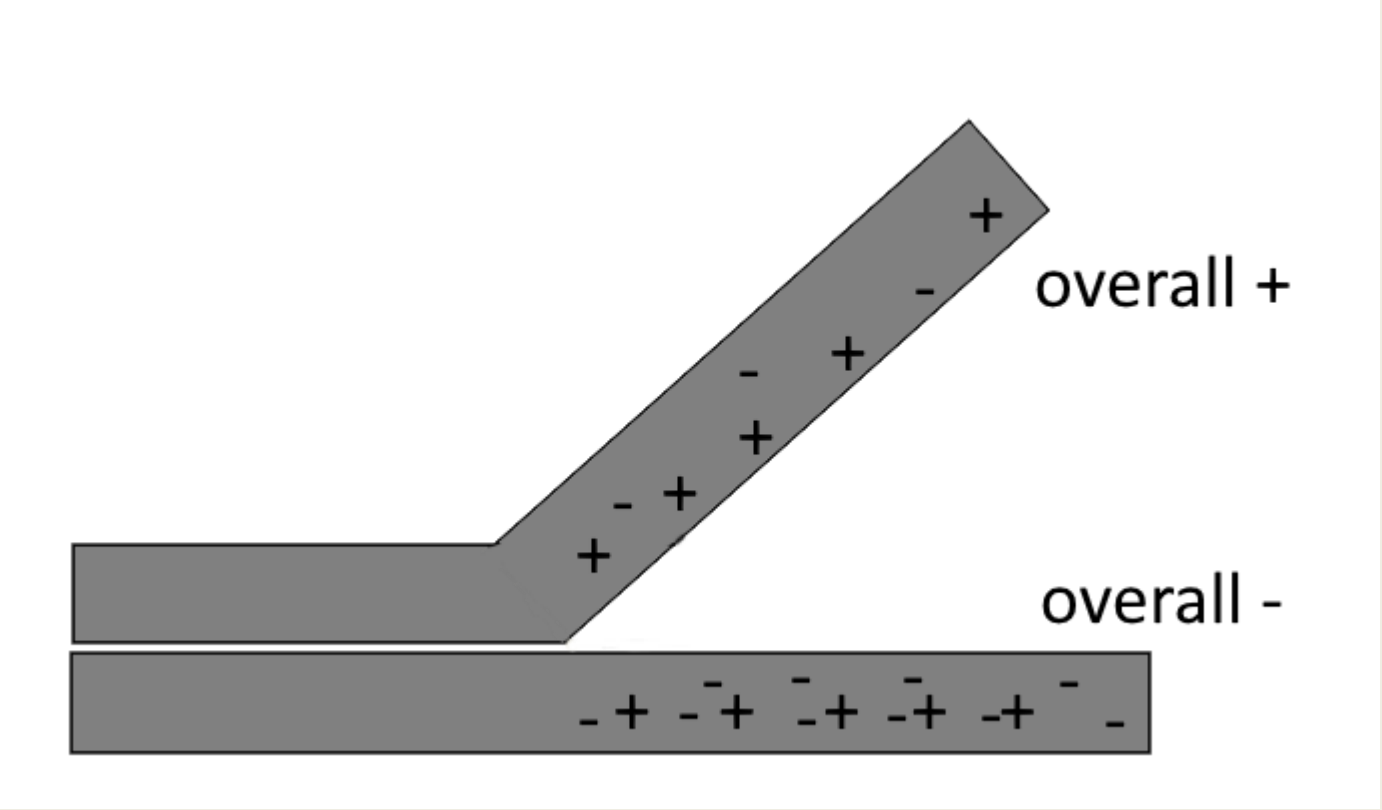


What we saw:

- When a tape was charged, what did it do?
- When a tape (or something else) was neutral, what did it do?

Let’s look at the molecular level.





Let’s take this a step further.

Rubber balloons pick up electrons very easily (and thus become negative). Inflate a balloon and rub it vigorously in your hair or on carpet. Use the balloon to determine the charge on Tape D.

- Writing Prompt: What is the charge on Tape D? How do you know? Explain at the molecular level what is causing Tape D to have that charge.
  - *What science words will you want to include in your answer?*

Let’s break this static electricity lesson down.

- Make a quick outline of the parts/steps in the lesson.
- What worked in this lesson (in terms of what you would like for your classroom)?
- What would you have done differently if you were teaching it?
- Physical science teachers: What would you do next?

