**Electricity Project Assignment (150 pts.)**

**Task:**

Candidates will work in assigned teams to develop holiday-themed classroom activity that delivers basic electricity content. The activity should be suitable for 4th grade students and help them develop an understanding that energy can be transferred from place to place by electrical currents. The activity should be focused on the following STEM content standards:

**Science**

4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

**Technology and Engineering**

STL 12: Students will develop the abilities to use and maintain technological products and systems.

1. Follow step-by-step directions to assemble a product.

E. Select and safely use tools, products, and systems for specific tasks.

STL 16: Students will develop an understanding of and be able to select and use energy and power technologies.

C. Energy comes in different forms.

D. Tools, machines, products, and systems use energy in order to do work.

**Mathematics**

MP.2 Reason abstractly and quantitatively. (4-ESS3-1)

MP.4 Model with mathematics. (4-ESS3-1)

**Content Information:**

The best teachers are always looking for a way to tie classroom learning to upcoming events/holidays that students are anticipating—i.e., Thanksgiving, Christmas, etc. This provides a natural hook for the students and typically provides the student with something that can be taken home and placed prominently on the refrigerator door! Remember making a Thanksgiving turkey from a trace of your hand during elementary school?

In this case, you are being asked to develop a holiday-themed activity that both represents an upcoming holiday or community event and an introduction to basic electricity. You are welcome to utilize a traditional holiday craft item, but you must also find a way to electrify the activity. As we have learned in this class, it is not enough to simply a purchase a clever craft item at the flea market and then have your students replicate that item in class. ALL ACTIVITIES MUST DELIVER A BIG IDEA and in this case, they must deliver integrated STEM education!

**Electrical Circuits -** Basic Background Information

Electrical current is the flow of charge. The diagram at the left shows a simple series circuit. When the switch is connected, electrons flow from the anode (positive/top of battery) to the cathode (negative) at the bottom of the battery and return to the positive pole. The illustration is a diagrammatic form (i.e. circuit diagram or schematic) used to illustrate an electrical circuit. The two parallel lines of different lengths marked battery actually represent a single cell. Single cells supply 1.5 volts and are what we generally mean when we say a battery (e.g. "I must change the batteries in my flashlight"). Technically, a battery is a series of single cells joined together to provide a greater voltage in, for example, a car battery.

The battery provides the electromotive force (or e.m.f.) that "pushes" the electrons through the wires of the circuit. Electromotive force is measured in volts. In some ways it is similar to the potential energy stored in an object at the top of a hill. The object might roll down the hill and lose its potential energy and, in an analogous way, the electrons flow down the voltage drop (or potential difference) as they move around the circuit.

As the switch is turned on, the light bulb ignites (lights up). When the circuit is closed, by throwing the switch, the battery forces those electrons to flow around the wire, thereby creating the current. Standard units used in electricity (in the United States) are:

* **VOLTS (V)**: unit of potential difference, emf, or voltage
* **OHM (Ω)**: unit of resistance
* **AMPS (AMPERES) (A)**: unit of current
* **COULOMBS (C)**: unit of charge (= the charge moved when one amp of

 current runs for one second).

* **WATTS (W)**: unit of power (power energy per unit time). In electrical

circuits, **one watt** is produced when a current of **one amp** flows down a

 potential difference of **one volt**.

* **JOULE (J)**: unit of energy.

**Reading:** Chapter 1: <http://www.allaboutcircuits.com/vol_1/index.html>

Looking for ideas for different types of switches? Check out the following videos:

How to make a toggle switch - <https://www.youtube.com/watch?v=MGXw9bkfM1A>

How to make a slide switch - <https://www.youtube.com/watch?v=qSmYT6hPjUU>

How to make a rotary switch - <https://www.youtube.com/watch?v=I24G3TlSLow>

**Assignment Parameters:**

Working as a team, complete the assignment following the parameters outlined below:

* You will have multiple class meetings to experiment with electricity and complete the craft item and STEM activity, but you will need to develop individual responsibilities so that some of the research and materials development can be completed outside class.
* You will use the Technical/Procedural format (step-by-step instructions) for this lesson, as basic electricity doesn’t lend itself nicely to ill-structured engineering design problem.
* The completed lesson must be submitted electronically as an e-mail attachment and each team member must submit a working sample of the completed project for presentation in class. The completed activity must include high quality photos of you constructing the project.
* The completed activity must clearly delivers the basic concepts of electricity and identified STEM content standards.

