­­Transdisciplinary Inquiry-Based Learning Project (TPBL)

Solar Eclipse Grade 7

# How to use this document to implement this TPBL:

* **Problem-based, project-based learning** is a challenging instructional method that requires educators to pre-plan anticipated supports learners may need as they engage in their learning.  True PBL cannot be fully scripted in advance, because when students have ownership of their inquiry process, their learning will undoubtedly take them in directions the educator could not have predicted.

**👍 This document is:** a starting point for a TPBL with a compilation of suggestions and considerations for educators to pull from to design an authentic PBL in their classrooms.  Pay attention to the word “consider” indicated in red font for many opportunities to personalize and extend this PBL for your unique learning environment!

**🙅‍♀️ This document is NOT:** a concrete script of exactly how a PBL should or could be done which does not need any further design on the part of the educator. Even the [sample design brief](#_Student_Design_Brief) can be used as a starting place that educators can make a copy of and tailor to their needs!

* Authentic PBL anchored in **inquiry-based learning** allows learners to obtain content knowledge and hone skills through the process of answering the driving question and/or designing the solution to the problem.  This requires learners to engage in the challenge of discovery and connecting skills and content from multiple academic disciplines.

**👍 Educators should:** embrace inquiry and spark curiosity with the driving question and problem statement to allow students to learn through the process of creating their artifacts and final products. Please consider reviewing the sample roll out activity in the third table to see how an inquiry project launch could be implemented.

**🙅‍♀️ Educators should NOT:** frontload content through lessons and activities before rolling out the PBL and engaging students in inquiry and use the final product / project as a culmination of learning / assessment.

* **Transdisciplinary learning** is an authentic representation of how we live in “the real world.”  Many of the issues of importance to modern society are rooted in the social and natural sciences, explored in the humanities, modeled using mathematics, and communicated through language and the arts.  Achieving this in classrooms while maintaining disciplinary independence and integrity of standards, while utilizing existing instructional approaches, is a challenge. A TPBL uses an authentic problem and/or driving question that creates an opportunity for this kind of learning.

**👍 This PBL should:** require students to apply skills and content from at least science, English-language arts and literacy, social studies, and technology (and possibly additional content areas depending on how this is implemented).  While this PBL can be implemented in one class / with one educator, we strongly encourage educators to collaborate with additional content area teachers (whether behind the scenes or by implementing the PBL in multiple courses together) to ensure students are provided with adequate support from subject-matter experts.   
**🙅‍♀️ This PBL should NOT:** reinforce the silos between academic subject areas.

* New to transdisciplinary learning and/or PBL? Consider…
  + Reaching out to Ohio experts in PBL at [one of Ohio’s STEM or STEAM Designated Schools near you](https://education.ohio.gov/Topics/STEM-Science-Technology-Engineering-and-Mathem/STEM-and-STEAM-School-Designation), [The Ohio STEM Learning Network (OSLN)](https://osln.org/contact-us/), [OSLN Regional Hub Directors](https://osln.org/schools-hubs/hubs/), [Regional Personalized Learning Specialists](https://www.personalizeoh.org/pages/regional-personalized-learning-support), [INFOhio](https://openspace.infohio.org/), [The Teaching Institute for Excellence in STEM (TIES)](https://www.tiesteach.org/#1475569789470-4a7e00b7-936fa2ae-edb6), or [Regional STEM Learning Ecosystem Leaders](https://stemecosystems.org/ecosystems/#northeast-ohio-stem-learning-ecosystem).
  + Exploring training and introduction to some of these practices through:
    - [NSTA](https://my.nsta.org/resource/126186/archive-transforming-science-learning-part-1-project-based-learning-principle)
    - [The PAST Foundation](https://www.pastfoundation.org/educators)
    - [PBLWorks](https://www.pblworks.org/what-is-pbl)
    - [STEM Teaching Tools](https://stemteachingtools.org/brief/35)*\*This is a sample list and not a comprehensive list of all possible resources and organizations that provide training and resources for STEM practices such as PBL.*

Backwards Design Mapping

# What are the desired results of this experience?

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| **Driving Question** | **How does space weather affect our planet?** |
| **Learning Outcomes** | **I can…**   * show that I know how solar eclipses work. * show that I know how space weather occurs. * show that I know how scientists have studied space weather during total solar eclipses. * teach others at least one way that space weather affects our society or the natural world. |
| **Goals** | **Acquire Transferable Skills:**   * Collaboration * Personal Accountability * Documentation * Design Thinking * Computational Thinking * Critical Thinking * Problem-Solving * Sustained Inquiry   **Understand Big Ideas:**   * The Nature of Science   + Scientific discoveries create ripples throughout society and humanity.   + Scientific discoveries can be made through collective citizen effort, and not just individual scientists in labs. * Earth’s Place in the Universe   + Our sun, Earth’s magnetic field, and space weather all impact our daily lives more than we may realize.   + Rare events like total solar eclipses provide a glimpse into the deeper workings of the universe.   **Build Literacy Skills:**   * Reading informational text * Citing evidence to justify claims * Communication of ideas |
| **Content Alignment** | **Prior Learning Connections:**   * Science: the structure of our solar system * Literacy: evaluation of informational texts for validity * Math: light and shadows * Technology: video production   **Future Learning Connections:**   * Science: Weather topics, Space science topics * ELA: Media literacy, Presentation skills * Social Studies: History of science, How do scientific discoveries impact our society? * Technology: Broadcasting, Wearable devices * Math: Scaling, Geometry   **Consider expanding this PBL beyond 7th grade and leverage grade level content experts to align additional standards.** |