What is your knowledge/ experience with “learning cycles” as a method of science teaching?

I know about learning cycles and use them in teaching, at least sometimes.

I'm familiar with them, but don't really use them.

I've never heard of a learning cycle.

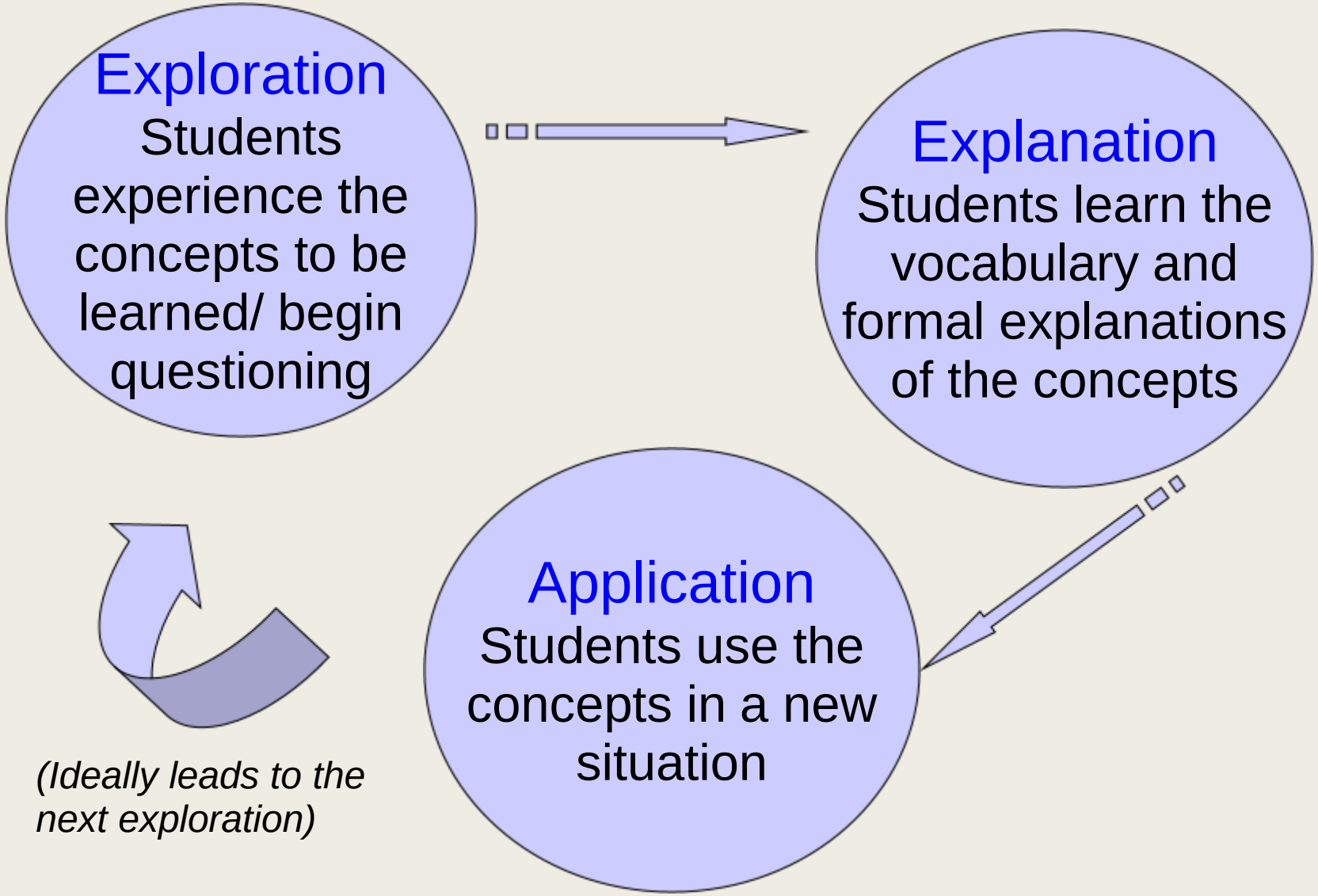
How about the phrase “lab before lecture”?

I've heard it and it makes sense.

