

## SPACEGATE STATION VIDEO SERIES

### Flight of the Pegasus



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## EPISODE SUMMARY

A group of Starfleet cadets begins a research mission aboard the shuttle *Pegasus*, using advanced systems such as propulsion, navigation, and life support. The mission quickly escalates when they encounter a powerful **gravitational anomaly** that disrupts their motion, causing uncontrolled acceleration and severe system failures, including overheating and loss of life support stability. This situation provides a realistic context for understanding how gravity and energy affect motion and engineered systems in space.

To survive, the cadets rely on **scientific inquiry and engineering problem-solving**, using sensor data to analyze the anomaly and diagnose system damage. They apply key science practices, observation, data analysis, and testing, to stabilize the spacecraft, demonstrating how real scientists and engineers respond to complex problems using evidence-based reasoning and teamwork.

The crisis intensifies when the anomaly causes a **temporal displacement**, sending the crew to the early 21st century. With limited resources and outdated technology, they must repair their advanced ship while considering the consequences of altering the timeline. This introduces systems thinking and ethical decision-making, highlighting how changes in one system can impact others.

Using **engineering design principles**, the cadets identify materials, adapt available tools, and perform complex calculations to restore their propulsion system and navigate back to their proper time. Throughout the episode, students engage with key science concepts, including:

- **Energy transfer and transformation** (heat, radiation, propulsion)
- **Gravity and motion** (effects on trajectory and speed)
- **System interactions** (how failures affect connected systems)

Ultimately, the crew succeeds through **collaboration, logical reasoning, and persistence**, reinforcing that scientific problem-solving involves trial, revision, and teamwork.

**Core Instructional Focus:** This episode supports instruction by allowing students to:

- Apply **scientific inquiry and problem-solving skills**
- Analyze **energy transformations and system failures**
- Understand **gravity's impact on motion in space**
- Explore **engineering design and troubleshooting**
- Distinguish between **real science and science fiction**
- Develop **teamwork, decision-making, and resilience**

## Florida Science Standards Alignment

SC.7.N.1.1 – Define problems, collect data, analyze and communicate solutions

SC.7.N.1.3 – Distinguish between empirical evidence and opinion

SC.6.E.7.9 – Effects of gravity on motion and objects in space

SC.7.P.10.1 – Energy transfer through waves and radiation

SC.7.P.11.2 – Energy transformations between forms

SC.6.P.13.1 – Identify different forms of energy

SC.6.N.1.4 – Use tools to collect and analyze data

5E Phase	Primary Standards
Objective	SC.7.N.1.1, SC.7.N.1.3
Engage	SC.7.N.1.1, SC.6.N.1.4, SC.6.E.6.1
Explore	SC.7.P.10.1, SC.7.P.11.2, SC.6.P.13.1, SC.6.E.7.9
Explain	SC.7.N.1.3, SC.7.N.3.2, SC.6.N.2.2
Elaborate	SC.7.N.1.1, SC.7.P.11.2, SC.6.P.12.1
Evaluate	SC.7.N.1.1, SC.7.N.1.6, SC.6.N.1.5

## **Lesson Plan: "Pegasus" – Science & Engineering Integration**

**Objective:** Students will identify scientific concepts in the video and connect them to real-world science principles.

**Engage (10 min):** **SC.7.N.1.1; SC.6.N.1.4; SC.6.E.6.1**

- (00:00:00 – 00:01:25) Show opening distress call. Ask students to list observed technologies and systems.

**Explore (15 min):** **SC.7.P.10.1; SC.7.P.11.2; SC.6.P.13.1; SC.6.E.7.9**

- (00:05:08 – 00:08:45) Have students work in groups to identify examples of energy, gravity, motion, and problem-solving.

**Explain (15 min):** **SC.7.N.1.3; SC.7.N.3.2; SC.6.N.2.2**

- (00:08:45 – 00:12:00) Teacher explicitly connects scenes to standards and corrects misconceptions.

**Elaborate (20 min):** **SC.7.N.1.1; SC.7.P.11.2; SC.6.P.12.1**

- (00:12:00 – 00:21:30) Students draw and label a system diagram (energy flow or propulsion).

**Evaluate (10 min):** **SC.7.N.1.1; SC.7.N.1.6; SC.6.N.1.5**

- (00:21:30 – 00:27:30) Students complete written responses and exit ticket.

