Ipso Integrated Science I
Course of Study

Integrated Science I is one of three science courses for 9th, 10th, and 11th grade students based on the Next Generation Science Standards (NGSS). Integrated science will combine content from the areas of Biology, Chemistry, Physics, and Earth Science through project and problem based learning. This course will additionally be taught via interdisciplinary connections with other mathematics, English, and Social Studies courses. The Integrated Science sequence is laboratory based and uses a thematic approach to organize content. Throughout the course, students will conduct research, analyze data and communicate results with others. Students will learn to work collaboratively, communicate effectively, be creative, and take ownership of their own learning.

Integrated Science 1 is a 10 unit course open to all students. The course will be submitted for approval by the University of California System for “d” lab credit.

Instructional Materials. Teachers will use staff-generated curriculum with the support of CK-12 Flexbooks and curricular resources such as that from LearnZillion, Modular Workbench, EduCanon, Expeditionary Learning, and the Buck Institute of Education.

Scope and Sequence

One of Ipso School’s major pillars is personalized learning. While learning can be personalized through individual lessons, Ipso also believes in personalizing content within contextualized projects. We know that students come to our school with a wide variety of backgrounds. Some will already be proficient in some Next Generation Science Standards, while others might need remediation to be able to access grade-level content. Students will not only collaborate with peers, but will also have access to individual supports to help them learn content.

At Ipso, students will have the opportunity to move into other content standards as they approach mastery in their current standard. Students also may need to spend longer amounts of time on a concept that they struggle to master. For example, a student might be approaching a project on type 2 diabetes in San Rafael through the lens of genetics and identifying the genetic markers for diabetes, while another could be approaching it through interactions of the body systems and how the body maintains homeostasis. Both students are solving a common problem and developing their collaboration skills by working together with two varying points of view. The following units are examples of how a student could progress through the content within their first year of science.

Unit 1	Matter and Its Interactions
Major content understandings and applications	As a result of this unit, students will gain scientific knowledge of matter in order to explain the outcome of a (simple) chemical reaction. Students will then apply this newly-acquired knowledge to understand and develop materials used in 3D printing. This process will require that students display mastery of the following DCIs through various learning activities: ● Students will demonstrate understanding of the periodic table and patterns of chemical properties so they can make predictions and construct explanations for outcomes of chemical reactions. (HS-PS1-1, HS-PS1-2) ● Students will understand scientific principles of matter in order to develop an explanation about the effects of changing temperature or concentration of the reacting particles on the rate at which a reaction occurs (HS-Ps1-5) ● Students will engage in hands-on investigations to gather evidence in order to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles (HS-PS1-3) ● Students will demonstrate their understanding of bond energy and its impact on chemical reactions by creating a model of this process. (HS-PS1-4) ● Students will understand how a change in conditions could produce increased amounts of products at equilibrium, and will show this understanding by refining the design of a chemical system. (Ps-PS1-6) ● Students will be able to use mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion, so that they can fully explain reactivity (Hs-PS1-7)
Driving Question	How can we identify or develop easily accessible materials for use in 3D printing to use in prosthetics for developing countries?
Duration	5-7 weeks

