Problem Based Lesson Starters

Don't forget to create a PROBLEM Question!!

Engineering Lesson: Designing Your Own Travel Bag

As you read the Project Story, can you think of what kind of travel bag you would need to hold and protect your laptop computer, cellular phone, and other essential items for your travel and still be light enough to carry? If you could design your bag to meet the needs of this trip, what kind of bag would you have? Does it have to be water resistant? In this lesson, you will use the engineering design process to generate research questions, brainstorm ideas, design, build, and test a prototype of your travel bag.
http://www.ciese.org/curriculum/shipproj/engineering_lesson/

Ant Day Care Center

In this lesson students will solve the problem: How can we house ants in a structure where we will be able to observe/study them? Students will use the Engineering Design Process to create a suitable container/habitat for keeping and observing ants for one day.
http://www.ciese.org/curriculum/squareproj/engineering_ants/

Scratch My Back

This lesson is based on the book Big Smelly Bear by Britta Teckentrup. In the book, a big, smelly bear has an itch in the middle of his back and can't scratch it. Nothing the bear tries works. Using the Engineering Design Process, children will design, build, and test a backscratcher for themselves.
(Grades K - 2)
http://www.ciese.org/curriculum/engineering/backscratcher.html

Engineer a Sneaker

The goal is for students to understand the basics of engineering that go into the design of a sneaker. The bottom or sole of a sneaker provides support, cushioning, and traction. In addition the sole is flexible and can have some fashion based functions such as cool colors and added height. The sneaker is a well-engineered product, utilizing a variety of materials to create a highly functional, useful shoe. In this activity, students select specific design requirements, such as good traction or deep cushioning, and then select from a variety of materials to build prototype shoes that meet the design criteria.
Grade Level: 5 (5-6)
http://www.teachengineering.org/view_activity.php?url=collection/wpi_/activities/wpi_engineer_a_sneaker/engineer_a_sneaker.xml

At the Doctor's

In this simulation of a doctor's office, students play the roles of physician, nurse, patients, and time-keeper, with the objective to improve the patient waiting time. They collect and graph data as part of their analysis. This serves as a hands-on example of using engineering principles and engineering design approaches (such as models and simulations) to research, analyze, test and improve processes.
Grade Level: 5 (3-5)
http://www.teachengineering.org/view_activity.php?url=collection/usf_/activities/usf_healthcare/usf_healthcare_lesson01_activity1.xml

Problem Solve Your School

Students apply what they have learned about the engineering design process to a real-life problem that affects them and/or their school. They chose a problem as a group, and then follow the engineering design process to come up with and test their design solution. This activity teaches students how to use the engineering design process while improving something in the school environment that matters to them. By performing each step of the design process, students can experience what it is like to be an engineer.
Grade Level: 5 (4-6)
http://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_design/cub_design_lesson01_activity2.xml

The Puck Stops Here

After learning about transfer of energy, specifically the loss of kinetic energy to friction, students get a chance to test friction. In groups they are given a wooden block, different fabrics, and weights and asked to design the "best" puck. The class first needs to define what makes the "best" puck. Each group should realize that the most desirable puck will travel the furthest, thus the puck with the least amount of friction. In the context of hockey the "best" puck is the one that travels farthest and loses the least kinetic energy to friction. Students then need to apply their knowledge of friction to design a new optimal puck for the National Hockey League. The friction is the transfer from kinetic energy to heat energy.
Grade Level: 5 (5-7)
http://www.teachengineering.org/view_activity.php?url=collection/duk_/activities/duk_hockey_music_act/duk_hockey_music_act.xml

Make an Alarm!
After reading the story "Dear Mr. Henshaw" by Beverly Cleary, students create an alarm system for something in the classroom, just as the main character Leigh does to protect his lunchbox from thieves. Students learn about alarms and use their creativity to devise an alarm system to protect their lockers, desk, or classroom door. Note: this activity can also be done without reading "Dear Mr. Henshaw."
Grade Level: 4 (3-5)
http://www.teachengineering.org/view_activity.php?url=collection/wpi_/activities/wpi_make_an_alarm/make_an_alarm.xml

Design Packing to Safely Mail Raw Spaghetti
Students use their creative skills to determine a way to safely mail raw (dry, uncooked) spaghetti using only the provided materials. To test the packing designs, the spaghetti is mailed through the postal system and evaluated after delivery.
Grade Level: 4 (3-5)
http://www.teachengineering.org/view_activity.php?url=collection/wpi_/activities/wpi_design_packing/design_packing.xml

What Happened to the Water? Designing Ways to Get and Clean Water
In this scenario-based activity, students design ways to either clean a water source or find a new water source, depending on given hypothetical family scenarios. They act as engineers to draw and write about what they could do to provide water to a community facing a water crisis. They also learn the basic steps of the engineering design process.
Grade Level: 4 (3-5)
http://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_earth/cub_earth_lesson3_activity1.xml

Mint-Mobiles
Students design, build and test model race cars made from simple materials (lifesaver-shaped candies, plastic drinking straws, Popsicle sticks, index cards, tape) as a way to explore independent, dependent and control variables. They measure the changes in distance travelled with the addition of mass to the vehicles. Students also practice the steps of the engineering design process by brainstorming, planning, building, testing, and improving their "mint-mobiles."
Grade Level: 4 (3-5)
http://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_measurement/cub_measurement_lesson01_activity2.xml