# How will students demonstrate evidence of their learning?

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| **Performance Summative Assessment** | **Create an engaging news segment that will spread awareness about space weather conditions, how they affect us and how scientists have studied space weather during total solar eclipses.** |
| **Formative Assessment Suggestions** | * **Key Vocabulary:**   + Pre-Assessment   + Creation of vocabulary cards, anchor charts, etc.   + Vocabulary Quiz   + Class Quizlet or Kahoot competition * **Project Completion Checkpoint Assessment Options:**   + [Know/Need-To-Know charts](https://www.magnifylearningin.org/know-need-to-know)   + Draft Submissions   + Peer Review of Drafts (we encourage use of [Design Thinking cycles](https://www.iste.org/node/6651) in this practice)   + Chunking project steps into mini-submissions for teacher input and personalized support * **End-of-Project Reflection Options:**   + Forms (Google, Microsoft, Jot, etc.) with open-ended reflection questions, Likert scales based on rubric, ways to improve the project for the teacher’s future use, etc.   + [Fishbowl](https://research.qut.edu.au/eportfolio/practitioner-resources/teaching-patterns/fishbowl-reflection/)   + [Self-Assessment](https://www.edutopia.org/practice/mastering-self-assessment-deepening-independent-learning-through-arts) |
| **Standards** | Consider how the implementation of this PBL in your classroom may remove or add standards from those listed below.  For example, if your students engage in the optional Math extension activities suggested throughout this document, the math standards will align.  However, if this PBL is done without the Math extension opportunities, supplemental activities, or a collaboration with a licensed teacher, they may not apply.  Similarly, the Social Studies Standards listed may be built into this PBL through extensions and supplemental activities or in collaboration with a licensed teacher. As with all components of this document and PBL supplemental materials linked throughout, this is intended to be used as a guide that each educator can personalize for their unique learning environment and students.  **Science:**   * **Ohio: 7th Grade Science**   + **7.ESS.4:** The relative patterns of motion and positions of Earth, moon and sun cause solar and lunar eclipses, tides and phases of the moon.     - The moon’s orbit and its change of position relative to Earth and sun result in different parts of the moon being visible from Earth (phases of the moon).     - A solar eclipse is when Earth moves into the shadow of the moon (during a new moon). A lunar eclipse is when the moon moves into the shadow of Earth (during a full moon).   + **Nature of Science:**     - **Science is a Way of Knowing:** Science assumes the universe is a vast single system in which basic laws are consistent. Natural laws operate today as they did in the past and they will continue to do so in the future. Science is both a body of knowledge that represents a current understanding of natural systems and the processes used to refine, elaborate, revise and extend this knowledge.     - **Science is a Human Endeavor:** Science has been, and continues to be, advanced by individuals of various races, genders, ethnicities, languages, abilities, family backgrounds and incomes.     - **Scientific Knowledge is Open to Revision in Light of New Evidence:** Science is not static. Science is constantly changing as we acquire more knowledge. * **Next Generation Science Standards (NGSS): 6-8 Grade Band**   + MS-ESS1-1: Earth’s Place In The Universe: 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   **Ohio 7th Grade English- Language Arts:**   * **CCS RI.7.1.** – I can cite several pieces of evidence to support an analysis of the informational text. * **CCS RI.7.7.** – I can compare and contrast different media versions of informational text (written vs. audio vs. film) * **CCS W.7.2./ 7.8** – Gather and write an informational/explanatory text to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. * **CCS SL.7.1** – I can effectively engage in collaborative discussions with my peers. * **CCS SL.7.5** – I can use multimedia components and visual displays to clarify claims and to add emphasis.   **2012 Ohio 7th Grade Fine Arts Standards:**   * **Theater:**   + **3CE** Demonstrate the ways in which cultural traditions and perspectives are reflected in the content of live theatre, film, video and electronic media.   + Collaborate with peers to dramatize a contemporary social issue and its impact on society. * **Visual 3PR Arts:**   + **6PE** Connect various art forms to their social, cultural or political purposes and include regional examples.   **Consider: DRAFT 2023 Ohio 7th Grade Fine Arts Standards:**   * **Theater:**   + **7.1CR** Write a scripted scene that includes stage direction prompts and provides exposition, consistent point of view, sensory details and dialogue.   + **7.2PE** Participate in rehearsals for a staged work that will be shared with an audience.   + **7.3PE** Construct and produce the technical components for a script using art or media to present design ideas. * **Visual Arts:**   + **7.4RE** Connect various art forms to their social, cultural or historical purposes. * **Media Arts:**   + **7.2CR** Implement production processes to integrate content and components for a determined meaning in media art.   + **7.3CR** Formulate artistic elements to improve understanding of purpose for an audience.   + **7.3PE** Demonstrate adaptability using tools, techniques and content to achieve an assigned purpose using traditional and experimental techniques when producing media art.   + **7.1CO** Construct and communicate creative ideas based on personal and external resources.   **Consider: Ohio 7th Grade Math:**   * **7.RP:** Ratios and Proportional Relationships: Analyze proportional relationships and use them to solve real world and mathematical problems * **7.EE:** Expressions and Equations: Solve real-life and mathematical problems using numerical and algebraic expressions and equations. * **7.G:** Geometry:   + Draw, construct, and describe geometrical figures and describe the relationships between them.   + Solve real-life and mathematical problems involving angle measure, circles, area, surface area, and volume. * **7.SP:** Statistics and Probability:   + Broaden understanding of statistical problem solving.   + Investigate chance processes and develop, use, and evaluate probability models.   **Consider: Ohio 7th Grade Social Studies:**   * The civilizations that developed in Greece and Rome had an enduring impact on later civilizations. This legacy includes governance and law, engineering and technology, art and architecture, as well as literature and history. * Improvements in transportation, communication and technology have facilitated cultural diffusion among peoples around the world. * Analyzing individual and group perspectives is essential to understanding historic and contemporary issues. Opportunities for civic engagement exist for students to connect real-world issues and events to classroom learning.   **Consider: International Society for Technology in Education (ISTE) Student Standards:**   * **1.1. Empowered Learner:** Students leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by the learning sciences. Students:   + **1.1.a.** articulate and set personal learning goals, develop strategies leveraging technology to achieve them and reflect on the learning process itself to improve learning outcomes. * **1.3. Knowledge Constructor:** Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others. Students:   + **1.3.a.** plan and employ effective research strategies to locate information and other resources for their intellectual or creative pursuits.   + **1.3.b.** evaluate the accuracy, perspective, credibility and relevance of information, media, data or other resources.   + **1.3.c.** curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.   + **1.3.d.** build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions. * **1.4. Innovative Designer:** Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions. Students:   + **1.4.a.** know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.   + **1.4.b.** select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.   + **1.4.c.** develop, test and refine prototypes as part of a cyclical design process.   + **1.4.d.** exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems. * **1.6. Creative Communicator:** Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals. Students:   + **1.6.a.** choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.   + **1.6.b.** create original works or responsibly repurpose or remix digital resources into new creations.   + **1.6.c.** communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.   + **1.6.d.** publish or present content that customizes the message and medium for their intended audiences. |
| **Collaboration with Individual Accountability** | **Some Example Group Roles:** Consider having students create group norms and fine-tuning group roles. Consider narrowing roles down to three roles for four group members in the event a student is absent (and having the fourth group member rotate through roles, etc.).   * **Project Management Engineer:**   + Represent your team by asking the teacher any questions from the group or getting help with any obstacles.   + Compile whole group progress on deliverables by coordinating with the Information Technology engineer.   + Contribute to project deliverables.   + Can independently explain academic concepts involved in project. * **Research Engineer:**   + Ensure all team members can understand the science involved in the project.   + Track sources where information is cited from and verify the sources are scientifically valid.   + Contribute to project deliverables.   + Can independently explain academic concepts involved in project. * **Information Technology Engineer:**   + Coordinate team meeting agendas.   + Record notes during meetings.   + Track and monitor group member progress on deliverables by checking in with each group member individually on their role and goals.   + Contribute to project deliverables.   + Can independently explain academic concepts involved in project. * **Media Relations Engineer:**   + Ensure final product language is clear and presented in a way anyone can understand but still accurate by coordinating with the Scientific Research Engineer.   + Ensure all materials created are complete, polished, and professional.   + Communicate with other student groups to share resources and compare progress.   + Contribute to project deliverables.   + Can independently explain academic concepts involved in project. |