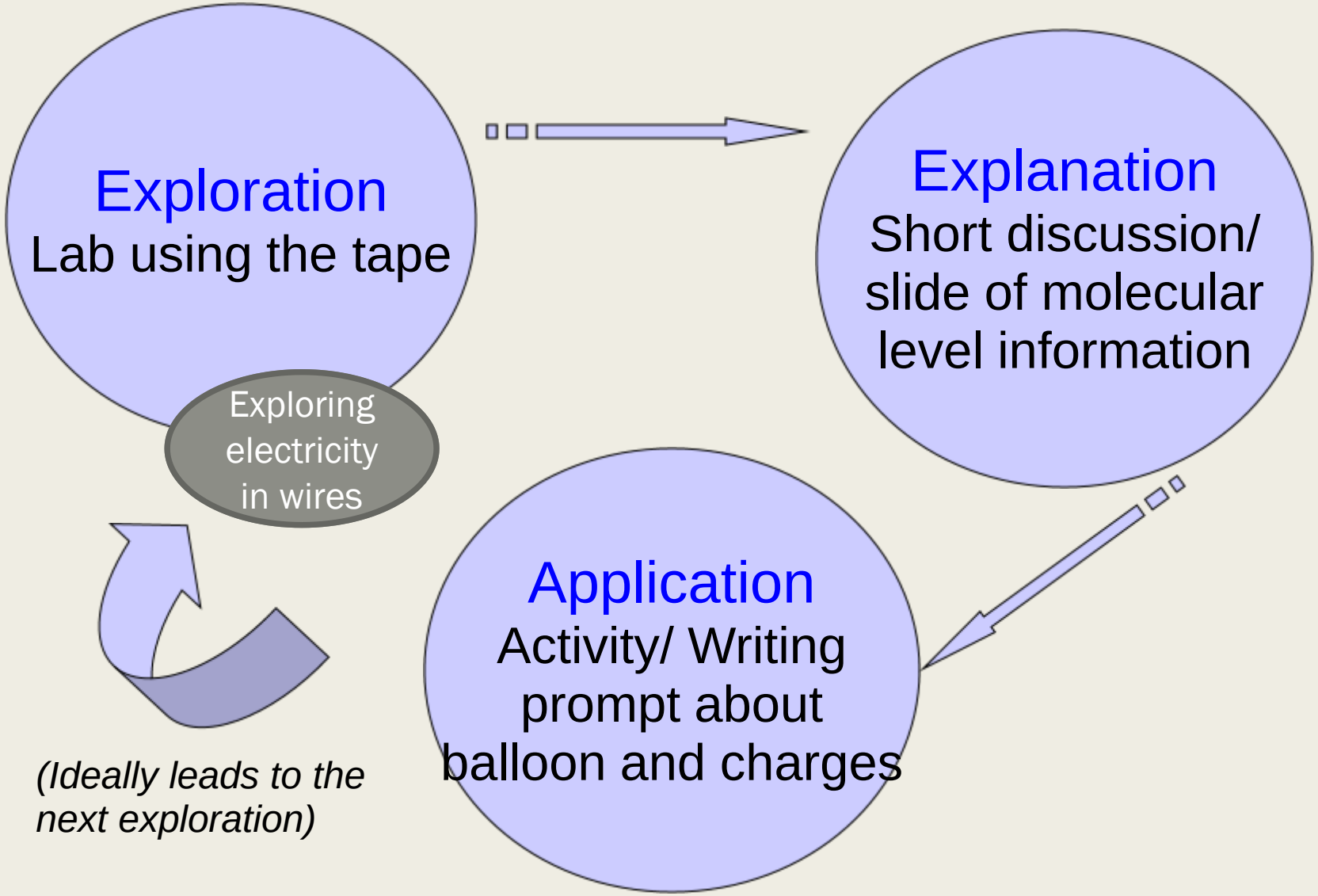
I've heard the phrase but I don't get it.

Nope. Never heard of it.