Science Content and Skills	**Additional Skills**	**Assessment**	**Differentiation Spotlight**	**Interdisciplinary Connections**	**IPSO Approach in Action**
Science and Engineering Practices: • Develop and Use Models (HS-PS1-4, HS-PS1-1) • Plan and Carry out Investigations ((HS-PS1-3) • Use Math & Computational Thinking (HS-PS1-7) • Construct Explanations and Design Solutions (HS-PS1-5, HS-PS1-2, HS-PS1-6) Cross Cutting Concepts: • Observe patterns and use as evidence in explanations (HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-5) • Identify role and functionality of energy & matter in a system (HS-PS1-4, HS-PS1-7) • Construct	Oral Communication: • Verbal defense of predictions and explanations Written Communication: • Written explanations of observed processes and predictions • Develop constructed arguments with the use of scientific data as support. Collaboration: • Labs, models as collaborative assignments Creativity: • Creation of scientific model • Interdisciplinary opportunities to explore fine arts and creative writing, analogous to scientific concepts Agency: • independence and ownership	Formative • Technical literacy assignments • Periodic table elements & explanation written assignment • Mole Conversion assignments, quiz • Lab investigation reports • Research notes, outline for final writing • Outline, plans for model Summative • Expository writing • Oral presentation of research findings and developed model.	ELL: • Specific scaffolds to develop reading, writing, listening and speaking. • Technical literacy support (front- loading, alternative reading material, word wall, visual cues) • Process visuals, graphic organizers SPED: • ELL supports listed above, in addition to: • Additional benchmarks developed • Models provided • Collaboration support with peers *Extensions: • Ionization energy beyond relative trends • Name specific intermolecular	CCSS ELA: • RST.11-12.1 • WHST.9-12.2. • WHST.9-12.5 • WHST.9-12.7 • WHST.9-12.8 • WHST.9-12.9 • SL.11-12.5 • LITERACY.W.9-10.10 CCSS Math: • MP.2 • MP.4 • HSN-Q.A.1 • HSN-Q.A.2 • HSN-Q.A.3 CA SS: • Chronological and spatial thinking 1,2 • Historical research, evidence and point of view 4 • Historical interpretations 1,2 VAPA • 2.0 creative expression • 5.0 Connections, relationships & Applications	Social Justice/Equity: • Heterogenous grouping Personalized learning: • Various mediums to access content and research Community Partnership: • Local university science department Continuous Learning: • Inquiry driven research

explanations for stability & change (HS-PS1-6) Key vocabulary: • Matter • Protons Neutrons, Electrons • Atoms • Ioms • Molecules • Metals • Bonds • Energy • Reaction • Properties • Elements • Combustion • Substances • Infer • Force • Particle • Vapor pressure • Surface tension • Melting, boiling point • Absorption • Avogadro's Number • Reactant • Product • Conservation • Concentration • Collisions • Equilibrium • Le Chatelier's Principle • Macroscopic • Mole	of learning during labs/investigations • Growth-mindset when approaching new content/application • Seek challenge options provided via extensions • Ability to make connections and see relevance in science content to real-world context		forces • Raoult's law calculation of vapor pressure • Calculating the total bond energy changes during a reaction from the bond energies of reactants and products • Mathematical calculations for complex chemical reactions • Creative writing [CCSS.ELA-LITERACY.W.9-10.3]		

*Extensions Note: This is not additional work, rather the following is a list of alternative, deeper content concepts that advanced students could explore, in an effort to further challenge high-achieving/advanced students.

Unit 2	Mobility and Stability I: Forces and Motion
Major content understandings and applications	As a result of this unit students will gain scientific knowledge of force and motion in order to design a device that minimizes force during collision. This process will require that students display mastery of the following DCIs through various learning activities : ● Students will be able to analyze Newton's second law of motion and its application in diverse contexts. In each scenario students will be able to describe the mathematical relationships among the net force on a macroscopic object, its mass, and its acceleration (HS-PS2-1) ● Students will understand that the total momentum of a system of objects is conserved when there is no net force on the system, and will use mathematical representations to support this claim (HS-PS2-2) ● Students will understand and apply scientific and engineering ideas to design, evaluate and refine a device that minimizes the force on a macroscopic object during a collision (HS-PS2-3)
Driving Question	How can we design or develop collision safety equipment to decrease concussion risks in sporting events?
Duration	3-4 weeks

