

High School Science Emergency Sub Binder

Emergency sub plans for high school science, any course, grades 9 to 12, all on paper. The sub needs no science background: every step is on the page.

PREVIEW

What is included

- 7 front pages: binder cover, important information, note to the sub, the filled-in lesson plan, schedule, class list, how it went
- 9 activities with sub scripts and student pages (34 pages): 3 individual, 6 with a partner, a team or the whole class
- A Say this to the class script for every activity, star challenges for fast finishers, every answer in a key
- 8 of the 9 activities list their NGSS performance expectations on the sub script (not the optional bingo game)
- Color and ink-saver B&W, US Letter and A4

How it works

1. Leave the binder out. The lesson plan lists every activity with its page and minutes.
2. The sub reads the Say this to the class box word for word.
3. Students work from their own pages, with the steps on the page. The sub needs no science background: every answer is in the key.
4. No prep, no tech: print and go.

The 9 activities, 35 to 45 minutes each

1. **Quiet Reading**, 45 min SOLO: reading science for evidence: leaf pigments and light, and the ozone layer, CFCs and the Montreal Protocol
2. **The Choice Board**, 40 min SOLO: science calculations with units, unit changes and significant figures, plus populations, the ocean, plants and solutions
3. **One Idea, Three Ways**, 40 min SOLO: energy changes in a bouncing ball and freezing point drop from dissolved salt, as a model, in words and in numbers
4. **Describe and Draw**, 40 min PAIRS: reading a contour map for slope, runoff and erosion, and reading a DNA gel for matching bands, charge and piece size
5. **Teach It Back**, 40 min PAIRS: auroras and Earth's magnetic field: charged particles, field lines, the outer core and magnetic reversals
6. **The Analogy Workshop**, 40 min TEAMS OF 4: testing models: circuits, atoms, enzymes and the greenhouse effect, where each analogy fits and breaks, then a wave
7. **Revise the Model**, 40 min TEAMS OF 4: how a plant regulates its growth toward light: building and revising a model from evidence, from Darwin to auxin
8. **The Read-Aloud Lab**, 37 min WHOLE CLASS: recording and graphing data by ear: a spring that stores elastic energy, and how much oxygen warm and cold water hold
9. **Science Review Bingo**, 35 min WHOLE CLASS: reviewing the key words of the other eight activities by ear, from leaf pigments to auxin

What this preview shows: the note to the substitute, the lesson plan, the other front pages, one page of every activity, a sub script, four more student pages and one ink-saver page. Every product page is watermarked. Answer keys are not shown. The full binder has 41 pages.

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Note to the Substitute

High school science, any course, grades 9 to 12 · 9 one-period activities · no prep, no science background needed

Thank you for covering my class

The front pages are filled in for today. After them come 9 science activities: the first 3 are individual work, the other 6 are for partners, teams or the whole class. Each one fills most or all of a 40 to 55 minute period, runs from the printout alone and carries its own answer key, so you never teach anything new. They review biology, chemistry, physics and earth and space science, and every sheet carries the science it needs, so they work in any science course. Print this binder one-sided, because the keys sit behind student pages when it is two-sided.

Science and talk: Everything here is paper and pencil: no lab supplies, no heat, no chemicals, nothing to taste or touch. Every activity works in any science course, and all the science a student needs is on the sheet. Climate science and evolution are stated plainly as science. A student with a question writes it down for me; a student who is upset goes to the school counselor or another trusted adult.

Every activity except the review game lists the NGSS high school performance expectations it practices on a small line under its focus line (for you, not the students). It practices part of a standard; it is review, not a full assessment.

The first page of every activity is your script: read the **Say this to the class** box aloud word for word. Every answer is in a key on the script page or the page after it; keep those and hand out only the student pages. Every student sheet has one **Challenge** box for early finishers.

