Catch the Sun

Design and test a room that uses seasonal sunlight.

ESS.3.2 "Enrichment: Use an engineering design process to explore the concepts of passive solar architecture to design a structure that best utilizes solar incidence.*"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the two comfort goals, circle the window and overhang choices, and number the testing and redesign steps in order. Use your marks to track how the team improves its design.

A Reading Room for Every Season

1. A town in northern Colorado wants a reading room that stays comfortable with little heating or cooling. Its design team cannot move the building, but it can choose window placement, a roof overhang, and interior materials. At this latitude, the midday sun travels lower across the southern sky in winter and higher in summer. Sunlight through south-facing glass can warm a floor in winter. An overhang can block higher summer rays while admitting lower winter rays. The team sets two goals: collect winter sunlight and limit summer overheating, without blocking the view from the reading tables.

2. The team builds two identical small room models, except for the overhang depth. Both have south-facing windows and dark tile floors. A lamp shines at a low angle to represent a winter midday sun, then at a higher angle to represent a summer midday sun. Each model starts at the same indoor temperature, and the team records temperature after ten minutes under each angle. With a short overhang, the model warms by 5°C in the winter test and 7°C in the summer test. With a deep overhang, it warms by 1°C in winter and 2°C in summer.

3. Neither version meets both goals: the short overhang admits too much summer light, and the deep one shades the window even when winter sun is low. The team sketches a middle-depth overhang and plans to test it at the same lamp angles, distance, and exposure time. It also considers a light-colored exterior roof to reduce unwanted heat from above, while keeping the tile floor to absorb sunlight that enters the window. A model cannot predict every real weather condition, so the team will check its design with local sun-angle data before building.

2 ANSWER WITH EVIDENCE

Use the passage

1. Why did the team choose south-facing windows and an overhang for this Colorado room?

2. Which tested overhang better limits summer warming? What test result supports your choice, and what winter drawback does it have?

3. Why is a middle-depth overhang a reasonable next design to test? State what the team hopes it will do in each season.

4. What must stay the same when the team tests the new overhang, and what information should it check before building?

3 YOUR TURN

Your own words

Design a passive-solar study room for a school in southern Chile, where the midday sun is north of the building, lower in winter and higher in summer. In 4 to 5 sentences, name two design features, explain how they use seasonal sun angles, give one constraint, and describe a fair test plus a revision you would make if summer overheating occurs.

Catch the Sun

PART 1 · READ AND MARK

Underline the two comfort goals, circle the window and overhang choices, and number the testing and redesign steps in order. Use your marks to track how the team improves its design. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Why did the team choose south-facing windows and an overhang for this Colorado room?	**The windows can admit lower winter sunlight for warmth. The overhang can block higher summer sunlight to limit overheating.**
2	Which tested overhang better limits summer warming? What test result supports your choice, and what winter drawback does it have?	**The deep overhang limits summer warming to 2°C, compared with 7°C for the short one. It also limits winter warming to 1°C.**
3	Why is a middle-depth overhang a reasonable next design to test? State what the team hopes it will do in each season.	**It may admit more low-angle winter sunlight than the deep overhang while blocking more high-angle summer sunlight than the short one.**
4	What must stay the same when the team tests the new overhang, and what information should it check before building?	**The team should keep the lamp angles, distance, and exposure time the same and check local sun-angle data.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would put large windows on the north wall and add a moderate roof overhang. Lower winter rays could enter and warm a tile floor, while the overhang would block higher summer rays. The room must still have enough daylight for reading. I would compare matching models with and without the overhang using the same lamp distance and exposure time at winter and summer angles. If the overhang model overheated in summer, I would extend its overhang and retest both seasons.

Accept other designs that correctly use north-facing winter sunlight and account for higher summer sun in southern Chile. The proposed test should control relevant conditions, and the revision should respond to summer overheating.