**SUBJECT: STEM 2 PHYSICAL SCIENCE APPLICATIONS TIMELINE: Aug 9 - 20**

**UNIT 1: Z-SPACE Virtual Reality Computer System - Franklin Lab: Electricity and Circuits**

**Essential Questions for this Unit**

1. How do devices plugged into an outlet get their power?

2. What affects the flow of electricity?

3. What are the relationships that allow you to measure electrical output?

| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| --- | --- | --- | --- | --- | --- |
| **Educational Technology Strand 1 Concept 2** *Models and Simulations:* Students use digital models and simulations to examine real-world connections, explore complex systems and issues, and enhance understanding.  ETHS-S1C2-01: Summarize the relationship amongst interdependent elements of a digital model or simulation.  **Educational Technology Strand 2 Concept 2** *Communication and Collaboration:* Students contribute to project teams to produce original works or solve problems.  ETHS-S2C2-01: Communicate and collaborate for the purpose of producing original works or solving problems.    **SCIENCE**  **Unifying Concept for Quarter 1**  Students will understand how to ask scientific questions and communicate ideas  **Reading Focus:**  Information  **Writing Focus:**  Narrative, Informative/Explanatory  **SCIENCE STANDARDS**  **Highly Leveraged:**  HS.S1.C1,C2,C3,C4  **Supporting:**  HS.S2.C2  HS.S4.C3  **Constant:**  HS.S2.C1  HS.S2.C2,C3  **Plus HS+Phy.P4U2.7**  Design, evaluate, and refine a device that works within given constraints to transfer energy within a system.  **Plus HS+Phy.P4U1.8**  Use mathematics and computational thinking to explain the relationships between power, current, voltage, and resistance.  **Science and Engineering Practices** #2. Develop and Use Models | Students build, apply, and extend basic knowledge of electrical current, voltage and resistance.  Ohm’s Law is central to the understanding of circuits.  Students need to master this relationship, and they can only do this with experience in building their own circuits.  Students will be challenged to design a circuit with a given value for the current leaving the battery. With each challenge, the tasks become more difficult. | 1. Design circuits to minimize and maximize resistance  2. Apply Ohm’s Law to determine resistance | 1. Handwritten, typed or verbal answers to discussion questions  2. Students complete performance tasks which allows them to apply their understanding of circuitry  3. Students design solutions to real world challenges | Z-Space Activity Video  Investigation: **Maximizing and Minimizing Resistance**  Franklin’s Lab  2. Schematic Drawing  Page  3. Franklin’s Lab  Backpack  4. Frayer’s vocabulary model | Current  Ohms  Ohm’s Law  Parallel  Resistance  Series  Voltage  Combination Circuits |
| 1. Build a circuit that functions as described with specific criteria  2. Test the circuit with a multimeter  Use resistors in series, parallel, and combination to get the desired resistance  3. Students formally quantify voltage, amps and current using Ohm’s Law. | 1. Handwritten, typed or verbal answers to discussion questions  2. Demonstrations  3. Performance Tasks | Z-Space Investigation: **Get That Current**  Franklin’s Lab |

**SUBJECT: STEM 2 PHYSICAL SCIENCE APPLICATIONS TIMELINE: Aug 23 - 31**

**UNIT 2: Z-SPACE Virtual Reality Computer System - Franklin Lab: Electricity and Circuits**

**Essential Questions for this Unit**

1. What is an electric motor?

2. How does an electric motor work?

3. What are period and frequency?

| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| --- | --- | --- | --- | --- | --- |
| **Educational Technology Strand 1 Concept 2** *Models and Simulations:* Students use digital models and simulations to examine real-world connections, explore complex systems and issues, and enhance understanding.  ETHS-S1C2-01: Summarize the relationship amongst interdependent elements of a digital model or simulation.  **Educational Technology Strand 2 Concept 2** *Communication and Collaboration:* Students contribute to project teams to produce original works or solve problems.  ETHS-S2C2-01: Communicate and collaborate for the purpose of producing original works or solving problems.  **SCIENCE STANDARDS**  **Essential** HS.P4U1.10  **Construct an explanation** about the relationships among the frequency, wavelength, and speed of waves traveling in various media, and their applications to modern technology.  **Plus** HS+Phy.P4U2.7  [**Design, evaluate, and refine**](https://www.nap.edu/read/13165/chapter/12#205)a devicethat works within given constraints to transfer energy within a system. | Content builds on the previous investigations involving circuits.  Students will begin to illustrate concepts with mathematical formulas and make mathematical connections. | 1. Predict how resistance and current affect the rate at which a motor spins  2. Determine the period of rotation  3. Convert period into frequency in hertz (Hz) and revolutions per minute (rpm) | 1. Handwritten, typed or verbal answers to discussion questions  2. Students determine the rate at which a motor in an automobile is rotating is measured in revolutions per minute (rpm)  3. Students design solutions to real world challenges | Z-Space Activity Video  Investigation: **Period and Frequency**  Franklin’s Lab  2. Stopwatch (can be smart phone)  3. Frayer’s vocabulary model | Frequency  Hertz (Hz)  Period  Revolutions per minute (rpm) |
| 1. Build a circuit that functions as described with specific criteria  2. Test the circuit with a multimeter  Use resistors in series, parallel, and combination to get the desired resistance  3. Students formally quantify voltage, amps and current using Ohm’s Law. | 1. Handwritten, typed or verbal answers to discussion questions  2. Demonstrations  3. Performance Tasks | Z-Space Investigation: **AND/OR**  Franklin’s Lab |