The 9 activities

- **Quiet Reading** quiet single · 45 min · p. 7
- **The Choice Board** quiet single · 40 min · p. 13
- **One Idea, Three Ways** quiet single · 40 min · p. 16
- **Describe and Draw** pairs · 40 min · p. 19
- **Teach It Back** pairs · 40 min · p. 23
- **The Analogy Workshop** teams of 4 · 40 min · p. 27
- **Revise the Model** teams of 4 · 40 min · p. 31
- **The Read-Aloud Lab** whole class · 37 min · p. 35
- **Science Review Bingo** whole class · 35 min · p. 39

If the class is loud

- Switch to a quiet single activity: Quiet Reading; The Choice Board; or One Idea, Three Ways. Nobody needs to move.
- In Science Review Bingo, reading the five words back keeps the class honest.
- If an activity is not working, stop it and switch. Every activity can start at any point in the period.
- The bingo game is optional: a fun way to end the class or to use extra time.



Which activity when?

- A student says the class never learned this? Let them try the first problem with a partner, and leave me a note.
- The same activity in every period is fine: each class sees it once. The lesson plan (next page) lists all 9.
- A class that needs to settle: start with a quiet single activity. A restless class: a group activity uses the energy.
- Short period? One Quiet Reading article or one Choice Board (about 20 min) fits. Science Review Bingo (35 min) reviews the other activities, so use it after them.

Before you leave

Please fill in the How It Went page at the back. It takes two minutes and I read every word. Thank you!

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Lesson Plan

Filled in for today: 9 activities, 35 to 45 minutes each. Write the time of each period you use.

ACTIVITY	PLAN	PAGE
Quiet Reading Quiet single · about 45 min Time ____ : ____ to ____ : ____	• One article and its question sheet per student; fast finishers take the other • Silent reading and questions, about 20 minutes per article • Read the answers out from the key, or collect for me	p. 7
The Choice Board Quiet single · about 40 min Time ____ : ____ to ____ : ____	• Both boards to every student • On each board, any three squares in a straight line, like tic-tac-toe • More squares if there is time; the key is on the script	p. 13
One Idea, Three Ways Quiet single · about 40 min Time ____ : ____ to ____ : ____	• The ball sheet to every student; fast finishers take the salt sheet • Each puzzle three ways: draw it, explain it, number it • Collect for me, or read the numbers out from the key	p. 16
Describe and Draw Pairs · about 40 min Time ____ : ____ to ____ : ____	• Pairs: Partner A gets the contour map, Partner B the DNA gel, one questions sheet per pair • Describe in words only while the partner draws, then swap • Compare, then answer the questions together; key on the script	p. 19
Teach It Back Pairs · about 40 min Time ____ : ____ to ____ : ____	• Pairs: Partner A reads about auroras, Partner B about Earth's magnetic field • Notes, then teach each other; answer questions about the other text from notes • Link sheet together, then swap and check	p. 23
The Analogy Workshop Teams of 4 · about 40 min Time ____ : ____ to ____ : ____	• Teams of 4 with roles (Reader, Matcher, Skeptic, Reporter) • Four analogy cards: match the parts, find where it breaks, fix it • Own analogy for a wave; Reporters share at the end	p. 27
Revise the Model Teams of 4 · about 40 min Time ____ : ____ to ____ : ____	• Teams of 4 with roles; the plant puzzle and Model 1 • Read the four evidence cards aloud, one at a time, about 6 minutes apart • Teams revise the model after each card, then answer sheet 2	p. 31
The Read-Aloud Lab Whole class · about 37 min Time ____ : ____ to ____ : ____	• Both sheets to every student • Read each notebook aloud twice; students record, graph and answer alone • Read the answers from the key	p. 35
Science Review Bingo Whole class · about 35 min Time ____ : ____ to ____ : ____	• Students copy the 24 bank words onto their card in any order • Read the clues in order, twice each; five in a row wins • Optional, a fun way to end the class or for extra time	p. 39

Fast finishers

Any quiet single activity can follow any other activity: Quiet Reading (p. 7), The Choice Board (p. 13) and One Idea, Three Ways (p. 16).

