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| **Lesson Title:** Space Craft Construction |  |
| **Grade Level:** 4th  | **Quarter:** 3rd |
| **Science:** **S4E1**: Students will compare and contrast the physical attributes of stars, star patterns, and planets.d. Identify how technology is used to observe distant objects in the night sky.**Math:****MGSE4.NBT.4** Fluently add and subtract multi-digit whole numbers using the standard algorithm.**Technology:****4T1c1.** Students will describe and illustrate a concept or process using models, simulations, or concept-mapping software.**4T6b1**. Students will apply criteria for selecting an appropriate technology application for use with a learning activity.  |
| **Lesson Essential Question:** * How is technology used to observe distant objects?
* How can I add and subtract whole numbers to create a budget?
 | **Vocabulary:**PlanetSolar SystemSpace Technology  |
| **Lesson Materials**Toilet paper tubesPaper towel tubesCereal boxesMasking tapeBottle capsPlastic grocery bagsConstruction paperGlueStringPipe CleanersToothpicksCraft SticksPaper plates / bowlsCoffee Filters(Various other recycled materials such as plastic containers, etc.)Computers for creating owner’s manual | **Lesson Assessment:** Student STEM JournalTeacher ObservationsSpace Craft ModelBudget Sheet Completed Accurately- attached |
| **STEM Challenge Overview:**Students will design and build a model space craft to orbit and land on a distant object (one of Jupiter’s Moons Europa).Students will create an owner’s manual for operating the space craft using publishing software and accurately complete a budget sheet. |
| **Teacher Background:**Preview the videos beforehand to be sure they work. Students need some experiences with the planets before participating in this lab. Students will use a budget to build their space craft – suggested pricing is given on the budget sheet. A store will need to be set up so teams can purchase the materials needed to build their space craft. Other materials may be substituted. Each spacecraft will be dropped by the teacher standing in a chair to see if the designs land properly (not on its side) and does not break. |
| **INSTRUCTION** |
| 1. **Ask/Engage Day 1 (25 min)**
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| Share the video <http://youtu.be/3gMe3Xh3OnY> about the Hubble Space Telescope.Discuss how technology such as the telescope has allowed humans to observe distant objects in space. As technology increases what do you predict we will be able to see? Why is space exploration important?Show students the video 7 Minutes of Terror: <http://www.jpl.nasa.gov/video/?id=1090#fragment-2>About the landing of the Mars Rover Curiosity. Discuss with students the challenges of landing on another planet. Questions to consider:1. How has technology like the telescope and planetary rovers allowed humans to observe objects in space?
2. What technology would be needed to create a rover like these?
3. If you could design and build a craft to observe an object in space, what types of things would you want to observe? Where would you want to go?

Introduce the challenge and have students complete the ask/engage part of their student journal.**Challenge**: NASA is looking for a new space craft to orbit Jupiter’s Moon Europa. Your challenge is to design and build a model space craft which will orbit Europa and land safely on its surface. |
| 1. **Imagine/Brainstorm Day 1 (15-20 min)**
 |
| Introduce the constraints of the design plan. Define the criteria for success. Ask each student to work independently to come up with 1-2 possible design solutions. Students should draw/label their designs. **Criteria:**1. Model space craft is realistic and hand-made from recycled materials.
2. Owner’s manual detailing the components of the craft (ex: brochure, booklet, etc.)
3. Method for landing safely from orbit (ex: parachute) when dropped
4. Model craft includes a dish with antenna for sending data back to Earth
5. Model craft includes a name

**Constraints:**1. Craft is built within a $200 budget
2. Craft is less than 1 meter tall or 1 meter wide
3. Craft is completed within the allotted time frame.
 |
| 1. **Plan/Design Day 2 (25 min)**
 |
| Each student presents their ideas to their team. Student teams collaborate to come up with final design plan. Students draw final design plan and make a list of needed supplies. Remind students that they will need to remain within a $200 budget. Students will need the budget sheet to calculate the cost of their spacecraft. |
| 1. **Create / Test Day 2/Day 3 (60 min)**
 |
| Student teams build their design according to their design plan. As students build their craft, they should write the information for the owner’s manual. Students test their design plan and record data.  |
| 1. **Evaluate/Improve –** and repeat Steps 1-5 **Day 4 (30 – 45 min)**
 |
| Students evaluate their design for success. Did it meet the established criteria? Did their final design match their planned design? How would students improve their design?Students publish the owner’s manual for their space craft using software such as Microsoft Publisher, Google Docs, or other available software. Formats might include brochure, greeting card, flyer, etc. |

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 **STEM Challenge**

**4th Grade**

**Challenge**: NASA is looking for a new space craft to orbit Jupiter’s Moon Europa. Your challenge is to design and build a model space craft which will orbit Europa and land safely on its surface.