**SUBJECT: STEM 2 PHYSICAL SCIENCE APPLICATIONS TIMELINE: Sep 1 - 17**

**UNIT 3: Z-SPACE Virtual Reality Computer System - Franklin Lab: Troubleshooting Circuits**

**Essential Questions for this Unit**

1. How does energy flow through a circuit?

2. How can trial and error be used to troubleshoot problems?

3. How is energy converted from one form into another?

| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| --- | --- | --- | --- | --- | --- |
| **Educational Technology Strand 1 Concept 2** *Models and Simulations:* Students use digital models and simulations to examine real-world connections, explore complex systems and issues, and enhance understanding.  ETHS-S1C2-01: Summarize the relationship amongst interdependent elements of a digital model or simulation.  **Educational Technology Strand 2 Concept 2** *Communication and Collaboration:* Students contribute to project teams to produce original works or solve problems.  ETHS-S2C2-01: Communicate and collaborate for the purpose of producing original works or solving problems.    **SCIENCE STANDARDS**   * Same as Unit 1 | Provides opportunities for students to apply their knowledge of circuits and motors to evaluate and repair broken quadcopters by using parts from a functioning quadcopter | 1. I will repair multiple circuits with unknown malfunctions  2. I will determine the requirements to light an LED | 1. Demonstrations  2. Handwritten, typed or verbal answers to discussion questions | Z-Space Activity Video  Investigation: **Troubleshooting Basics**  Franklin’s Lab | Troubleshooting Flow Chart  Circuit  Electricity  Motor  Prototype  Quadcopter |
| 1. I will evaluate broken drone motors (quadcopters), determine the cause of the problem and restore the system to working order | Z-Space Investigation: **Quadcopter 1, 2 and 3**  Franklin’s Lab |
| 1. I can design a solution to a problem and build a circuit based on that design  2. I can test the circuit and analyze how the circuit might work with LEDs instead of light bulbs |  | Z-Space Investigation: **Classic Riddle** | Closed Circuit Efficiency Incandescent LED  Open Circuit |

**SUBJECT: STEM 2 SCIENTIFIC METHOD APPLICATIONS TIMELINE: Sept 11 - 22**

**UNIT 3: Z-SPACE Virtual Reality Computer System – Newton’s Park**

**Essential Questions for this Unit**

1. How are scientific research questions formulated?

2. How are variables identified and designed in the scientific process?

3. How are hypotheses tested through experimentation?

4. How are observational data collected and organized for analysis?

5. How can scientific results be presented?

| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| --- | --- | --- | --- | --- | --- |
| **Educational Technology Strand 2 Concept 2** *Communication and Collaboration:* Students contribute to project teams to produce original works or solve problems.  ETHS-S2C2-01: Communicate and collaborate for the purpose of producing original works or solving problems.    **Engineering Strand 6 *Technology Operations and Concepts* Concept** **1 *Understanding:*** Recognize, define and use technology processes, systems, and applications.  EHS-S6C1-03  **SCIENCE STANDARDS**  **Plus** HS+Phy.P4U1.6  [**Analyze and interpret data**](https://www.nap.edu/read/13165/chapter/7#61)to quantitatively describe changes in energy within a system and/or energy flows in and out of a system.  **Plus** HS+Phy.P4U2.7  [**Design, evaluate, and refine**](https://www.nap.edu/read/13165/chapter/12#205)a devicethat works within given constraints to transfer energy within a system.  **Plus** HS+Phy.P4U1.8  [**Use mathematics and computational thinking**](https://www.nap.edu/read/13165/chapter/7#64)to explain the relationships between power, current, voltage, and resistance. | The scientific method is a way we ask and answer questions by conducting experiments and making observations. This a series of 6 activities that will walk students through the steps of the scientific method. Students will create their own research question, pose a hypothesis (prediction), and run an experiment. | 1. I will identify a research question, formulate hypotheses related to a research question and evaluate hypotheses using experimental observations | 1. Handwritten, typed or verbal answers to investigation and discussion questions | Z-Space How-To Video  on Newton’s Park  Investigation:  **Developing a Research Question and Hypothesis**  Newton’s Park | Experiment Hypothesis Research question  Controlled variables Constants Dependent variable  Gravity Hypothesis Independent variable  Hypothesis Qualitative data Quantitative data |
| 1. I can identify and define dependent and independent variables  2. I will create an experiment and identify the variables involved | 1. Handwritten, typed or verbal answers to investigation and discussion questions | Z-Space Investigation:  **Define Variables**  Newton’s Park |
| 1. I can collect and record qualitative data on how the balls move  2. I can collect and record quantitative data on how the balls move | 1. Handwritten, typed or verbal answers to investigation and discussion questions | Z-Space Investigation: **Make Observations**  Newton’s Park  Data Collection Worksheet  Newton’s Park Schematic Drawing Page |
| 1. I can analyze how errors affect an experiment  2. I can redesign experiments to allow for accurate data collection | 1. Handwritten, typed or verbal answers to investigation and discussion questions | Z-Space Investigation: **Is This a Good Experiment?**  Newton’s Park | Control Constant Dependent variable Hypothesis Independent variable Observation |
| 1. I will design an experiment  2. I will identify and control variables within the experiment  3. I will evaluate an experiment in terms of data collection and hypothesis testing | 1. Handwritten, typed or verbal answers to investigation and discussion questions | Z-Space Investigation: **Design and Build Your Own Experiment**  Newton’s Park | Dependent variable Experiment Hypothesis Independent variable Observation Qualitative data Quantitative data Research questions |
| 1. I can differentiate between qualitative and quantitative data  2. I will accurately collect and record data  3. I will effectively present data | 1. Handwritten, typed or verbal answers to investigation and discussion questions | Z-Space Investigation: **Present Your Data**  Newton’s Park | Data Experiment Hypothesis Observations Qualitative data Quantitative data Research question |
| 1. I will create a research question and hypothesis  2. I will plan and conduct an experiment  3. I will collect and present data | 1. Handwritten, typed or verbal answers to investigation and discussion questions | Z-Space Investigation: **Scientific Method Challenge**  Newton’s Park | Data Experiment Hypothesis Observations Qualitative Data Quantitative Data Research question |