Universal Design for Learning Alignment

# Engagement: How will learners be motivated and interested in learning?

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| **Authentic Connection** | * Ohioans will be able to directly experience a total or partial solar eclipse on April 8, 2024. * Solar weather impacts our technology, which students interface with daily. |
| **Inquiry-Based Learning** | * Students will take ownership of their learning through open-ended questions that foster curiosity. * Students will complete reflections and self-assessments to monitor progress and make personal connections to their learning. |
| **Accessibility Resources** | * [OCALI SIFTS Assistive Technology Online Platform](https://sifts.ocali.org/) * [OCALI Lending Library (assistive technology, braille, practice tests, books, etc.)](https://www.ocali.org/project/lending_library) * [Educational Service Guidelines for the Students who are Deaf or Hard of Hearing](https://deafandblindoutreach.org/storage/ocali-ims-sites/ocali-ims-outreach/documents/Educational-Guidelines-DHH822019.pdf) * Examples of Some Project Accommodations:   + Small group for vocabulary quizzes, work time for individual contributions to group work   + Repeated directions (written, verbal, picture cards)   + Rephrasing of directions   + Provide audio (audiotapes if available) reading of material   + Pre-teach vocabulary   + Checklists for project deliverables   + Physical demonstrations and modeling project deliverables   + Read materials aloud   + Chunking project work into smaller checkpoints |

# Representation: How will learners be presented with information and content?

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| **Content Differentiation** | * Students can select from provided resources to answer questions and complete project deliverables. * Students can use inquiry skills to identify and verify resources beyond those provided by the educator. |
| **Process Differentiation** | Educators are encouraged to:   * consider supporting students in creating their own goals and guiding them to determine how they can achieve those goals within the constraints of the project. * provide students with opportunities to collaborate within their group and among other groups to share resources, peer review ideas, and support each other. * provide students with guidance for how each individual can contribute to the project deliverables.  Consider facilitating a class discussion when students can collectively identify solutions to problems they may encounter in the project or common pitfalls they may experience in an inquiry-driven learning experience. * consider modeling the research process with your students to demonstrate the resilience and reflection inherent in sustained inquiry. * as guided by the educator’s organizational remediation policy, consider opportunities for students to reflect on, revise, and improve upon their work based on peer and/or educator feedback. |

# Action & Expression: How will learners express what they know?

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| **Action & Expression: How will learners express what they know?** | |
| **End Product Differentiation** | * Voice and Choice in Process:   + Students work in small groups and submit group work trackers showing individual contributions. * Voice and Choice in Product and Content:   + Students must include visuals, verbal explanations, and at least one other method of communicating the information shared, which they can choose.   + Student news segments must each have at least one unique fact or experiment discussed that no other groups in the class include, requiring collaboration between groups.   + While all groups must include the following two segments:     - Breaking news!     - (Space) Weather Forecast   They have the choice to include any two additional segments:   * + - Entertainment     - Investigative     - Sports     - Advertisements     - Expert interview     - Eyewitness interview     - Feel Good / Community     - [Student’s creative idea here pending teacher approval]   + Students have voice and choice in how they perform their segment (filmed live in front of the audience OR pre-recorded as a video that will be played for the audience).   + Students must submit additional evidence of their learning process:     - Pre-written script, which must include verified evidence in citations for all claims.     - Pre-written cue cards.   + Consider expanding the topics for news segments to include more specific phenomena such as solar flares, local weather, etc. * Consider:   + Expanding the final product to be an entire media campaign:     - Video / performed news segment (the current PBL end product)     - Flyers, brochures, and visual media, etc.     - Podcasts, radio, and auditory media, etc.     - Websites and online media, etc.     - Video other than news segments (trailer/teaser, engineering safety for viewing, etc.) |

