

High School Science Long-Term Sub Plans, 4 Weeks

Four complete week binders of high school science, grades 9 to 12. One topic a day on paper, solo work and a team task, a "say this" script for every task.

PREVIEW

What is included

- Four week binders (71, 71, 73, 68 pages): 283 pages
- 52 front pages: binder cover, important information, note to the sub, the week plan filled in, schedule, set index, class list, how it went, Monday opener
- 40 solo blocks (20 science sets, 20 calm blocks) and 20 team tasks for groups of four
- A "say this to the class" script for all 84 tasks: 2 or 3 sentences the sub reads out
- A core task and a ★ challenge in every science set and team task
- Every science set lists the NGSS performance expectations it practices
- 20 optional games, each on that day's lessons
- Answer keys for everything; color and ink-saver B&W, US Letter and A4

How it works

1. Leave the four binders out. Each has its own filled-in plan with page numbers.
2. The sub reads the "say this" box out, then runs the day's science set in every period. Everyone does the core task, early finishers go on to the ★ challenge.
3. The calm block fits any gap, the team task fills a block period or extra time, the game the last 15 minutes.
4. No prep and no tech: paper and pencil, print and go.

The 20 days: a science set, a team task and a game

- **Week 1, days 1 to 5. Science:** Scientific Method and Data; Cells and Genetics; Chemical Reactions; Forces, Energy and Work; Ecology and Climate Data. **Team:** The Paper Pack Audit, The Unlabeled Culture, The Mass Balance Relay, The Elevator Bid Review, Beavers for Willow Creek.
- **Week 2, days 6 to 10. Science:** Measurement, Units and Precision; Cell Transport and Homeostasis; Decay and Half-Life; Gravity and Orbits; Plate Tectonics and Earth's Interior. **Team:** The Estimate Build, Membrane Border Control, The Darrow Bend Dig, The Orbit Planner, The GPS Plate Map.
- **Week 3, days 11 to 15. Science:** Evaluating Scientific Claims; Cell Division and Specialization; Reaction Rates and Collision Theory; Electromagnetism: Motors and Generators; Water, Weathering and Earth's Feedbacks. **Team:** The Evidence Ladder, The Root Tip Census, Collision Snapshots, The Hut Generator, The Feedback Loop Builder.
- **Week 4, days 16 to 20. Science:** Engineering Design and Tradeoffs; Meiosis and Genetic Variation; Energy in Chemical Reactions; Electromagnetic Waves and Communication; Natural Hazards and Risk. **Team:** The Bridge Is Closed, The Meiosis Storyboard, The Unlabeled Energy Diagrams, The Parity Bit Relay, The Shelter Site Search.

Optional game every day, on that day's lessons: Mon **Whiteboard Quiz Game** Tue **Paper Password** Wed **Class Feud** Thu **Classroom Millionaire** Fri **Mystery Box**

What this preview shows: the note to the substitute, the Week 1 plan, more front pages, one page of every daily part, a full science set with its key, a calm block, a team task, the game types and one ink-saver page. Every product page is watermarked. The full product has 283 pages.
What the sub gets: a note that explains the routine, a "say this" script for every task (84 in all), a sub script for every Monday opener, a "Read this out" box on most games, and every answer in the key.



Note to the Substitute

Grades 9 to 12 · five days · every set runs from the printout alone

Thank you for covering my classes this week

Everything you need is in this binder. The weekly plan is filled in for you. I fill in the important information page and the class list before you arrive; if anything there is still blank, please fill in what you can. After the binder pages come the five days in order, Monday to Friday. Monday starts with a short opener (about 15 minutes), then each day has its work sets: **Science 1** is Monday's set, **Science 2** is Tuesday's, and so on to **Science 5** on Friday. Run the day's set in every period you teach that day. Each set is one period (45 to 55 minutes), stands alone, and has its own answer key at the back of the binder, so you never have to make anything up or know the subject. Every task starts with a short **Say this to the class** box under its title: read it out, and the class knows what to do and how to start.

Every science and team page has a core task first, then a ☆ challenge. Every student does the core task. Students who finish early go on to the ☆ challenge; it fills a few extra minutes, and nobody has to finish it.

Each day's work set is followed by that day's calm block, team task and game. The **calm block** is always allowed: for time left at the end, a loud class, or anyone who finishes early. The **team task** fills a period on its own. The **game** is optional: a fun way to end the class, or something for extra time. Fifteen minutes, from the script; items marked (calm) or (team) can be skipped if the class did not do that part.

Every science set lists the standards it practices on a small line under its title (for you, not the students): the high school performance expectations of the Next Generation Science Standards (NGSS). A sub plan set practices part of a standard; it is review and practice, not a full assessment of it. Every set is a self-contained reading with its own data, so it works in any science class: biology, chemistry, physics, earth and space, or environmental science.

Each day has

- One Science set (one period, core task + ☆ challenge on every page)
- A calm and quiet block: learn 8 terms from the day's topic, then a quiet self-test
- A team task for groups of four
- A paper game from the script

If the class is loud

- Set a voice level with a number, 0 to 3, and use it all week (the Day 1 opener explains it).
- Switch to the calm block. Nobody needs to move.
- If a set is not working, stop it and use the calm block or the team task. Every set starts cold.

At the end of each day

Please fill in that day's line on the "How it went" page. It takes two minutes and I read every word.