Collect / leave for me

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SUBSTITUTE BINDER

Science · One Day · Grades 9 to 12

Teacher _____

Room _____

Grade and subject _____

School year _____

Everything a sub needs for today's science class is in this binder: the schedule, the class list, a filled-in lesson plan, and 9 one-period classroom activities that run from the printout alone, 3 for individual work and 6 for partners, teams or the whole class. Each one has a script, a Say This to the Class box and its own answer key, so the sub needs no science background and no technology. Paper and pencil only.

Individual work

- Quiet Reading
- The Choice Board
- One Idea, Three Ways

Partner, team and whole-class activities

- Describe and Draw
- Teach It Back
- The Analogy Workshop
- Revise the Model
- The Read-Aloud Lab
- Science Review Bingo



Important Information

The page the sub reads first. Fill it in once and keep it current. Print this binder one-sided.

People to call

Office _____

Teacher next door _____

Nurse _____

Principal / admin _____

Tech help _____

Emergency procedures

Fire: exit and meeting point _____

Lockdown _____

Severe weather _____

Medical _____

Where the first aid kit is _____

Helpful students

Students who need extra support

Where things are

Attendance / how to take it _____

Paper, pencils, supplies _____

Hall passes _____

Copier, if the sub may use it _____

Class routines

Start of class _____

Bathroom _____

Phones _____

End of class _____

Seating and groups

Seating chart is _____

Groups for group work _____

Students who should not sit together _____

Technology and passes

Classroom or other room for today _____

Laptops or tablets: allowed when _____

Computer or board login _____

Students who leave the room (time, why) _____

Anything else today

For the teacher who bought this binder: if it worked well for your class, leaving a review on TpT helps other teachers find it and gives you credits toward future purchases. Thank you!

Schedule of the Day

Write the times in. Cross out or rename any period to match the school's day, then write the activity for each class.

TIME	PERIOD	CLASS / ROOM	ACTIVITY AND PAGE
___ : ___ to ___ : ___	Homeroom / attendance		
___ : ___ to ___ : ___	Period 1		
___ : ___ to ___ : ___	Period 2		
___ : ___ to ___ : ___	*Break*		
___ : ___ to ___ : ___	Period 3		
___ : ___ to ___ : ___	Period 4		
___ : ___ to ___ : ___	*Lunch*		
___ : ___ to ___ : ___	Period 5		
___ : ___ to ___ : ___	Period 6		
___ : ___ to ___ : ___	Period 7		
___ : ___ to ___ : ___	Dismissal		
___ : ___ to ___ : ___			

The activities

ACTIVITY	WHAT IT PRACTICES	STYLE	TIME	PAGE
Quiet Reading	reading science for evidence: leaf pigments and light, and the ozone layer, CFCs and the Montreal Protocol	Quiet single	45 min	p. 7
The Choice Board	science calculations with units, unit changes and significant figures, plus populations, the ocean, plants and solutions	Quiet single	40 min	p. 13
One Idea, Three Ways	energy changes in a bouncing ball and freezing point drop from dissolved salt, as a model, in words and in numbers	Quiet single	40 min	p. 16
Describe and Draw	reading a contour map for slope, runoff and erosion, and reading a DNA gel for matching bands, charge and piece size	Pairs	40 min	p. 19
Teach It Back	auroras and Earth's magnetic field: charged particles, field lines, the outer core and magnetic reversals	Pairs	40 min	p. 23
The Analogy Workshop	testing models: circuits, atoms, enzymes and the greenhouse effect, where each analogy fits and breaks, then a wave	Teams of 4	40 min	p. 27
Revise the Model	how a plant regulates its growth toward light: building and revising a model from evidence, from Darwin to auxin	Teams of 4	40 min	p. 31
The Read-Aloud Lab	recording and graphing data by ear: a spring that stores elastic energy, and how much oxygen warm and cold water hold	Whole class	37 min	p. 35
Science Review Bingo	reviewing the key words of the other eight activities by ear, from leaf pigments to auxin	Whole class	35 min	p. 39

Class List and Dismissal

Names, what a sub must know, and how every student goes home. Check Here at the start and Gone at the end.