Project Roll Out and Student-Facing Materials

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| **Hook / Roll Out Suggestion** | These activities can be used individually or broken up across multiple lessons / days as is appropriate for your students.  We are providing a sample ~90 minutes of roll out activities in a suggested order to foster inquiry as an example that you are encouraged to adapt in your setting.   1. (5 minutes) Listen Listen to an excerpt from this episode, [“Where the Sun Don’t Shine” from Radiolab](https://radiolab.org/episodes/sun-dont-shine)  * **Keep the topic (solar eclipse) a secret for this part of the lesson!** * Be sure to print out the transcript for accessibility for students with deafness or who are hard of hearing. * Play from 00:00:00 - 00:02:00 (first two minutes, after the cheering but before the podcast host, Jad starts speaking). *\*Note: there may be ads that play in the beginning. If you are concerned about the appropriateness of the content in the ads for your students, we recommend muting the audio until the podcast itself begins.* * Ask students what they think they’re listening to and what they think the voices in the podcast are watching. * Ask any students if they have ever seen an eclipse in person and if so to describe their experience.  1. (2+ minutes) When and where is the next total solar eclipse?    * + Show [NASA’s Eclipse Countdown](https://solarsystem.nasa.gov/eclipses/2024/apr-8-total/overview/) for the next solar eclipse and see that the path of totality will pass through many parts of Ohio in April 2024.      + Show the [Ohio Eclipse Webpage](http://eclipse.ohio.gov) to show where the path of totality will be and identify if your classroom is in the path.      + The [Ohio Department of Education eclipse](https://education.ohio.gov/Topics/Learning-in-Ohio/Science/Resources-for-Science/2024-Solar-Eclipse) webpage has a more detailed map in the FAQs as well as additional resources for educators. 2. (5+ minutes) What does a total solar eclipse look like?  Play [this Veritasium video](https://www.youtube.com/watch?v=G10m2ZZRH4U) showing the 2017 total solar eclipse, [this NASA animation](https://svs.gsfc.nasa.gov/20233), and/or [this National Geographic video](https://youtu.be/cxrLRbkOwKs). Optional: explore the videos created in the [Eclipse Mega Movie Project](https://eclipsemegamovie.org/).    * Be sure to turn closed captions on for accessibility.    * Have students record their thoughts and feelings watching the event.    * Ask students to think about what individuals might not be able to experience this awe-inspiring event (persons with blindness or visual impairments). Prompt students to brainstorm ways that they might be able to share this experience with those individuals. 3. (10 minutes) How can we explain and share what this experience looks like?  On a device that allows you to cast or share with the whole class, download the [Eclipse Soundscapes app](https://eclipsesoundscapes.org/mobile-app/). Or, if there is the option for students to download the app on a mobile phone or tablet, allow them to do this in small groups.    * Prompt students to explore the rumble maps.    * Play several of the accessible videos that describe the eclipses.    * Have students record specific words which were used that helped them picture the event in their mind’s eye. 4. (30+ minutes) Design Challenge: How do total solar eclipses work? ([NSTA 5Es Lesson](https://www.nsta.org/phases-moon))    * Place students in groups of 3 or 4 or allow them to choose their groups.    * Provide each group with a flashlight and two balls of different sizes      + Optional extension: MATH: The radius of the moon is about ¼ the radius of Earth, and is about 220 moon radii away from Earth if you want to use this as an opportunity to introduce geometry, measurement, and scale.  Consider trying [this demonstration activity with your students for scale and proportions](https://www.exploratorium.edu/snacks/solar-eclipses).  Here’s a great article from NASA: [How can the little moon hide the giant sun?](https://solarsystem.nasa.gov/resources/2706/how-can-the-little-moon-hide-the-giant-sun/?category=total_eclipse_activities)    * Provide the students with the driving question, “How do total solar eclipses work?” and inform them they must come up with a demonstration using the materials you’ve provided or any other classroom materials they have access to and are allowed to use to demonstrate to other groups in the class.    * Prompt them to use the words and language they recorded from the previous Eclipse Soundscapes activity (#4 above) to make their verbal explanation clear and accessible.    * Encourage them to use their creativity to make their demonstration engaging and interesting. Some possible suggestions you may provide include a dance, rap, song, skit, play, drawings, or any other communication methods outside of verbal that they may wish to use!    * Provide them with guidelines about criteria that must be included, such as:      + Vocabulary terms like:        - Total solar eclipse        - Path of totality        - Corona        - Solar System        - More vocabulary terms aligned with this content are included in the table below.      + Citing accurate sources to ensure the information in their demonstration is correct.        - Optional extension: ENGLISH-LANGUAGE ARTS: This can be an opportunity to introduce methods such as the CRAAP test, MLA or APA citation formatting, claim-evidence reasoning, or other related ideas.    * Allow time to prepare their demonstration and be sure to circulate and provide personalized support to groups as needed.    * Have students present their demonstrations to the class.      + Optional extension: REFLECTION SKILLS: Have students practice [giving feedback using thinking hats](http://www.mediafactory.org.au/elizabeth-maidment/2017/03/13/thinking-hats-giving-constructive-feedback/) on each others’ demonstrations.      + Optional extension: EXPERIMENTATION: using heat lamps and ice, consider having the students further experiment with scaling and modeling the Earth + Sun system to explore additional topics in weather and seasons. 5. (15+ minutes) Building Curiosity:    * Have the class create a [wonder wall](https://artsintegration.com/2018/09/01/a-low-prep-strategy-to-cultivate-inquiry-voice-and-choice/) about the questions they have about total solar eclipses (it’s expected they will have questions about even broader topics including space, the solar system, etc., too!).  Some that you can have prepared if the students are getting stuck include:      + How do solar eclipses advance scientific discoveries?  (Please see supplemental lessons below for an optional extension: HISTORY)      + How do total solar eclipses affect our society and the natural world?  (Please see supplemental lessons below for an optional extension: HISTORY)      + How do phases of the moon work?      + How are solar eclipses and lunar eclipse different? 6. (15+ minutes) NASA Articles: How do scientists study space weather during total solar eclipses?    * Consider creating a thought catcher for students to complete during the stations.    * Consider using creating something using an interactive online tool to engage students with the articles.    * Split the students into groups.  After they have engaged with their assigned articles, have each group share with the whole class:      + 3 things they learned;      + 2 questions they have after reading the article and watching the video;      + 1 summary of the scientific experiment that was conducted during the total solar eclipse in 2017 and what was learned about space weather from the experiment.    * Group 1: [Studying the Sun’s Atmosphere with the Total Eclipse of 2017](https://www.nasa.gov/feature/goddard/2017/studying-the-sun-s-atmosphere-with-the-total-solar-eclipse-of-2017)    * Group 2: [Day to Night and Back Again: Earth’s Ionosphere During the Total Solar Eclipse](https://www.nasa.gov/feature/goddard/2017/day-to-night-and-back-again-earth-s-ionosphere-during-the-total-solar-eclipse)    * Group 3: [Eclipse 2017 Shines Light on the Sun-Earth Connection](https://www.nasa.gov/feature/goddard/2020/eclipse-2017-shines-light-on-the-sun-earth-connection)    * Group 4: [Total Solar Eclipses Shine a Light on the Solar Wind with Help from NASA’s ACE Mission](https://www.nasa.gov/feature/goddard/2021/total-solar-eclipses-shine-light-solar-wind-ace)    * Group 5: [Research Highlights from NASA’s GOLD Mission](https://blogs.nasa.gov/sunspot/2021/01/14/research-highlights-from-nasas-gold-mission/)    * Group 6: [Citizen Cate Experiment](https://nso.edu/citizen-cate/) 7. 5 minutes) PBL Roll Out: See [Student Facing Design Brief](#_Student_Design_Brief) (also linked below)    * Leverage the students’ curiosities to connect to the driving question of this PBL:  How does space weather affect our planet?    * Provide students with the problem statement and design statement.    * Consider posting the problem statement, design statement, and constraints on large chart paper around the room.  Allow students to rotate through and write their questions or spot pieces they are confused about in reference to the project.    * Consider future lessons that allow students to create a project work plan and set goals and their timeline as a group to spark accountability and ownership of their learning.    * Consider supplementing work time with lessons on specific content that will support the students in their project deliverables (some examples below). |
| **Student Facing Project Documents** | * [Design Brief](#_Student_Design_Brief)   + We encourage you to make a copy and personalize, if you wish.   + Consider transferring information into bite-size pieces through slides instead of all in one document.   + Consider adding areas for student voice and choice in how they show what they know. * Consider creating your own rubric based on your classroom grading policies (a sample rubric is included below in this planning document). * Consider a project timeline checklist for your classroom for students to monitor progress and deadlines (a sample checklist is included below the sample calendar in this planning document). * Consider creating a model or example of deliverables for your students to see a sample end product and for you to uncover potential obstacles your students may encounter in their designs. * Consider creating a student reflection form that can be assessed where students have to note the unique facts and information in their peers’ news segments to ensure they are paying attention. * Consider creating a quiz or exam after the presentations of segments to assess student mastery of key competencies and learning outcomes. |

