



COSMIC CLUTTER: THE MISSION TO CLEAN UP SPACE DEBRIS

DURATION

8 Lessons
12–15 Class periods (50 min)

GRADE LEVELS

5–9

LESSON PLAN

OVERVIEW

In this unit, students will simulate a team chosen by Blue Origin to design and build a space debris mitigation system. Students will create proposals, submit designs, build a prototype, and then compete with other teams to see which team can collect the most space debris.

LESSON BREAKDOWN

- Lesson 1: Introduction to the Mission and Blue Origin
- Lesson 2: Introduction to Satellites
- Lesson 3: Space Debris Mitigation Systems
- Lesson 4: Team Mission Project Plan
- Lesson 5-7: Team Mission Design and Build
- Lesson 8: Competition

MISSION SETTING

There is a trail of space debris headed toward the International Space Station (ISS) because of a satellite collision. The ISS is key to enabling a sustainable future in space, and the astronauts on board are running low on supplies. Their supply ship will not be able to launch from Earth and dock with the ISS if the debris is not cleared. **Blue Origin has chosen your team to compete in a challenge: design a satellite to remove the debris endangering the ISS and save the astronauts on board.**

Success is crucial in this mission! Blue Origin can choose **only one satellite** to save the astronauts. You will be **competing against the other mission teams** to develop the most successful satellite to earn the contract. **Creating a more sustainable future in space now depends on you!**

MISSION IS COMPLETE WHEN...

- Prototype has been built
- Each team member has completed their tasks

STANDARDS

NEXT GENERATION SCIENCE STANDARDS (NGSS)

MSETS1-2

Evaluate competing design solutions based on jointly developed and agreed-upon design criteria using a systematic process to determine how well they meet the criteria and constraints of the problem.

MSETS1-3

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.

HS ETS 1-1

Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS ETS 1-2

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS ETS 1-3

Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

COMMON CORE: ELA**CCSS.ELA-LITERACY.W.6.2**

Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

CCSS.ELA-LITERACY.SL.6.5

Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.

CCSS.ELA-LITERACY.L.6.1

Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

CCSS.ELA-LITERACY.L.6.2

Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

CCSS.ELA-LITERACY.L.6.3

Use knowledge of language and its conventions when writing, speaking, reading, or listening.

LESSON 01: INTRODUCTION

15 min	Slides Student Mission Packet Student Notes Packet	(Slide 1-2) - Introduce the new unit to students. (Slide 3) - Go over the learning objectives. - Pass out the student mission packet. (Slide 4) - Have students flip to the “Mission Overview” and “Mission Prompt” in their packet. You can either read it to students or call on different students to read it aloud. (Slide 5) - Depending on your students, you can either have them read through the packet themselves, or you can go through the packet together calling on students to read key parts. (Slide 6) - Go over key parts of the project. - Answer any questions students might have afterwards. (Slide 7) - Overview of project timeline, in the notes section of the slides, you will find the link to the document in Canva. You can adjust the timeline accordingly.
15 min	Student Mission Packet Video on Blue Origin Student Notes Packet	(Slide 8) - To understand more about this topic, we are going to learn some background information about space, why we go there, and some baseline vocabulary. We will be introducing Blue Origin, a space company, and what they are doing to make space more sustainable and how that could benefit us here on Earth. (Slide 9) - Show the 9 min video. If you find your students cannot sit through a 9 min video or the video isn’t suitable for them, use this shorter version instead https://www.youtube.com/watch?v=1YOL89kY80g&list=PLAXaf_0Jgf8E-M7KkYwcgcOE0t-fvaCI5N&index=8 (Slide 10) - Blue Origin’s vision is to have millions of us living and working in space for the benefit of Earth. We need to build a road to space. (Slide 11) - To do that, we must reduce the cost of going to space. - We need to utilize space resources, so we don’t deplete the ones on Earth. - And we will need multiple generations to do it. This means we need you all to help build that road to space.
20-30 min	Student Mission Packet Student Notes Packet	(Slide 12) - So now we are going to talk about sustainability, what does it mean to make something sustainable? (Slide 13) - Tell students to go to page 1 in their notes packet titled “Lesson 1: What is Blue Origin? What is Sustainability?” - They will take notes as you go through the slides. (Slide 14) - Have students in their table groups think of a definition for sustainability and 2-3 examples. - Have students share out after 3 minutes. They can share one example per group. Make sure their example does not match one that has already been shared. (Slide 15) - Go over the definition of sustainability with students. Have students put it in their own words and fill in their handout.