(B) bus (write the number) (W) walks (P) picked up (write who) (A) after-school program (O) other

#	STUDENT NAME	NOTES (ALLERGIES, NEEDS, HELPFUL, LEAVES EARLY)	HOME	BUS # / PICKED UP BY / PROGRAM	HERE	GONE
1					☐	☐
2					☐	☐
3					☐	☐
4					☐	☐
5					☐	☐
6					☐	☐
7					☐	☐
8					☐	☐
9					☐	☐
10					☐	☐
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22					☐	☐
23					☐	☐
24					☐	☐
25					☐	☐
26					☐	☐
27					☐	☐
28					☐	☐
29					☐	☐
30					☐	☐

How It Went

For you to leave for me. Two minutes: check the boxes and go.

Today

Date _____ Period(s) _____

Activities used _____

Sub name _____

The class

- ☐ Great, no problems
- ☐ Fine, a little loud
- ☐ A difficult day, see notes
- ☐ Finished the activity
- ☐ Stopped early (time)
- ☐ Used a second activity

Stars of the day

Students who helped, led a group well, or were a good sport:

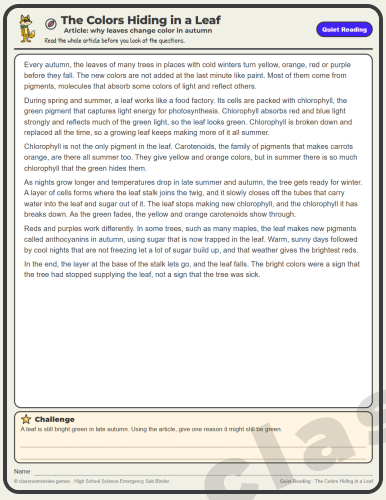
Work collected

Notes

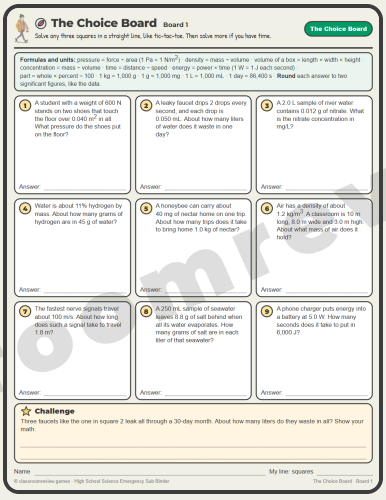
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ONE PAGE OF EVERY ACTIVITY

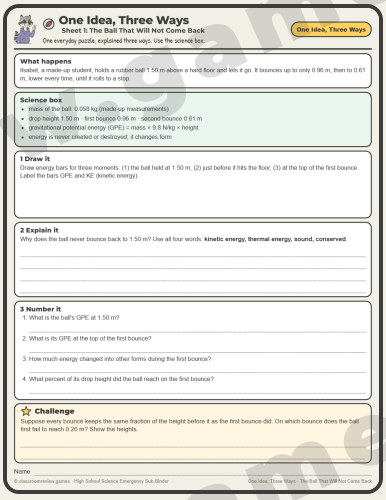
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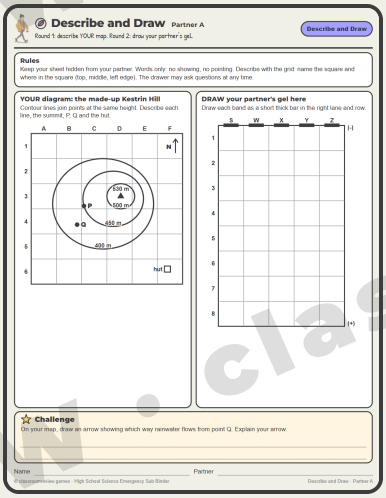
1. Quiet Reading, 45 min (solo)



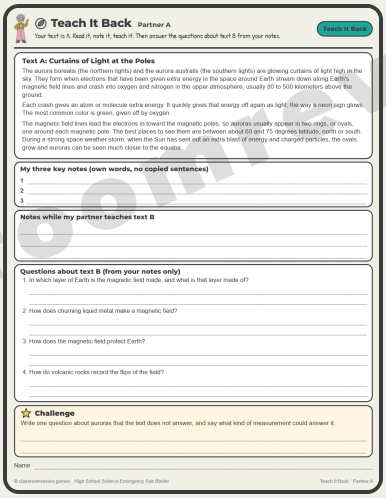
2. The Choice Board, 40 min (solo)