**Deliverables:**

* Integrated STEM education activity
* Completed projects for demonstration in class
* Teacher and student instructions for completing the lesson.

**Evaluation:**

The submissions will be evaluated based on the degree to which they meet the parameters outlined above, are engaging for elementary students, and deliver and address STEM standards*.*

**STEM 4033 Electricity Project Rubric (150 pts.)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Category** | Up to 6.5 pts. | Up to 12.5 pts. | Up to 18.5 pts. | Up to 25 pts. | Score |
| **Exemplary Teaching Model/Prototype (50pts.)** |
| Aesthetics | Construction lacked thought and planning. Many details need refinement to create an attractive product. Little to no use of creativity. | Construction process was successful, but 3-4 details could have been refined for a more attractive product. Minimal use of creativity. | Construction was careful and accurate but 1-2 details could have been refined for a more attractive product. Strong use of creativity. | Individual demonstrated careful thought and planning in construction process to create a neat and attractive product. Exceptional use of creativity. |  |
| Functionality | The model or prototype does not function |  |  | The model or prototype functions flawlessly and as intended. |  |
| **Curriculum Development (100pts.)** |
|  | Up to 12.5 pts. | Up to 25 pts. | Up to 37.5 pts. | Up to 50 pts. |  |
| **Technical Procedural Organization****(30 pts.)** | Curriculum does not present new information; does not follow recommended pattern; potential audience wouldn’t be able to grasp content or complete task due to incomplete information or minimal technical-procedural directions. Low-quality images. | Curriculum developer/s were clearly uncomfortable with curriculum content and technical procedural directions. Project included rudimentary information and/or partially met requirements. Included images, but these could have been taken with greater precision and attention to detail. | Curriculum developer/s were at ease with content, but fails to fully address all requirements of the curriculum assignment and technical procedural directions including high-quality images with consistent background. | Curriculum developer/s demonstrated full knowledge (more than required) and includes rich information that fully addresses the assigned task. Potential audience would learn STEM content and be able to complete the project using the technical-procedural directions. |  |
|  | Up to 5 pts. | Up to 10 pts. | Up to 15 pts. | Up to 20 pts. |  |
| **Curriculum Organization****(30 pts.)** | Potential curriculum audience would not understand because the product is not sequenced or organized adequately. | Potential curriculum audience would have difficulty following and completing the curriculum. | Curriculum is presented in logical sequence utilizing a recognized curriculum format. | Curriculum presents information in logical, interesting sequence using a recognized curriculum model which the potential audience can follow. The teacher’s guide is broken down so that the potential audience can understand the process for completing the activity with students. |  |
|  | Up to 5 pts. | Up to 10 pts. | Up to 15 pts. | Up to 20 pts. |  |
| **STEM Content and Alignment****(20 pts.)** | The curriculum does not thoroughly address standards or meet the intention of the standards. Minimal content information is provided. | The curriculum addresses standards but does not meet the intention of the standards. Some content information is provided. | Thoroughly addresses some of the standards and meets the intention of the standards. Some content information is provided. | Thoroughly covers standards and meets the intention of the standards. Thorough content information is provided. |  |
|  | 0 pts. | Up to 2.5 pts. | Up to 5 pts. | Up to 10 pts. |  |
| **Curriculum****Mechanics****(10 pts.)** | Curriculum has four or more spelling errors and/or grammatical errors. Organization was ill-conceived. | Curriculum had three misspellings and/or grammatical errors. Organization was an issue. | Curriculum has few misspellings and/or grammatical errors. Organization was adequate. | Curriculum has no misspellings or grammatical errors, was organized well, and was attractive. |  |
| **Comments: Total Points: /150** |