# Project Background Information

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| **Project Title** | Galaxy News |
| **Time Frame** | ~15-30 hours of student work time are recommended.   * However, based on your student needs and interests, consider expanding or contracting the timeline as needed.  If this PBL is implemented across subject areas, work time and workshops can be divided between content teachers. * Consider when you may want the news broadcast to be “aired” (before, during, or after the eclipse) and who the audience will be (class, grade, school, community). * If your school and community fall in the path of totality and you plan to have students view the eclipse in person, please ensure all students have safety glasses or other approved eye protection. |
| Key Vocabulary | * [total solar eclipse](https://solarsystem.nasa.gov/eclipses/about-eclipses/types/) * [annular solar eclipse](https://solarsystem.nasa.gov/eclipses/about-eclipses/types/) * [partial solar eclipse](https://solarsystem.nasa.gov/eclipses/about-eclipses/types/) * [hybrid solar eclipse](https://solarsystem.nasa.gov/eclipses/about-eclipses/types/) * [corona](https://spaceplace.nasa.gov/sun-corona/en/) * [coronagraph](https://www.space.com/what-is-a-coronagraph.html) * [diffraction](https://sciencing.com/diffraction-physics-definition-examples-patterns-13722359.html) * [radiation](https://www.nasa.gov/audience/foreducators/postsecondary/features/F_Understanding_Space_Radiation.html) * [infrared](https://science.nasa.gov/ems/07_infraredwaves) * [ultraviolet](https://science.nasa.gov/ems/10_ultravioletwaves) * [electromagnetic spectrum](https://www.nasa.gov/directorates/heo/scan/spectrum/txt_electromagnetic_spectrum.html#:~:text=The%20electromagnetic%20spectrum%20is%20comprised,make%20up%20the%20optical%20spectrum.) * [ionosphere](https://solarsystem.nasa.gov/news/1127/10-things-to-know-about-the-ionosphere/#:~:text=The%20ionosphere%20is%20where%20Earth's%20atmosphere%20meets%20space&text=Along%20with%20the%20neutral%20upper,Cred%3A%20NASA's%20Scientific%20Visualization%20Studio) * [ionization](https://www.nasa.gov/analogs/nsrl/why-space-radiation-matters) * [space weather](https://spaceplace.nasa.gov/spaceweather/en/) * [solar wind](https://www.jpl.nasa.gov/nmp/st5/SCIENCE/solarwind.html#:~:text=The%20solar%20wind%20is%20created,lines%20that%20extend%20radially%20outward.) * [heat](https://cosmicopia.gsfc.nasa.gov/qa_sp_ht.html) * [energy](https://science.nasa.gov/what-energy) * [chromosphere](https://www.nasa.gov/mission_pages/iris/overview/definitions.html) * [coronal mass ejection](https://www.nasa.gov/mission_pages/iris/overview/definitions.html) * [heliosphere](https://www.nasa.gov/mission_pages/iris/overview/definitions.html) * [photosphere](https://www.nasa.gov/mission_pages/iris/overview/definitions.html) * [plasma](https://www.nasa.gov/mission_pages/iris/overview/definitions.html) * [radiative zone](https://www.nasa.gov/mission_pages/iris/overview/definitions.html) * [solar flares](https://www.nasa.gov/mission_pages/iris/overview/definitions.html) * [solar wind](https://www.nasa.gov/mission_pages/iris/overview/definitions.html) * [transition region](https://www.nasa.gov/mission_pages/iris/overview/definitions.html) * [particles](https://spaceplace.nasa.gov/glossary/en/#N) * [convection](https://soho.nascom.nasa.gov/explore/lessons/convection.html) * [citizen science](https://education.nationalgeographic.org/resource/citizen-science/) * [solar cycle](https://svs.gsfc.nasa.gov/Gallery/TheSolarCycle.html) |
| Background Information | Source: [Ohio Department of Education Eclipse Webpage](https://education.ohio.gov/Topics/Learning-in-Ohio/Science/Resources-for-Science/2024-Solar-Eclipse)  This image is a map of Ohio showing the path of totality for the April 8, 2023 eclipse.“The difference between a partial eclipse and a total eclipse is literally night and day. Most of us have experienced partial eclipses, and while interesting, they do not have the awe-inspiring effects of total eclipses. It is well worth the effort to travel to an area of totality from anywhere in Ohio, as all areas are within a short drive of the “real deal.” The last totality in Ohio occurred in1806, so unless someone has traveled, they have never seen anything quite like what is coming our way.  **Where can I experience totality in Ohio during the April 8, 2024, eclipse?**  Most of the western and northern portions of the state will achieve totality. The map shows in blue the area of Ohio which will experience a total eclipse. Between the top and bottom lines is the totality zone. The closer to the centerline the longer totality will last. Along the center line is the longest duration. Portions of the state in yellow will have a partial eclipse. Areas near the blue center line are expected to be the most affected by tourists. The remainder of the state will experience a partial solar eclipse.  [Eclipse.ohio.gov](http://eclipse.ohio.gov) has interactive maps showing locations and events for viewing the eclipse. If your school is in the totality zone, you can plan an eclipse viewing event there. For those who prefer an informal viewing experience, any open area is good. Plan to get there early and take your time leaving, as traffic is expected to be extremely heavy throughout the state. This is particularly true in totality areas and on major access highways into and out of the state. Traffic could remain heavy into Tuesday.  **How long will the eclipse last?**  The entire event takes several hours, but the period of totality is relatively short, under 5 minutes. The further you are from the center line, the shorter the totality time. At the center line, it may be 4 or more minutes, but at the edge lines, totality will last just few seconds. Keep this in mind as you plan your viewing site.”  Source: [NASA: Eclipse Science](https://solarsystem.nasa.gov/eclipses/science/nasa-research/)  “Eclipses aren’t just beautiful – they’re great for science. In addition to inspiring artists and musicians, eclipses have driven numerous scientific discoveries. For over a century, solar eclipses helped scientists decipher the Sun’s structure and explosive events, find evidence for the theory of general relativity, and discover a new element, among other things.  Today, NASA scientists still study eclipses to make new discoveries about the Sun, Earth, and our space environment. Total solar eclipses are particularly important because they allow scientists to see a part of the Sun’s atmosphere – known as the corona – that’s too faint to see except when the bright light of the Sun is blocked.  Scientists use instruments called coronagraphs to block the Sun’s light in a manner similar to a total eclipse, but these instruments still struggle to reveal the region of the corona closest to the Sun, where many important processes occur.  Studying the innermost part of the corona – visible only during total solar eclipses – is key to answering fundamental questions about how heat and energy are transferred from the Sun out into the solar wind, the constant stream of particles that the Sun spews into the solar system. The solar wind can impact humans and technology at Earth, so understanding how it becomes accelerated at the Sun can help predict its impacts at home.”  Source: [NASA: Eclipse 2017](https://www.nasa.gov/feature/goddard/2017/eclipse-2017-nasa-supports-a-unique-opportunity-for-science-in-the-shadow)  “During a total solar eclipse, the moon blocks out the Sun’s overwhelmingly bright face, revealing the relatively faint solar atmosphere, called the corona. Scientists can also use an instrument called a coronagraph – which uses a disk to block out the light of the Sun – to create an artificial eclipse. However, a phenomenon called diffraction blurs the light near the disk in a coronagraph, making it difficult to get clear pictures of the inner parts of the corona, so total solar eclipses remain the only opportunity to study these regions in clear detail in visible light. In many ways, these inner regions of the corona are the missing link in understanding the sources of space weather – so total solar eclipses are truly invaluable in our quest to understand the Sun-Earth connection.  Total solar eclipses are also an opportunity to study Earth under uncommon conditions. The sudden blocking of the Sun during an eclipse reduces the light and temperature on the ground, and these quick-changing conditions can affect weather, vegetation and animal behavior.”  Additional Resources:   * [FEMA Preparing the Nation for Space Weather Events Training](https://emilms.fema.gov/is_0066/) * [NOAA Space Weather Prediction Center](https://www.swpc.noaa.gov/) * [Citizen Science Projects related to Eclipses](https://eclipse2017.nasa.gov/citizen-science) * [Eclipse Soundscapes Project](https://science.nasa.gov/science-activation-team/eclipse-soundscapes) |