Phases of the Learning Cycle



Static Electricity and Tape Learning Cycle



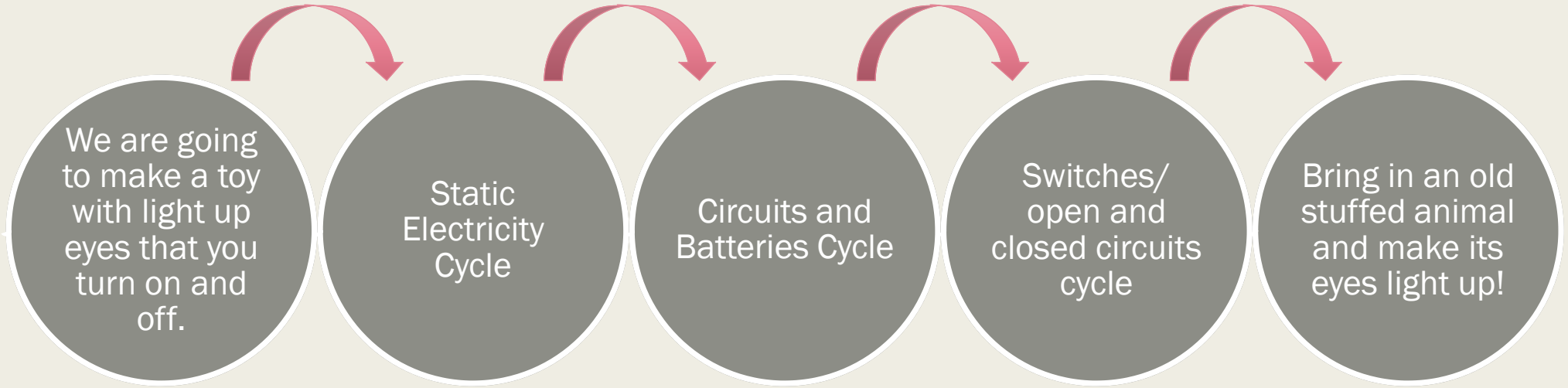
Key issues in Exploration

- Should involve *experiencing* and ***thinking*** about the concept
  - Careful thought should go into the *questions* that accompany an exploration
  - There should be something to figure out or start figuring out
- In many situations, students can be led to develop the concept for themselves from the exploration
- No New Vocabulary is Introduced (or very little, just as needed)

The “5-E” Learning Cycle

- *Engage: Get them interested!*
- *Explore*
- *Explain*
- *Extend (Apply)*
- *Evaluate: Did they understand?*

Learning cycles in units



What is the value of this approach?

- Your thoughts?
- Research shows increased student learning, maintained for longer.
- Especially powerful for students who don’t come from “enriched” backgrounds—it gives them the background knowledge they need to understand the content.

QUESTIONS?

(Let’s Take a Short Break)

LOOK OUT BELOW!

What do we expect students to take away from that exploration?

What questions do we expect students to be wondering about?

Coding

Begin by reading the article individually. As you read, mark sentences with the following codes:

! *This is important*

✓ *I knew that*

x *This is different from what I thought*

? *I don't understand*

You don't have to mark every sentence!

Coding

! This is important
✓ I knew that
x This is different from what I thought
? I don't understand

If you urinated this morning, drank a glass of water, or washed your hands, you participated in the water cycle. The water cycle is the phrase used to describe the movement of water around the Earth.✓ You are probably familiar with some of these movements, such as rain, snow, or other precipitation falling from the atmosphere. When that precipitation reaches the ground, some of it runs into rivers, lakes, and oceans.✓ Some of it ends up frozen in ice caps or glaciers. And some of it soaks into the soil. Water that soaks into the ground is called groundwater. And groundwater is more powerful than you might imagine. X

In your reading groups:

- Shortest person starts with the card
- Lead your group through the procedure for the first section.
- Pass the card to your right. That person leads for the second section.
- Pass the card again. That person leads for the third section.
- If you have a problem, raise your orange flag.
- When you've read it all, work together to answer the Big Question.

What's on the Card

- Everyone in the group reads the section and codes (marks ✓, x, ?, !) as they read.
- The leader for this round tells what the section was about. If you're stuck, try starting with, "What I understand so far is…"
- Ask if anyone found something confusing (marked X or ?).
  - *The group should work together to figure out what the confusing words, sentence, or idea means.*
  - *If the group cannot make sense of it, raise your orange flag for help.*
- Pass the card to your right and move on to the next section.
- When your group has read and discussed all three sections, work together to answer the Big Question.

Writing Prompt

Late one night in 2011, a UPS store in Georgetown, South Carolina, collapsed into a sinkhole.

The store was located over a limestone aquifer that had been stable until the collapse. The owners are suing the South Carolina Department of Transportation because the department had been draining groundwater nearby to allow for the installation some underground structures.

Pretend you are a filing a legal brief (report) to support the UPS store's case. **Explain how the Department of Transportation's groundwater work might have led to a sinkhole under the UPS store.**

Not going to write this, but here are 3 prewriting questions to consider:

- How do you want to set up your brief? What writing words might you use?
- What science words do you want to include?
- Should you use formal or everyday language?

LUNCH?