For the teacher who bought this kit: if it worked well for your class, leaving a review where you bought it, on TpT or classroomreview.games, helps other teachers find it. Thank you!

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This Week's Plan

Filled in for you: run the day's set in every period you teach. Keep it as it is, or use the blank schedule on the next page for your own order.

WHEN	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Start of class	**Meet Your Sub** p. 11 · 15 min, every period	Attendance, voice level	Attendance, voice level	Attendance, voice level	Attendance, voice level
Main work, every period	**Science 1** Scientific Method and Data p. 14	**Science 2** Cells and Genetics p. 23	**Science 3** Chemical Reactions p. 32	**Science 4** Forces, Energy and Work p. 41	**Science 5** Ecology and Climate Data p. 52
Early finishers or a loud moment	**Learn and Test: Measurement Terms** p. 17	**Learn and Test: Cell and Heredity Terms** p. 26	**Learn and Test: Reaction Terms** p. 35	**Learn and Test: Force and Machine Terms** p. 45	**Learn and Test: Climate and Life Terms** p. 56
Block period or extra time	**The Paper Pack Audit** p. 19	**The Unlabeled Culture** p. 28	**The Mass Balance Relay** p. 37	**The Elevator Bid Review** p. 47	**Beavers for Willow Creek** p. 58
Last 15 minutes (optional): a fun way to end the class, or for extra time	**Whiteboard Quiz Game** p. 21	**Paper Password** p. 30	**Class Feud** p. 39	**Classroom Millionaire** p. 50	**Mystery Box** p. 60

How to use this plan

- Page numbers point to the first page of each set. Copy work sets and calm blocks one per student. Team tasks: copy them as the copy line on each task's first page says (per group or per student), plus any cards or sheets it asks for. Copy any page that gets torn apart (role cards, game cards) one-sided, on its own sheet, so the page on its back stays whole. Game scripts are for you only (do not copy them). Game boards: copy the board page one-sided and tape up the copy, never the binder page (the page on its back is still needed).
- The calm block is always allowed: time left at the end, a loud class, or anyone who finishes early.
- On Monday the opener takes the first 15 minutes, so stop the set where the bell falls; finish page 3 as early-finisher work on Tuesday or leave it for another day.
- The game is optional: a fun way to end the class, or something for extra time.

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HS SCIENCE SUB PLANS WEEK 1

High School Science, Any Course, 5 Days of Print and Go Work

Teacher _____

Room _____

Grade and classes _____

Week of _____

Everything a sub needs for five days is in this binder: a filled-in weekly plan, a blank schedule, the class list, and for every day one Science set, a calm block, a team task and a paper game. Each set is one period, stands alone, and has its own answer key. Nothing needs subject knowledge, a login or a projector.



Important Information

The page the sub reads first. Fill it in once and keep it current.

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 _____

Weekly Schedule (Blank)

Your own order: write the set for each period (Monday: Science 1, Tuesday: Science 2, and so on) and the class next to each period. Cross out or rename periods to match the school day.

PERIOD / CLASS	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Period 1 ____ · ____ Class: _____					
Period 2 ____ · ____ Class: _____					
Period 3 ____ · ____ Class: _____					
Period 4 ____ · ____ Class: _____					
Period 5 ____ · ____ Class: _____					
Period 6 ____ · ____ Class: _____					
Period 7 ____ · ____ Class: _____					

How to fill it in

- One set per period. Each set runs 45 to 55 minutes; if a period runs longer, the ☆ challenges fill a few minutes, or add that day's team task.
- Same subject all day? Write the day's set in every period you teach. Planning, lunch and duty periods: cross them out.
- On Monday the opener (15 minutes) comes first in every period, then the set.
- The game is optional: put it in the last 15 minutes of any period as a fun way to end the class, or use it for extra time. The calm block goes in any gap.

Set naming

Sets are named by subject and day: **Science 1** is Monday's set, **Science 2** is Tuesday's, and so on to **Science 5** on Friday. The set index lists every set with its minutes and page.

Set Index (1 of 3)

Every set in the binder with its length and page. Day = the weekday it is written for. Any science set works on any day; each game reviews its own day's set.

DAY	SET	WHAT IT IS	MINUTES	PAGE
SCIENCE, DAYS 1 TO 5				
1	**Science 1: Scientific Method and Data**	**Reviews:** hypotheses, independent, dependent and controlled variables, mean and range of trials, and the shape of a graph. Variables and controls, a 5 by 3 trial data set to average, a graph to finish, computed questions, a star challenge on every page. Key included.	50	p. 14
2	**Science 2: Cells and Genetics**	**Reviews:** genes and alleles, genotype and phenotype, Punnett squares with ratios and percents, incomplete dominance, codominance and blood type. Alleles and inheritance, eight key terms, four Punnett squares with ratios, five questions, a star challenge on every page. Key included.	50	p. 23
3	**Science 3: Chemical Reactions**	**Reviews:** conservation of mass, balancing equations with coefficients, and sorting reactions into five types. Conservation of mass and the five reaction types, eight equations to balance and classify, two atom tally proofs, harder equations. Key included.	50	p. 32
4	**Science 4: Forces, Energy and Work**	**Reviews:** force, work, power and energy calculations with units, and how speed changes kinetic energy. Seven formulas, four worked examples, sixteen practice calculations, six word problems, a braking distance challenge. Key included.	50	p. 41
5	**Science 5: Ecology and Climate Data**	**Reviews:** the carbon cycle, the carbon dioxide record and its rate, carrying capacity, limiting factors and predator and prey cycles. The carbon cycle and carrying capacity: a sixty year carbon dioxide record to graph, a made-up island survey, computed questions. Key included.	50	p. 52
MONDAY OPENER				
1	**Meet Your Sub**	Fifteen minutes at the start of every period on Monday: sub sheet, three questions, the agreement and voice levels. Spare: a keyed Testable or Not?	15	p. 11

Class List and Dismissal

Names, what a sub must know, and how every student goes home. Copy one per class.