Science Content and Skills	**Additional Skills**	**Assessment**	**Differentiation Spotlight**	**Interdisciplinary Connections**	**IPSO Approach in Action**
Science and Engineering Practices: ● Analyze and Interpret data (HS-PS2-1) ● Use mathematics and computational thinking (HS-PS2-2) ● Construct Explanations and design solutions (Hs-	Oral Communication: ● Converse with "users" for data collection ● Present findings Written Communication: ● Expository writing of scientific and design processes	Formative ● Data collection and analysis checkpoints ● Key technical vocab quiz ● processes comprehension assignments ● Written research benchmarks ● Mathematical modeling assignments	ELL: ● Specific scaffolds to develop reading, writing, listening and speaking. ● Technical literacy support (front- loading, alternative reading material, word wall, visual	CCSS ELA: ● RST.11-12.1 ● RST.11-12.7 ● WHST.9-12.7 ● WHST.9-12.9 CCSS Math: ● MP.2 ● MP.4 ● HSN-Q.A.1 ● HSN-Q.A.2 ● HSN-Q.A.3 ● HSA-SSE.A.1 ● HSA-SSE.B.3	Social Justice/Equity: ● Heterogenous grouping ● Focus on empathy of "user" Personalized learning: ● Opportunities for student-created design ● Opportunities to explore student

PS2-3) Crosscutting concepts • Can identify and articulate cause and effect (HS-PS2-1, HS-PS2-3) Key Vocabulary: • Velocity • Acceleration • Newton's laws of motion • Force • Momentum • Mass • Gravity	Collaboration: • Work with peers on design,prototyping process • Interact with “users”for testing and feedback Creativity: • innovating/designing a new product to address DQ Agency: • Persistence when failure during prototype/testing • Ownership over innovative ideas	• Graphing, formulas & equation assignments and quizzes Summative • Final panel/”user” presentation of designed device • Expository writing of design overview	cues) • Process visuals, graphic organizers SPED: • ELL supports listed above, in addition to: • Additional benchmarks developed • Models provided • Collaboration support with peers • Formula/equation Card provided Extensions: • 3D printing of developed device • *multi-dimensional motion of microscopic objects moving at non-relativistic speed	• HSA-CED.CA.1 • HSA-CED.CA.2 • HSA-CED.CA.4 • HSF-IF.C.7 • HSS-ID.A.1 VAPA: • 2.3 Assemble and display objects or works of art as a part of a public exhibition • 2.6 Present a universal concept in a multimedia work of art that demonstrates knowledge of technology skills.	interest/inquiry Community Partnership: • Interacting with “users” in the community as data collection, testing and presenting findings Continuous Learning: • Multiple points for self and peer reflection throughout design process

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Unit 3	Motion and Stability II: Interactions
Major Understandings	In this unit students will build off of knowledge from the previous unit on forces and motion, and gain understanding of types of interactions in space. With this evolved knowledge students will design an educational exhibit for a Laser Interferometer Gravitational-wave Observatory. This exhibit will either serve as a proposal for local community education or one of the 2 existing LIGOs. This process will require that students display mastery of the following DCIs through various learning activities: ● Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects (HS-PS2-4) ● Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current (HS-PS2-5) ● Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials (HS-PS2-6)
Driving Question	Why is it important for humans to understand the complexities of interactions in space and how do we best educate them?
Duration	3-4 weeks

Science Content and skills	Additional Skills	Assessment	Differentiation Spotlight	Interdisciplinary Connections	IPSO Approach in Action
Science and Engineering Practices: ● Plan and Carry out investigations ● Use Mathematical and Computational Thinking ● Obtain, Evaluate, and communicate information	Oral Communication: ● Possible oral communication extension for educational exhibit design Written Communication: ● Educational materials ● Expository writing assignments Collaboration:	Formative ● Assignments/quiz that requires Qualitative and conceptual descriptions of gravitational and electric fields ● Design drafts and check points ● investigation/lab reports ● Literacy	ELL: ● Specific scaffolds to develop reading, writing, listening and speaking. ● Technical literacy support (front- loading, alternative reading material, word wall, visual	CCSS ELA: ● RST.11-12.1 ● W.9-10.1 ● W.9-10.4 ● W.9-10.7 ● WST.9-12.2 ● WHST.9-12.7 ● WHST.11-12.8 ● WHST.9-12.9 CCSS Math: ● MP.2 ● HSN-Q.A.1 ● HSN-Q.A.2 ● HSN-Q.A.3	Social Justice/Equity: ● Heterogenous grouping Personalized learning: ● Opportunities to explore student interest/inquiry/product Community Partnership: ● Interactions for proposal