**SUBJECT: STEM 2 EARTH SCIENCE/ENGINEERING AND DESIGN TIMELINE: Sept 22 – Oct 8**

**UNIT 4: Problem Based Learning: Solar Activities and building a Solar Cooker – includes a global awareness project**

**Essential Questions for this Unit**

1. How does the Sun affect the Earth?

2. How can the energy from the Sun be used to do work?

3. How can the engineering design process be used to create sustainable solutions?

| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| --- | --- | --- | --- | --- | --- |
| **Educational Technology Strand 2 Concept 2** *Communication and Collaboration:* Students contribute to project teams to produce original works or solve problems.  ETHS-S2C2-01: Communicate and collaborate for the purpose of producing original works or solving problems.    **SCIENCE STANDARDS**  **Essential** HS.E1U1.11  **[Analyze and interpret data](https://www.nap.edu/read/13165/chapter/7" \l "61)** to determine how energy from the Sun affects weather patterns and climate.  **Plus** HS+E.E1U1.1  **Construct an explanation** based on evidence for how the Sun’s energy transfers between Earth’s systems.  **Plus** HS+E.E1U1.2  [**Develop and use models**](https://www.nap.edu/read/13165/chapter/7#56)to describe how variations in the flow of energy into and out of Earth’s systems result in changes in climate.  **END OF QUARTER ONE** | Students research the issue of health ­related problems, deforestation, and environmental impact due to the world’s continued dependence on wood fuel. Students research alternatives to wood­burning stoves (pellet stoves, oil stoves, solar stoves, etc.).  Students will build actual solar stoves and then measure their efficiency. | 1. I understand the inner workings of the Sun  2. I I can understand the role of Earth’s atmosphere in maintaining plant and animal life  3. I can explain how solar energy is converted into thermal energy  4. I can compare different solar cookers to see which design is most efficient  5. I can use engineering processes to design, build, and test a working solar cooker  6. I can evaluate peers’ solar cookers and provide feedback for improvement  7. I can improve my presentation skills  8. In an engineer’s role, I will submit a proposal analyzing current conditions in the Sudan and offering a viable solar oven alternative to the Sudanese government. | 1. Handwritten, typed or verbal answers to discussion questions  2. Graphing worksheet  3. Product – solar cooker  4. Reflection  5. Proposal  6. Portfolio – Students will organize and submit a complete portfolio on this unit | Cardboard boxes and sheets (pizza boxes, shoe boxes, moving boxes, etc.)  Clear cling wrap  Clear plastic containers (about ½ cup capacity) Heavy ­duty aluminum foil  Masking tape  Small thermometers Sun protection  Expert: cook or food scientist  Internet access zSpace Studio  Building a Solar Cooker Graphing Worksheet | Conduction Convection Deforestation Greenhouse effect Heat transfer Infrared radiation Ozone layer Solar energy Thermal energy Units (watt, joule) |
|  |  |