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

☆ in the notes: a student who finds the core task easy may start with the challenge

#	STUDENT NAME	NOTES (allergies, needs, helpful, leaves early)	HOME	BUS # / PICKED UP BY / PROGRAM
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
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16				
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25				
26				
27				
28				
29				
30				

How It Went

For the substitute. One line per day, two minutes at the end of each day. Check the boxes and go.

Monday

Sets done: _____ Class was: ☐ Great ☐ Fine ☐ Hard, see notes

Notes / stars of the day: _____

Tuesday

Sets done: _____ Class was: ☐ Great ☐ Fine ☐ Hard, see notes

Notes / stars of the day: _____

Wednesday

Sets done: _____ Class was: ☐ Great ☐ Fine ☐ Hard, see notes

Notes / stars of the day: _____

Thursday

Sets done: _____ Class was: ☐ Great ☐ Fine ☐ Hard, see notes

Notes / stars of the day: _____

Friday

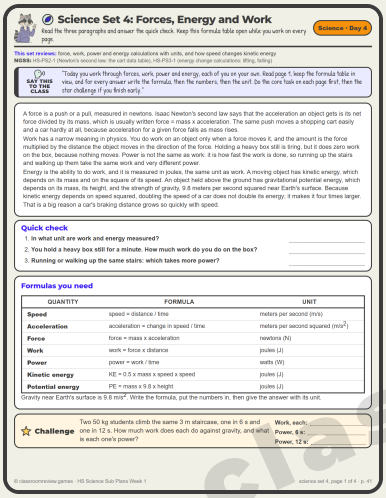
Sets done: _____ Class was: ☐ Great ☐ Fine ☐ Hard, see notes

Notes / stars of the day: _____

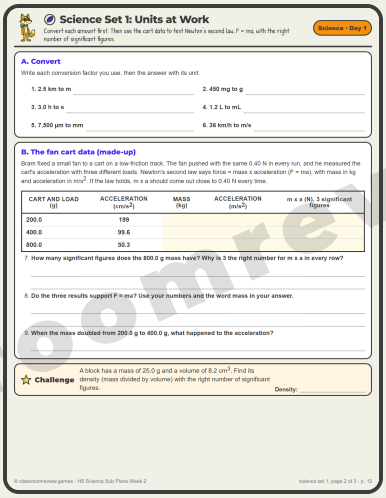
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ONE PAGE OF EVERY DAILY PART

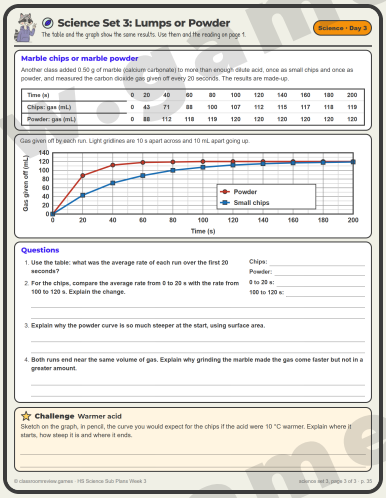
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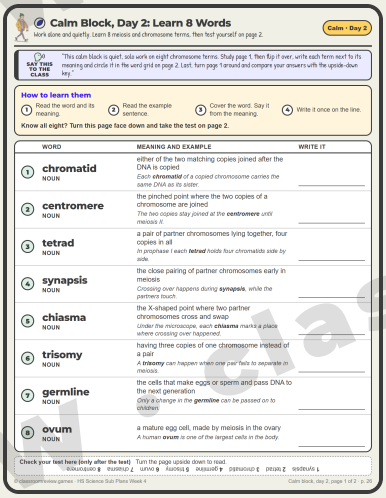
Science set: the lesson, Week 1 (solo)



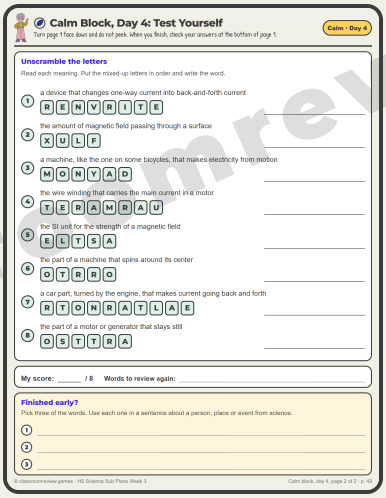
Science set: practice, Week 2 (solo)



