ADDITIONAL DOCUMENTS

Research Project Info Cards

RESEARCH PROJECT INFO CARD | **1. ENERGY-SMART DESIGN AND BUILDING ORIENTATION**

Instructions: Do not write on this card. Return it to your teacher after the experiment.

Your experiment: Compare temperatures in two buildings, one with its long axis directly facing the sun and one with its long axis at a right angle to the sun.

Tip: The buildings should be at 90 degrees to each other. This experiment is not about windows, so neither window should face toward the sun.

What's this about?

The shape and orientation of buildings is important in passive solar design. (Orientation means which way the building is lined up.) In Arizona, the best design is a rectangular building with its long axis oriented east-west.
The sun's position changes with the seasons. In winter, the sun stays low in the southern sky. A long wall on its south side exposes a building to more winter sun – a good thing. In summer, the sun is not in the southern sky but high overhead. Short walls on the east and west expose a building to less summer sun, especially less afternoon sun in the west – another good thing. This experiment shows how heat gain differs with a long wall versus a short wall facing the sun.

RESEARCH PROJECT INFO CARD | **2. ENERGY-SMART DESIGN AND WINDOW PLACEMENT**

Instructions: Do not write on this card. Return it to your teacher after the experiment.

Your experiment: Compare temperatures in two buildings, one with a window facing toward the sun and one with a window facing away from the sun.

Tip: The buildings should be lined up parallel except for their windows being on opposite sides. Place one building so its window faces straight at the sun. Place the other building so its window faces straight away from the sun.

What's this about?

In passive solar design, the size and placement of windows is important. Window glass allows more energy transfer inside by radiation than a solid wall does. Some of this energy stays in the building and warms it. In winter, when it is cold outside and we want to keep a building warm, this is a good thing. In summer, when it is hot outside and we want to keep a building cool, this is not a good thing. In technical terms, the thermal energy or heat energy gained from the sun is called solar gain. We want to maximize solar gain in winter and minimize it in summer. This experiment is about how windows affect solar gain.

ADDITIONAL DOCUMENTS

Research Project Info Cards *(Continued)*

RESEARCH PROJECT INFO CARD | **3. ENERGY-SMART DESIGN AND SHADE**

Instructions: Do not write on this card. Return it to your teacher after the experiment.

Your experiment: Compare temperatures in two buildings, one that is fully exposed to the sun and one that is shaded.

Tip: Be sure the buildings are at the same angle in relation to the sun. The windows in both buildings should face the sun. Be sure to shade one building (including its window) but not the other building.

What's this about?

Passive solar design looks at how a building is designed and at the site where the building is located. In the winter, it is best to let radiant energy from the sun help warm a building. In summer, it is best to have as much shade as possible. Shade can be provided in several ways. Eaves on a building can help shade its walls. Other buildings nearby can give shade. Trees, shrubs, and vines in the right places can make a big difference too. Plants that lose their leaves in winter can be used to shade a building from summer sun but allow winter sun to reach it. This experiment looks at shade in general and how much difference it can make in radiant heat gain.

RESEARCH PROJECT INFO CARD | **4. ENERGY-SMART DESIGN AND BUILDING COLOR**

Instructions: Do not write on this card. Return it to your teacher after the experiment.

Your experiment: Compare temperatures in two buildings, one that is black in color and one that is white.

Tip: Keep the buildings lined up at the same angle in relation to the sun. The windows in both buildings should face the sun.

What's this about?

Different kinds of surfaces absorb or reflect the radiant energy of the sun to different degrees. Shiny and light surfaces absorb the least energy. Dull, dark surfaces absorb the most. There is a whole range in between. Even a tan-colored building absorbs more radiant energy than a white building. (The difference between tan versus white is an established fact but would be hard to test with little paper models.)

The best choice of house color depends on where you live. In most of Arizona, the sun is bright and hot much of the year. White or light colors are best. This experiment looks at the difference in heat absorbed by a black building and a white building.