Cross-Cutting Concepts: • Recognize Patterns • Explain Cause and Effect • Investigate structure and function Key Vocabulary • Force • Electrostatic force • Transfer • Currents • Transformation • Attraction • Repulsion • Atomic scale • Newton's • Coulomb's law • Electrostatic force • Gravitational field • Electric field • Magnetic field	• Group investigation and design Creativity: • Creation of exhibit, model Agency: • independence and ownership of learning during labs/investigations • Growth-mindset when approaching new content/application • Seek challenge options provided via extensions • Ability to make connections and see relevance in science content to community	checks-vocabulary and technical reading comprehension • Written drafts to accompany exhibit Summative • Quiz • Expository or persuasive writing to accompany exhibit • Final exhibit	cues) • Process visuals, graphic organizers SPED: • ELL supports listed above, in addition to: • Additional benchmarks developed • Collaboration support with peers • laws/Formula/equation Card provided • Presentation of information in various formats/mediums Extensions: • *Math related to systems with more than 2 objects	• HSA-SSE.A.1 VAPA: • 2.3 Assemble and display objects or works of art as a part of a public exhibition. • 2.6 Present a universal concept in a multimedia work of art that demonstrates knowledge of technology skills.	Continuous Learning: • Multiple points for self and peer reflection throughout the learning process

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Unit 4	Using knowledge of energy to understand shark behavior
Major Understandings	As a result of this unit students will gain scientific knowledge of energy and ecosystems in order to answer the unit DQ in a final presentation to an identified authentic audience. This process will require that students display mastery of the following DCIs through various learning activities : ● Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms.(HS-PS3-1),(HS-PS3-2) ● Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1),(HS-PS3-4) ● Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. (HS-PS3-1) ● Understanding energy transfer through the design of a circuit (HS-ETS1 Engineering Design) ● Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species) (LS2.A) ● Understanding the impact of human activity on the earth and animals (ESS3)
Driving Question	How can we decrease the likelihood of a shark attack occurring during times of the year where tourism is at its highest?
Duration	7-8 weeks

Science Content and skills	Additional Skills	Assessment	Differentiation Spotlight	Interdisciplinary Connections	IPSO Approach in Action
Science and Engineering Practices ● Develop and use models	Oral Communication: ● Final presentation ● Interviewing	Formative ● Mathematical representations about factors	ELL: ● Specific scaffolds to develop	CCSS ELA: ● RST.11-12.1 ● WHST.9-12.7 ● WHST.11-12.8	Social Justice/Equity: ● Strive to make the world a just for all

• Plan and carry out investigations • Use Mathematics and computational thinking Crosscutting Concepts • Use models to understand systems • Understand energy and matter • Understand scale, proportion and quantity Vocabulary • Energy • Motion • Matter • Radiation • Transfer • Forms • Light • Sound • Thermal • Particles • Electromagnetism • Volt Potential Difference • Conservation • Transport • Configuration • Kinetic • Stability • Distribution • Component	experts in the field Written Communication: • Lab notes and reports • Technical reading and Research notes/analysis • Expository writing in response to scientific questions Collaboration: • Labs • Design • Final presentation Creativity: • Generator design is open-ended Agency: • Grow from setbacks during design process • Impact local and global community	affecting biodiversity • Quiz on Electromagnetism • Assignments on energy transfer Summative • math/computational representation tied to ecosystem explanations • Device write-up • Final presentation of proposal	reading, writing, listening and speaking. • Technical literacy support (front- loading, alternative reading material, word wall, visual cues) • Process visuals, graphic organizers SPED: • ELL supports listed above, in addition to: • Additional benchmarks developed • Models provided • Collaboration support with peers • Modified audience for presentations if needed Extensions: • Actually create, rather than describe, shark repellent or shark attractant device	• WHST.9-12.9 • SL.11-12.5 CCSS Math: • MP.2 • MP.4 • HSN-Q.A.1 • HSN-Q.A.2 • HSN-Q.A.3 CA SS: • Chronological and spatial thinking 1-4 • Historical Research, Evidence, and Point of View 4 • Historical Interpretation 5 VAPA: • 2.3 Assemble and display objects or works of art as a part of a public exhibition. • 2.6 Present a universal concept in a multimedia work of art that demonstrates knowledge of technology skills.	members of ecosystem Personalized learning: • Freedom in design and use of technology Community Partnership: • Learn from community organizations/efforts related to ecosystem, animal conservation Continuous Learning: • Innovation through design of devices