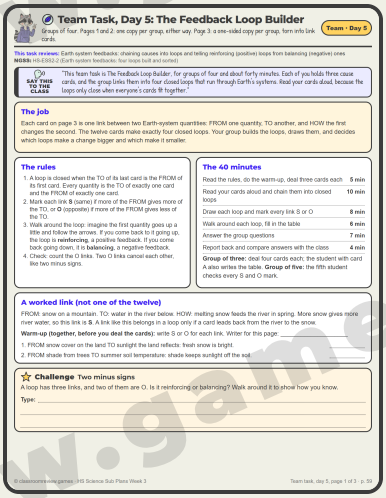
Science set: the third page (solo)



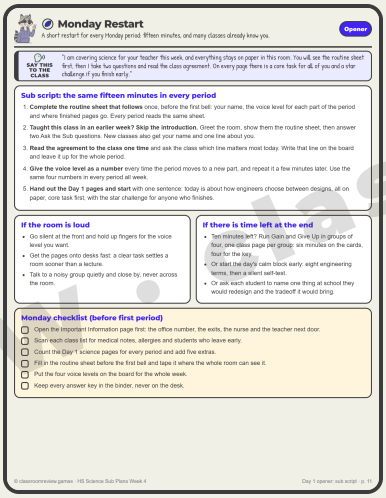
Calm block: learn 8 words (solo)



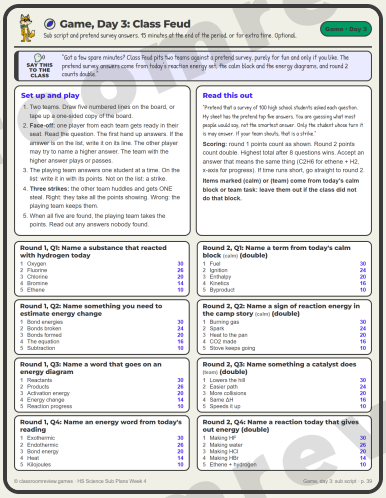
Calm block: test yourself (solo)



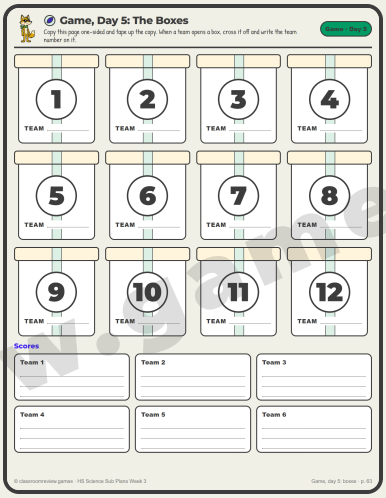
Team task (groups of four)



Monday opener (whole class)



Game: Class Feud (whole class)



Game: Mystery Box (whole class)

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Every day: a science set, a calm block, a team task and an optional game



Science Set 1: Engineering Design and Tradeoffs

Science · Day 1

Read the four paragraphs, then total the running costs under them. Pencil and paper only.

This set reviews: measurable criteria and constraints, ruling out options that break a constraint, life-cycle cost and judging a tradeoff
NGSS: HS-ETS1-1 (criteria and constraints: a village water supply), HS-ETS1-3 (evaluating design tradeoffs)

SAY THIS TO THE CLASS "Today you choose a water supply for a made-up mountain village, the way an engineer would. Read the four paragraphs on page 1 first, because pages 2 and 3 use them. Do the core task on each page first, then the star challenge when you finish."

Engineers begin by pinning down the problem. They list criteria, the measurable features that would make a solution good enough, and constraints, the hard limits set by money, time, materials, the law and safety. Engineers write both as numbers whenever possible, so that two people judging the same design reach the same verdict. "Easy to fetch" is a wish; "a tap within 100 m of every home" is a criterion anyone can check.

Some problems are huge. About 2.1 billion people, roughly 1 in 4 people on Earth, did not have safely managed drinking water at home in 2024. United Nations guidance puts the water a person needs for most basic needs at between 50 and 100 liters a day. No single invention fixes a problem that size, so engineers break it into smaller problems they can solve one at a time: finding a source, cleaning the water, moving it to homes, paying for it and keeping it running.

The price tag is only the start. A design is paid for once when it is built, but pumps, filters and pipes also cost money every year for power, parts and repairs. Adding the building cost to all the running costs over the design's whole working life gives its life-cycle cost. A design that is cheap to build but expensive to run can end up costing more than one that costs more to build.

Most decisions trade one good thing against another. Accepting less of one feature in return for more of another is called a tradeoff. A careful team also checks how sensitive its choice is: it changes one number, such as a running cost or the length of the design's life, and watches whether the best choice changes. If a small change flips the answer, the choice depends on that number, and the people who will live with the design should help decide it.

Count the running costs (made-up figures)

Maelis listed what two of the village's options cost to run each year. Total each list.

OPTION B: SOLAR-PUMPED WELL	$ A YEAR
Electricity for the pump (the solar panels make it)	$0
Filter parts	$400
Pump repairs	$500
Cleaning the tank	$400
Total a year	

OPTION D: WIND-PUMPED WELL	$ A YEAR
Electricity for the pump (the wind turns it)	$0
Filter parts	$400
Windmill and pump repairs	$1,700
Greasing and painting the tower	$700
Total a year	

1. **Which single cost makes Option D more expensive to run than Option B, and by how much?**

.....

☆ Challenge A summer camp of 240 people plans for the low end of the United Nations range. How many liters a day is that? How many at the high end?

Low end: .....

High end: .....

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Science Set 1: Choosing a Water Supply

Rule out the options that break a constraint, then work out the life-cycle cost of the ones left.