**SUBJECT: STEM 2 ALTERNATIVE FORMS OF ENERGIES TIMELINE: Oct 12 - 22**

**UNIT 5: Alternative Forms of Energy – the Power Wheel**

**Essential Questions for this Unit**

1. What is energy and how is it measured?

2. What is the relationship between Potential and Kinetic energy?

3. How are Potential and Kinetic energy calculated?

4. What are the advantages and disadvantages of hydroelectricity?

| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| --- | --- | --- | --- | --- | --- |
| **SCIENCE STANDARDS**  **Essential** HS.E1U3.14  [**Engage in argument from evidence**](https://www.nap.edu/read/13165/chapter/7#71)about the availability of natural resources, occurrence of natural hazards, changes in climate, and human activity and how they influence each other.  **Plus** HS+E.E1U3.10  **[Ask questions](https://www.nap.edu/read/13165/chapter/7" \l "54), [define problems, and evaluate a](https://www.nap.edu/read/13165/chapter/7" \l "67)**  **[solution](https://www.nap.edu/read/13165/chapter/7" \l "67)** to a complex problem, based on  prioritized criteria and tradeoffs, that account  for a range of constraints, including cost,  safety, reliability, and aesthetics, as well as  possible social, cultural, and environmental  impacts. | This lesson builds on previous investigations in Electricity and Circuits involving frequency, period and Ohm’s Law.  Prior to beginning this activity, students should have an understanding of calculating resistance using Ohm’s Law.  This unit is inquiry-based lessons learning about the various parts and their functions in a PowerWheel | 1. I can identify parts and their function of a PowerWheel in an inquiry lesson  2. I can define energy and the different types of energy with reference to hands-on activities with the PowerWheel  3. I can measure voltage and current, and electric power using the power equation | **Formative** Completion of inquiry-based questions and verbal replies to teacher questioning  Short videos on each part are followed by a  hands-on activity involving water as the energy source  **Summative** Performance Tasks | Teacher Demonstrations  1. Uses mechanical energy to power the PowerWheel, lighting a LED light strip  2. Illustrates early water wheels using water as the energy source  3. Bridge rectifier for application to charging cell phones, I-pads | Power  Potential and Kinetic Energy  Mechanical energy  Electrical  energy  Thermal energy  Radiant energy  Chemical energy  Generator  DC /AC |

**SUBJECT: STEM 2 COMMUNICATION AND COLLABORATION TIMELINE: Oct 25 - 29**

**UNIT 6: Collaboration: Philosophical Chair**

**Essential Questions for this Unit**

1. What is a Philosophical Chair debate?

2. What type of evidence is needed to support claims?

3. How can a Philosophical Chair activity support construction of concepts with minimal teacher intervention?

| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| --- | --- | --- | --- | --- | --- |
| **Educational Technology Strand 2 Concept 1** *Effective Communications and Digital Interactions*:  ETHS-S2C1-01. I can collaborate and communicate with peers, experts, or others employing a variety of digital tools to share findings and/or publish.  **Educational Technology Strand 2 Concept 2** *Communication and Collaboration:* Students contribute to project teams to produce original works or solve problems.  ETHS-S2C2-01: I can communicate and collaborate for the purpose of producing original works or solving problems | This STEM unit builds the skills of argumentation, collaboration and communication through inquiry based activities.  The goal of this project-­based learning activity is to give students opportunities to extend scientific concepts and practice 21st­ century skills (creativity, critical thinking, collaboration, and communication) | 1.I can ask questions and clarify problems  2. I can construct explanations and design solutions  3. I can engage in argument from evidence  4. I can obtain, evaluate and communicate information | **Formative:** Informal teacher checks, web organizer, student reflections and team communication  **Summative:** Debate and supporting evidence for Points and Rebuttals | Internet  Scientific Journals | Consensus  Evidence  Reasoning  Rebuttal  Counter  evidence |

**SUBJECT: STEM 2 PHYSICAL SCIENCE APPLICATIONS TIMELINE: Nov 1 – Dec 3**

**UNIT 7: Realityworks Electricity Kit with Wall Panels**

**Essential Questions for this Unit**

1. Do we use DC or AC in our homes

2. How is a house wired for electricity?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| **SCIENCE STANDARDS**  **Highly Leveraged:**  HS.S1.C1,C2,C3,C4  **Supporting:**  HS.S2.C2  HS.S4.C3  **Constant:**  HS.S2.C1  HS.S2.C2,C3  **Plus** HS+Phy.P4U2.7  Design, evaluate, and refine a device that works within given constraints to transfer energy within a system.  **Plus** HS+Phy.P4U1.8  Use mathematics and computational thinking to explain the relationships between power, current, voltage, and resistance.  **Science and Engineering Practices** #2. Develop and Use Models | Students will use an Electricity Kit in combination with a wall panel to practice basic wiring in a safe environment – all  Realityworks provides comprehensive learning solutions that pair curriculum with hands-on learning aids, student activities and assessment tools to engage students, teach needed skills and provide career exploration opportunities. | 1. I understand the difference between DC and AC  2. I am able to do basic house wiring safely and competently | Embedded (online) in Realityworks curriculum | Realityworks curriculum, Electrical Kit and Wall Panels | Students use two websites:  [**https://www.platinumelectricians.com.au/blog/basic-electrical-terms/**](https://www.platinumelectricians.com.au/blog/basic-electrical-terms/)  [**http://thecircuitdetective.com/glossary.php**](http://thecircuitdetective.com/glossary.php) |