## Discussion Questions

Aligned to First Five Science Areas – sample responses can be found in the teacher suggested answer key on next page.

### 1. Nature of Science (SC.7.N.1.1, SC.7.N.1.3)

**How did the crew use scientific inquiry to understand and respond to the problem?**

- What evidence did they collect?
- How did they use that evidence to make decisions?
- Did their ideas change as they gathered more data?

### 2. Physical Science – Energy (SC.7.P.10.1, SC.7.P.11.2, SC.6.P.13.1)

**What forms of energy are present during the mission, and how do they change?**

- Identify examples of at least two different forms of energy
- How does energy transfer or transform within the ship's systems?
- How does energy contribute to system failure?

### 3. Earth & Space Science – Gravity and Motion (SC.6.E.7.9)

**How does gravity affect the movement of the ship during the anomaly?**

- What happens to the ship's speed and direction?
- Why does the ship lose control?
- How is this like real gravitational effects in space?

### 4. Engineering & Technology (SC.6.N.1.4, SC.7.N.1.1)

**How did the crew use engineering and technology to repair the ship?**

- What steps did they take to diagnose and fix the problem?
- What tools or systems did they rely on?
- How is this like how engineers solve problems in real life?

### 5. Scientific Application / Real vs. Fictional Science (SC.7.N.1.3, SC.6.N.2.2)

**Which parts of the episode are real science, and which are science fiction?**

- Give examples of each
- Why is it important to tell the difference?
- How does science fiction help us learn about real science?

## Teacher Answer Guide

**1. Nature of Science Expected Answer:** Students should explain that the crew followed a process like scientific inquiry:

Observed a problem (ship losing control, system failure), Collected data (sensor readings, diagnostics), Analyzed information (gravity anomaly affecting motion) and Tested solutions (repairs, navigation adjustments). **Key Teaching Point:** Science is **not a single step**, but a process involving testing and revision.

**2. Physical Science – Energy: Correct Answers:** Students should identify at least two:

Thermal energy (heat) – overheating systems, Kinetic energy (motion) – ship acceleration, Radiant energy (radiation) – signals, energy fluctuations. **Key Teaching Point:** Energy is constantly **transferred and transformed**, especially in systems under stress.

**3. Earth & Space Science – Gravity and Motion: Expected Answer:** The **gravitational anomaly** acts like a strong gravity well.

It causes Increased acceleration, Loss of control (trajectory disruption), and Difficulty slowing down or stopping. **Key Teaching Point:** Gravity is a **force that directly affects motion**, even in empty space.

**4. Engineering & Technology: Expected Answer:** Students should describe an engineering problem-solving process:

Identify system failure, diagnose cause, develop repair plan, Test and adjust. **Examples from Episode include** Repairing propulsion systems, using sensors and computers, Replacing, or fixing damaged components. **Key Teaching Point:** Engineering is about **solving problems using design and testing**.

**5. Scientific Application / Real vs. Fictional Science:**

**Real Science:** Students may include Gravity affecting motion, Energy transfer and heat buildup or Use of sensors and data.

**Fictional Science:** Students may include Warp drive (faster-than-light travel), Transporters and Time travel caused by anomalies

**Why It Matters:** Helps students think critically. Ensures understanding of **evidence-based science and prevents** misconceptions. **Key Teaching Point:** Science fiction can be **inspired by real science**, but it is not always scientifically accurate.

Name: \_\_\_\_\_ period: \_\_\_\_\_ Date: \_\_\_\_\_

### Student Worksheet - Pegasus

#### 1. ENGAGE — Opening Scene (Begin Video)

A. List at least THREE technologies or systems you observe in the opening scene:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

B. What do you think each system is used for? (Choose one and explain)

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C. Why are these systems important for space travel?

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#### 2. EXPLORE — Identifying Science Concepts

A. Identify TWO examples of energy transfer or transformation in the video:

1. \_\_\_\_\_
2. \_\_\_\_\_

B. For each example, describe what is happening to the energy:

- Example 1 explanation:

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- Example 2 explanation:

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C. What problems occur when too much energy builds up in a system?

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**3. EXPLAIN — Gravity and Motion**

A. Describe how the gravitational anomaly affected the ship:

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B. What happened to the ship's speed and direction?

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C. Why was the crew unable to control the ship at first?

