Spectroscopic Analysis Lab	Supplementary Activity 14
Chemistry:1.j	j.* spectral lines are a result of transitions of electrons between energy levels. Their frequency is related to the energy spacing between levels using Planck's relationship (E=hn).
Spectroscopic Analysis Lab	
Chemistry:11.a	a. protons and neutrons in the nucleus are held together by strong nuclear forces which are stronger than the electromagnetic repulsion between the protons.
Age of the Sun Radiation lab	Distribution of Novae in M31
Chemistry:11.b	b. the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions: change in mass (calculated by E=mc^2) is small but significant in nuclear reactions.
Age of the Sun Radiation lab	Distribution of Novae in M31
Chemistry:11.c	c. many naturally occurring isotopes of elements are radioactive, as are isotopes formed in nuclear reactions.
Radiation lab	
Chemistry:11.d	d. the three most common forms of radioactive decay (alpha, beta, gamma) and how the nucleus changes in each type of decay.
Distribution of Novae in M31	Radiation lab
Chemistry:11.e	e. alpha, beta, and gamma radiation produce different amounts and kinds of damage in matter and have different penetrations.
Distribution of Novae in M31	Radiation lab
Chemistry:11.f	f.* how to calculate the amount of a radioactive substance remaining after an integral number of half lives have passed.
Distribution of Novae in M31	Radiation lab

Chemistry:11.g	g.* protons and neutrons have substructure and consist of particles called quarks.
Distribution of Novae in M31	
Earth Science:1.a	a. how the differences and similarities among the sun, the terrestrial planets, and the gas planets may have been established during the formation of the solar system.
Planet Reports	
Earth Science:1.b	b. evidence from Earth and moon rocks for the solar system's formation from a nebular cloud of dust and gas approximately 4.6 billion years ago.
Planet Reports	Radiation lab
Earth Science:1.c	c. evidence from geological studies of the Earth and other planets that the early Earth was very different from today.
Planet Reports	
Earth Science:1.d	d. evidence that the planets are much closer than the stars.
Jupiter's moons lab	Planet Reports
Earth Science:1.e	e. the sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium.
Age of the Sun	Age of the Sun
Planet Reports	Stellar Evolution Game
Earth Science:1.f	f. evidence for the dramatic effects of asteroid impacts in shaping the surface of planets and their moons, and in mass extinctions of life on Earth.
Planet Reports	
Earth Science:1.g	g.* evidence for the existence of planets orbiting other stars.
Jupiter's moons lab	Measuring the distance to the moon through parallax

Earth Science:2.a	a. the solar system is located in an outer edge of the disc-shaped Milky Way galaxy which spans 100,000 light years.
Distribution of Novae in M31	Planet Reports
Supplementary Activity 14	
Earth Science:2.b	b. galaxies are made of billions of stars and form most of the visible mass of the universe.
Distribution of Novae in M31	
Earth Science:2.c	c. evidence that all elements with an atomic number greater than that of Lithium have been formed by nuclear fusion in stars.
Age of the Sun	Distribution of Novae in M31
Spectroscopic Analysis Lab	Stellar Evolution Game
Earth Science:2.d	d. stars differ in their life cycles, and visual, radio, and X-ray telescopes collect data that reveal these differences.
Distribution of Novae in M31	Lens Lab
Spectroscopic Analysis Lab	Supplementary Activity 14
Earth Science:2.f	f.* evidence that the color, brightness and evolution of a star are determined by a balance between gravitational collapse and nuclear fusion.
Age of the Sun	Distribution of Novae in M31
Spectroscopic Analysis Lab	Stellar Evolution Game
Earth Science:2.g	g.* how the red-shift from distant galaxies and the cosmic background radiation provide evidence for the "big bang" model that suggests that the universe has been expanding for 10 to 20 billion years.
Spectroscopic Analysis Lab	
Investigation and Experimentation:1.a	a. select and use appropriate tools and technology (such as computer-linked probes, spread sheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
Centripetal Force Lab	Distribution of Novae in M31
Jupiter’s moons lab	Measuring the distance to the moon through parallax
Radiation lab	Rocket Impulse Lab

Investigation and Experimentation:1.b

b. identify and communicate sources of unavoidable experimental error.