		15. (Slide 16) - Have students in their table groups think of a definition for space sustainability. - Call on groups to share their definitions. 16. 6. (Slide 17) - Go over the definition of space sustainability with students. Have students put it in their own words and fill in their handout. 17. (Slide 18) - Show 1 min 44sec video on Blue Origin's sustainability efforts. 18. (Slide 19) - How is Blue Origin making space more sustainable? Reusable rockets, reusable engines, cleaner fuel, harnessing and utilizing in-space resources. Blue Origin's New Shepard runs on liquid hydrogen and liquid oxygen. Anyone know what is made when we burn that? WATER! 19. (Slide 20-23) - So, let's go back and talk about why we even go to space. What are some reasons we go to space? Take some hands and then go over the slides. 20. (Slide 24-25) - What is in space that might interest us? Take some hands. Then go over slide 25.
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LESSON 02: INTRODUCTION TO THE PROBLEM: SATELLITES

TIME	MATERIALS	ACTIVITY
5 min	Slides Student Mission Packet Student Notes Packet	1. (Slide 26) - Today we are going to introduce the central problem your project will be trying to fix. 2. (Slide 27) - Go over the learning objectives. 3. (Slide 28) - Overview of project timeline, in the notes section of the slides, you will find the link in the document in Canva. You can adjust the timeline accordingly. - Have students take out the notes packet and turn to lesson 2 and take notes.
45 min	Slides Student Mission Packet Student Notes Packet	4. (Slide 29) - Can anyone tell me what a satellite is? *The definition comes up upon clicking so don't click until you have taken a few hands to answer. 5. (Slide 30) - Give examples of satellites. Have students think of some other examples. 6. (Slide 31) - Can anyone tell me what we use satellites for? 7. (Slide 32) - Go over some examples. 8. (Slide 33) - The satellites we put up in space have different paths or orbits depending on what they are used for 9. (Slide 34) - There are two main paths. One where the satellites orbit Earth around the equator (west to east) and one where they orbit around the poles (south to north). 10. (Slide 35) - Equatorial orbits are what we call the ones that orbit around the equator. - They rotate the same way as the Earth.

		11. (Slide 36) - Polar orbits are the ones that go around Earth's poles. These can cover more of Earth's surface because they are opposite of Earth's rotation. 12. (Slide 37) - Take a look at this video showing how this works. - Turn and talk to a partner, why would we want to use polar orbits instead of equatorial orbits or vice versa? 13. (Slide 38) - Go over benefits of polar orbits. 14. (Slide 39) - So now that you've learned a little about satellites, what possible problems do you see with them? 15. (Slide 40) - Yes, we are creating a lot of space junk that is orbiting Earth right now. We send more satellites up into orbit than we take down. - As of 2024, there are 28,300 satellites in space, and this doesn't even account for the broken ones, where there are just pieces orbiting Earth. - This is becoming a problem. If we want to keep space sustainable, we must fix this. 16. (Slide 41) - With more things in Low Earth Orbit (which is where the satellites are), there are more chances of a collision happening with space debris. - Take a look at some collisions we have had in the past. 17. (Slide 42) - Go over space collisions. 18. (Slide 43) - Watch video on the power of space debris. Video talks about how at greater speeds, something small can have greater impact. Play video from 0:58 to 2:04. 19. (Slide 44) - Go over slide 20. (Slide 45) - Go over slide 21. (Slide 46) - There are two ways we have gone about this; one is to clean it up or remove it completely. The other way is to mitigate it, which means making it less of a problem by reducing the severity of it. - We are going to discuss ways organizations are trying to do this. 22. (Slide 47) - But before that, I want you at your tables to brainstorm ways you think we could clean up space debris. 23. (Slide 48-51) - Go over each of the clean-up methods. 24. (Slide 52) - See if groups made any correct guesses
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LESSON 03: SATELLITE RESEARCH

TIME	MATERIALS	ACTIVITY
5 min	Slides Student Mission Packed Student Notes Packet Poster board and art supplies	You can now break students into their teams of three for the mission. Or you can have students continue in their table group and break them up when you start the project. For team selection, you can introduce the roles and have students rank roles they want, and you can put them into teams, or you can randomly assign teams of three and have students select roles.