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**4. ELABORATE — System Diagram (Modeling Activity – see example in glossary)**

A. Choose ONE system from the video (excluding the sample diagram):

- Propulsion system
- Energy system
- Navigation system

B. Draw a labeled diagram of your chosen system below:  
(Include arrows to show flow of energy or movement)

C. Explain how your system works in 2–3 sentences:

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**5. EVALUATE — Science Reflection**

A. Explain ONE real scientific concept shown in the video:

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B. Identify ONE fictional idea from the video:

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C. Why is it important to know the difference between real science and science fiction?

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## Teacher Answer Key (With Standards)

**1. ENGAGE:** SC.7.N.1.1, SC.6.N.1.4, SC.6.E.6.1

**Correct Responses May Include:**

- Engines / propulsion
- Sensors / scanners
- Navigation systems
- Communication systems

**Expected Explanation:**

- Systems collect data, move the ship, and support life

**Key Concept:** Students are practicing **observation and identification of scientific tools**

**2. EXPLORE:** SC.7.P.10.1, SC.7.P.11.2, SC.6.P.13.1

**Correct Energy Examples:**

- Thermal energy (heat buildup)
- Kinetic energy (motion)
- Radiant energy (signals, radiation)

**Correct Explanation:**

- Energy changes forms (ex: engine → motion → heat)
- Uncontrolled energy leads to system failure

**Key Concept:** Energy is **transformed and transferred within systems**

**3. EXPLAIN:** SC.6.E.7.9, SC.6.P.12.1

**Correct Answer:**

- Gravity anomaly increased force on ship
- Caused acceleration and trajectory change

**Expected Student Ideas:**

- Ship sped up and changed direction
- Crew could not overcome gravitational force

**Key Concept:** Gravity **directly affects motion in space**

**4. ELABORATE:** SC.7.N.1.1, SC.7.P.11.2

**Diagram Requirements:**

- Labeled parts
- Arrows showing flow
- Logical system structure

**Explanation Should Include:**

- How energy or motion moves through system

**Key Concept:** Students are **modeling systems and explaining interactions**

**5. EVALUATE:** SC.7.N.1.3, SC.6.N.2.2, SC.7.N.1.1

**Real Science Examples:**

- Gravity affecting motion
- Energy transfer (heat, radiation)
- Data analysis

**Fiction Examples:**

- Warp drive
- Time travel
- Transporters

**Importance:**

- Helps distinguish **evidence-based science vs fiction**
- Builds critical thinking

## Glossary of Science Terms

**Acceleration** – The rate at which velocity (speed or direction) changes.

**Anomaly** – Something unusual or unexpected that does not follow normal patterns.

**Data** – Information collected during an investigation (numbers, measurements, readings).

**Diagnostics** – Tests used to find or identify a problem.

**Energy** – The ability to do work or cause change.

**Energy Transfer** – The movement of energy from one object or system to another.

**Energy Transformation** – When energy changes from one form to another (ex: engine energy → motion → heat).

**Engineering Design Process** – A series of steps (identify problem, design solution, test, improve) used to solve problems.

**Evidence** – Data or observations used to support a scientific explanation.

**Gravitational Field** – The area around an object where gravity affects other objects.

**Gravity** – A force that pulls objects toward each other.

**Hypothesis** – A testable explanation for a scientific question.

**Inference** – A conclusion based on observations and prior knowledge.

**Kinetic Energy** – Energy of motion (an object that is moving).

**Life Support System** – A system that provides air, temperature, and conditions needed for survival.

**Model** – A drawing, diagram, or representation used to explain how something works.

**Navigation System** – A system used to guide movement and direction.

**Observation** – Information gathered using senses or tools (what you see, hear, or measure).

**Orbit** – The curved path of an object around another object due to gravity.

**Propulsion** – The force that moves an object forward (like a rocket engine).

**Pseudoscience** – Claims that appear scientific but are not supported by evidence.

**Radiant Energy** – Energy that travels in waves, such as light or radio signals.

**Radiation** – The transfer of energy through space in the form of waves.

**Real Science** – Scientific ideas that are supported by evidence and experimentation.

**Science Fiction** – Imaginary science-based stories that may include ideas not possible with current science.

**Scientific Explanation** – A statement based on evidence and scientific knowledge.

**Scientific Inquiry** – The process scientists use to ask questions, collect data, analyze results, and draw conclusions.

**Sensor** – A device that detects and measures physical properties like heat, motion, or radiation.

**Signal** – A form of communication using waves or electronic transmission.

**Subsystem** – A smaller part of a larger system.

**System** – A group of parts that work together to perform a function.

**Technology** – Tools, machines, or systems designed to solve problems.

**Thermal Energy (Heat)** – Energy related to temperature; produced by moving particles.

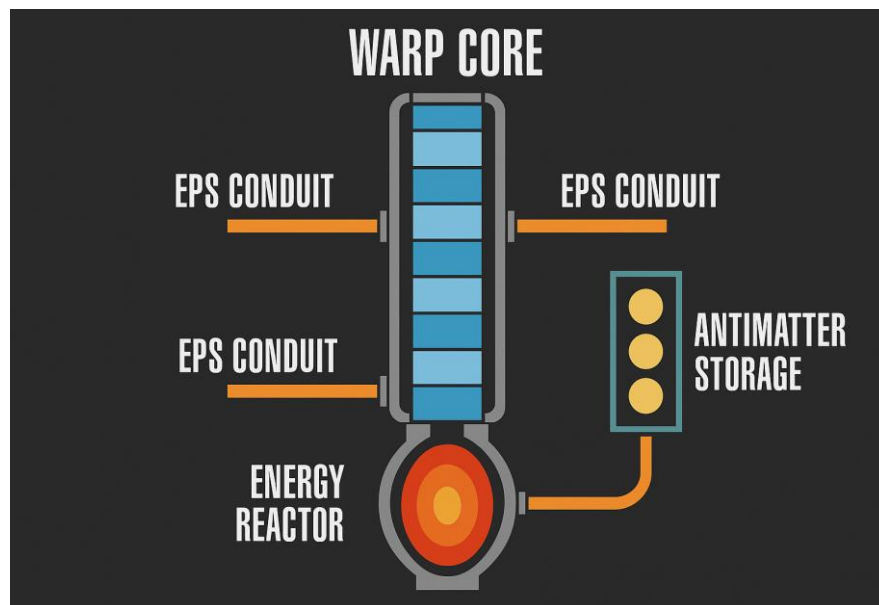
**Trajectory** – The path an object follows as it moves.

**Troubleshooting** – The process of identifying and fixing problems.

## Fictional Glossary of Terms

- **Hypo Spray** - A medical device that delivers medication through the skin without needles.
- **Impulse Drive** - A fictional propulsion system used for slower-than-light travel within a star system.
- **Shield Generators** - A fictional system that creates an invisible energy barrier to protect a spacecraft.
- **Subspace** - A fictional dimension or layer of space used for faster-than-light travel and communication.
- **Subspace Energy Fluctuations** - Fictional changes in energy within subspace that can affect spacecraft systems.
- **Temporal Displacement (Time Travel)** - The idea that a ship or person can move backward or forward in time due to an anomaly.
- **Tractor Beam** - A fictional beam that can move or pull objects from a distance without physical contact.
- **Transporter (“Beaming”)** - A fictional device that converts matter into energy, moves it, and then reassembles it elsewhere.
- **Tricorder** - A handheld device that scans environments and collects data instantly.
- **Verterium** - A fictional material used in advanced spacecraft systems, especially warp engines. (No such material exists in real chemistry or physics.)
- **Warp Bubble** - A fictional field surrounding a spacecraft that allows it to move through warped space.
- **Warp Core** - A fictional energy source that powers a ship’s warp drive system. It produces the energy needed for faster-than-light travel.
- **Warp Drive** - A fictional propulsion system that allows a spacecraft to travel faster than the speed of light by bending or “warping” space.
- **Warp Factor** - A fictional measurement of speed used when traveling faster than light. Higher warp factors represent faster speeds.

### Example Systems Diagram for Fictional Warp Core



## STEM Lab: Energy, Motion, and Gravity Simulation

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**Standards Alignment ( SC.7.P.10.1; SC.7.P.11.2; SC.6.E.7.9; SC.7.N.1.1)**

### **Objective**

Students investigate how gravity and energy influence motion using a simple model system.

### **Materials (Per Group)**

- Marble or small ball
- Ramp (book, folder, cardboard)
- Cup or object (gravity source)
- Ruler or meter stick
- Flat surface

### **Teacher Setup**

Place ramp so marble rolls onto flat surface.  
Place cup near the path to simulate gravity.  
Prepare measuring tools.

### **Procedure (Student Directions)**

1. Roll marble down ramp without interference; record distance.
2. Place cup near path and roll marble again
3. Observe changes in direction and motion.
4. Move cup closer and farther and repeat.
5. Record results in table.

### **Data Table (Graph Results Optional)**

Trial 1 – Far distance

Trial 2 – Medium distance

Trial 3 – Close distance

### **Analysis Questions**

1. What happened to motion as object moved closer?
2. How did gravity affect direction?
3. Where did energy come from?
4. How did energy change?
5. How does this relate to the video?

### **Teacher Answer Guide**

Motion curves toward object as distance decreases.

Energy transforms from potential to kinetic.

Gravity changes trajectory similar to spaceship scene.

## Student Lab Worksheet: Energy, Motion, and Gravity Simulation

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Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

### Part 1: Pre-Lab Thinking (ENGAGE)

1. What do you think will happen to an object's motion if another object is placed close to its path?

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2. What do you already know about gravity and how it affects objects?

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### Part 2: Procedure

1. Roll marble down ramp with no object nearby and observe.
2. Place an object near the path and repeat.
3. Move the object farther and closer and repeat trials.

### Part 3: Data Table (EXPLORE)

Trial	Distance of Object	Path (Straight/Curved)	Distance Traveled	Observations

### Part 4: Analysis Questions (EXPLAIN)

1. What happened to the marble's motion when the object was closer?

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2. How did the object affect direction?

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3. Where did the marble's energy come from?

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4. How did energy change as the marble moved?

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**Part 5: System Modeling (ELABORATE)**

Draw a labeled diagram of your setup.

(Label ramp, marble, and gravity object; show motion with arrows)

**Part 6: Reflection (EVALUATE)**

1. How does this lab relate to the spaceship in the video?

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2. What is ONE real science concept demonstrated?

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3. What is ONE fictional idea from the video?

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4. Why is it important to know the difference between real science and science fiction?

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Name: \_\_\_\_\_ Date: \_\_\_\_\_ Period: \_\_\_\_\_

### Exit Ticket

#### Part 1: Science & Engineering

**1. What caused the ship to lose control during the mission?**

- Engine failure
- Gravity well (gravitational anomaly)
- Communication failure
- Pilot error

**2. Which example BEST shows energy transformation in the video?**

- The crew talking on the communicator
- The ship changing direction
- Engine energy turning into motion and heat
- The ship sitting still in orbit

#### Part 2: Gravity & Motion

**3. What effect did the gravitational anomaly have on the ship?**

- It slowed the ship down
- It caused the ship to accelerate uncontrollably
- It turned off the ship's systems
- It had no effect

#### Part 3: Problem Solving & Engineering

**4. Which step BEST describes how the crew solved their problem?**

- Ignored the issue and hoped it would go away
- Used data and worked together to repair the system
- Shut down all systems permanently
- Waited for help without taking action

#### Part 4: Real vs. Fictional Science

**5. Which of the following is an example of REAL science?**

- Warp drive
- Gravity affecting motion
- Transporters
- Subspace travel

**6. Which of the following is an example of FICTIONAL science?**

- Energy transfer
- Gravity
- Warp drive
- Motion

**Short Answer**

**7. How does gravity affect objects in space? (Short Response)**

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**8. One way the crew used teamwork was:**

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**9. Why is it important to know the difference between real science and science fiction?**

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**Bonus Question (Optional)**

**If you were a crew member, what role would you have and why?**

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## Teacher Answer Key

### Multiple Choice

1. Gravity well
2. Engine energy → motion → heat
3. Uncontrolled acceleration
4. Used data + teamwork
5. Gravity affecting motion
6. Warp drive

### Short Answer

7. Gravity pulls objects, changes motion/direction

8. Examples:

- Dividing tasks
- Communicating
- Repairing systems together

9. Should include:

- Helps identify real science.
- Prevents misconceptions.
- Builds critical thinking.

Bonus: Any logical explanation

## Instructional Rubrics

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### Discussion Questions Rubric

Criteria	4 - Exceeds	3 - Meets	2 - Developing	1 - Beginning
<b>Scientific Understanding</b>	Deep & accurate	Correct	Partial	Incorrect
<b>Evidence</b>	Strong examples	Some examples	Limited	None
<b>Reasoning</b>	Clear & detailed	Logical	Basic	Minimal
<b>Connection</b>	Strong links	Some links	Weak	None

### Student Worksheet Rubric

Criteria	4 - Exceeds	3 - Meets	2 - Developing	1 - Beginning
<b>Understanding of Content</b>	Demonstrates complete understanding; answers are accurate and thorough	Shows good understanding with minor errors	Shows partial understanding; several incorrect answers	Little to no understanding; mostly incorrect or missing
<b>Completion</b>	All questions answered fully	Most questions answered	Some questions missing or incomplete	Many questions missing
<b>Accuracy</b>	All answers correct	Few mistakes	Several mistakes	Many incorrect responses
<b>Effort &amp; Detail</b>	Strong effort; detailed explanations/work shown	Good effort; some detail provided	Minimal effort; limited detail	Little to no effort shown
<b>Organization &amp; Neatness</b>	Very neat and easy to read; well organized	Mostly neat and organized	Somewhat messy or hard to follow	Disorganized and difficult to read
<b>Following Directions</b>	Followed all instructions precisely	Minor issues following directions	Some directions not followed	Did not follow directions

### Lab Activity Rubric

Criteria	4 - Excellent	3 - Good	2 - Needs Improvement	1 - Incomplete
<b>Preparation &amp; Materials</b>	Fully prepared; brought all materials and understood procedure	Mostly prepared; minor gaps	Some preparation missing	Not prepared
<b>Procedure &amp; Participation</b>	Followed all steps; actively participated	Followed most steps; participated	Missed steps or limited participation	Did not follow procedure
<b>Data Collection</b>	Complete, accurate, well recorded	Mostly complete; minor errors	Incomplete or somewhat inaccurate	Missing or incorrect
<b>Analysis &amp; Conclusions</b>	Insightful analysis; supported conclusions	Good analysis; mostly supported	Limited analysis	No analysis
<b>Lab Report/Responses</b>	Clear, detailed, well-organized	Mostly clear	Limited detail	Incomplete or unclear
<b>Safety &amp; Clean-Up</b>	Followed all safety rules; cleaned up	Minor reminders needed	Some unsafe or messy behavior	Unsafe behavior/no cleanup

### Exit Ticket Rubric

Criteria	4 - Exceeds	3 - Meets	2 - Developing	1 - Beginning
<b>Understanding</b>	Complete	Correct	Partial	Incorrect
<b>Accuracy</b>	All correct	Most correct	Some correct	Few
<b>Real vs Fiction</b>	Clear distinction	Correct	Partial	Incorrect
<b>Writing Quality</b>	Clear & detailed	Clear	Limited	Unclear

## NGSS Compliance Summary

This instructional resource aligns with the **Next Generation Science Standards (NGSS)** by integrating core science concepts, engineering practices, and crosscutting themes through an engaging, problem-based scenario. The Star Trek context allows students to explore **energy, motion, gravity, and systems** while applying scientific reasoning, engineering design and real world application.

### 1. NGSS Standards Addressed

- **MS-PS3-5** – Energy transfer and changes in motion
- **MS-PS3-4** – Relationships among energy, matter, and temperature
- **MS-ESS1-2** – Gravity’s role in motion of objects in space
- **MS-ETS1-1** – Define engineering problems
- **MS-ETS1-2** – Evaluate design solutions

### 2. Science & Engineering Practices: Students engage in key practices such as:

- **Asking questions and defining problems** (system failures, gravity effects)
- **Using models** (system diagrams and energy flow)
- **Analyzing data** (motion changes, energy behavior)
- **Constructing explanations** (effects of gravity and energy)
- **Using evidence** to distinguish real science from fiction

### 3. Crosscutting Concepts: The lesson emphasizes:

- **Cause and Effect** – Gravity changes motion
- **Systems and Models** – Spacecraft as interacting systems
- **Energy and Matter** – Energy transfer and transformation
- **Stability and Change** – System failures impact performance

### 4. Instructional Application

- **5E Lesson:** Observation → analysis → explanation → modeling → evaluation
- **Worksheet:** Data collection, modeling, and explanation
- **Lab:** Hands-on investigation of gravity and motion

### 5. Instructional Value: This lesson supports NGSS by:

- Connecting **scientific concepts to real-world contexts**
- Promoting **active inquiry and modeling**
- Developing **critical thinking and scientific literacy**