Science · Day 1

The village of Wrenfield Ridge (made-up)

Wrenfield Ridge is a made-up mountain village of 400 people. Its old water line has failed, and the village council has asked an engineer, Maelis, to choose a new supply. The council set three constraints: the build cost may not be more than $60,000, and the supply must give every resident at least 50 liters a day, the low end of the United Nations range, in the normal season and in the dry season. Every system is planned to last 20 years. All numbers in the table are made-up.

OPTION	BUILD COST	RUNNING COST A YEAR	LITERS A DAY, NORMAL SEASON	LITERS A DAY, DRY SEASON
A. Rain tanks on every roof	$38,000	$500	14,000	8,000
B. Solar-pumped well	$54,000	$1,300	26,000	26,000
C. Pipeline from the river with a filter plant	$72,000	$3,000	40,000	38,000
D. Wind-pumped well	$48,000	$2,800	22,000	21,000
E. Spring line flowing downhill to a tank	$40,000	$800	21,000	16,000

1. **How many liters a day must the supply give the whole village? Show the calculation.**

2. **Which three options break a constraint? For each, name the constraint it breaks.**

Life-cycle cost over 20 years

Life-cycle cost = build cost + 20 x running cost a year. Cost per person per year = life-cycle cost / (20 years x 400 people).

OPTION	20 YEARS OF RUNNING	LIFE-CYCLE COST	COST PER PERSON PER YEAR
B. Solar-pumped well			
D. Wind-pumped well			

Challenge Option E was ruled out, but what would its life-cycle cost and its cost per person per year have been?

Life-cycle: .....

Per person per year: .....

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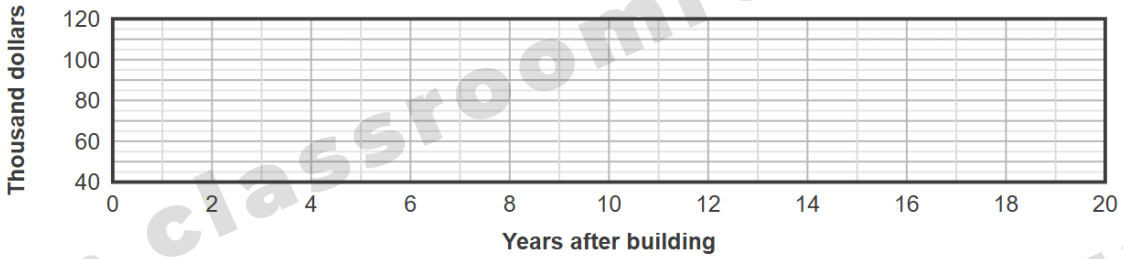


Science Set 1: When Do the Costs Cross?

Draw a straight line for each option, then answer. Use full sentences where a question asks why.

Science · Day 1

Total spent, year by year. Each line starts at the build cost in year 0 and rises by the running cost every year. The axis starts at $40,000. Mark year 0 and year 20 for B and D, join each pair with a ruler line and label it.



3. **In which year do the two lines cross? Check it with the numbers: how much more does B cost to build, and how much does it save each year?**

4. **Over the full 20 years, which option costs less in total, and by how much?**

5. **Name the tradeoff the village makes if it picks Option D: what does it gain, and what does it give up?**

Evidence from the reading

6. **Which sentence from the reading best explains why the cheapest design to build may not be the best buy?**
   - (A) "A design that is cheap to build but expensive to run can end up costing more than one that costs more to build"
   - (B) "Some problems are huge"
   - (C) "Engineers begin by pinning down the problem"
   - (D) "Most decisions trade one good thing against another"

7. **Which sentence from the reading best supports the claim that the villagers should help choose between two close options?**
   - (A) "No single invention fixes a problem that size"
   - (B) "Engineers write both as numbers whenever possible"
   - (C) "Accepting less of one feature in return for more of another is called a tradeoff"
   - (D) "If a small change flips the answer, the choice depends on that number, and the people who will live with the design should help decide it"

★ Challenge Rescue the spring line

Lazlo, a council member, suggests the spring line plus half of the rain tanks ($19,000 more to build, $250 more a year to run, 4,000 more liters a day in the dry season). Does that plan meet all three constraints? What is its 20-year life-cycle cost, and how does it compare with Option B?

Constraints:

Life-cycle:

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Answer Keys (1 of 10)

Day 1. Teacher copy. Keep these pages out of the student sets.

Day 1 opener: Gain and Give Up, example answers

1. gains less weight, easier to pedal uphill and to carry; gives up strength: the frame bends or dents more easily. **2.** gains more hours between charges; gives up a heavier, thicker phone that may cost more. **3.** gains more warmth on cold days; gives up a bulkier coat that is harder to move in and to pack. **4.** gains dry books and papers in the rain; gives up less air flow, so damp gym clothes stay damp, and a higher price. **5.** gains more students on each trip; gives up a longer bus that is harder to turn on narrow streets. **6.** gains more light to read by; gives up more energy used and more glare. **7.** gains a code that is harder to guess; gives up a code that is harder to remember and slower to type. **8.** gains more cushioning on hard ground; gives up a heavier shoe that feels less steady on sharp turns.

One point for each card with a sensible gain and a sensible give-up (accept any pair a reasonable designer would name, cost included). Score: 8 points at most.