• Thermodynamics • Ecosystem • Organism • Predation • Competition • Disease • Abundance • Resources • Biodiversity • ampullae of lorenzini • instrumentation			• Create a documentary, model, simulation, or other educational material for discovery channel or community organization		

Unit 5	Understanding and evaluating waves in technology
Major Understandings	As a result of this unit students will gain scientific knowledge of waves and their applications in technologies for information transfer, to be able to effectively evaluate their effects when absorbed by matter. With this knowledge students will educate a collectively-identified community about potential damage from electromagnetic radiation. This process will require that students display mastery of the following DCIs through various learning activities: • Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media (HS-PS4-1) • Evaluate questions about the advantages of using a digital transmission and storage of information (HS-PS4-2) • Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other (HS-PS4-3) • Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. (HS-PS4-4) • Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy (HS-PS4-5)
Driving Question	How can medical professionals better protect patients from radioactive particles while undergoing medical imaging?
Duration	6-8 weeks

Science Content and Skills	Additional Skills	Assessment	Differentiation Spotlight	Interdisciplinary Connections	IPSO Approach in Action
Science and Engineering Practices • Ask Questions and define problems • Use mathematical computational thinking • Engage in argument from evidence • Obtain, evaluate and communicate information Crosscutting Concepts • Identify and evaluate cause and effect • Understand systems and system models • Understand stability and change Vocabulary • Frequency • Wavelength • Speed • Waves • Electromagnetic • Radiation • Transmission • Transfer • Stability	Oral Communication: • Educating and interacting with identified community Written Communication: • Expository writing of wave processes Collaboration: • Labs completed with a partner • Final product created in small group Creativity: • Medium/delivery of information/product • Inquiry and exploration of self-identified topic for final product Agency: • independence and ownership of learning during labs/investigations • Growth-	Formative • Exercises to Interpret and produce expressions related to waves and electric fields • Development of mathematical model to explain waves in various media • Review of technical literature on electromagnetic radiation • Position statement on digital transmission and storage information • Evaluation of wave and particle models Summative • Final product presentation to identified community • Informative/explanatory writing in developed educational	ELL: • Specific scaffolds to develop reading, writing, listening and speaking. • Technical literacy support (front- loading, alternative reading material, word wall, visual cues) • Process visuals, graphic organizers SPED: • ELL supports listed above, in addition to: • Additional benchmarks developed for final product • Collaboration support with peers • Presentation of information in various formats/mediums	CCSS ELA: • RST.9-10.8 • RST.11-12.1 • RST.11-12.8 • WHST.9-12.2. • WHST.11-12.8 CCSS Math: • MP.2 • MP.4 • HSA-SSE.A.1 • HSA-SSE.B.3 • HSA.CED.A.4 CA SS: • Chronological and spatial thinking 1, 2 • Historical research, evidence and point of view 4 VAPA • 2.3 Assemble and display objects or works of art as a part of a public exhibition. • 2.6 Present a universal concept in a multimedia work of art that demonstrates knowledge of	Social Justice/Equity: • Empathy building to better understand community needs • Heterogenous grouping Personalized learning: • Interest-driven inquiry for final product Community Partnership: • Potential experts to support student learning • Potential collaboration on educating community Continuous Learning: • Multiple points for self and peer reflection throughout the learning process