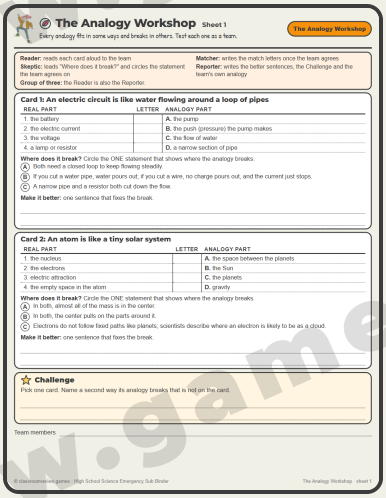
3. One Idea, Three Ways, 40 min (solo)



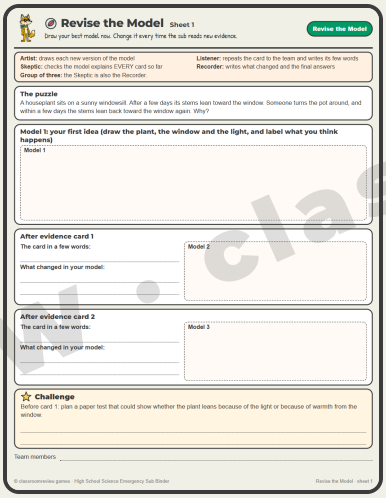
4. Describe and Draw, 40 min (pairs)



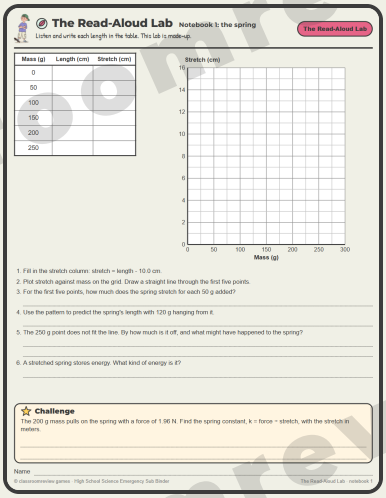
5. Teach It Back, 40 min (pairs)



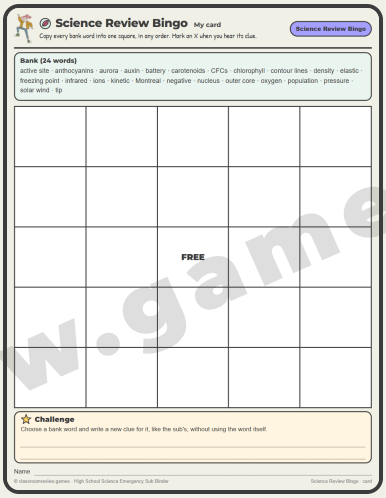
6. The Analogy Workshop, 40 min (teams of 4)



7. Revise the Model, 40 min (teams of 4)



8. The Read-Aloud Lab, 37 min (whole class)



9. Science Review Bingo, 35 min (whole class)

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Every activity also has a sub script with a Say this to the class box



Revise the Model

Sub script: the evidence to read aloud

One period · teams of 4

This activity practices: how a plant regulates its growth toward light: building and revising a model from evidence, from Darwin to auxin
NGSS: HS-LS1-2 (levels of organization)
You need: the printed sheets and pencils

SAY THIS TO THE CLASS

"Today your team builds a model to explain why a houseplant leans toward the window, and then you change it as new evidence arrives. I read four evidence cards aloud, one at a time, and after each one you revise your drawing and write what changed. A good model explains every card so far, not just the newest one."

Set up (3 minutes)

1. Teams of 4, one copy of the two sheets per team. Roles: **Artist** (draws each new version of the model), **Listener** (repeats the card to the team and writes its few words), **Skeptic** (checks the model explains EVERY card so far), **Recorder** (writes what changed and the final answers). Group of three: the Skeptic is also the Recorder.
2. Read the puzzle at the top of sheet 1 aloud. Teams draw Model 1, their first idea (5 min).

