

**Buckhannon-Upshur Middle School**

**LESSON PLAN**

Name of Teacher: Christina Sterck

Date: Days 1 & 2 Time: 47 Minutes Grade/Subject/Course: 7<sup>th</sup> Grade Science

1. **Lesson Topic(s)** Inca Engineering- Q'eswachaka Bridge

2. **Length of Time** 47 minutes

3. **Lesson Material(s) and Special Equipment**

Rubber bands, string, roll of pennies, toothpicks, Popsicle sticks, cardstock, cardboard, paper clips, binder clips, computers, dry erase markers, whiteboards,

4. **Adaptations for Special Needs**

- Students will have directions read to them and rephrased.
- Students will be questioned for understanding of directions/procedures.

5. **Objective(s) and Related Academic Standards Code(s)**

- S.6-8ETS.1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- S6-8ETS.2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- S6-8ETS.3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- S6-8ETS.4 Develop a model to generate data for iterative testing

6. **Assessments and Checking for Understanding** (*match these to your objectives and include them in your procedures below*)

- Ability of groups to develop a bridge that can withstand a roll of pennies.
- Evaluation of design by groups that shows ability to problem solve issues and modify design.

## 7. Anticipatory Set and Motivation Activities/ Accessing Prior Knowledge

Day 1 Bellringer- What plans need to be considered before building a house?

Answer- Location of house, proximity to utilities, cell service in the area, etc.

Teacher- Ask What steps do we need to make to build a bridge?

Day 2 Bellringer- Test your bridge to see if it will support the weight of the pennies.

Answer- Students will evaluate their design.

- Students will answer the following questions.
  - Describe if your bridge supported/did not support the full weight of the pennies.
  - What worked well in your planning and construction of your bridge?
  - What could be improved in your planning and construction?

## 8. Procedures and Content Presentation (*attach all handouts, presentation notes, etc.*)

Day 1- In pairs, students will design and build a bridge using specific materials.

- Students are to look at materials available.
- Students will decide what building materials will be used.
- Students will be given ten (10) minutes to plan their bridges.
- Groups will spend twenty-five (25) minutes building their bridges.
- Criteria
  - Bridges can only be made with provided materials.
  - Bridges must be able to support one unopened roll of pennies.
  - Everyone in the group must assist in building the bridge.
  - Bridges must be 6-12 inches long.
- Students will record what types of building materials were used and quantity of each material.

Day 2- Groups will walk around the room for ten (10) minutes and look at each other's designs.

- For at least three different stations, students will evaluate each other's designs. Students will answer the following questions:
  - Did this bridge support the weight of the pennies?
  - What do you like about this group's designs?
  - Compare three things and contrast three things between your bridge and this group's bridge.
- Review the answers to the questions as a group. \*\*\* Ensure that evaluation of the work is done respectfully. \*\*\*
- \*\*\*Prior to class, collect the long grass from alongside of the soccer fields. \*\*\*

- Teacher will ask the students “Can you make a bridge from grass?”
- Students will spend three (3) minutes talking with the individuals at their table to discuss their ideas. Students must defend their answers.
- Discuss the question “Can you make a bridge from grass?”
  - o Yes/No
  - o Explain your answer.
- On laptops and in pairs, students will research what materials are used to build bridges. Ten (10) minutes
  - o Lists may include: stone, cement. metal, sand, bricks, tires, wood, plastic, rope
- On one of the wipe boards, Teacher and students will generate a list of materials used to build a bridge.
- If no primitive material are stated, guide students to specific websites.
  - o Smithsonian- Museum of Native Americans
- Teacher will talk about the Inca Empire.

## 9. Summary and Closure

Day 1- Groups will mark their bridges and place them in a safe location.

- Teacher will review the activities of the day and expectations for the next class.

Day 2- Students will draw a picture of how they think the Inca people looked.

## 10. Assignments and Enrichment Activities

**Buckhannon-Upshur Middle School**

**LESSON PLAN**

Name of Teacher: Christina Sterck

Date: Days 3 & 4 Time: 47 Minutes Grade/Subject/Course: 7<sup>th</sup> Grade Science

1. **Lesson Topic(s)** Inca Engineering- Q'eswachaka Bridge

2. **Length of Time** 47 minutes

3. **Lesson Material(s) and Special Equipment**

Computer, whiteboards, dry erase markers, overhead projector, laptop, , 45 lb kettlebell/weighted plate, video "Why are there so many different types of bridges?" By Sebastian Kalilikane (YouTube)

4. **Adaptations for Special Needs**

- Students will have directions read to them and rephrased.
- Students will be questioned for understanding of directions/procedures.
- Partner with higher functioning peers in group

5. **Objective(s) and Related Academic Standards Code(s)**

- S.6-8ETS.1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- S6-8ETS.2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- S6-8ETS.3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- S6-8ETS.4 Develop a model to generate data for iterative testing

6. **Assessments and Checking for Understanding** (*match these to your objectives and include them in your procedures below*)

- Students will perform a fill-in –the-blank form for the video to gather notes on bridges,
- Students will complete a video question guide on the Inca Empire.

## 7. Anticipatory Set and Motivation Activities/ Accessing Prior Knowledge

Day 3 Bellringer- In what countries was the Inca Empire?

Day 4 Bellringer- Define the word force.

Answer- a push or pull upon an object resulting from the objects interaction with another object.