**Criteria:**

1. Model space craft is realistic and hand-made from recycled materials.
2. Owner’s manual detailing the components of the craft (ex: brochure, booklet, etc.)
3. Method for landing safely from orbit (ex: parachute) when dropped
4. Model craft includes a dish with antenna for sending data back to Earth
5. Model craft includes a name

**Constraints:**

1. Craft is built within a $200 budget
2. Craft is less than 1 meter tall or 1 meter wide
3. Craft is completed within the allotted time frame

**Materials: Cost:**

|  |  |
| --- | --- |
| 1 Toilet Paper Tube  | $10 |
| 1 Paper Towel Tube | $15 |
| 1 meter of masking tape | $20 |
| 1Cereal Box or piece of card board | $40 |
| 1 Craft Stick | $5  |
| 1 Toothpick | $1 |
| 1 Plastic Grocery Bag | $20 |
| 1 Sheet of Construction Paper | $5  |
| 1 Meter of string | $10 |
| 1 Piece of Tissue Paper | $20 |
| 1 Pipe Cleaner | $5 |
| 1 Paper plate  | $20 |

1. **ASK / ENGAGE:** What is the problem you are being asked to solve?

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1. **IMAGINE/BRAINSTORM:** What are some possible solutions to the problem that you are trying to solve? After you brainstorm, draw and label your ideas below.

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| --- | --- |
| **Idea #1** | **Idea #2** |

1. **PLAN/DESIGN:** Share your ideas with your group and collaborate to decide on a final design plan. Draw your team’s design below and make a list of the materials that you will need to complete your design.

|  |  |
| --- | --- |
| **Team Design Plan** | **Materials List** |

1. **CREATE/TEST**: Use your Final Design Plan to create and build your solution. Test your design. Did it meet all the criteria? Can your craft land safely from a distance of 5 feet? Why or Why not?

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1. **EVAULATE/IMPROVE:**  How well did your design work? Did your solution solve the problem within the given constraints?

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How can you improve your design? How can you make it better? Draw and label your improved design below.

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| --- |
| **Improved Design Plan** |

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5 10 15 20 25 30 35

40 45 50 55 60 65 70

75 80 85 90 95 100 110

120 130 140 150 160 170 180

190 200

**NASA**

**Spacecraft Budget- $200**

**Teacher:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Team #:\_\_\_\_\_\_\_\_\_\_\_**

 **Materials: Cost:**

|  |  |
| --- | --- |
| 1 Toilet Paper Tube | $10  |
| 1 small piece of foil | $15 |
| 1 meter of masking tape | $20 |
| 1 small Cardboard piece | $40 |
| 1 Popsicle stick | $5  |
| 1 Toothpick | $1 |
| 1 Plastic Grocery Bag | $20 |
| 1 piece of Construction Paper | $5  |
| 1 Meter of string | $10 |
| 1 Piece of Tissue Paper | $10 |
| 1 Pipe Cleaner | $5 |
| 1 Paper plate  | $10 |

***Directions:*** *Calculate your budget below. You only have $200 for both tests, so save some money for your improvements*.

**TEST 1 Budget**

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| **Material** | **Number****Purchased** | **Cost** |
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**Test 1** **Total:\_\_\_\_\_\_\_\_\_\_\_**

 **Materials: Cost:**

|  |  |
| --- | --- |
| 1 Toilet Paper Tube | $10  |
| 1 small piece of foil | $15 |
| 1 meter of masking tape | $20 |
| 1 small Cardboard piece | $40 |
| 1 Popsicle stick | $5  |
| 1 Toothpick | $1 |
| 1 Plastic Grocery Bag | $20 |
| 1 piece of Construction Paper | $5  |
| 1 Meter of string | $10 |
| 1 Piece of Tissue Paper | $10 |
| 1 Pipe Cleaner | $5 |
| 1 Paper plate  | $10 |

**Directions:** Improver your design and calculate your final budget below. Be sure to include cost for materials from test 1.

**Test 2 Budget**

|  |  |  |
| --- | --- | --- |
| **Material** | **Number****Purchased** | **Cost** |
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**Test 1 and 2** **Total:\_\_\_\_\_\_\_\_\_\_\_**

**Show below how much money you have left over from your $200 budget.**