Science Set 1: Engineering Design and Tradeoffs

Running costs: Option B 0 + 400 + 500 + 400 = **$1,300**; Option D 0 + 400 + 1,700 + 700 = **$2,800** (these are the running costs in the table on page 2). The repairs: $1,700 against $500, $1,200 more a year (accept greasing and painting, $300 more, with that reasoning). **Page 1 star challenge:** 240 x 50 = 12,000 liters a day; 240 x 100 = 24,000 liters a day.

Page 2: 1. 400 x 50 = 20,000 liters a day. 2. Option A (only 14,000 liters a day in the normal season; only 8,000 liters a day in the dry season, under 20,000); Option C (build cost $72,000, over $60,000); Option E (only 16,000 liters a day in the dry season, under 20,000). **Life-cycle:** Option B: 20 x $1,300 = $26,000; $54,000 + $26,000 = **$80,000**; $80,000 / 8,000 = **$10**. Option D: 20 x $2,800 = $56,000; $48,000 + $56,000 = **$104,000**; $104,000 / 8,000 = **$13**. **Page 2 star challenge:** $40,000 + 20 x $800 = **$56,000**; $7 per person per year.

Graph: B from $54,000 to $80,000, D from $48,000 to $104,000. 3. **Year 4**: B costs $6,000 more to build and saves $1,500 a year, and $6,000 / $1,500 = 4 years (accept 3 to 5 read off the graph, checked by the numbers). 4. Option B, by $104,000 minus $80,000 = **$24,000**. 5. D gains a lower build cost ($6,000 less now) and gives up a lower total cost and a little water; accept any pair read off the table. 6. A. 7. D.

Page 3 star challenge: build $40,000 + $19,000 = $59,000, under $60,000; dry season 16,000 + 4,000 = 20,000 liters a day, exactly the 20,000 needed; normal season 28,000, so **yes, all three** (the dry season only just). Life-cycle: $59,000 + 20 x ($800 + $250) = **$80,000**, the same as Option B, so the village would weigh B's extra water against the spring's lower risk of a pump breaking down.

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Calm Block, Day 1: Learn 8 Words

Work alone and quietly. Learn 8 study checking terms, then test yourself on page 2.

Calm · Day 1

SAY THIS TO THE CLASS

"Calm block time: alone and silent, you add eight words for checking how a study was done. Read each word and its example on page 1, then lay page 1 face down and pair words with meanings on page 2. Keep the upside-down key strip on page 1 for the very end."

How to learn them

1. Read the word and its meaning.
2. Read the example sentence.
3. Cover the word. Say it from the meaning.
4. Write it once on the line.

Know all eight? Turn this page face down and take the test on page 2.

	WORD	MEANING AND EXAMPLE	WRITE IT
1	**confounder** NOUN	a hidden factor that changes along with the thing tested and muddies the result *Sunny weather was a **confounder**: it rose with ice cream sales and with swimming.*	
2	**blinding** NOUN	keeping people from knowing who got the treatment, so it cannot sway them *With **blinding**, the tasters did not know which bread had the new flour.*	
3	**randomize** VERB	to put subjects into groups by chance, such as a coin toss *The team **randomized** the seeds into two trays by drawing numbers.*	
4	**debunk** VERB	to show with evidence that a popular claim is false *The class **debunked** the claim that cold weather alone gives you a cold.*	
5	**preprint** NOUN	a scientific paper posted for others to read before peer review *The team posted a **preprint**, then waited for reviewers to check it.*	
6	**funder** NOUN	the person or group that pays for a study *The report listed its **funder**, so readers could judge any conflict.*	
7	**verifiable** ADJECTIVE	able to be checked by someone else with their own tests or records *A **verifiable** result comes with enough detail for others to repeat it.*	
8	**overstate** VERB	to describe a result as bigger or surer than the evidence shows *The headline **overstated** a small study as a cure.*	

Check your test here (only after the test) Turn the page upside down to read.

1 debunk 2 confounder 3 blinding 4 randomize 5 funder 6 preprint 7 overstate 8 verifiable

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Team Task, Day 2: The Root Tip Census

Groups of four. Voice level 1 while counting, 2 while pooling. Every student gets a copy of this page; each group gets one page 2.

Team · Day 2

This task reviews: telling interphase and the four stages of mitosis apart, and using counts to estimate how long each stage lasts