Your job

Read each evidence card below aloud, twice, slowly, at about minutes 8, 14, 20 and 26. Do not show this page: teams must not hear a card before its turn. After each card, teams have about 5 minutes to revise their model. Then sheet 2's questions (8 min).

The four evidence cards (read aloud)

Evidence card 1. Seedlings grown in a closed box with one small hole in the side bend toward the hole. Seedlings grown in complete darkness grow straight up, tall and pale.

Evidence card 2. In 1880, Charles Darwin and his son Francis put tiny caps on the tips of grass seedlings lit from one side. Seedlings with a cap that blocked light on the very tip did not bend. Seedlings with a clear cap, or with the lower stem covered instead, still bent toward the light.

Evidence card 3. Scientists measured the cells in stems that were bending toward the light. The cells on the shaded side of the stem had grown longer than the cells on the lit side.

Evidence card 4. In the 1920s, the Dutch scientist Frits Went cut the tips off seedlings and set them on small blocks of gel. Later he put one of those gel blocks, with no tip, on one side of a cut seedling shoot kept in the dark. The shoot bent away from the side with the block. A chemical had moved from the tips into the gel. It was later named auxin.

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The Choice Board Board 1

Solve any three squares in a straight line, like tic-tac-toe. Then solve more if you have time.

The Choice Board

Formulas and units: pressure = force ÷ area (1 Pa = 1 N/m^2) · density = mass ÷ volume · volume of a box = length × width × height · concentration = mass ÷ volume · time = distance ÷ speed · energy = power × time (1 W = 1 J each second) · part = whole × percent ÷ 100 · 1 kg = 1,000 g · 1 g = 1,000 mg · 1 L = 1,000 mL · 1 day = 86,400 s · **Round** each answer to two significant figures, like the data.

1 A student with a weight of 600 N stands on two shoes that touch the floor over 0.040 m^2 in all. What pressure do the shoes put on the floor?

Answer: .....

2 A leaky faucet drips 2 drops every second, and each drop is 0.050 mL. About how many liters of water does it waste in one day?

Answer: .....

3 A 2.0 L sample of river water contains 0.012 g of nitrate. What is the nitrate concentration in mg/L?

Answer: .....

4 Water is about 11% hydrogen by mass. About how many grams of hydrogen are in 45 g of water?

Answer: .....

5 A honeybee can carry about 40 mg of nectar home on one trip. About how many trips does it take to bring home 1.0 kg of nectar?

Answer: .....

6 Air has a density of about 1.2 kg/m^3. A classroom is 10 m long, 8.0 m wide and 3.0 m high. About what mass of air does it hold?

Answer: .....

7 The fastest nerve signals travel about 100 m/s. About how long does such a signal take to travel 1.8 m?

Answer: .....

8 A 250 mL sample of seawater leaves 8.8 g of salt behind when all its water evaporates. How many grams of salt are in each liter of that seawater?

Answer: .....

9 A phone charger puts energy into a battery at 5.0 W. How many seconds does it take to put in 6,000 J?

Answer: .....

Challenge

Three faucets like the one in square 2 leak all through a 30-day month. About how many liters do they waste in all? Show your math.

.....

.....

Name ..... My line: squares .....

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One Idea, Three Ways

Sheet 1: The Ball That Will Not Come Back

One everyday puzzle, explained three ways. Use the science box.

One Idea, Three Ways

What happens

Ilsabet, a made-up student, holds a rubber ball 1.50 m above a hard floor and lets it go. It bounces up to only 0.96 m, then to 0.61 m, lower every time, until it rolls to a stop.

Science box

- mass of the ball: 0.058 kg (made-up measurements)
- drop height 1.50 m · first bounce 0.96 m · second bounce 0.61 m
- gravitational potential energy (GPE) = mass × 9.8 N/kg × height
- energy is never created or destroyed; it changes form

1 Draw it

Draw energy bars for three moments: (1) the ball held at 1.50 m, (2) just before it hits the floor, (3) at the top of the first bounce. Label the bars GPE and KE (kinetic energy).