		(Slide 53) - Today you will go more in depth with the satellite clean up methods we talked about yesterday. (Slide 54) - Go over the learning objectives. (Slide 55) - Go over project timeline (Slide 56) - Before a space mission takes place, research is conducted to ensure the mission's success. Companies must also do a lot of research to win space contracts from places like NASA. - You will be doing the same thing. Before you come up with your own space debris clean up prototypes, you must understand what has already been done, what the pros and cons are of those methods, and why they haven't completely solved the problem. - I will assign your method to you. (Slide 57) - In your packets, flip to Satellite research. You will be writing down all of your notes here. - Make sure you have at least three sources. - You will create a presentation. - Your presentation must: - Explain what your method is - Have some sort of visual (poster, PowerPoint, etc.) - Include all of the things you researched - Everyone in the group must speak - Rest of class they will be doing research and creating their presentations
30 min	Slides Student Mission Packet Student Notes Packet	(Slide 58) - Go over guidelines for their presentations. Give students time to gather materials and get ready for their presentations. - Students will take notes on other groups' presentations in the handout titled "Lesson 3: Satellite Research Notes".
20 min	Slides Student Mission Packet Student Notes Packet	(Slide 59-60) - Go over the summary of satellites. (Slide 61) - Kahoot to go over what students have learned. https://create.kahoot.it/details/fd9644cb-4a51-434f-a8e5-068a7066fa11 (Slide 62) - Students go to Kahoot.it and put in the code. - Top three students get extra credit points added to their projects. At this point, if teams have not been chosen, break students into groups of three. For groups, you can introduce the roles and have students rank roles they want, and you can put them into teams, or you can randomly assign teams of three and have students select roles.

LESSON 4 – 7: MISSION

TIME	MATERIALS	ACTIVITY
50 min	Slides	1. (Slide 63-64)

	Student Mission Packet Student Notes Packet Graph Paper	- Go over the learning objectives. 2. (Slide 65) - Go over project timeline. 3. (Slide 66-67) - You are going to officially begin your mission today. - Your goal is to fully understand all of your mission objectives by the end of the period. - As a group, read over pages 3 (Mission Overview), 4 (Mission Prompt), and 5 (Competition Details) of your mission packet. 4. (Slide 68) - Come back together as a class and go over the basics of their mission. 5. (Slide 69) - Remaining class period should be spent as work time. - They must turn in 2-3 detailed sketches by the end of class. - Come up with a team name. 6. (Slide 70) - Design sketch must include: - Prototype sketch - Possible materials - Pros and cons of your design - Label all parts - Include different angles If you need an extra lesson on how to draw a detailed engineering design, you can add in this lesson: https://www.teachengineering.org/activities/view/cub_detdrawings_lesson01_activity1
50 min	Slides Student Mission Packet Student Notes Packet Building supplies as listed	7. (Slide 71-72) - Today, you'll be choosing a design, going over your budget, and purchasing materials. - Go over the learning objectives. 8. (Slide 73) - Go over project timeline. 9. (Slide 74) - Go over budgeting rules. - All contracts for space have a certain budget. Companies must try to stay within those budgets, otherwise, they need to find extra funding, or their profits may be reduced. 10. (Slide 75) - Go over available materials and their cost. - The table in their packets have blank spots for your customization. Feel free to add or remove materials. - Students have until the end of the period to purchase at this price. They can purchase more later but at an increased rate. (1.5x) 11. (Slide 76) - Go over slide. - Rest of the period is work time. - Mission designers bring up their completed sheet. Double check it, give them materials, then sign off on the bottom.
50 min	Slides Student Mission Packet Student Notes Packet Building supplies as listed	12. (Slide 77-80) - These are periods where students need to work on individual tasks as well as building their prototype. - You can add more work days if you feel your students need them. - Each slide has a progress meter and objectives to fulfill by the end of the period to keep students on track. - Students might also purchase more materials or do extra credit assignments to increase their budget.