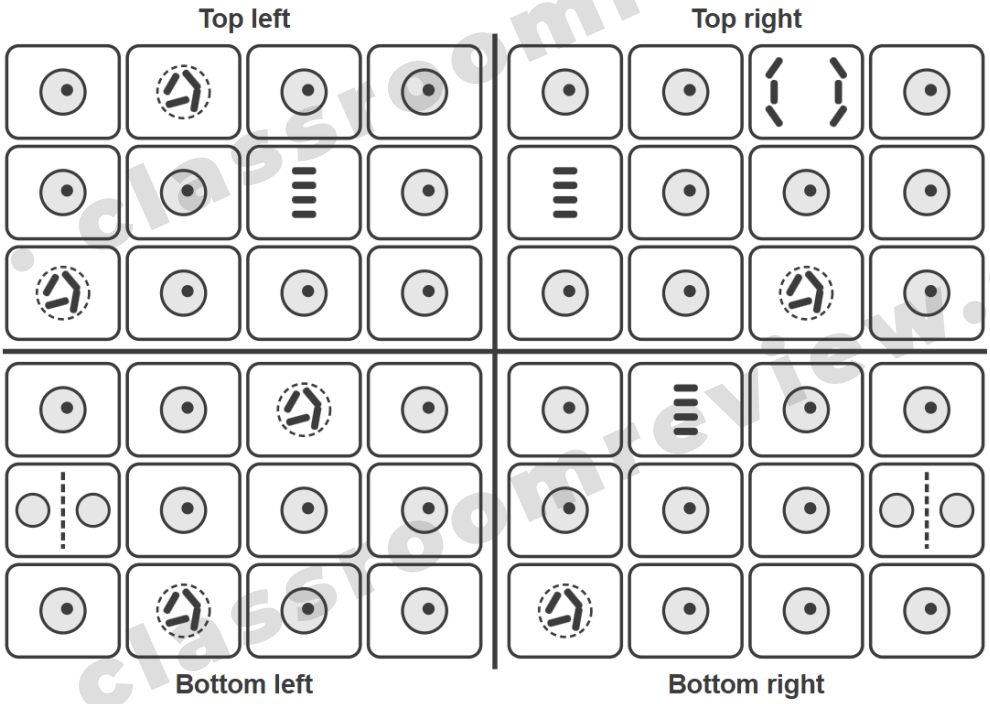
SAY THIS TO THE CLASS

"Today's team task is The Root Tip Census, for groups of four and about forty minutes. Each of you counts the cells in one quarter of the drawing by their stage, then the group pools the counts. The more cells a stage holds, the longer that stage lasts, and that is how you will time it."

The job

The tip of a growing root is full of dividing cells. Below is a drawing of 48 root tip cells as they might look under a microscope at one moment. Each cell is caught in one stage. Count the cells in **your** quarter by stage, using the key. **Group of three:** the Recorder also counts the bottom right quarter.

- **Interphase** one round nucleus with a dark dot; no chromosomes visible
- **Prophase** thick, coiled chromosomes inside the nucleus area
- **Metaphase** chromosomes lined up across the middle
- **Anaphase** two groups of chromosomes pulled toward the two ends
- **Telophase** two new nuclei at the ends, a new wall forming between them



MY QUARTER	INTERPHASE	PROPHASE	METAPHASE	ANAPHASE	TELOPHASE	TOTAL

Challenge What percent of the cells in the top left quarter are in interphase? **Percent:** .....

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Game, Day 1: The Board

Copy this page one-sided and tape the copy to the whiteboard (or draw the grid). Cross squares off as they are played.

Game · Day 1

CRITERIA	COSTS	CHOICES	TERMS	CROSSING
100	100	100	100	100
200	200	200	200	200
300	300	300	300	300
400	400	400	400	400
500	500	500	500	500

Scores

Team 1	**Team 2**	**Team 3**
Team 4	**Team 5**	**Team 6**

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Game, Day 2: Paper Password

Sub script and science word list. 15 minutes at the end of the period, or for extra time. Optional.

Game · Day 2

SAY THIS TO THE CLASS

"Got a few minutes? Pairs can play Password on cell division, an optional word game just for fun. Secret words come from the cell division set, the calm words and the root tip census; one partner clues in single words."

Set up (2 minutes)

1. Before class, copy the card page one-sided and fold and tear it into four cards, one card per round. Hand each pair only the current round's card; pairs keep each used card and add the four round totals at the end.
2. Partner A is the clue giver in rounds 1 and 3, Partner B in rounds 2 and 4. The guesser never sees the card.
3. Rounds last 2 minutes, with 30 seconds between them to swap roles. One-word clue, then ONE guess; wrong means another clue.
4. After five clues without a right guess, the word scores 0. Say "Go" and "Stop" for each round.

Read this out

"Your clue is one word only. You may not say the secret word or any part of it. If the word is snowman, you cannot say snow or man. No gestures, no spelling, no rhymes. Break a rule and that word scores zero."

Scoring: guessed on clue 1 = 5 points, clue 2 = 4, clue 3 = 3, clue 4 = 2, clue 5 = 1. The clue giver circles the number on the card. After round 4, pairs add their round totals. Highest total wins.

Words marked (calm) or (team), here and on the cards, come from today's calm block or team task. If the class skipped that block, pairs leave them out (and any round left empty).

Referee calls

Two words glued together ("sunlight") count as one clue only if they make a real word. No plurals or "-ing" forms of the secret word. A disputed clue scores zero. Each example clue below is allowed, and a good first clue.

Timing (15 minutes)

0:00	2:00	4:30	7:00	9:30	12:00
Set up, rules	Round 1, Partner A	Round 2, Partner B	Round 3, Partner A	Round 4, Partner B	Add totals, winners

Round 1: Partner A gives clues

PROPHASE	example clue: coil
METAPHASE	example clue: middle
ANAPHASE	example clue: apart
TELOPHASE	example clue: nuclei
CULTURE	example clue: dish

Round 2: Partner B gives clues

DOUBLING	example clue: twice
MARROW	example clue: bone
IDENTICAL	example clue: twins
GENES	example clue: switch
GROWTH	example clue: bigger

Round 3: Partner A gives clues

CENTRIOLE (calm)	example clue: pair
CHROMATIN (calm)	example clue: threads
MERISTEM (calm)	example clue: tip
CALLUS (calm)	example clue: lump
BLASTULA (calm)	example clue: ball

Round 4: Partner B gives clues

CENSUS (team)	example clue: count
POOLED (team)	example clue: combined
ROOT (team)	example clue: ground
TALLY (team)	example clue: marks
MINUTES (team)	example clue: time

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Game, Day 4: Classroom Millionaire

Sub script and the 12 questions. 15 minutes at the end of the period, or for extra time. Optional.