2 Explain it

Why does the ball never bounce back to 1.50 m? Use all four words: **kinetic energy, thermal energy, sound, conserved**.

3 Number it

1. What is the ball's GPE at 1.50 m?
2. What is its GPE at the top of the first bounce?
3. How much energy changed into other forms during the first bounce?
4. What percent of its drop height did the ball reach on the first bounce?

☆ Challenge

Suppose every bounce keeps the same fraction of the height before it as the first bounce did. On which bounce does the ball first fail to reach 0.20 m? Show the heights.

Name .....

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Describe and Draw Partner B

Round 1: draw your partner's map. Round 2: describe YOUR gel.

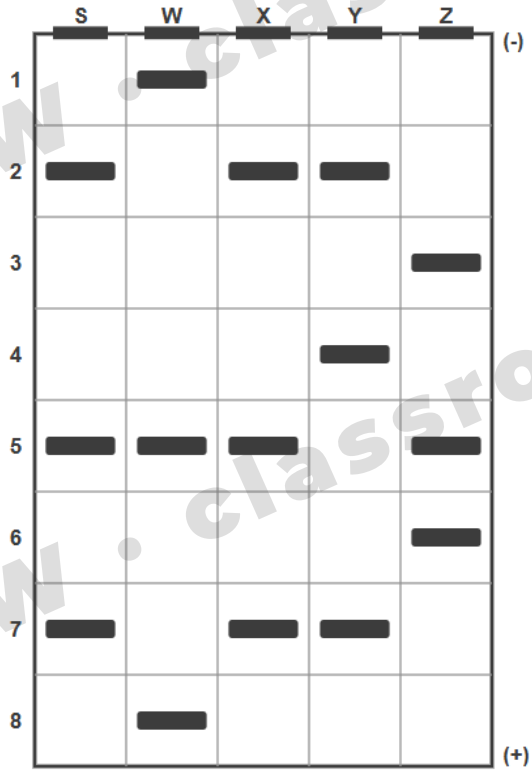
Describe and Draw

Rules

Keep your sheet hidden from your partner. Words only: no showing, no pointing. Describe with the grid: name the square and where in the square (top, middle, left edge). The drawer may ask questions at any time.

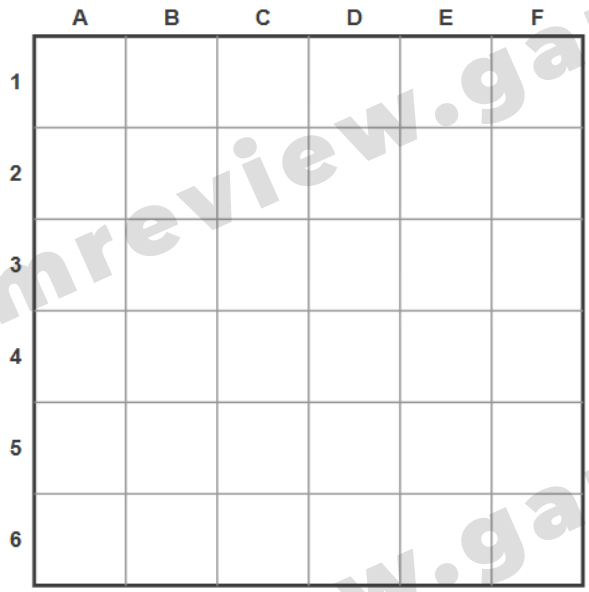
YOUR diagram: a DNA gel

Lane S is the seed sample; W, X, Y and Z are made-up bean varieties. Describe each lane's bands by row.



DRAW your partner's map here (Kestrin Hill, made-up)

Draw each contour line, label its height, and draw the summit, P, Q and the hut.



Challenge

A new seed sample has bands in rows 1, 5 and 8. Which variety is it? Which of its pieces is the longest?

Name ..... Partner .....

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The Analogy Workshop Sheet 1

Every analogy fits in some ways and breaks in others. Test each one as a team.