50 min	Slides Student Mission Packet Student Notes Packet Building supplies as listed	13. (Slide 81) • As engineers, the most important thing to do with any design and build is to test and rebuild. • Today they should be testing their prototypes and then rebuilding and fixing as needed. • In the classroom, you might want a testing area with objects like the ones they will be picking up on competition day, so they can test their prototypes. • If you feel it is needed, you can add two test and rebuild days. • Remind students to practice blindfolded and pick the teammate who will be giving them directions.
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LESSON 8: COMPETITION

TIME	MATERIALS	ACTIVITY
50 min	Slides Student Mission Packed Student Notes Packet Competition materials	1. (Slide 83-84) • Today will be competition day. • Go over the learning objectives. 2. (Slide 85) • Go over project timeline. 3. (Slide 86) • Go over competition guidelines. • Have a competition area that is open and have different objects for them to pick up. • Have 2-4 groups go at a time, depending on how many groups your classroom has. You want enough groups going at the same time where space is a bit of a challenge, but you also want to be able to watch the groups. • Groups that are not participating are on the sidelines as judges. They are watching for the person operating the prototypes to not bump into other groups, to stay blindfolded, and to not bend at the waste. 4. (Slide 87) • Go over items and their point values. • You can add items or take them out depending on what you have around. • Objects that are heavier and oddly shaped have the most point values. 5. (Slide 88) • After the competition, have students clean up. • If any of the group's salesperson wanted to present their pitch to the class, this is a good opportunity for that. • They should each be completing the conclusion portion of their mission packets. • You can either give them the next period to type up their conclusions and turn them in or have them finish it for homework.

STUDENT NOTES PACKET

Name: _____ Period: _____ Date: _____

LESSON 1: WHAT IS BLUE ORIGIN? WHAT IS SUSTAINABILITY?

1. Sustainability: _____

2. Space Sustainability: _____

3. Blue Origin Sustainability Initiatives:

a) _____

b) _____

c) _____

d) _____

4. Why Do We Go to Space?

a) _____

b) _____

c) _____

d) _____

e) _____

5. Space consists of _____ and _____ matter.

• Examples of _____ matter:

- _____
- _____
- _____
- _____
- _____

• Examples of _____ matter:

- _____
- _____
- _____
- _____

Name: _____ Period: _____ Date: _____

LESSON 2: WHAT IS A SATELLITE?

1. A _____ is an object that moves around a larger object.
2. The 4 main purposes of a satellite are:
 - a) _____
 - b) _____
 - c) _____
 - d) _____
3. There are different _____, or paths, that a satellite may take depending on its purpose.
4. _____ orbits revolve around the equator of the Earth.
5. _____ orbits revolve around the poles of the Earth.
6. _____ orbits are commonly used by GPS, communication, and weather satellites due to their need to observe as much of the Earth's surface as frequently as possible.
7. What percentage of active satellites are in the common polar orbit, LEO? _____
8. What is the average speed of a satellite in LEO? _____
9. Space Debris Mitigation Methods: Draw a line to match the mitigation method with the definition.

Nets could be deployed to catch and retrieve large pieces of debris.	Magnetic Force
Lasers stationed on the ground are in development to use high energy beams to deflect, or push, small debris pieces from hitting an object on the same path.	Net Capture
In-orbit satellites equipped with magnets could be used to attract or repel out-of-service satellites or debris.	Claw Capture
A claw-shaped satellite could retract its arms to capture not operational satellites and large debris.	Laser Detection

Name: _____ Period: _____ Date: _____

LESSON 3: SATELLITE RESEARCH

Group member names:

Mitigation Method:

Summary of Method:

Pros and Cons of Method (at least 3 each):

Pros	Cons

Sources:

1. _____
2. _____
3. _____

Name: _____ Period: _____ Date: _____

LESSON 3: SATELLITE RESEARCH NOTES

Take notes on each method as the groups present.

Mitigation Method:

Summary of Method:

Diagram:

Pros:

Cons:

Mitigation Method:

Summary of Method:

Diagram:

Pros:

Cons:

Name: _____ Period: _____ Date: _____

Mitigation Method:
Summary of Method:

Diagram:

Pros:

Cons:

Mitigation Method:
Summary of Method:

Diagram:

Pros:

Cons:

STUDENT NOTES PACKET **KEY**

Name: _____ Period: _____ Date: _____

LESSON 1: WHAT IS BLUE ORIGIN? WHAT IS SUSTAINABILITY?