• Particle • Resonance • Interference • Diffraction • Photoelectric • Photons	mindset when approaching new content/application • Seek challenge options provided via extensions • Ability to make connections and see relevance in science content to community	materials	Extensions: • *Use Quantum theory to evaluate electromagnetic radiation • *Quantitative descriptions of waves • *Band theory to communicate wave behavior and interactions	technology skills.	

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Unit 6	Earth's place in the universe
Major Understandings	As a result of this unit students will gain an understanding of the Big Bang theory, and related/causal cycles, elements, motion and compositions. With this knowledge students will be able to develop a claim/solution to address a scenario offered through a problem-based question. This process will require that students display mastery of the following DCIs through various learning activities: • Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation (HS-ESS1-1) • Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe (HS-ESS1-2) • Communicate scientific ideas about the ways stars, over their life cycle, product elements (HS-ESS1-3) • Use mathematical or computational representations to predict the motion of orbiting objects in the solar system (HS-ESS1-4)
Driving Question	How might we predict which planet within the universe will successfully inhabit human life?
Duration	3-4 weeks

Science Content and Skills	**Additional Skills**	**Assessment**	**Differentiation Spotlight**	**Interdisciplinary Connections**	**IPSO Approach in Action**
Science and Engineering Practices ● Develop and use models ● Use mathematical and computational thinking ● Construct explanations and design solutions Crosscutting Concepts ● Identify the significance of a phenomenon is based on the scale, proportion and quantity at which it occurs ● Use algebraic thinking to examine scientific data ● Understand the role of energy and matter, specifically the nuclear process Vocabulary ● Atoms ● Conservations ● Protons ● Neutrons ● Energy ● Linear	Oral Communication: ● Presentation of findings to expert panel or targeted audience Written Communication: ● Argumentative statement Collaboration: ● Peer feedback ● Discussion protocols Creativity: ● Format of presentation Agency: ● Growth-mindset when approaching new content/application ● Seek challenge options provided via extensions	Formative ● Analysis of technical texts ● Graph and data interpretation ● Model write-up: informative/explanatory writing Summative ● Article for submission to online science magazine	ELL: ● Specific scaffolds to develop reading, writing, listening and speaking. ● Technical literacy support (front- loading, alternative reading material, word wall, visual cues) ● Process visuals, graphic organizers SPED: ● ELL supports listed above, in addition to: ● Additional benchmarks developed for final product ● Writing workshops for literacy scaffolds Extensions: ● Use of technology to	CCSS ELA: ● RST.11-12.1 ● WHST.9-12.2 ● SL.11-12.4 CCSS Math: ● MP.2 ● MP.4 ● HSN-Q.A.1 ● HSN-Q.A.2 ● HSN-Q.A.3 ● HSA-CED.A.1 ● HSA-CED.A.2 ● HSA-CED.A.4 CA SS: ● Chronological and spatial thinking 3	Social Justice/Equity: ● Heterogenous grouping ● Interaction with experts in the field-increase awareness and connections from students from underrepresented populations in STEM Personalized learning: ● Various mediums to access content and research Community Partnership: ● Experts in the community to provide feedback and audience for ideas Continuous Learning: ● Multiple points for self and peer reflection throughout the learning process ● Developing community contacts and connections

• Exponential • Phenomenon • Kepler's Law • Orbits • Gravity • Collisions • Big Bang theory • Fusion • Electromagnetic energy • Supernova • Gases • Radiation • spectra			enhance written assessment (ie., stop-motion video, PSA, podcast) • *atomic and sub-atomic processes involved with the sun's nuclear fusion • *different nucleosynthesis pathways for stars of differing masses • Calculus connections		