YOUR CHALLENGE

If you have never/rarely taught with learning cycles:

- Plan a learning cycle that you can teach between now and January 8.
- Fill out the planning page with your general plan
- Conference with me at some point in the process

Everyone:

- Feel free to work with a partner(s).
- Feel free to use a lesson from one of these books.
- Feel free to search for your topic with "learning cycle" at nsta.org (I'm happy to log you in.)
- Physical Science might like the resources at middleschoolchemistry.com (from ACS)

If you are comfortable with teaching through learning cycles:

- Plan a new cycle to try by January 8, with one added piece:
  - *Try having students read in groups*
  - *Create a problem for them to solve*
  - *Add an engineering element*
  - *Add something of your choosing*
- Fill out the planning page with your general plan
- Conference with me at some point in the process

For January 11

- Teach the lesson you have planned
- Complete the reflection questions on the back.
- Bring the general plan and reflection questions on the 11th.

TOMORROW: BEGINNING PEER OBSERVATION

WHY are you observing me?

- Peer observation has the potential to be very powerful.
- New ideas, new perspectives, new lessons and materials, comparison of what students are expected to achieve.
- Peer observation allows you to do something that is harder to do as the teacher—you can focus on the ***student*** experience of the lesson.

Why are you observing ME?

- Peer observation can be intimidating.
- Someone has to go first…

Observation Protocols—Before the lesson

- Observed teacher situates the lesson in what students have been learning. (2 minutes)
- Observed teacher explains instructional decisions that led to this lesson. (2 minutes)
- Lead or Observed teacher requests specific observation methods. (2 minutes)
  - *Observers ask clarifying questions. (2 minutes)*
- Observed teacher shares logistical info on observation/ post-observation discussion. (2 minutes)
  - *Observers ask clarifying questions. (2 minutes)*

What to watch for—
the student experience

- Select a student or group of students to focus on (not set in stone).
- Look for evidence of student learning—specific moments and interactions:
  - *Script or summarize interactions/ comments*
  - *Describe behaviors*
- Likewise, where are the points of confusion or disconnect for students?
- What teacher actions/decisions might have helped? (I'm ok with you engaging with the students.)

Bring with you:

- Paper/ something to bear down on
- Writing utensil
- Observation slip

Observer Questions?

Logistical Information: Amber?

Contact Information: ask if you need help!

OnceUponAScienceBook.com

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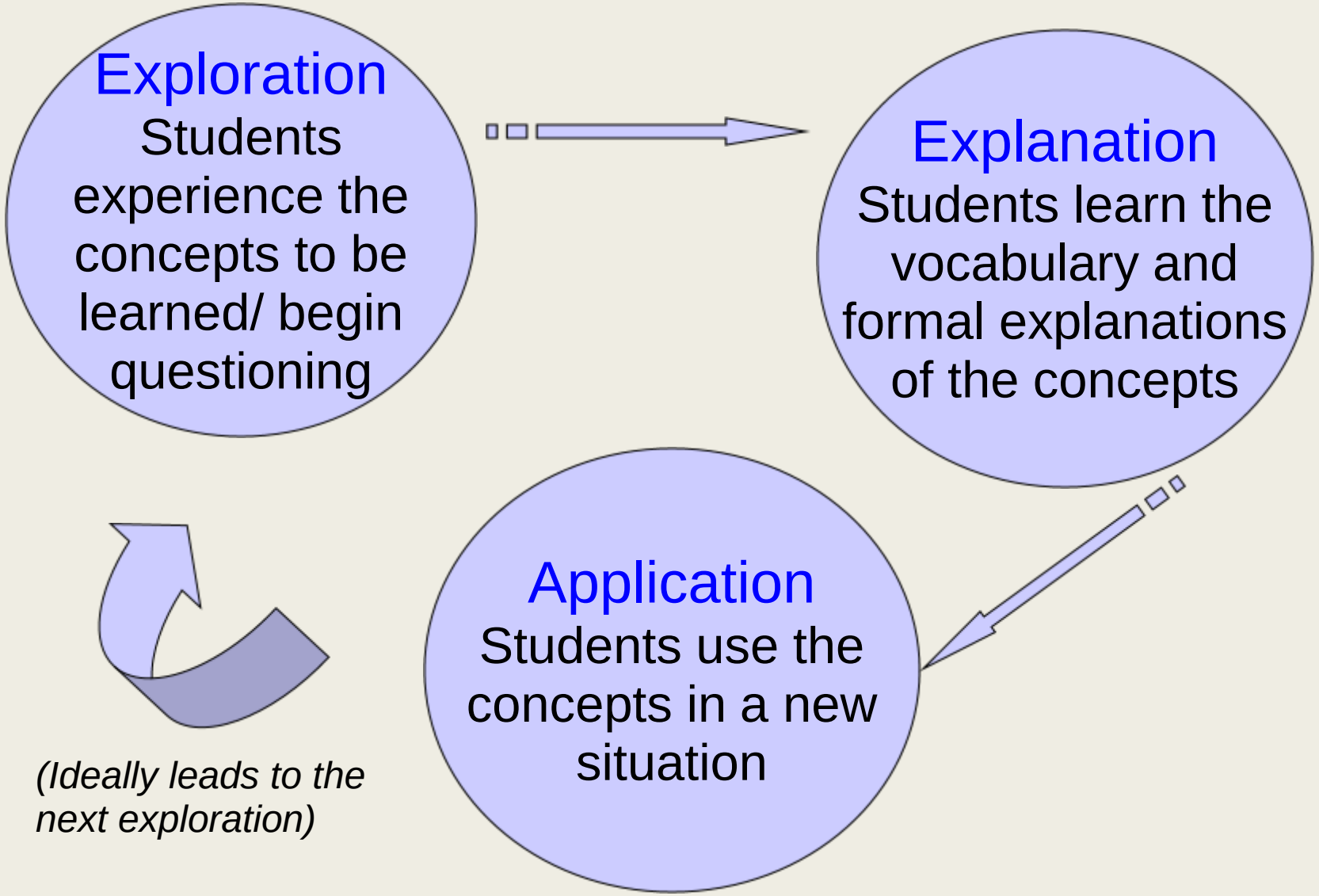
THINKING ABOUT EXPLORATIONS