1. Sustainability: avoidance of the depletion of natural resources to maintain an ecological balance.
Sustainability means using resources in a way that meets our needs today without using it all up so
future generations cannot use it.
2. Space Sustainability: Space sustainability is the effort to use space and Earth-friendly resources to
protect our environment from long-term damage.
3. Blue Origin Sustainability Initiatives:
 - a) Reusable Rockets
 - b) Reusable Engines
 - c) Cleaner Fuel
 - d) In-space resource utilization
4. Why Do We Go to Space?
 - a) To discover what's around us
 - b) Understanding Earth's history
 - c) Tourism
 - d) Develop New Technology
 - e) Harness space materials and preserve Earth's resources
5. Space consists of Natural and Man-Made matter.
 - Examples of Natural matter:
 - Stars
 - Planets
 - Comets/Asteroids
 - Black holes
 - Galaxies
 - Examples of Man-Made matter:
 - Telescopes
 - Rockets
 - Rovers
 - Satellites

Name: _____ Period: _____ Date: _____

LESSON 2: WHAT IS A SATELLITE?

1. A Satellite is an object that moves around a larger object.
2. The 4 main purposes of a satellite are:
 - a) Communications
 - b) Observations/Imaging
 - c) Navigation
 - d) Scientific
3. There are different orbits, or paths, that a satellite may take depending on its purpose.
4. Equatorial orbits revolve around the equator of the Earth.
5. Polar orbits revolve around the poles of the Earth.
6. Polar orbits are commonly used by GPS, communication, and weather satellites due to their need to observe as much of the Earth's surface as frequently as possible.
7. What percentage of active satellites are in the common polar orbit, LEO? 88%
8. What is the average speed of a satellite in LEO? 17,000 miles per hour
9. Space Debris Mitigation Methods: Draw a line to match the mitigation method with the definition.

Nets could be deployed to catch and retrieve large pieces of debris.

Lasers stationed on the ground are in development to use high energy beams to deflect, or push, small debris pieces from hitting an object on the same path.

In-orbit satellites equipped with magnets could be used to attract or repel out-of-service satellites or debris.

A claw-shaped satellite could retract its arms to capture not operational satellites and large debris.

Magnetic Force

Net Capture

Claw Capture

Laser Detection

STUDENT MISSION PACKET

TABLE OF CONTENTS

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7. MISSION DESIGNER TASK
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9. STRUCTURAL ENGINEER TASK
10. CONCLUSION

MISSION OVERVIEW

MISSION PROMPT

Blue Origin has selected your team to compete for the chance to develop a unique space debris mitigation system to save the ISS and astronauts on board. You will have three days to brainstorm, design, and build your system with a budget of \$300 million. Throughout the process, your team will have the opportunity to earn additional budget by participating in extra-credit activities. The final competition will require one person from your team to maneuver your prototype around the classroom, competing with your classmates to design the most successful satellite. The team with the most points will be awarded the contract from Blue Origin. Your time begins now!

ROLES AND RESPONSIBILITIES

Mission Designer

Using the mission design worksheet, keep track of your team's budget, points, materials, and quantities. Write a description of your satellite, including what materials you used, what design you chose, and why.

Salesperson

Choose from a list of marketing strategies such as a logo, mission patch, sales pitch, infomercial, advertisement, or infographic to convince the Blue Origin sales team why your satellite team should be awarded the contract.

Structural Engineer

Using the materials purchased, build your team's design. Additionally, you are responsible for submitting a drawing of your team's final design concept, labelling the materials used.

SCORING SYSTEM

Earning Points:

Collecting Debris
Leftover Budget
Extra Credit Activities

Losing Points:

Satellite Crashing
Unfinished Satellite
Incomplete Tasks

SUMMARY

Think Sustainably

- Design a debris mitigation satellite
- Objective: earn the most points
- Leftover Budget = + Points
- Budget: \$300M
- Time Constraint: 3 days

MISSION TIMELINE

L1: What is Blue Origin / Space Sustainability?
L2: What is a satellite?
L3: Satellite Research
L4: Mission Introduction
L5: Budgeting and Supplies
L6: Work Day

RECORD KEEPING

Your team is responsible for keeping track of supplies and quantities during your build, as well as keeping an count of any additional points, budget, or deductions.

COMPETITION

On competition day, satellites must be able to be controlled above the knees. Satellite maneuverers may not bend down to collect debris. Be creative! Think simple machines.

MISSION PROMPT

COSMIC CLUTTER: THE MISSION TO CLEAN UP SPACE DEBRIS

There is a trail of space debris headed toward the International Space Station (ISS) because of a satellite collision. The ISS is key to enabling a sustainable future in space, and the astronauts on board are running low on supplies. Their supply ship will not be able to launch from Earth and dock with the ISS if the debris is not cleared. **Blue Origin has chosen your team to compete in a challenge: design a satellite to remove the debris endangering the ISS and save the astronauts on board.**

Success is crucial in this mission! Blue Origin can choose **only one satellite** to save the astronauts. You will be **competing against the other mission teams** to develop the most successful satellite to earn the contract. Creating a more sustainable future in space now depends on you!