Game · Day 4

SAY THIS TO THE CLASS

"Classroom Millionaire is an optional, fun way to finish: the whole class climbs twelve questions together. Every question comes from today: the waves and signals set, the wave and signal terms and the parity bit relay."

How it works

1. Tape up a one-sided copy of the ladder page. The whole class is one player. Pick a student for the hot seat (a new student for every question).
2. Read the question and the four options, then read the options again. The hot seat may listen to quiet advice, then says "final answer" and a letter.
3. Right: the class climbs one rung. Before hearing the next question, the class may vote to walk away and keep what it has.
4. Wrong: the climb ends. Rungs 4 and 8 are safe: the class keeps the last safe amount it passed.
5. Time left over? Play the questions again as a team quiz.

Three lifelines (one use each)

Ask the class: everyone shows 1, 2, 3 or 4 fingers at once for A, B, C or D. The hot seat looks, then decides.

50/50: read out the two wrong options listed under the question. Cross them off.

Phone a friend: the hot seat picks one classmate, who has 30 seconds to say what they think out loud.

"Only the hot seat's final answer counts. Shout an answer and the class loses a lifeline."

Items marked (calm) or (team) come from today's calm block or team task: leave them out if the class did not do that block.

Rungs 1 to 4, rung 4 is safe

1. $100 In space, what do radio and light share?
A. Color B. Speed C. Wavelength D. Frequency
Answer: B. Speed (50/50 removes A and C)

2. $250 Which term means the height of a wave? (calm)
A. Latency B. Bandwidth C. Amplitude D. Photon
Answer: C. Amplitude (50/50 removes A and D)

3. $500 Which of these has the longest wavelength?
A. Radio B. Visible C. X-ray D. Gamma
Answer: A. Radio (50/50 removes C and D)

4. $1,000 How many bits per letter, before parity? (team)
A. Four B. Six C. Eight D. Five
Answer: D. Five (50/50 removes A and C)

Rungs 5 to 8, rung 8 is safe

5. $2,500 Wavelength of an FM station at 96 MHz?
A. 0.3125 m B. 3.125 m C. 31.25 m D. 312.5 m
Answer: B. 3.125 m (50/50 removes C and D)

6. $5,000 Which term means a signal delay? (calm)
A. Amplitude B. Receiver C. Photon D. Latency
Answer: D. Latency (50/50 removes A and C)

7. $10,000 How many bits make one byte?
A. 4 B. 6 C. 8 D. 16
Answer: C. 8 (50/50 removes A and D)

8. $25,000 Parity makes each count of 1s what? (team)
A. Even B. Odd C. Zero D. Above five
Answer: A. Even (50/50 removes C and D)

Rungs 9 to 12

9. $50,000 About how long does radio take to the Moon?
A. 0.13 s B. 1.3 s C. 13 s D. 130 s
Answer: B. 1.3 s (50/50 removes C and D)

10. $100,000 Which verb: send out for anyone to pick up? (calm)
A. Encrypt B. Broadcast C. Modulate D. Receive
Answer: B. Broadcast (50/50 removes A and D)

11. $500,000 In glass fiber, light keeps what share of its speed?
A. 1/10 B. 1/2 C. 2/3 D. 9/10
Answer: C. 2/3 (50/50 removes A and B)

12. $1 MILLION What did the damaged groups fail? (team)
A. Time plan B. Code table C. Sender test D. Parity check
Answer: D. Parity check (50/50 removes A and C)

If the class misses

Wrong on rung 1 to 4	**class keeps $0**
Wrong on rung 5 to 8	**class keeps $1,000**
Wrong on rung 9 to 12	**class keeps $25,000**
Walk away before a question	**class keeps the amount of the last rung it climbed**

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Science Set 4: Wavelengths of Real Signals

Use wavelength = speed / frequency, with speed = 3.00 x 10^8 m/s. Show each division.

Science · Day 4

Worked example

A station broadcasting at 150 MHz: wavelength = 3.00 x 10^8 m/s divided by 150,000,000 Hz = 3.00 x 10^8 / 1.5 x 10^8 = 2.0 m.

SIGNAL	FREQUENCY AS GIVEN	FREQUENCY (Hz)	WAVELENGTH (m)
An FM station at 96 MHz	96 MHz		
An AM station at 1,000 kHz	1,000 kHz		
Wi-Fi in the 2.4 GHz band	2.4 GHz		
Wi-Fi in the 5 GHz band	5 GHz		

Show each division here

3. **Which signal in the table has the longest wavelength? Explain using the reading's rule about frequency.**

4. **Kalinda's router can switch from the 2.4 GHz band to the 5 GHz band. By what factor does the wavelength change, and does it get longer or shorter?**

5. **An FM station moves from 100 MHz to 50 MHz. What happens to its wavelength? (Every US FM station is between 88 and 108 MHz, so this one is pretend.)**

☆ **Challenge** Green light has a wavelength of 500 nm (500 x 10^{-9} m). What is its frequency, in hertz?

Frequency: .....

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



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