## 8. Procedures and Content Presentation (*attach all handouts, presentation notes, etc.*)

Day 3- Inca Empire

- Students will watch a video about the Incan Empire and its achievements.
  - o Students will complete a video question guide on the Inca Empire.
- After video, discuss with students.
  - o At what elevations did these people live?
  - o What were some engineering accomplishments?
    - Moving heavy objects without the use of the wheel or work animals.
    - Demo- Have a 45 lb kettlebell/weighted plate on the floor.
      - Ask a student to move the weight across the room.
      - Ask the student to return the weight to the original position in the room. **\*\*this time using a cart\*\***
      - Ask the students which method of moving the weight was easier?
      - Which method took less time?
      - Teacher will have students imagine how much work it took to complete the Inca Road without help.
- Teacher will ask “what forces does the Inca Road have to withstand each day?”
  - o Students will generate ideas such as wind, rain, cars, earthquakes, etc.
  - o Define force.

Day 4- Demonstrate force

- o Have the students grab hands with the students across from them (4-person tables) or beside them (2-person tables)
- o Teacher will direct students to gently pull the person toward them.
- o Teacher will direct students to gently push the other person away from them.
- Teacher will ask “what are some force interactions going on in the classroom at this moment?”
  - o Ex: Books on desk, person on chair, ponytail holder in hair, stretchy fabric against skin, shoelaces on shoes, my stump/ cement block against the door, magnets holding the fire doors, etc.
- Teacher states “bridges are many types of bridges”.

- Show short introduction video “Why are there so many different types of bridges?” by Sebastian Kalilikane (YouTube)
  - o Students will perform a fill-in –the-blank form for the video to gather notes on bridges,
- Definition- Arch bridge- a bridge with abutments at each end shaped as a curved arch
- Show images of arch bridges
- Definition- Suspension bridge- bridges with overhead cables supporting its roadway.
- Show images of suspension bridges
- Review bridge building materials list with class. Challenge the kids to answer the question “Can you make a bridge from grass?”

### **9. Summary and Closure**

Day 3- Review bridge building materials list with class. Ask students to define the word “Force” for homework.

Day 4- Review bridge building materials list with class. Challenge the kids to answer the question “Can you make a bridge from grass?”

### **10. Assignments and Enrichment Activities**

**Buckhannon-Upshur Middle School**

**LESSON PLAN**

Name of Teacher: Christina Sterck

Date: \_Days 5 & 6+\_ Time: 47 Minutes Grade/Subject/Course: 7<sup>th</sup> Grade Science

1. **Lesson Topic(s)** Inca Engineering- Q'eswachaka Bridge

2. **Length of Time** 47 minutes

3. **Lesson Material(s) and Special Equipment**

Computer, whiteboards, dry erase markers, overhead projector, laptop, Video titled "Grass-bridge" in Video folder on laptop, string/twine, grass from outside by the soccer field, Suspension Bridge Project guide

4. **Adaptations for Special Needs**

- Students will have directions read to them and rephrased.
- Students will be questioned for understanding of directions/procedures.
- Partner with higher functioning peers in group

5. **Objective(s) and Related Academic Standards Code(s)**

- S.6-8ETS.1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
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- S6-8ETS.4 Develop a model to generate data for iterative testing

6. **Assessments and Checking for Understanding** (*match these to your objectives and include them in your procedures below*)

- Teacher will walk around and check progress sheets for students.
- Teacher will question students and answer any questions posed by the students.

## 7. Anticipatory Set and Motivation Activities/ Accessing Prior Knowledge

Day 5 Bellringer- “Can you make a bridge from grass?”

Answer- bridges can be made from grass and many other materials such as cotton, hemp, metal cables, etc.

Day 6 Bellringer- List three steps that were accomplished while building your bridge the previous day.

Answer- cut supports, measured main ropes, tied ropes to supports, etc.

## 8. Procedures and Content Presentation (*attach all handouts, presentation notes, etc.*)

Day 5- Inca Road and Bridge building

- Students and teacher will review bridge types.
- Teacher will state that the Inca used suspension bridges to move materials.
- Students will watch the Video entitle “Grass-bridges” from the Video folder on the laptop.
- With the grass from the field, Students will emulate the way the grass was make in the video.
  - o Lay some grass in your hands
  - o Roll the grass between your hands
  - o Add more grass and repeat
- Teacher and students will evaluate the progress of the rope making.
  - o Good, Bad, indifferent
- Students will receive “Suspension Bridge Project” guide.
  - o Students will work in pairs or groups of three
  - o Each group is to construct a three (3) feet long suspension bridge using yarn, string or twine.
  - o Each bridge must have supports on only the ends.
  - o Bridges must suspend over a gap and be self-supporting.
  - o Bridge must support the weight of a composition book without collapsing.
  - o Grades for participation will be given daily. As well, an overall group score will be given for the project.
- Set expectations for what students should accomplish by the end of the class period.
- Students are to work on projects for remainder of the period.
  - o Day 1- planning and gathering materials.

Day 6 and 7- Students are to work on projects for the period.

- Students are expected to begin construction by the end of the class period.



- Students need to plan how they want their bridge to look, how many supports are needed, how many strands of twine need to be used, etc.
  - Students can spread out in the room to fit the available space
  - **\*\*\*Projects must be left in the room overnight\*\*\*the projects must not be taken home. Work must be completed at school**
- Day 7- End of period- projects must be turned in for grading.

## **9. Summary and Closure**

Day 5- Review project expectations. Review work that should have been accomplished by the end of the period.

Day 6- Review project expectations. Review work that should have been accomplished by the end of the period.

Day 7- Collect materials for grading.

## **10. Assignments and Enrichment Activities**