**SUBJECT: STEM 2 PHYSICAL SCIENCE APPLICATIONS TIMELINE: Dec 6 - 17**

**UNIT 8: Review and Performance Task Assessment Z-SPACE Virtual Reality Computer System - Franklin Lab: Electricity and Circuits**

**Essential Questions for this Unit**

1. How does energy flow through a circuit?

2. How can trial and error be used troubleshoot problems?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| **Educational Technology Strand 1 Concept 2** *Models and Simulations:* Students use digital models and simulations to examine real-world connections, explore complex systems and issues, and enhance understanding.  ETHS-S1C2-01: Summarize the relationship amongst interdependent elements of a digital model or simulation.  **Educational Technology Strand 2 Concept 2** *Communication and Collaboration:* Students contribute to project teams to produce original works or solve problems.  ETHS-S2C2-01: Communicate and collaborate for the purpose of producing original works or solving problems.    **SCIENCE STANDARDS**   * Same as Unit 1 | Assesses understanding and use of academic vocabulary of electrical currents, closed circuits and conductivity | 1.I can identify the components of a simple robot  2. I can explore the effects of changing a robot’s components  3. I can identify the failing components in an electronic toy  4. I can repair an electronic toy by replacing the broken components | 1. Handwritten, typed or verbal answers to discussion questions  2. Schematic drawing of each student’s circuit | Franklin’s Lab  Exploration: **zBot**  Troubleshooting: **zBot**  Challenge: **zBot** | Circuit Current Electricity LED  Motor Ohms Resistance Resistors Switch |

**3 Review Days for Final Exams**

**FINAL SUMMATIVE ASSESSMENT for SEMESTER 1**

**SUBJECT: STEM 2 ENGINEERING AND DESIGN TIMELINE: Jan 5 - 31**

**UNIT 8: 3-D Printing**

**Essential Questions for this Unit**

1. What specialized technological meaning have common words such as input and output?

2. What significance do file extensions have?

3. Are there physical risks to working with 3D printers? If so, how do you avoid injury?

4. How is similarity shown when scaling?

5. How do I document the creative process?

| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| --- | --- | --- | --- | --- | --- |
| **Content Standard Alignment:**  This STEM lesson combines the three disciplines of Visual Arts, Geography and Educational Technology through inquiry based learning (STEAM).  **Educational Technology Strand 1 *Creativity and Innovation*** Concept 4 *Original Works:* Students use technology to create original works in innovative ways.  ETHS-S1C4-01: Students create innovative products or projects using digital tools to express original ideas.  **Educational Technology Strand 6: *Technology Operations and Concepts***Concept 1: *Understanding*: Students recognize, define and use technology processes, systems, and applications.  ETHS-S6C1-02: Students define and apply knowledge of various technical process terms.  ETHS-S6C1-05: Students analyze and evaluate physical risks of using digital technology.  **Mathematics GeometryA: *Understand congruence and similarity using physical models, transparencies, or geometry software.***  HS.G.A.1. Verify experimentally the properties of rotations, reflections, and translations: students need multiple opportunities to explore the transformation of figures so that they can appreciate that points stay the same distance apart and lines stay at the same angle after they have been rotated, reflected, and/or translated. Students are expected to work formally with properties of dilations in Geometry.  **Visual Arts Artistic Process: *Creating***Anchor Standard #2 – Students organize and develop artistic ideas and work.  HS VA.CR.2.8a Take risks to pursue ideas, themes, meanings and approaches – applying artistic norms of diverse cultures ...in contemporary art that emerge in the process of art making or designing.   |  |  | | --- | --- | | |  | | --- | |  | | | The mathematical concept of Transformations is used in a real-world context.  Students use Tinkercad to create models for 3-D printing.  Students must use scaling (Dilation) as the .stl files brought in from Tinkercad have to be scaled for students to save model as an .x3g file (unique to Makerbot) for 3D printing. | 1. I can create a model in Tinkercad for 3-D printing  2. I can save a model as an .obj or .stl file in Tinkercad for export  3. Import file into the Design Center  4. Use Tinkercad to create models in appropriate dimensions  5. Scale model for 3D printing  6. Virtually slice the model for successful 3D printing  7. Save as a .g file on a SD memory card  8. Successfully print out model on the 3-D printer  9. Redesign model if necessary and reprint | **Formative**  Informal teacher checks (verbal replies to teacher questioning) and partner communication  **Summative** Performance task: successful 3D print of model  Documentation of the creative process,  Written reflection and Quiz on terms | 1. Tinkercad  2. Tinkercad FAQ’s  3. Thingiverse  4. Makerbot Desktop  5. 3-D printer | Input  Output  Scaling  Raft  .x3g files  .stl files  .obj files |

