EDUCATIONCLOSET

GRADES 6-8

KINETIC ENERGY

STEAM LESSON

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Sample Steam Unit

Unit Lesson:
Alexander Calder
Balance and Kinetic Energy

For the Teacher

Teacher Overview

This unit is meant for the Middle School levels but can easily be adjusted for either high school or elementary levels as well. It is planned for 6, 45 minute sessions but can easily be shortened or lengthened depending on the age or population you are working with. This unit is meant for students who have some prior knowledge of the scientific principles of balance and kinetics. It is assumed that they will be able to apply this knowledge to understanding how Calder used them to create his mobiles.

This unit showcases the work of artist/engineer Alexander Calder and his kinetic sculptures as an avenue to further explore balance and kinetic energy. Alexander Calder created the first mobiles. Mobiles are balanced, kinetic sculptures that respond to environmental factors such as wind. His artworks had moving parts that were intended to be interactive. Students will investigate and explore the principles of balance and kinetics (along with any environmental factors that can affect them) in the work of Alexander Calder. Dance and technology will be used to enhance this unit of study. For a culminating project, students will create a Calder inspired Mobile (taking into consideration constraints and environmental factors) that demonstrates their understanding of balance and kinetics. Students will be using the 21st century skills of creating, critical thinking and problem solving during this unit.

CORE Standards Addressed

These are the standards that will be addressed at the end of the unit.

Science: MS-ETS-1.1 Define the criterias 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.	Visual Art: VA:Cr1.2.7 Develop criteria to guide making a work of art or design to meet an identified goal.

Additional Standards Addressed

These are standards which are used to enhance the unit, but are not the focus for assessment of skills and process.

Dance: DA:Pr5.1.7a Apply body-use strategies to accommodate physical maturational development to technical dance skills(for example, functional alignment, coordination, balance, core support, kinesthetic awareness, clarity of movement, wight shifts, flexibility /range of motion).	Technology: ISTE 4 Innovative Designer a. Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions. b. Students develop, test and refine prototypes as part of a cyclical design process.

Essential Question:

How do scientific principles and environmental factors affect design?

Learning Outcomes

Students will…

- Understand and apply scientific knowledge of balance and kinetics in planning and creating a mobile.
- Develop criteria and list constraints of the design problem of creating a mobile that interacts with the environment.
- Use the list of generated criteria and constraints to guide the creation of a mobile.
- Balance objects from a balance point.
- Use the elements of art in creating a mobile (especially balance, shape, space, variety, rhythm, and emphasis)
- Use good craftsmanship to build a mobile that does not fall apart when exposed to environmental factors.

Schedule of Sessions

This schedule is based on 45 minute sessions but can be adjusted as needed.

Session 1:

- Overview of unit
- I Can statement
- Warm Up Activity - See, Think, Wonder
- Activity - Review scientific concepts of balance and kinetics. Allow students time to experiment with scales, etc.

Session 2:

- Quick review from last session
- Go through stations on Calder. 3 stations, 15 minutes at each
  Video, books/magazine articles, interactive mobile creating app

Session 3

- Review balance/kinetics using dance
- Plan/design Calder-like mobile on paper
- Produce a prototype using pipe cleaners and cardboard/foam shapes
- Make note of what works/doesn't work and adjust plans accordingly
- Revise mobile according to notes
- Plan and select materials to create final mobile. Students will be introduced to using the 3D printer in the next session but do not have to use it.

Session 4 & 5

- Introduce & demo **3D Builder** program to create forms for mobile using 3D printer
- Students who choose to will program for their shapes and print them.
- Assemble mobiles using choice of materials.

Session 6

- Present mobiles
- Evaluations/Discussions

Assessment

The formal assessment for this unit is the rubric below.