# Supplemental Lessons, Project Workshops, & Content-Specific Resources

|  |  |
| --- | --- |
| Science Supplemental Lessons and Resources | * Additional ideas for science lessons * What is the path of totality? Show [this interactive map of other eclipses that will be visible in different parts of the world](https://www.timeanddate.com/eclipse/list.html). * There are many videos available related to space weather, the eclipse and general astronomy topics. * Have students complete the [Eclipse Soundscapes Apprentice Training](https://eclipsesoundscapes.org/roles/#apprentice-role)   + Consider engaging in the [other Eclipse Soundscapes Roles](https://eclipsesoundscapes.org/individuals/), too! * [Indiana University Bloomington Short Lessons](https://research.college.indiana.edu/news-events/solar-eclipse/teacher-tool-kit.html) * [Measuring Solar Energy During an Eclipse (NASA)](https://www.jpl.nasa.gov/edu/teach/activity/measuring-solar-energy-during-an-eclipse/) |
| History Supplemental Lessons and Resources | * Consider planning supplemental workshops on the social studies content that applies to news media. * [NASA: Eclipse History](https://eclipse2017.nasa.gov/eclipse-history) * [Three times scientists learned something from solar eclipses—and three times they were tricked](https://www.science.org/content/article/three-times-scientists-learned-something-solar-eclipses-and-three-times-they-were) * Article: [Eclipses in ancient cultures Mayank Vahia](https://www2.nao.ac.jp/~mitsurusoma/WS2014/vahia.pdf) * Geography: The solar eclipse of 2017 was an exceptional event as it’s crossing the entire continental United States. Encourage students to examine a map and identify the states and cities in the path of totality. Compare these to the locations being crossed by the 2023 annual eclipse and the 2024 total eclipse. * Examining History: Look at the history of eclipses in the United States and create a timeline aligning their occurrence with other important world events. You might have students research to find out what, if any, popular culture or primary sources exist about solar eclipses during each time period. * Eclipse Culture & Mythology: Have students examine the mythology of ancient cultures surrounding eclipses. |
| English-Language Arts Supplemental Lessons and Resources | * Additional ideas for English Language Arts lessons * Consider planning supplemental workshops on engaging script writing and journalism best practices. . * Journal: Have students keep a log describing the way the eclipse impacts their different senses. What they see is easy, but while experiencing a solar eclipse students should feel cooler temperatures, hear night creatures, and have a variety of other sensations. * Recording History: Today when I Google “solar eclipse,” I get 52 million pieces of information in return; but imagine what it would’ve been like to experience a solar eclipse as little as 100 years ago. Encourage students to record their own histories for posterity. Have students compose an informational article for people 200 years in the future about what it felt like to experience a total eclipse or have them journey back in time and write from the perspective of someone without our advancements in science or technology. * Mythology: Similar to the prompt above, throughout history people have observed eclipses and constructed their own explanations. Have students write a myth or creative story about “The Day the Earth Went Dark.“ |
| Fine Arts Supplemental Lessons and Resources | * Additional ideas for fine arts * Consider planning supplemental workshops on recording and editing videos to be aesthetically pleasing. * Visual Arts: [Smithsonian Eclipse Art](https://americanart.si.edu/artwork/eclipse-24007) & [Lesson Plan: Making EMS Visible](https://drive.google.com/file/d/1KpNAQNLzyfUWQV5mrg_Ja2YT8IB0nxXz/view?usp=share_link) * Music:   + [Eclipse Orchestra Video](https://www.youtube.com/watch?v=Io5ya10jUTo)   + [Another eclipse orchestra (middle school)](https://www.youtube.com/watch?v=i3zkx53S71M)   + Topic: Frequency (connects to electromagnetic spectrum for science) * Additional [Fine Arts Ideas](https://docs.google.com/document/d/1M-ykrb_hTpTrRKSrd7XgZWd8Wu995rJA97XMMQRlobM/edit) |
| Mathematics Supplemental Lessons and Resources | * Additional ideas for mathematics * Data Collection: Have students record data (temperature, luminosity, etc.) during the eclipse and then develop a graph showing the changes over time. * Estimation: Use [population statistics](https://www2.census.gov/geo/pdfs/maps-data/maps/thematic/us_popdensity_2010map.pdf) to estimate the percentage of the U.S. population able to experience the eclipse. * [Calculate Lunar Shadow Speed](https://eclipse2017.nasa.gov/lunar-shadow-speed): Have students record the time the shadow is visible and then divide the average diameter of the Moon’s shadow (110 km) by the time the shadow is overhead. |