**SUBJECT: STEM 2 LIFE SCIENCE APPLICATIONS TIMELINE: Feb 1 - 18**

**UNIT 9: Anatomy – Systems of the Body**

**Essential Questions for this Unit**

1. What are the structures and functions of the skeletal system and the musculosystem?

2. How are these two systems interrelated?

3. What applications does this have for me in my daily life?

| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| --- | --- | --- | --- | --- | --- |
| **Content Standard(s)**  **Educational Technology Strand 2 Concept 1** *Effective Communications and Digital Interactions*:  ETHS-S2C1-01. I can collaborate and communicate with peers, experts, or others employing a variety of digital tools to share findings and/or publish.  **Educational Technology Strand 2 Concept 2** *Communication and Collaboration:* Students contribute to project teams to produce original works or solve problems.  ETHS-S2C2-01: I can communicate and collaborate for the purpose of producing original works or solving problems  **SCIENCE STANDARDS**  **Essential** HS.L1U1.20  [**Ask questions**](https://www.nap.edu/read/13165/chapter/7#54) **and/or make predictions** based on observations and evidence to demonstrate how cellular organization, structure, and function allow organisms to maintain homeostasis. | The goal of this project-­based learning unit is to give students an opportunity to practice the 21st­ century skills (creativity, critical thinking, collaboration, and communication) while extending scientific concepts.  Students identify the structures and functions of each system and explain how these systems interact with each other to create a whole working system. | In the zSpace activities on the Skeletal System, students:   * *Explain* the function of the skeletal system and the musculosystem * *Identify* the locations of the major and the major muscles bones in the human body   In the zSpace activities on the Musculosystem, students:   * *Explain* the function of the skeletal system and the musculosystem * *Identify* the locations of the major and the major muscles bones in the human body | **Formative:** Informal teacher checks, student reflections and partner communication  **Summative:**  1. Handwritten, typed or verbal answers to discussion questions  2. Performance Tasks:  ZSpace Activities  3. Socratic Seminars   * Are dissections ethical at the high school level? * Should animals be bred for dissections? | 1. Z-Space Investigations:  **Human Anatomy: The Skeletal System**  **Human Anatomy: The Musculosystem**  2.Anatomical Diagrams  3. Worksheets  4. WEBSITES:  <http://www.bbc.co.uk/science/humanbody/body/factfiles/skeleton_anatomy.shtml>    <https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-course-biology-science/v/crash-course-biology-129>  <https://www.youtube.com/watch?v=rDGqkMHPDqE&list=PL8dPuuaLjXtOAKed_MxxWBNaPno5h3Zs8&index=19>  [https://www.youtube.com/watch?v=DLxYDoN634c&index=20&list=PL8dPuuaLjXtOAKedMxxWBNaPno5h3Zs8](https://www.youtube.com/watch?v=DLxYDoN634c&index=20&list=PL8dPuuaLjXtOAKed_MxxWBNaPno5h3Zs8) | **Skeletal:** Appendicular Axial  Carpels Clavicle Femur  Fibia Humerus Mandible Metacarpals Pelvis  Radius Scapula  Skull  Sternum  Tibia  Thorax  Ulna  Vertebra  **Musculo-:** |

**SUBJECT: STEM 2 EARTH SCIENCE APPLICATIONS TIMELINE: Feb 22 – Mar 11**

**UNIT 10: Earthquakes and Tsunamis**

**Essential Questions for this Unit**

1. How do earthquakes cause tsunamis?
2. What are P, S and surface waves and their impact?
3. How fast do the different waves travel?
4. How far from the epicenter are the waves picked up by seismographs?
5. Do the different waves have unique characteristics on the seismographs?

| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| --- | --- | --- | --- | --- | --- |
| **SCIENCE STANDARDS**  **Essential** HS.E1U1.13  **[Evaluate explanations](https://www.nap.edu/read/13165/chapter/7" \l "67)** and theories about the role of energy and matter in geologic changes over time.  **Plus** HS+E.E1U1.6  [**Obtain, evaluate, and communicate information**](https://www.nap.edu/read/13165/chapter/7#74)of the theory of plate tectonics to explain the differences in age, structure, and composition of Earth’s crust.  **Plus** HS+E.E1U1.8  [**Develop and use models**](https://www.nap.edu/read/13165/chapter/7#56)to illustrate how Earth's internal and surface processes operate over time to form, modify, and recycle continental and ocean floor features. | **Content Standard Alignment:**  Earth and Space Science provides the foundation for students to develop an understanding of the Earth, its history, composition, and formative processes, and an understanding of the solar system and the universe. Students study the regularities of the interrelated systems of the natural world. In doing so, they develop understandings of the basic laws, theories, and models that explain the world (NSES, 1995).  By studying the Earth from both a historical and current time frame, students can make informed decisions about issues affecting the planet on which they live. | 1. I can explain continental drift theory  2. I understand how earthquakes and tsunami are created  3. I can use the data from early warning systems to calculate the speed of *P* and *S* waves | **Formative:** Informal teacher checks, student reflections and partner communication  **Summative:**  1. Handwritten, typed or verbal answers to discussion questions  2. Performance Tasks | 1. Activities in Z-Space *STUDIO*2. Educational websites such as:Cascadia EarthScopeEarthquake and Tsunami Education Program 3. Animations: CEETEP DVD  4. Images (online)  5. Introductory video clips of earthquakes, tsunamis, warning systems, evacuation systems, megathrust earthquakes | Faults  Tectonic Plate  Movement  Pacific Rim  Early warning  systems  Megathrust  earthquake Tsunami  P waves  S waves |