Key issues in Exploration

- Should involve *experiencing* and ***thinking*** about the concept
  - Careful thought should go into the *questions* that accompany an exploration
  - There should be something to figure out or start figuring out
- In many situations, students can be led to develop the concept for themselves from the exploration
- No New Vocabulary is Introduced (or very little, just as needed)

Have you taught a lesson that ended up in roughly this format?



What was your exploration? (Even if you didn't call it that)

In general, explorations should be as *concrete* as possible

More concrete

- Interact with the actual concept
- Interact with a simulation/ model of the concept
- Interact with a video of the concept
- Interact with a diagram/ picture of the concept

Less concrete

What to be watching for in the next set of slides:

- A general picture of what an exploration looks like
- Any specific ideas for subjects you teach that you would like to remember/ follow-up on later

“Interact with the Actual Concept”: Labs

(This is where the phrase “lab before lecture” comes from)

- Investigating effects of variables
  - Variables that affect pendulum swing
  - Temperature and reaction rate

Many labs you already use can be adjusted by removing vocabulary.

- Finding out “what happens”
  - Tape lab (charges)
  - Which part of a plant absorbs water?
  - What happens if you put HCl on limestone?

Some of the “post-lab” questions may need to be moved until after the explanation phase.

Which of your explorations fits one of these categories?

“Interact with the Actual Concept”: Labs

- Experiments/ demonstrations that create a need for explanation
  - Kids love a hint of mystery!
  - Discrepant events
  - Egg osmosis lab
  - Layering salted and unsalted water (ocean density)
  - Doesn’t have to be elaborate: Can you swallow upside down?

Which of your explorations fits this category?

Labs, continued

- Developing Categories
  - Monocot vs. dicot lab
  - Mixtures vs. solutions
  - Types of rocks
- Observing and Drawing (still good to have a problem to solve)
  - Slides of a variety of cells
  - Instances of erosion in the schoolyard
- Studying Data
  - Particularly in higher-level classes where kids will be able to *completely* understand where the data came from
  - Lots of real data sets online: earthquakes, weather, citizen science results, etc.

Which of your explorations fits one of these categories?

Simulations and Manipulatives

- Simulations
  - Oh, Deer
  - Sex-linked traits

- Paper cut-outs or other models

(If you have access, there are fantastic computer simulations of so many things)

- Molecules and chemical reactions (what would have to happen for the molecules I've given you to become X and y; write the equation)
- Formation of geological layers
- Life cycles: a baggie with the steps—put them in order

Which of your explorations fits one of these categories?