	3	2	1	0
Conceptualization	Student produced a detailed and cohesive plan including 3 or more criteria they deemed necessary to create a balanced mobile and solve the design problem and meet the goal of balancing a mobile with moving parts.	Student produced a cohesive plan that includes at least 2 criteria they deemed necessary to create a balanced mobile and solve the design problem and meet the goal of balancing a mobile with moving parts.	Student produced a plan that had fewer than 2 criteria necessary they deemed necessary to create a balanced mobile and solve the design problem and meet the goal of balancing a mobile with moving parts.	No plan was completed or produced.
Use of the Elements & Principles of Art	Student produced a very effective mobile demonstrating exceptional use and awareness of balance, shape, space, variety, rhythm, and emphasis.	Student produced an effective mobile using balance, shape, space, variety, rhythm, and emphasis.	Student produced a mobile but had limited use of balance, shape, space,variety, rhythm, or emphasis.	There is no sense that any elements or principles of art were used or no mobile was created.
Scientific Knowledge & Understanding	Students mobile demonstrated an advanced understanding of balance and kinetics, including multiple balance points and attached in a manner so that nothing falls off under any environmental influences (wind or vibration).	Student's mobile demonstrated an understanding of balance and kinetics including a balance point and attached in a manner so that nothing falls off under any environmental influences (wind or vibration).	Student's mobile demonstrated a limited amount of balance and/or kinetics and some parts detached under environmental influences (wind and vibration).	There was no demonstration of balance or kinetics, no balance point, or mobile fell apart under environmental influences or no mobile was created.
Craftsmanship	Student's work demonstrates a high level of	Students work demonstrates good	Student's mobile is lacking good craftsmanship. It	There was no care taken in the production of the

	craftsmanship and attention to detail, no major defects or kinked wire. It is meticulous.	craftsmanship and attention to detail - clean, no major defects and few minor defects and no kinked wire.	lacks attention to detail, has some defects and kinked wires.	mobile or no mobile was created.
Using criteria to meet a goal	Student was able to follow their plan and anticipate and make revisions before they were needed to meet the goal of creating their mobile.	Student was able to follow their plan and make revisions as needed to meet the goal of creating their mobile.	Student was able to partially follow their plan and had difficulty making revisions as needed to meet the goal of creating their mobile.	The student was unable to follow a plan or make revisions to meet the goal of creating their mobile or no mobile was created.

Resources

Books

Greenfeld, Harold. *The Essential Alexander Calder*

Lipman, Jean. *Calder and His Magical Mobiles*.

Stone, Tanya Lee. *Sandy's Circus*

Websites

http://www.calder.org/

http://www.christies.com/Features/Alexander-Calder-7749-1.aspx

10 Things to Know About Calder

Videos

https://www.youtube.com/watch?v=QMFICm6Yyxw

https://www.youtube.com/watch?v=DScnuGhDuOc

https://www.youtube.com/watch?v=tYQD5jiQ62g&t=1s

Apps

https://www.nga.gov/education/kids/kids-mobile.html

Computer Program

3D Builder

Student's Begin Here - I Can

Session 1

Essential Question:

How do scientific principles and environmental factors affect design?

Session 1 - Let's Warm Up!

Look at Rouge Triomphant(Triumphant Red) by Alexander Calder.

Rouge Triomphant (Triumphant Red) (1959-1963) by Alexander Calder, via Gagosian Gallery

Questions

What do you see? What do you think? What do you wonder?

I see...

I think ...

I wonder ...

After sharing what they see, think, and wonder students will break into pairs and experiment with balance scales. Various items should be available for use. They can include but are not limited to coins, blocks, feathers, foam shapes, etc. They should explore the following ideas.

How do you get things to balance?
Do they need to be identical on both sides in order to balance?
Discuss symmetrical and asymmetrical balance.
What environmental factors could change how things balance?
Does motion come into play at all?

Session 2
Calder Stations

During this session, students will rotate through a minimum 3 stations in small groups or pairs. Each station will represent a different method for exploring information on Alexander Calder and his kinetic mobiles. There is a video station, book station, and an interactive, online link (https://www.nga.gov/education/kids/kids-mobile.html). Please see the Resource section for a list of videos and books. At the end of the rotations students will answer questions on the handouts and draw a sketch of the mobile they created using the interactive site
https://www.nga.gov/education/kids/kids-mobile.html

Name:_____ Date:_____
Class: _____

Alexander Calder

List 3 things you learned from the video or books about the Artist Alexander Calder.

