

## Middle School standards for eclipse

### Science

- Grade 6
  - PS4.B: Electromagnetic Radiation: When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends.
    - Reflection of sunlight of moon causing phases and effect on eclipse
  - MS-ESS1-1: Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, **eclipses of the sun and moon**, and seasons.
  - ESS1.A: The Universe and Its Stars: Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.
    - Apparent motion of Sun and moon causes eclipses
    - Also discuss planets and star visible during the eclipse
- Grade 7
  - PS2.B: Types of Interactions: Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun.
    - Discussion how gravity influences the orbits of Earth and Moon, which allows for eclipse to occur
  - PS3.A: Definitions of Energy: Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.
    - Discussion of how eclipse causes temperature change
- Grade 8
  - PS3.A: Definitions of Energy: The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (secondary)
    - Discussion of how eclipse causes temperature change
  - LS4.C: Adaptation: Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and

reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.

- Discussion how animals respond to eclipse
  - Discuss in terms of natural response to stimulus

## Math

- Grade 6
  - PS.4: Model with mathematics. Mathematically proficient students apply the mathematics they know to solve problems arising in everyday life, society, and the workplace using a variety of appropriate strategies. They create and use a variety of representations to solve problems and to organize and communicate mathematical ideas. Mathematically proficient students apply what they know and are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts, and formulas. They analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
    - Talk about how mathematical models of the solar system naturally predict eclipses and allow us to predict the time and place of an eclipse 100s of years in the future.
  - 6.GM.1 Convert between measurement systems (Customary to metric and metric to Customary) given the conversion factors, and use these conversions in solving real-world problems.
    - Talk about conversions from astronomical units (AU) to km, use to talk about Sun-Earth distance and Earth-Moon distance and how it is related to eclipses
- Grade 7
  - 7.RP.3 Represent real-world and other mathematical situations that involve proportional relationships. Write equations and draw graphs to represent these proportional relationships. Apply the definition of unit rate to  $y = mx$ .
    - Ratio between Sun/moon size and Sun/moon distance and how that causes them to be the same size in our sky
  - 7.GM.2 Understand the formulas for area and circumference of a circle and use them to solve real-world and other mathematical problems; give an informal derivation of the relationship between circumference and area of a circle.
    - Discussion of Kepler's laws of planetary motion
      - Orbits of Earth and moon and how they relate to eclipses.
- Grade 8

- PS.4: Model with mathematics. Mathematically proficient students apply the mathematics they know to solve problems arising in everyday life, society, and the workplace using a variety of appropriate strategies. They create and use a variety of representations to solve problems and to organize and communicate mathematical ideas. Mathematically proficient students apply what they know and are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts, and formulas. They analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
  - Talk about how mathematical models of the solar system naturally predict eclipses and allow us to predict the time and place of an eclipse 100s of years in the future.
- 8.GM.3 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and other mathematical problems in two dimensions.
  - Prove that the size and distance of Sun and moon make them both look to be the same angular size in our sky

#### Literacy

- 6-8.LST.1.1: Read and comprehend science and technical texts within a range of complexity appropriate for grades 6-8 independently and proficiently by the end of grade 8.
  - Read scientific papers about eclipse
    - Both current and historical
- 6-8.LST.2.1: Cite specific textual evidence to support analysis of science and technical texts.
  - Read scientific papers about eclipse
    - Both current and historical
- 6-8.LST.4.1: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
  - Read scientific papers about eclipse
    - Both current and historical