The Analogy Workshop

Reader: reads each card aloud to the team
Skeptic: leads "Where does it break?" and circles the statement the team agrees on
Group of three: the Reader is also the Reporter.

Matcher: writes the match letters once the team agrees
Reporter: writes the better sentences, the Challenge and the team's own analogy

Card 1: An electric circuit is like water flowing around a loop of pipes

REAL PART	LETTER	ANALOGY PART
1. the battery		**A.** the pump
2. the electric current		**B.** the push (pressure) the pump makes
3. the voltage		**C.** the flow of water
4. a lamp or resistor		**D.** a narrow section of pipe

Where does it break? Circle the ONE statement that shows where the analogy breaks.

(A) Both need a closed loop to keep flowing steadily.

(B) If you cut a water pipe, water pours out; if you cut a wire, no charge pours out, and the current just stops.

(C) A narrow pipe and a resistor both cut down the flow.

Make it better: one sentence that fixes the break.

Card 2: An atom is like a tiny solar system

REAL PART	LETTER	ANALOGY PART
1. the nucleus		**A.** the space between the planets
2. the electrons		**B.** the Sun
3. electric attraction		**C.** the planets
4. the empty space in the atom		**D.** gravity

Where does it break? Circle the ONE statement that shows where the analogy breaks.

(A) In both, almost all of the mass is in the center.

(B) In both, the center pulls on the parts around it.

(C) Electrons do not follow fixed paths like planets; scientists describe where an electron is likely to be as a cloud.

Make it better: one sentence that fixes the break.

☆ Challenge

Pick one card. Name a second way its analogy breaks that is not on the card.

Team members

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The Colors Hiding in a Leaf

Article: why leaves change color in autumn

Read the whole article before you look at the questions.

Quiet Reading

Every autumn, the leaves of many trees in places with cold winters turn yellow, orange, red or purple before they fall. The new colors are not added at the last minute like paint. Most of them come from pigments, molecules that absorb some colors of light and reflect others.

During spring and summer, a leaf works like a food factory. Its cells are packed with chlorophyll, the green pigment that captures light energy for photosynthesis. Chlorophyll absorbs red and blue light strongly and reflects much of the green light, so the leaf looks green. Chlorophyll is broken down and replaced all the time, so a growing leaf keeps making more of it all summer.

Chlorophyll is not the only pigment in the leaf. Carotenoids, the family of pigments that makes carrots orange, are there all summer too. They give yellow and orange colors, but in summer there is so much chlorophyll that the green hides them.

As nights grow longer and temperatures drop in late summer and autumn, the tree gets ready for winter. A layer of cells forms where the leaf stalk joins the twig, and it slowly closes off the tubes that carry water into the leaf and sugar out of it. The leaf stops making new chlorophyll, and the chlorophyll it has breaks down. As the green fades, the yellow and orange carotenoids show through.

Reds and purples work differently. In some trees, such as many maples, the leaf makes new pigments called anthocyanins in autumn, using sugar that is now trapped in the leaf. Warm, sunny days followed by cool nights that are not freezing let a lot of sugar build up, and that weather gives the brightest reds.

In the end, the layer at the base of the stalk lets go, and the leaf falls. The bright colors were a sign that the tree had stopped supplying the leaf, not a sign that the tree was sick.

☆ Challenge

A leaf is still bright green in late autumn. Using the article, give one reason it might still be green.

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Name .....

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In the full binder

A whole science sub day, planned and ready to print.

41 pages in color and ink-saver B&W, US Letter and A4

9 activities of 35 to 45 minutes, one per class period

7 front pages: note to the sub, lesson plan, schedule, class list

3 + 6 individual activities + partner, team and whole-class activities

Use it your way

- A sudden sick day: emergency sub plans that are ready before you need them.
- Any high school science course, grades 9 to 12: every activity fits a 40 to 55 minute period. All paper and pencil, no tech.
- Your sub tub: print it once and keep it all year.
- Your own no prep day: teach it yourself when you need a break from planning.

Thank you! If this works for your class, a quick review helps other teachers find it, and gives you TpT credits.



Classroom REVIEW GAMES