**END OF QUARTER 3**

**SUBJECT: STEM 2 ENGINEERING AND DESIGN TIMELINE: Mar 21 – Apr 1**

**UNIT 11: Building Structures to Withstand Earthquakes**

**Essential Questions for this Unit**

1. How would I construct a open grid wall to illustrate earthquake tremors?

2. How may the structure of a building be reinforced to make it better able to withstand earthquake shaking?

3. What is the most efficient way to ensure an earthquake resistant building?

| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| --- | --- | --- | --- | --- | --- |
| **SCIENCE STANDARDS**  **Essential** HS.E1U3.14  [**Engage in argument from evidence**](https://www.nap.edu/read/13165/chapter/7#71)about the availability of natural resources, occurrence of natural hazards, changes in climate, and human activity and how they influence each other.  **Plus** HS+E.E1U3.11  [**Develop and use a quantitative model**](https://www.nap.edu/read/13165/chapter/7#56)to  illustrate the relationship among Earth  systems and the degree to which those  relationships are being modified due to human  activity. | Earth and Space Science provides the foundation for students to develop an understanding of the Earth, its history, composition, and formative processes, and an understanding of the solar system and the universe. Students study the regularities of the interrelated systems of the natural world. In doing so, they develop understandings of the basic laws, theories, and models that explain the world (NSES, 1995).  By studying the Earth from both a historical and current time frame, students can make informed decisions about issues affecting the planet on which they live. | 1. Recognize some of the structural elements of a building  2. Describe how the horizontal and vertical structural elements carry the horizontal and vertical loads of a building  3. Describe how diagonal braces, shear walls, and rigid connections provide paths for the horizontal load resulting from an earthquake  4. Observe how added structural elements strengthen a model wall to withstand shaking | **Formative:** Informal teacher checks, student reflections and partner communication  **Summative:**  1. Handwritten, typed or verbal answers to discussion questions  2. Performance Task:  Building of a wall (craft sticks) to simulate ground movement during earthquakes | 1. Activities in Z-Space *STUDIO*2. Educational Websites such as:Cascadia EarthScopeEarthquake and Tsunami Education Program 3. Animations: CEETEP DVD  4. Images (online)  5. *Building Strength* Video Lecture Dr. Robert Butler Geophysicist  7. Video Clips such as:   * How we design buildings to withstand earthquakes   <https://www.youtube.com/watch?v=c4fKBGsllZI>   * Bracing buildings for earthquakes   https://www.youtube.com/watch?v=i-e4Qkklfpk | load  load path rigid connections shear force  Shear walls braces or  bracing |

**SUBJECT: STEM 2 EARTH SCIENCE/CURRENT EVENTS TIMELINE: Apr 4 - 15**

**UNIT 12: Connection to Current Events**

**Essential Questions for this Unit:**

1. What is the cause of the recent 6.9 earthquake on the *Big Island* in Hawai’i?

2. What are the three main types of seismic events that occur in the islands of Hawi’i?

3. How do I read graphs of *ground motion visualization* from sensors in the continental states?

4. How is the Modified-Mercalli Intensity scale used by seismologists to estimate population exposure?

5. How fast were the P, S and surface waves travelling when they were recorded by seismographs in Bend, Oregon?

| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| --- | --- | --- | --- | --- | --- |
| **SCIENCE STANDARDS**  **Essential** HS.E1U3.14  **Engage in argument from evidence** about the availability of natural resources, occurrence of natural hazards, changes in climate, and human activity and how they influence each other.  **Plus** HS+E.E1U3.11  **Develop and use a quantitative model** to  illustrate the relationship among Earth  systems and the degree to which those  relationships are being modified due to human  activity.  **Plus** HS+E.E1U1.8  [**Develop and use models**](https://www.nap.edu/read/13165/chapter/7#56)to illustrate how Earth's internal and surface processes operate over time to form, modify, and recycle continental and ocean floor features. | Earth and Space Science provides the foundation for students to develop an understanding of the Earth, its history, composition, and formative processes, and an understanding of the solar system and the universe. Students study the regularities of the interrelated systems of the natural world. In doing so, they develop understandings of the basic laws, theories, and models that explain the world (NSES, 1995).  By studying the Earth from both a historical and current time frame, students can make informed decisions about issues affecting the planet on which they live. | 1. I can identify the three regions in which earthquakes are generated in the Hawaiian Islands  2. I can describe the movement of the shallow dipping thrust fault that resulted in the 6.9 recent earthquake in Hawai’i  3. I can read and interpret contour maps that indicate the Modified-Mercalli Intensity scale and estimate population exposure  4. I can interpret a ground motion visualization for the M 6.9 earthquake in Hawai`I generated from seismic signals reported by sensors in the continental states | **Formative:** Informal teacher checks, student reflections and partner communication  **Summative:**  1. Handwritten, typed or verbal answers to discussion questions  Performance Tasks:  2. Interpretation on contour maps indicating the Modified-Mercalli Intensity scale  3. Estimation of population exposure  4. Interpretation of ground motion visualization graphs  5. Determining average speed of P, S and surface waves from the epicenter to Bend, Oregon | 1. IRIS Teachable Moments May 4, 2018 powerpoint2. Images and Flash animations of shallow dipping thrust faults 3. Ground motion visualization graphs  4. Seismographs from sensors in Bend, Oregon recorded on May 4 | Shallow  dipping  thrust  fault  Seismograph  Ground motion  visualization  graphs |