COMPETITION DETAILS

COMPETITION OVERVIEW:

On the final day of this project, teams will participate in a competition, racing to **collect the most debris under a time constraint**. The team with the most points will be granted the satellite contract to save the ISS and astronauts.

Your classroom floor will be scattered with debris such as pencils, wadded paper, and other classroom objects. Your satellite must be able to pick up these objects. **Small or heavy objects (ex. pencils) will earn more points than big and light objects (ex. paper wads).**

A satellite cannot operate itself. It relies on programming to steer toward its target. Teams will have one **blindfolded** satellite operator, while one person from the team works to verbally navigate the satellite from the sidelines. Remember, **crashing into another satellite is mission failure!** Satellites who bump into one another will each lose points.

COMPETITION SPECIFICS:

1. Points can be earned and deducted throughout satellite testing and competition.
2. Satellites must be operated from above the knees. No bending down to collect debris.

RULES AND BUDGETING

BUDGETING RULES:

1. Each team will start with a budget of **\$300 million**.
2. You are not required to spend all of your budget.
3. Leftover budget will be rewarded with bonus points.
4. You can earn a budget increase through extra credit activities.
5. You may not exceed your budget.
6. Purchasing supplies after the deadline will result in a 1.5x increase of the original price.

PRICING GUIDE

\$1 Million	\$5 Million	\$25 Million	\$50 Million
1 sheet of paper	1 sheet of cardstock	1 pair of scissors	1 sq. foot of cardboard
1 straw	1 popsicle stick	1 stapler	-
1 index card	1 foot of string	1 glue stick	-
1 rubber band	1 foot of clear tape	1 foot of duct tape	-

SCORING GUIDE

BASE ACTIVITIES	POINTS
Satellite Completed	_____ /10
Team Participation	_____ /10
Mission Designer Tasks Completed	_____ /10
Salesperson Tasks Completed	_____ /10
Structural Engineer Tasks Completed	_____ /10
Staying Within Budget	_____ /10

COMPETITION	POINTS
Low-Difficulty Debris Collected	_____ /10
High-Difficulty Debris Collected	_____ /10
Per \$10 Million Leftover Budget	_____ /10
Satellite Collision	_____ /10

EXTRA CREDIT ACTIVITIES	POINTS (CIRCLE)
Kahoot Winners	+ 3
Video Reflection	+ 5
Job Search	+ 5
Research Project	+ 10

Total Score: _____ / 70

EXTRA CREDIT ACTIVITIES

Teams may increase their budget or earn points by participating in the following extra credit activities.

1. Kahoot Winners // \$10 Million + 3 Points

2. Video Reflection // \$25 million + 5 Points

- a. Find a ~10 minute long video related to a topic covered in this lesson. Then, write a 300 word analysis of something you learned from the video. Possible writing topics include a new idea for a space mission and how it relates to the video, a reflection on why the topic is important, or ways that you can apply this knowledge to other aspects of your life.

3. Job Search // \$25 million + 5 Points

- a. Research a job related to the space industry. Then create a simple resume application for the job including the following:
 - i. Job title and description
 - ii. Companies that hire this role (not currently, just generally)
 - iii. This role's average salary
 - iv. Skills which would make you a good candidate and why
 - v. Any experience or extracurriculars which would make you a good candidate

1. Research Project // \$50 million + 10 Points

- a. Conduct research on any satellite-focused space mission of your choosing. Then, deliver a 7-8 slide presentation including at minimum the following:
 - ii. What was the mission? What was the purpose?
 - iii. Was the mission successful?
 - iv. What did the space industry learn from this mission?
 - v. What can people learn from this mission?

MISSION DESIGNER TASK

PROMPT

Write a 1-page typed description of your finalized satellite, including what materials you chose, what design you chose, and why. Discuss inspiration you pulled from the mitigation methods learned in the lesson, pros/cons from those designs, and how you utilized them in your final design.

MISSION DESIGNER WORKSHEET

Using the mission designer worksheet, keep track of your team's budget, bonus points, materials, and quantities.

Bonus Activity Description	Points

NOTE: Items purchased after the deadline cost **1.5x** their original cost.