1.

2.

3.

What is 1 question you would lke to ask Alexander Calder if you could?

Name: _____ Date:_____
Class:_____

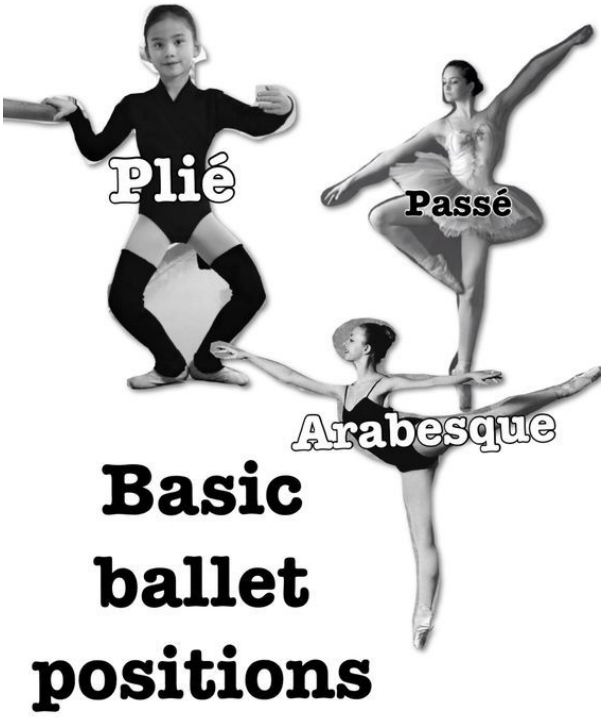
Draw a sketch of a 5 piece mobile you were able to blance using the Mobile Maker program.