**SUBJECT: STEM 2 ENGINEERING AND DESIGN TIMELINE: Apr 18 - 29**

**Unit 13: 3-D Printer Utilities**

**Essential Questions for this Unit**

1. How is a 3-D Printer prepared to accurate produce mesh layers that are approximately 1 micron in thickness?

2. How do you ensure that a 3-D print mesh will adhere to a heated build plate without warping?

3. How do custom settings in Makerbot Desktop provide adequate supports and bridging with a raft for a model?

| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| --- | --- | --- | --- | --- | --- |
| **Content Standard Alignment:**  This STEM lesson combines the three disciplines of Visual Arts, Geography and Educational Technology through inquiry based learning (STEAM).  **Educational Technology Strand 1 *Creativity and Innovation*** Concept 4 *Original Works:* Students use technology to create original works in innovative ways.  ETHS-S1C4-01: Students create innovative products or projects using digital tools to express original ideas.  **Educational Technology Strand 6: *Technology Operations and Concepts***Concept 1: *Understanding*: Students recognize, define and use technology processes, systems, and applications.  ETHS-S6C1-02: Students define and apply knowledge of various technical process terms.  ETHS-S6C1-05: Students analyze and evaluate physical risks of using digital technology. | Besides being able to use technology, students should also know how to perform maintenance of hardware and handle basic troubleshooting as the Makerbot unit will give electronic feedback when there is a problem.  This is an important aspect of learning to work with 3D printing. | 1. I can calibrate two nozzles for optimal performance  2. I can successfully level the build plate  3. I can use custom settings to provide proper supports and rafts  4. I can unload, change and reload filament | **Formative:** Informal teacher checks, student reflections and partner communication  **Summative:**  1. Handwritten, typed or verbal answers to test questions  Performance Tasks:  2. Calibration of Nozzles  3. Build Plate (Bed) Leveling  4. Changing filament | 1. Makerbot Desktop Printer Manual2. Makerbot online forum 3. printer-specific blogs and listserves | Mesh  Micron  Build plate  Bed leveling  Bridging  Calibration  Nozzles  Filament  ABS  PLA  Multi-material  printing |

**SUBJECT: STEM 2 ENGINEERING AND DESIGN TIMELINE: May 2 - 20**

**Unit 13: Levels, Simple Machines and Hydraulics**

**Essential Questions for this Unit**

1. How do levers accelerate force?

2. How are simple machines constructed?

3. How are hydraulics used to solve specific problems?

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| Standards | Content | Objectives | Assessment | Resources | Vocabulary |
| Although there are not specific standards for hands-on making of machines, basic knowledge of levers, how machines work and hydraulics is essential for students going into the STEM or Robotics fields.  **SCIENCE STANDARDS**  **Plus** HS+Phy.P4U2.7  [**Design, evaluate, and refine**](https://www.nap.edu/read/13165/chapter/12#205)a devicethat works within given constraints to transfer energy within a system. | Through experimentation and tinkering, students learn how to build basic machines, adapting them to solve real-world problems such as designing a machine that will help lift and move a wheelchair between two levels.  Students learn to use hydraulics to move a swing bridge, raise and lower a robot’s arm, etc.  Students also gain an appreciation of the mechanics of STEM and Robotics problem-solving. | 1. I understand the action of levers and can accelerate force using levers.  2. I can build simple machines such as a hurling machine or a lifting machine,  3. I can use hydraulics to build machines to accomplish specific tasks | 1. Written answers to discussion questions  2. Design Challenges: either to accomplish specific tasks (design a platform that can be adjusted in height and stay horizontal) or more open-ended (design a mechanism that will keep a laptop screen facing you but can be moved up and down) | Pathfinders Hydraulic STEM Engineering Maker Set  Design Challenges | Work  Power  Torque  Displacement  Force  Types of Levers  Acceleration  Fulcrum  Linkage  Hydraulics  O-Ring  Gripper |

**3 REVIEW DAYS**

**FINAL SUMMATIVE ASSESSMENT for SEMESTER 2**