| Technology / Computer Science / Engineering Supplemental Lessons and Resources | * Consider planning supplemental workshops on technical support for video editing. * Viewing an Eclipse:   + [How to view an eclipse safely](https://eclipse.aas.org/eye-safety)   + [Tree Leaves:  Nature’s Pinhole Camera](https://whyy.org/articles/see-the-solar-eclipse-using-natures-pinhole-camera-tree-leaves/)   + [How to make your own pinhole camera to view the eclipse](https://www.kpcc.org/2017-08-18/how-to-make-your-own-pinhole-camera-to-watch-the-e)   + [DIY activities to capture solar eclipse phenomena](http://www.solareclipse2015.org.uk/solar-eclipse-phenomena/)   + Consider creating an interactive tracking map (similar to Santa trackers) or scratch or other program animation for students who are not in the path of totality.   + Consider creating a live stream video feed for students who are in the path of totality and sharing this with other schools who are not in the path of totality. * [Video: launching a high-altitude balloon with a 360 degree camera](https://www.youtube.com/watch?v=iqXdr7ni4js) * Space Telescopes:   + Finish listening to the [Radiolab Podcast, “Where the Sun Don’t Shine,”](https://radiolab.org/episodes/sun-dont-shine)  which teaches listeners about the [Voyager Spacecraft](https://voyager.jpl.nasa.gov/)   + [JWST](https://webb.nasa.gov/) * [Moon Phases coding activity](https://rainydaymum.co.uk/coding-the-moon/) |
| Business, Industry, & Community Partnership Opportunities | * Your local news broadcasting channel journalists (PBS, etc.) * Your local library to support with technology, video, and broadcasting as well as content resources (books, research tools, etc.) * Your local government agencies including the Department of Tourism etc. * [Eclipse Ambassadors & Astronomy-related clubs](https://astrosociety.org/education-outreach/amateur-astronomers/eclipse-ambassadors/resources.html) * Create a podcast to air on a local station * NASA Facilities:   + Northeast Ohio: [NASA Glenn Research Center](https://www.nasa.gov/centers/glenn/about/contact_us.html)   + Northwest Ohio: [Neil A. Armstrong Test Facility (Sandusky)](https://www.nasa.gov/centers/glenn/about/testfacilities/ArmstrongTest_Contacts.html)   + National Headquarters: [NASA STEM Education](https://www.nasa.gov/news/media/info/index.html)   + [NASA SciAct](https://science.nasa.gov/learners) * Contact your local [Business Advisory Council (BAC)](https://education.ohio.gov/Topics/Career-Tech/Career-Connections/Business-Advisory-Councils) or STEM network leaders that may be able to provide you with local industry partners or higher education science researchers:   + STEM Learning Ecosystems in Ohio by region:     - [Northeast Ohio](https://stemecosystems.org/ecosystem/northeast-ohio-stem-learning-ecosystem/)     - [Central Ohio](https://stemecosystems.org/ecosystem/stem-works-east-central-ohio/)     - [Southeast Ohio](https://stemecosystems.org/ecosystem/ohio-valley-stem-cooperative/)     - [Southwest Ohio](https://stemecosystems.org/ecosystem/greater-cincinnati-stem-collaborative-gcsc/)     - [Dayton Ohio](https://stemecosystems.org/ecosystem/do-stem/)   + Ohio STEM Learning Network Hubs by region:     - [Northeast Ohio](https://osln.org/schools-hubs/hubs/northeast-ohio-hub/)     - [Akron Ohio](https://osln.org/schools-hubs/hubs/akron-hub/)     - [Northwest Ohio](https://osln.org/schools-hubs/hubs/northwest-ohio-hub/)     - [Central Ohio](https://osln.org/schools-hubs/hubs/central-ohio-hub/)     - [Southeast Ohio](https://osln.org/schools-hubs/hubs/southeast-ohio-hub/)     - [Southwest Ohio](https://osln.org/schools-hubs/hubs/southwest-ohio-hub/)     - [Dayton Ohio](https://osln.org/schools-hubs/hubs/dayton-hub/) * Consider bringing partners in to provide:   + subject matter expertise - students can interview and ask questions or guidance   + materials or activities to supplement student work on project deliverables   + expert panelists to assess student performance assessments * [Throw an eclipse party for your school community!](https://www.sciencefriday.com/educational-resources/eclipse-party-activities/) * Your local zoo may have activities around observing animal behavior during the eclipse.   + Study: [Total Eclipse of the Zoo: Animal Behavior during a Total Solar Eclipse](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7222787/)   + Article: [Surprising Ways Animals React to Solar Eclipse by Andrew Fazekas](https://www.nationalgeographic.com/science/article/animals-react-total-solar-eclipse-august-space-science) |
| Additional Grade Level Lessons and Activities | * [K-2 Lesson (SCDE)](https://drive.google.com/file/d/1B4aeBDwqv9-aej8HVUISdHk72sgXAoex/view) * [K-6 Solar Eclipse Experiences (Middle Tennessee State University)](https://drive.google.com/file/d/1Px8vhEbQ0wpnI2eaTMeWT58fmebBVf_-/view?usp=sharing) * [6-12 Inquiry-Based Lessons (Middle Tennessee State University)](https://drive.google.com/file/d/1PgmeVJJz5ncBrFjrBhVS6wT432FG_l5Y/view?usp=sharing) * 7-12 Space Lessons (X-STEM):   + [Return to the Moon (Zena Cardman): Homeostasis in Space Suits](https://d31hzlhk6di2h5.cloudfront.net/20230314/1e/ed/0b/85/ba454e35730f9957541892d1/Return-to-the-Moon-Zena-Cardman-FINAL.pdf)   + [Do the Climate Rock with NASA’s Josh Willis: Climate Models](https://d31hzlhk6di2h5.cloudfront.net/20230314/38/75/28/7f/f839c52d4f67c5f7f691e13a/Do-the-CLimate-Rock-Lesson-FINAL.pdf)   + [Wild about Animals with Jordan Veasley: Engineering Animal Enrichments](https://d31hzlhk6di2h5.cloudfront.net/20230314/af/81/78/a7/52322a489e4692a106790d25/Wild-About-Animals-FINAL.pdf)   + [Meteorology in Space with Captain Sophia Schwalbe](https://d31hzlhk6di2h5.cloudfront.net/20230314/e5/1d/18/39/60b421c1d89491ec56053a89/Meteorology-in-Space-Title-page-1-1.pdf)   + [One-on-One with Space Force Guardian Chief Abifarin Scott: Cyber Security](https://d31hzlhk6di2h5.cloudfront.net/20230314/b2/72/6d/b3/b33247e9ddc81f8d2ad7966f/One-on-One-with-Space-Force-Guardian-FINAL.pdf)   + [Real Life Robotics with Easton LaChappelle](https://d31hzlhk6di2h5.cloudfront.net/20230314/b6/97/b0/1d/9827e327789e1b4fbcd33009/Real-Life-Robotics-FINAL-1.pdf)   + [Life Beyond Our World with Christina Koch](https://d31hzlhk6di2h5.cloudfront.net/20230314/cc/e1/69/83/3db2b2f2d493bd50eac3e540/Life-Beyond-Our-Worl-FINAL.pdf) |

