Task: The Crab through Time

Alignment of Performance Task with National Standards

Grade Level: 9-12

Specific skills and knowledge demonstrated by the task:	**Alignment with Project 2061 Benchmarks for Science Literacy**	**Alignment with National Science Education Standards**
Students' ability to describe and interpret, using the different wavelengths of the electromagnetic spectrum. the different images generated by observation of the Crab Nebula and the supernova that produced it.	**4F- Motion (9-12)#3:** …A great variety of, radiation is in the form of electromagnetic waves: radio waves, microwaves, radiant heat, visible light, ultraviolet radiation, x-rays, and gamma rays. These wavelengths vary from radio waves, the longest, to gamma rays, the shortest....	**Standard B Physical Science: Interactions of Energy and Matter#2** …Electromagnetic waves include radio waves, microwaves, infrared radiation, visible light, ultraviolet radiation, x-rays, and gamma rays…
Students' ability to describe how technology has extended our senses to help us learn more about the universe.	**4A-Universe (9-12)#3**: Increasingly sophisticated technology is used to learn about the universe. Visual, radio and x-ray telescopes collect information from across the entire spectrum of electromagnetic waves; computers handle an avalanche of data and increasingly complicated computations to interpret them....	**Standard A- Inquiry (9-12)- Understandings About Scientific Inquiry**- Scientists rely on technology to enhance the gathering and manipulation of data. New techniques and tools provide new evidence to guide inquiry and new methods to gather data, thereby contributing to the advance of science.
Students' ability to accurately represent the vast scale of the interstellar space, through the relationship between the distance of the Crab Nebula from the Earth, and the time it takes for the light to travel that distance.	**4A- Universe (9-12)#2:** …Light from the next nearest star takes a few years to arrive. The trip to that star would take a rocket ship thousands of years. Some distant galaxies are so far away that their light takes several billion years to reach the earth. People on earth, therefore, see them as they were that long ago in the past.	**Unifying Concepts and Processes- Constancy, Change, and Measurement**- concepts of scale including speed of light.
Students' ability to accurately represent the supernova process within the life cycle of stars, and to describe the nature of the matter ejected from the supernova.	**4A Universe (9-12)#2** … Eventually, some stars exploded producing clouds containing heavy elements from which other stars (and presumably planets orbiting them) could later condense. The process of star formation and destruction continues.	**Standard D: Earth and Space- The Origin and Evolution of the Universe**- Stars produce energy from nuclear reactions, primarily the fusion of hydrogen to form helium, These and other processes in stars have led to the formation of all the other elements.

Students' skill in constructing 3 analogies, making the distance, the energy released, and the physical size of the nebula, more easily comprehensible.	**11B Models (See Essay p267)** "Conceptual models are tools for learning about the things they are meant to resemble. Imagery, metaphor, and analogy are every bit as much a part of science…"	**Unifying Concepts and Processes- Evidence, Models, and Explanation-** (mental constructs)…tentative schemes or structures that correspond to real objects, events, or classes of events, and that have explanatory power.
Students' ability to integrate information and images into a piece that communicates science to the general public.	**12D Communication Skills (see Essay p 295)** Translating scientific ideas to the general public.	**Standard A: Inquiry-Communication:** …accurate and effective communication including expressing concepts, reviewing information, summarizing data, using language appropriately, developing diagrams and charts…
Students' ability to describe historical and cultural contributions to scientific knowledge.	**1C The Scientific Enterprise (9-12)#1** The early …Chinese [and Native American] cultures are responsible for many scientific ideas…	**Standard G: History and Nature of Science- Historical Perspectives #1**: In history, diverse cultures have contributed scientific knowledge …