Construct and Test Roofs for Different Climates
We design and create objects to make our lives easier and more comfortable. The houses in which we live are excellent examples of this. Depending on your local climate, the features of your house have been designed to satisfy your particular environmental needs. In this activity, students design and build model houses, then test them against various climate elements, and then re-design and improve them. Students learn types of roofs found on various houses in different environments throughout the world.
Grade Level: 4 (3-5)
http://www.teachengineering.org/view_activity.php?url=collection/wpi_/activities/wpi_roofs_for_different_climates/roofs_for_different_climates.xml

A House is a House for Me
Students brainstorm and discuss the different types of materials used to build houses in various climates. They build small models of houses and test them in different climates.
Grade Level: 4 (3-5)
http://www.teachengineering.org/view_activity.php?url=collection/wpi_/activities/wpi_a_house_for_me/a_house_for_me.xml

Water Filtration
Students are asked to design methods to filter water using ordinary materials, while also considering their designs' material and cost efficiencies. They learn about the importance of water and its role in our everyday lives. They come to understand what must occur each day so that they can have clean water.
Grade Level: 4 (3-5)
http://www.teachengineering.org/view_activity.php?url=collection/wpi_/activities/wpi_water_filtration/water_filtration.xml

Space Shelter
Students are given the following challenge: "The invasion has taken place and we need to find a new home. To ensure your survival beyond Earth's occupation you must design a shelter that can be built on another planet." Then students research the characteristics of a planet of their choice. They design shelter that would allow them to survive on a new planet, and explain it in words.
Grade Level: 4 (3-5)
http://www.teachengineering.org/view_activity.php?url=collection/wpi_/activities/wpi_space_shelter/space_shelter.xml

Build Your Own Insect Trap
Students design and construct devices to trap insects that are present in the area around the school. The objective is to ask the right design questions and conduct the right tests to determine if the traps work.
Grade Level: 4 (3-6)
http://www.teachengineering.org/view_activity.php?url=collection/osu_/activities/osu_insect_trap/insect_trap_activity.xml

The Universal Language of Engineering Drawings

Students practice the ability to produce clear, complete, accurate and detailed design drawings through an engineering design challenge. Using only the specified materials, teams are challenged to draw a design for a wind-powered car. Then, they trade engineering drawings with another group and attempt to construct the model cars in order to determine how successfully the original design intentions were communicated through sketches, dimensions and instructions.

Grade Level: 4 (3-5)

http://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_engrdrawings/cub_engrdrawings_activity01.xml

Shapes of Strength

Students are introduced to brainstorming and the design process in problem solving as it relates to engineering. They perform an activity to develop and understand problem solving with an emphasis on learning from history. Using only paper, straws, tape and paper clips, they create structures that can support the weight of at least one textbook. In their first attempts to build the structures, they build whatever comes to mind. For the second trial, they examine examples of successful buildings from history and try again.

Grade Level: 4 (3-5)

http://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_intro/cub_intro_lesson01_activity1.xml

Wheeling It In!

In an open-ended design activity, students use everyday materials (milk cartons, water bottles, pencils, straws, candy) to build a small-scale transportation device. They incorporate the use of a wheel and axle, and lever into their design. Students choose their materials and engineer a solution suitable to convey pyramid-building materials (small blocks of clay). Students race their carts/trucks; measure distance, time and weight; and calculate speed.

Grade Level: 4 (3-5)

http://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_simple/cub_simple_lesson03_activity1.xml

Recycled Towers

Students learn about material reuse by designing and building the strongest and tallest tower they can, using only recycled materials. Students must follow design constraints, and build their towers to withstand an earthquake and high wind simulation.

Grade Level: 4 (3-5)

http://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_environ/cub_environ_lesson05_activity3.xml

Park It!

For this activity, the client is your teacher, and the desired structure is a parking garage. The requirements are that the parking garage must be able to hold either eight toy cars or one small book and must have a ramp, which will move cars to the top level of the garage.

http://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_intro/cub_intro_lesson03_activity1.xml

Bumps and Bruises

Athletes often wear protective gear to keep themselves safe in contact sports. In this spirit, students follow the steps of engineering design process as they design, build and test protective padding for an egg drop. Many of the design considerations surrounding an egg drop are similar to sports equipment design. Watching the transformation of energy from potential to kinetic, observing the impact and working under material constraints gives students a chance to experience some of the challenges engineers face in designing equipment to protect athletes.

Grade Level: 4 (3-5)

http://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_intro/cub_intro_lesson04_activity1.xml

Designing a Package that Works

Student teams act as engineers and brainstorm, design, build and test their ideas for packaging to protect a raw egg shipped in a 9 x 12-in envelope. They follow the steps of the engineering design process and aim for a successful solution with no breakage, low weight and recyled/reuse materials. Students come to understand the basics of engineering associated with the packaging of items to preserve, market and safely transport goods.

Grade Level: 3 (3-4)

http://www.teachengineering.org/view_activity.php?url=collection/wpi_/activities/wpi_design_packing_that_works/design_packing_that_works.xml

Cars: Engineering for Efficiency

At the end of this activity, we will conduct several experiments to see how changing the angle of the track affects the speed of a car. In this case, the angle of the track is called the independent variable because we intentionally change it to gauge its affect on our vehicles. The speed of the car is called the dependent variable because it will be affected by the changes we make to the angle of the track. Once we have chosen our variables, we need to be very careful to control all other factors so that we get really accurate results. Let's get started!

http://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_motion/cub_motion_activity1.xml