- Acceleration lab
- Centripetal Force Lab
- Distribution of Novae in M31
- Radiation lab
- Rocket Impulse Lab

Investigation and Experimentation:1.c

c. identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.

- Acceleration lab
- Centripetal Force Lab
- Distribution of Novae in M31
- Jupiter's moons lab
- Radiation lab

Investigation and Experimentation:1.d

d. formulate explanations using logic and evidence.

- Acceleration lab
- Centripetal Force Lab
- Distribution of Novae in M31
- Jupiter's moons lab
- Measuring the distance to the moon through parallax
- Radiation lab

Investigation and Experimentation:1.e

e. solve scientific problems using quadratic equations, and simple trigonometric, exponential, and logarithmic functions.

- Acceleration lab
- Distribution of Novae in M31
- Rocket Impulse Lab

Investigation and Experimentation:1.g

g. recognize the use and limitations of models and theories as scientific representations of reality.

- Acceleration lab
- Distribution of Novae in M31
- Momentum lab
- Rocket Impulse Lab

Investigation and Experimentation:1.i

i. analyze the locations, sequences, or time intervals of natural phenomena (e.g., relative ages of rocks, locations of planets over time, and succession of species in an ecosystem).

- Acceleration lab
- Centripetal Force Lab
- Jupiter's moons lab
- Momentum lab
- Radiation lab
- Rocket Impulse Lab

Investigation and Experimentation:1.j	j. recognize the issues of statistical variability and the need for controlled tests.
Acceleration lab	Centripetal Force Lab
Distribution of Novae in M31	Measuring the distance to the moon through parallax
Radiation lab	
Investigation and Experimentation:1.k	k. recognize the cumulative nature of scientific evidence.
Acceleration lab	Centripetal Force Lab
Investigation and Experimentation:1.l	l. analyze situations and solve problems that require combining and applying concepts from more than one area of science.
Acceleration lab	Distribution of Novae in M31
Radiation lab	
Investigation and Experimentation:1.n	n. know that when an observation does not agree with an accepted scientific theory, sometimes the observation is mistaken or fraudulent (e.g., Piltdown Man fossil or unidentified flying objects), and sometimes the theory is wrong (e.g., Ptolemaic model of the movement of the sun, moon and planets).
Measuring the distance to the moon through parallax	
Physics:1.a	a. how to solve problems involving constant speed and average speed.
Mercury Spacecraft Simulation	
Physics:1.b	b. when forces are balanced no acceleration occurs, and thus an object continues to move at a constant speed or stays at rest (Newton's First Law).
Mercury Spacecraft Simulation	
Physics:1.c	c. how to apply the law F=ma to solve one-dimensional motion problems involving constant forces (Newton's Second Law).
Acceleration lab	Mercury Spacecraft Simulation
Rocket Impulse Lab	Rocket Impulse Lab
Physics:1.d	d. when one object exerts a force on a second object, the second object always exerts a force of equal magnitude and opposite direction. (Newton’s Third Law).
Gravity and Orbits Activity	Mercury Spacecraft Simulation

Physics:1.e	e. the relationship between the universal law of gravitation and the effect of gravity on an object at the surface of the Earth.
Gravity and Orbits Activity	Mercury Spacecraft Simulation
Physics:1.f	f. applying a force to an object perpendicular to the direction of its motion causes the object to change direction but not speed (for example, the Earth's gravitational force causes a satellite in a circular orbit to change direction but not speed).
Centripetal Force Lab	Gravity and Orbits Activity
Gravity and Orbits Activity	Mercury Spacecraft Simulation
Physics:1.g	g. circular motion requires application of a constant force directed toward the center of the circle.
Centripetal Force Lab	Jupiter's moons lab
Physics:1.i	i.* how to solve two-dimensional trajectory problems.
Mercury Spacecraft Simulation	
Physics:1.l	l.* how to solve problems in circular motion, using the formula for centripetal acceleration in the following form: a=v2/r.
Centripetal Force Lab	Gravity and Orbits Activity
Physics:1.m	m.* how to solve problems involving the forces between two electric charges at a distance (Coulomb's Law) or the forces between two masses at a distance (Universal gravitation).
Gravity and Orbits Activity	
Physics:2.a	a. how to calculate kinetic energy using the formula E=(1/2)mv2.
Cratering Activity	
Physics:2.b	b. how to calculate changes in gravitational potential energy near the Earth using the formula (change in potential energy) =mgh (change in the elevation).
Cratering Activity	Jupiter's moons lab