# Project Calendar (Example)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Monday, March 4 | Tuesday, March 5 | Wednesday, March 6 | Thursday, March 7 | Friday, March 8 |
| Project Roll Out (see suggested activities above) | Work Time | Work Time | Work Time | Workshop / Checkpoint |
| Monday, March 11 | Tuesday, March 12 | Wednesday, March 13 | Thursday, March 14 | Friday, March 15 |
| Work Time | Work Time | Work Time | Work Time | Workshop / Checkpoint: Document Design Process Steps and Progress |
| Monday, March 18 | Tuesday, March 19 | Wednesday, March 20 | Thursday, March 21 | Friday, March 22 |
| Work Time | Work Time | Work Time | Work Time | Workshop / Checkpoint: Document Design Process Steps and Progress |
| Monday, March 25 | Tuesday, March 26 | Wednesday, March 27 | Thursday, March 28 | Friday, March 29 |
| Work Time | Work Time | Work Time | Workshop / Checkpoint: Peer Feedback | Work Time: Make Changes based on Peer Feedback |
| Monday, April 1 | Tuesday, April 2 | Wednesday, April 3 | Thursday, April 4 | Friday, April 5 |
| Work Time | Work Time | Presentations / Performance Assessment | Presentations / Performance Assessment | Presentations / Performance Assessment |
| Monday, April 8 | Tuesday, April 9 | Wednesday, April 10 | Thursday, April 11 | Friday, April 12 |
| TOTAL SOLAR ECLIPSE DAY! | