

Celestial Bodies

Grade-Level Expectations

The exercises in these instructional tasks address content related to the following grade-level expectations:

- SI-M-A4** Construct, use, and interpret appropriate graphical representations to collect, record, and report data (e.g., tables, charts, circle graphs, bar and line graphs, diagrams, scatter plots, symbols) (GLE 11)
- SI-M-A6** Identify faulty reasoning and statements that misinterpret or are not supported by the evidence (GLE 18)
- ESS-M-C2** Differentiate among moons, asteroids, comets, meteoroids, meteors, and meteorites (GLE 42)
- ESS-M-C8** Identify and explain advances in technology that have enabled the exploration of space (GLE 47)

Contents

- These instructional tasks contain a set of document- or resource-based exercises about *celestial objects*.
- Teachers may choose to use or modify the tasks as part of an instructional lesson or as a formative or summative assessment.
- The printable student version excludes teacher directions.

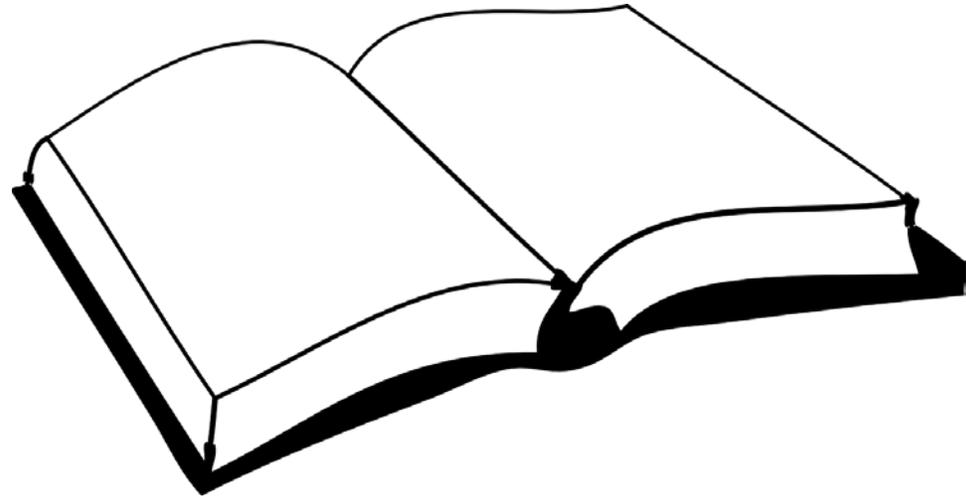
	Objective(s)
Scaffolding Exercise 1	<ul style="list-style-type: none"> · Research and build background knowledge about celestial objects
Scaffolding Exercise 2	<ul style="list-style-type: none"> · Analyze and interpret a scientific graph. · Identify faulty reasoning within a response · Make a claim and support the claim with evidence
Scaffolding Exercise 3	<ul style="list-style-type: none"> · Analyze an article to build knowledge about current technology affecting space technology and future goals of space exploration
Culminating Exercise	<ul style="list-style-type: none"> · Interpret information to differentiate between celestial objects
Scoring Rubric	
Scoring Notes	
Printable Student Version	

Scaffolding Exercise 1

Teacher Directions: Have students complete the following task.

Part 1: Research moons, comets, asteroids, and meteors using a variety of resources. Determine the similarities and differences between each of these celestial objects.

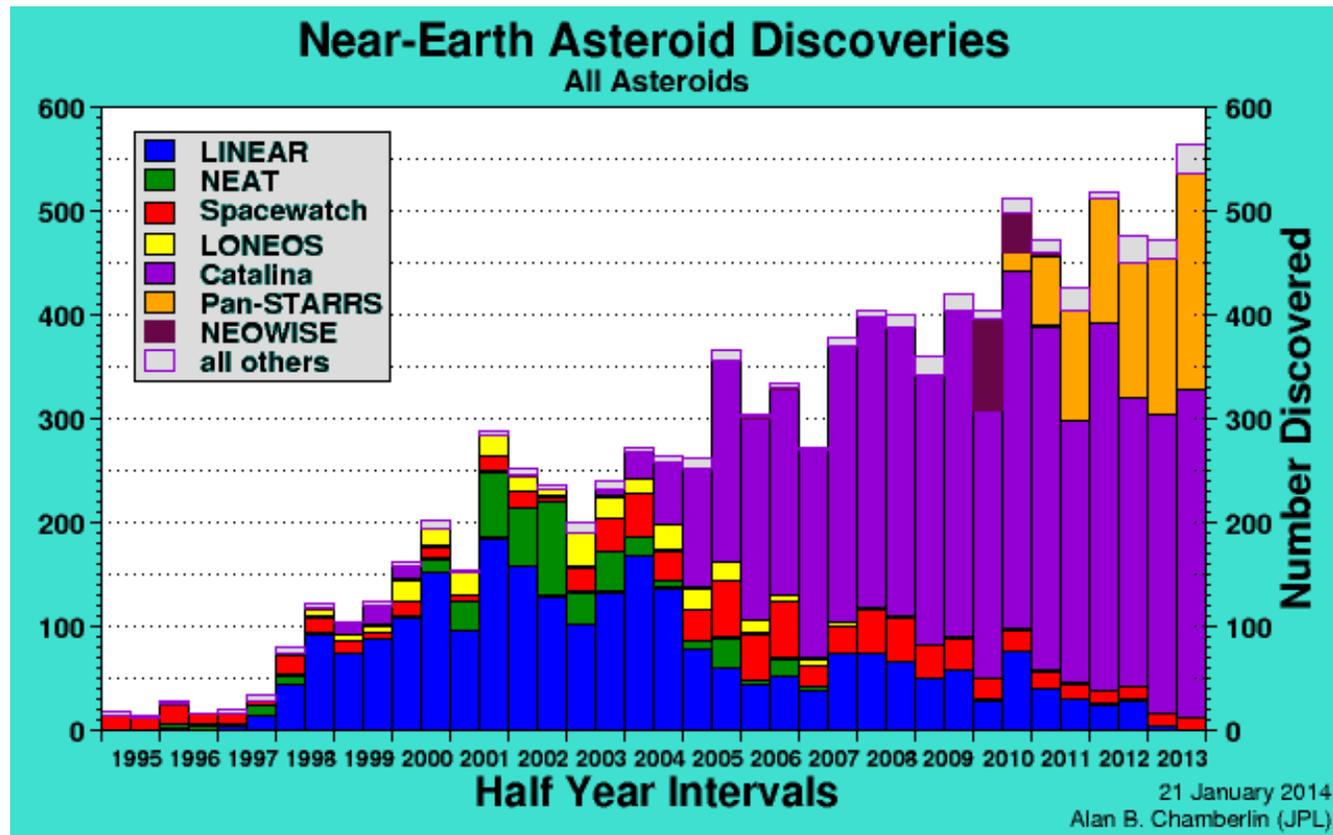
Part 2: Work with a partner or small team to create a children's book describing and illustrating each celestial object.



Scaffolding Exercise 2

Teacher Directions: Have students complete the following task.

Part 1: Work with a partner to analyze the graph. Fill in the chart and respond to the prompt that follows.



Program		Operational Years to Date	Approximate Number of Asteroids Detected
LINEAR	Lincoln Near-Earth Asteroid Research (NASA)		
NEAT	Near-Earth Asteroid Tracking (NASA)		
Spacewatch	(University of Arizona)		
LONEOS	Lowell Observatory Near-Earth-Object Search (NASA)		
Catalina	(NASA)		
Pan-STARRS	Panoramic Survey Telescope & Rapid Response System (University of Hawaii)		
NEOWISE	(NASA)		

Part 2: Mrs. Hessby's class found this graph on the NASA website and concluded that the number of Near-Earth Asteroids has increased dramatically over the last 20 years. Read the article found at http://pan-starrs.ifa.hawaii.edu/public/asteroid-threat/asteroid_threat.html. Do you agree with Mrs. Hessby's class' conclusion? Write an article stating your claim and defend your position.

Teacher Directions: Have students complete the following task.

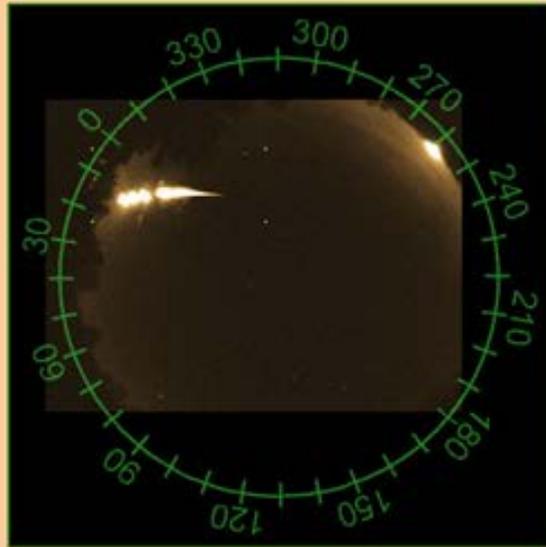
Read the article "[Daunting space task: Send astronauts to asteroid](#)," featured in *USA Today* in 2011. Choose one of the following products to demonstrate your understanding of the article.

- Draw an illustration of a possible mission of landing on an asteroid for scientific study. Use descriptions from the text as the basis of your drawings. You may also want to view photos or drawings of space vehicles designed by NASA.
- Write an argument to defend NASA's plans to visit an asteroid. Cite evidence from the article to support your argument.
- Describe three large obstacles or issues with landing on an asteroid. Then, propose two possible solutions for each obstacle. Use evidence from the text as the basis of your proposals, though you may have to brainstorm other possible solutions as well.

Cloudbait Observatory

Guffey, Colorado

October 6, 2014 Fireball

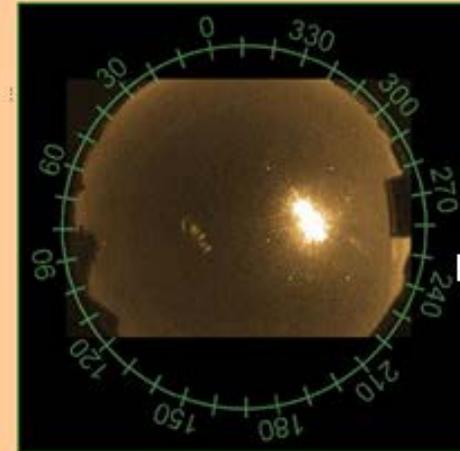


This bright fireball occurred at 4:08 AM MDT over Colorado. The magnitude at Denver was -12 , making it as bright as a full Moon.

Data has been recovered from the following cameras:

[Cloudbait \(details, video\)](#)

[DMNS \(details, video\)](#)



This map shows the ground path of the fireball.

The ground path is 68 km long, and the atmospheric path is 111 km long. It descended steeply at 38° from vertical, with an average speed of 44 km/s. It was first detected at a height of 123 km, and faded at a height of 35 km. The total duration was 2.5 seconds.

Study the webpage above. Determine whether the “fireball” is referencing a moon, comet, asteroid, or meteor. Support your claim with evidence. Provide evidence to show why the “fireball” could not be each of the other 3 options.

Rubric

Key Elements:

- A. Response determines the “fireball” is a meteor and gives evidence to support the claim.
- B. Response determines the “fireball” is not a moon and gives evidence to support this claim.
- C. Response determines the “fireball” is not a comet and gives evidence to support this claim.
- D. Response determines the “fireball” is not an asteroid and gives evidence to support this claim.

4 Points

Response includes all four key elements.
Response contains no scientific errors.

3 Points

Response includes three of the four key elements.
Response may include scientific errors.

2 Points

Response includes two of the four key elements.
Response may include scientific errors.

1 Point

Response includes one of the four key elements.
Response may include scientific errors.

A well-developed response should demonstrate a correct and thorough understanding of celestial objects. The response should be clear, include specific details, show a higher level of reasoning skills where appropriate, and address the key elements of the task.

Scoring Notes

Student responses will not be an exact imitation of the responses below. These are given only as examples.

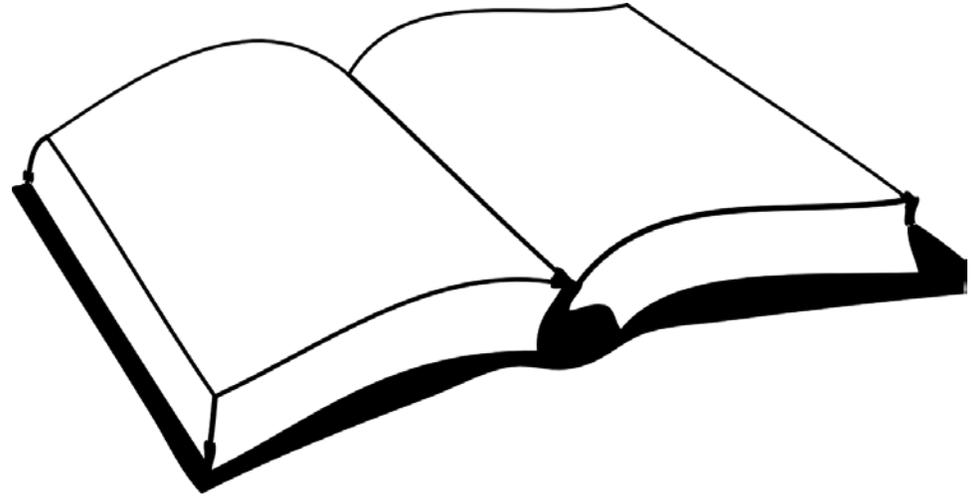
- A.** The object described as a “fireball” on the webpage is a meteor. One piece of evidence that supports this is the brightness of the object over the Denver sky. Meteors burn when they enter Earth’s atmosphere and appear as a “shooting star.”
- B.** The object described as a “fireball” on the webpage could not be a moon. Moons orbit planets. The only moon brightly visible in Earth’s night sky is the Moon. It does not appear brightly for 2.5 seconds then disappear unless it is covered by clouds. The webpage is describing a bright light that could be seen then quickly disappeared.
- C.** The object described as a “fireball” on the webpage could not be a comet. Comets are large celestial objects that orbit the sun. A comet could enter Earth’s atmosphere but it would create widespread damage, not just a “fireball” in the sky.
- D.** The object described as a “fireball” on the webpage could not be an asteroid. While asteroids and meteors are both made of rock and metal, the scientific name once they enter Earth’s atmosphere is meteor.

*Teacher’s Note: The International Astronomical Union defines “fireball” as a meteor brighter than the planet Venus.

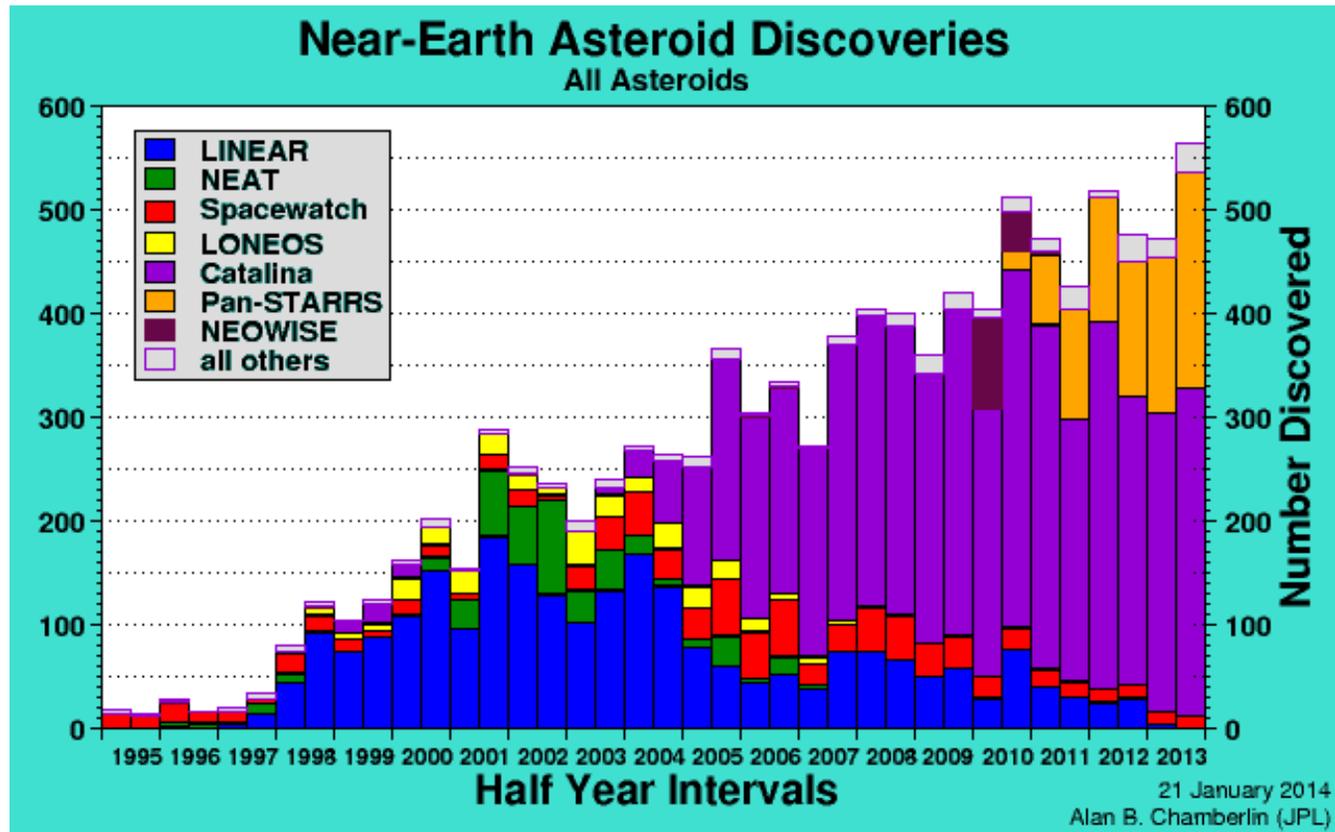
**Printable
Student Version**

Part 1: Research moons, comets, asteroids, and meteors using different resources. Determine the similarities and differences between each of these celestial objects.

Part 2: Work with a partner or small team to create a children's book describing and illustrating each celestial object.



Part 1: Work with a partner to analyze the graph. Fill in the chart and respond to the prompt that follows.



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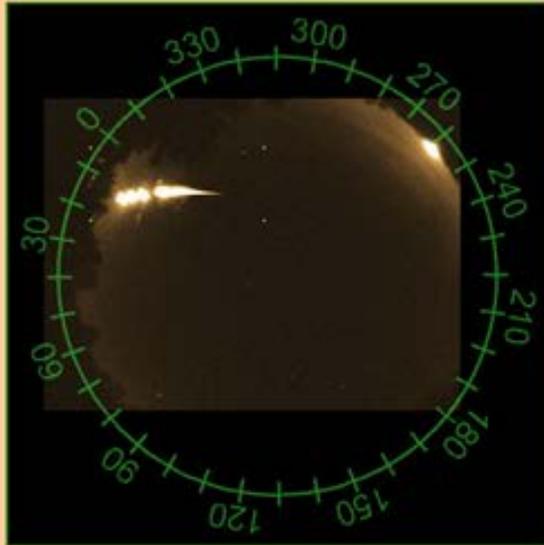
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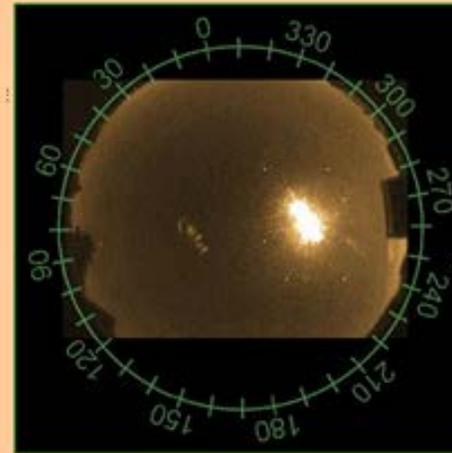
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