Videos, Diagrams, Pictures

- Video without narration
  - To describe a process (DNA replication)

[Note that just watching a video on a topic is NOT an exploration]

- Diagrams or photographs
  - Remove captions and give students guided questions and opportunities to make predictions

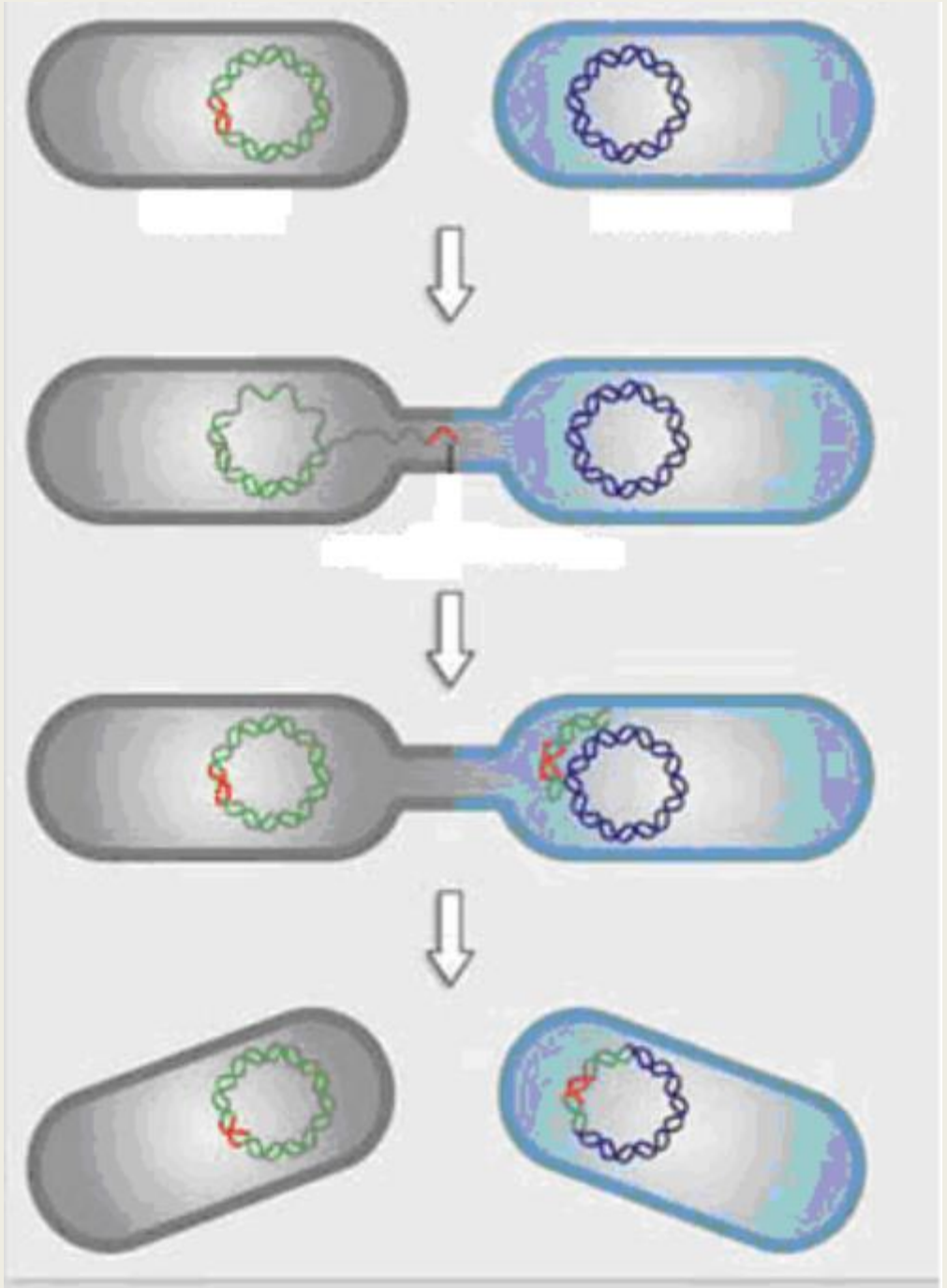
Which of your explorations fits one of these categories?

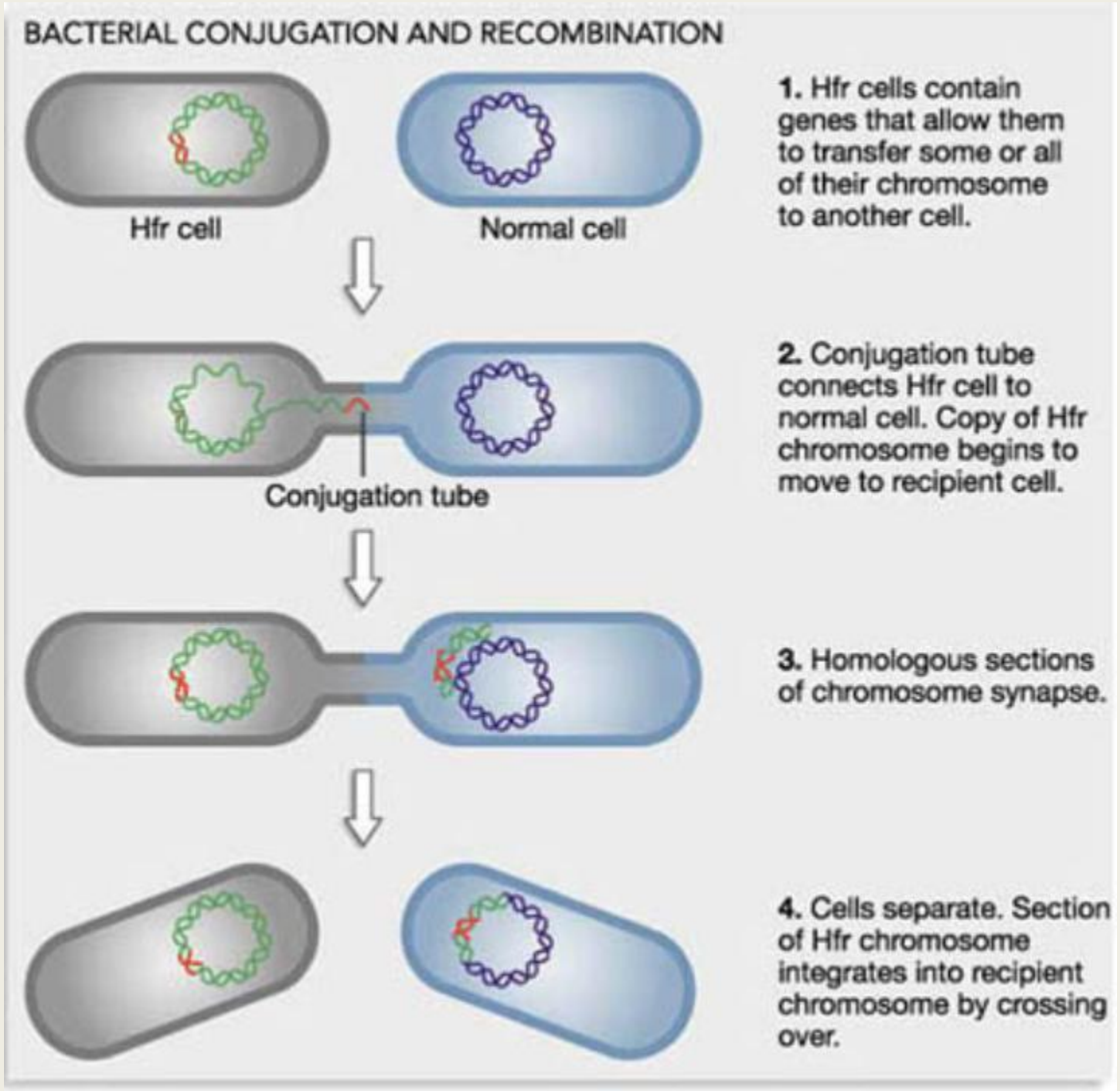
A

B

C

D




BACTERIAL CONJUGATION AND RECOMBINATION
Hfr cell
Normal cell
1. Hfr cells contain genes that allow them to transfer some or all of their chromosome to another cell.
Conjugation tube
2. Conjugation tube connects Hfr cell to normal cell. Copy of Hfr chromosome begins to move to recipient cell.
3. Homologous sections of chromosome synapse.
4. Cells separate. Section of Hfr chromosome integrates into recipient chromosome by crossing over.

So how do you get these activities?

- Look at the labs/ activities/ demonstrations you already know about. Can you rewrite the student directions so they don’t need the vocabulary?
- What would happen if you didn’t tell them what to expect?
- If it’s a concept they can’t see, can you think of a way to represent it with paper manipulatives? Or find a good diagram or video that you can use without labels? Or a computer simulation?