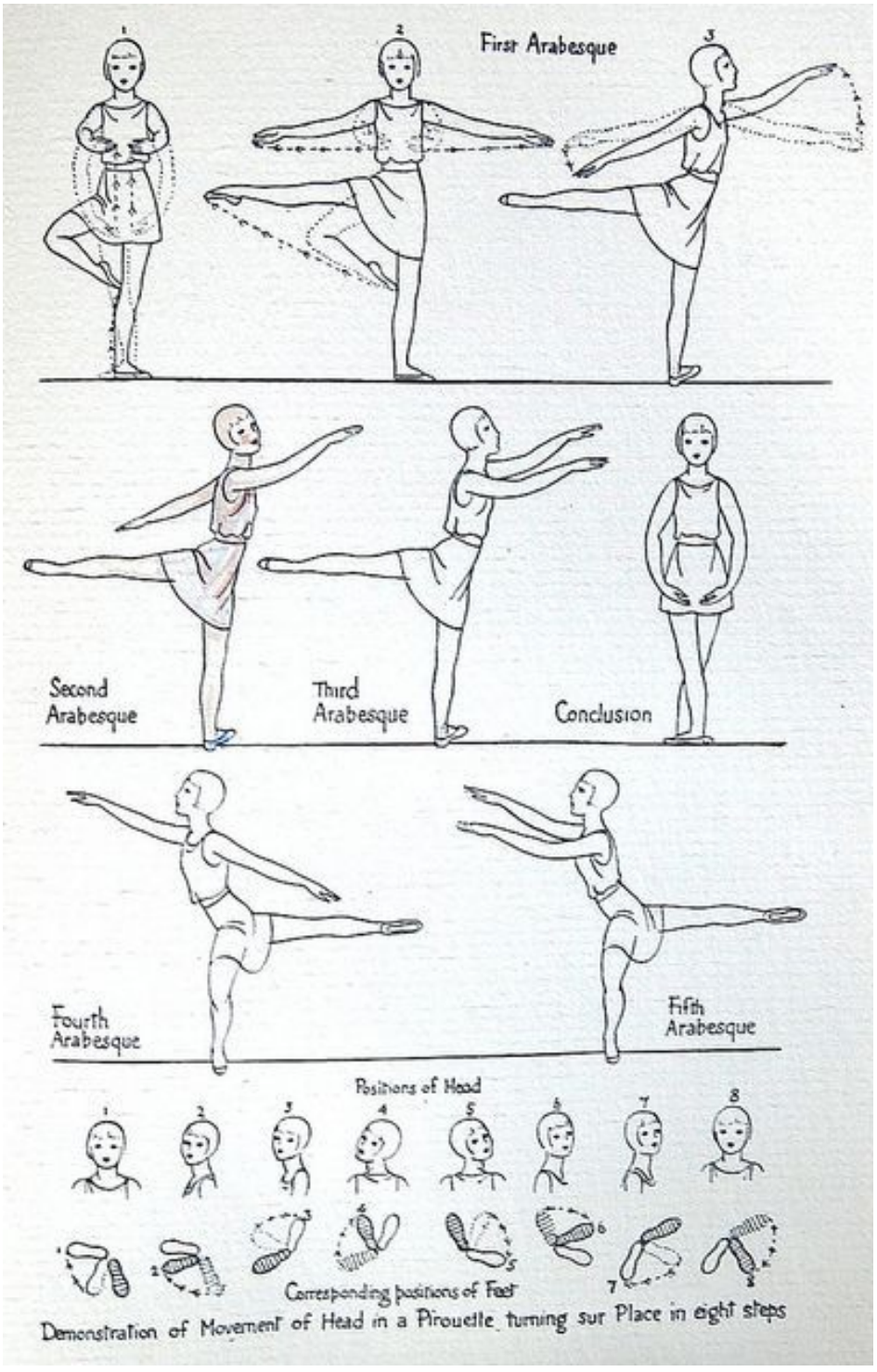
Session 3

Balance and Kinetics - Dance

Students can watch a video of some basic ballet moves. As they watch they should discuss how balance is achieved and how kinetic energy impacts the moves of the dancer. Students will then break into small groups with the handouts of some ballet poses. They should try the poses and compare/contrast them to the pieces in Calder's mobiles. How do the pieces in the mobiles dance? How is the use of balance and kinetics similar?

https://www.youtube.com/watch?v=j1DlCLj8Au8




First Arabesque
Second Arabesque
Third Arabesque
Conclusion
Fourth Arabesque
Fifth Arabesque
Positions of Head
Corresponding positions of Feet
Demonstration of Movement of Head in a Pirouette turning sur Place in eight steps

Mobile Challenge

You are now ready for the “Mobile Challenge.” Create a mobile like Alexander Calder. What criteria will you use to ensure that you create a mobile that will have moving parts? What constraints will you need to consider for your design problem? Use these criteria and constraints to develop a plan to meet the goal of creating a mobile. When you are done planning, create a prototype using pipe cleaners and foam shapes. Revise your mobiles. Will you use the **3D Builder** program in the next session? What materials will you use to create your mobile?

Name:_____ Date:_____
Class: _____

Alexander Calder - Mobile Design
Exit Ticket

Write an explanation for how your pipe cleaner and foam shape mobile is balanced.

Sessions 4 & 5

Now the students are ready to use the **3D Builder** program to print their shapes using the 3D printer. After a demonstration of how to use the program students can use the chromebooks if they chose to do so and will then take turns printing their pieces. If this takes more time than the session allows, students should print 1 piece and then the others can be printed and ready for the next session. As pieces are ready students should begin to assemble their mobiles. Additional supplies needed will be wire and pliers to shape and attach pieces. For students who have chosen other materials to create their mobiles they will create their parts and assemble them.

Session 6

This last session will be spent presenting mobiles to the class. At this point students can reflect on the processes they used as well as the success and/or difficulties they encountered along the way and any improvements or changes they could have made.