Material Purchased	Cost Per Unit	Quantity	Total Cost

Total Score: _____ Remaining Budget: _____ Teacher Initials: _____

SALESPERSON TASK

PROMPT:

Your team has been given the opportunity to design a satellite prototype to save the astronauts aboard the International Space Station. To win this contract, your satellite not only has to perform optimally, but must also be properly marketed to the sales team at Blue Origin who will ultimately decide who they will award the contract and funds to build the satellite. As the salesperson of your team, you are responsible for creatively marketing and pitching your satellite design.

You may choose from any of the following three options:

1. Invent a logo or mission patch for your satellite mission and write a brief ~200-word typed summary detailing the features of your logo or patch design.
 - a. Include key features of your satellite design, mission purpose, and any other detail that is unique to your system. Be deliberate in choice making such as color, shape, and featured aspects, and justify these choices in your summary.
2. Create a 1-2 minute sales pitch or infomercial for your satellite.
 - a. Your intended audience is the Blue Origin sales team. Include the cost of your satellite, physical features, materials required for your design, what makes your satellite unique, and credit to any inspiration your team pulled from debris mitigation methods. You may deliver this live to your classmates, or you may record and edit a video.
2. Design an advertisement or infographic for your satellite.
 - a. Using paper or digital tools, design an eye-catching advertisement or infographic. Include a sketch with added focus on the unique features of your satellite. Why should your team be given the contract? Is it due to low cost? High effectiveness? Sustainable features?

STRUCTURAL ENGINEER TASK

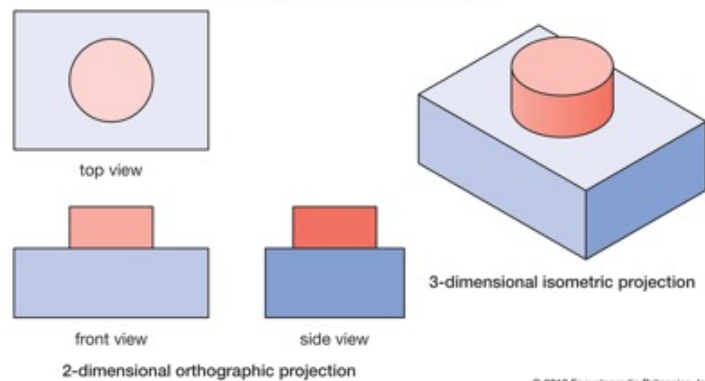
PROMPT:

Using the materials purchased, construct your team's design.

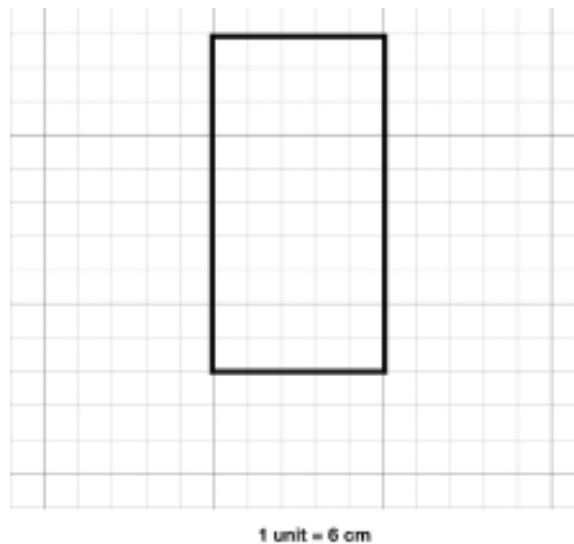
Additionally, you are responsible for completing a drawing of your team's final design concept. Briefly conduct research over engineering drawings, scaling, and different views. Utilize these skills and knowledge in your drawing by choosing either an isometric or orthographic view, labeling the materials used and various aspects of your design (ex. handle, pulley, clamp, etc), including a sizing scale.

Sketch View Examples:

Orthographic and isometric projections of an object



Sketch Scaling Example:



Conclusion

Note: Each team member should complete this task individually after all individual tasks are completed and your satellite has been experimentally tested in the final competition.

Prompt: Type 1-2 pages, chronologically document the design process.

Consider the following topics:

1. What was your team's initial design?
2. Did the final product turn out as planned?
3. How did your material selection affect your team's design?
4. How did your satellite perform in the final competition?
5. What were your limitations (budget, supplies, design, time, etc.).
6. What did your team struggle with?
7. What was a success?
8. What changes would you make?
9. What did you learn from this experience?