Physics:2.c	c. how to solve problems involving conservation of energy in simple systems such as falling objects.
Cratering Activity	
Physics:2.d	d. how to calculate momentum as product mv.
Momentum lab	Rocket Impulse Lab
Physics:2.e	e. momentum is a separately conserved quantity, different from energy.
Mercury Spacecraft Simulation	Momentum lab
Physics:2.f	f. an unbalanced force on an object produces a change in its momentum.
Mercury Spacecraft Simulation Rocket Impulse Lab	Momentum lab
Physics:2.g	g. how to solve problems involving elastic and inelastic collisions in one dimension using the principles of conservation of momentum and energy.
Mercury Spacecraft Simulation	Momentum lab
Physics:2.h	h.* how to solve problems involving conservation of energy in simple systems with various sources of potential energy, such as capacitors and springs.
Stellar Evolution Game	
Physics:3.c	c. thermal energy (commonly called heat) consists of random motion and the vibrations and rotations of atoms and molecules. The higher the temperature, the greater the atomic or molecular motion.
Stellar Evolution Game	Tracking sunspots and magnetic activity
Physics:3.d	d. most processes tend to decrease the order of a system over time, and energy levels are eventually distributed uniformly.
Tracking sunspots and magnetic activity	Tracking sunspots and magnetic activity

Physics:4.a	a. waves carry energy from one place to another.
Inverse Square law lab	Stellar Evolution Game
Physics:4.c	c. how to solve problems involving wavelength, frequency, and wave speed.
Jupiter's moons lab	Lens Lab
Physics:4.d	d. sound is a longitudinal wave whose speed depends on the properties of the medium in which it propagates.
Lens Lab	
Physics:4.e	e. radio waves, light and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in vacuum is approximately 3x108 m/s (186,000 miles/second).
Inverse Square law lab	Jupiter's moons lab
Spectroscopic Analysis Lab	
Physics:4.f	f. how to identify the characteristic properties of waves: interference (beats), diffraction, refraction, Doppler effect, and polarization.
Inverse Square law lab	Lens Lab
Physics:5.b	b. how to solve problems involving Ohm's law.
Mercury Spacecraft Simulation	
Physics:5.e	e. charged particles are sources of electric fields and experience forces due to the electric fields from other charges.
Radiation lab	Stellar Evolution Game
Tracking sunspots and magnetic activity	
Physics:5.f	f. magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and experience forces due to magnetic fields of other sources.
Tracking sunspots and magnetic activity	

Physics:5.g	g. how to determine the direction of a magnetic field produced by a current flowing in a straight wire or in a coil.
Stellar Evolution Game	
Physics:5.h	h. changing magnetic fields produce electric fields, thereby inducing currents in nearby conductors.
Stellar Evolution Game	
Physics:5.i	i. plasmas, the fourth state of matter, contain ions and/or free electrons and conduct electricity.
Radiation lab	Tracking sunspots and magnetic activity
Physics:5.j	j.* electric and magnetic fields contain energy and act as vector force fields.
Stellar Evolution Game	Tracking sunspots and magnetic activity
Physics:5.n	n.* the force on a moving particle (with charge q) in a magnetic field is qvB sin(a) where a is the angle between v and B (v and B are the magnitudes of vectors v and B, respectively), and students use the right-hand rule to find the direction of this force.
Tracking sunspots and magnetic activity	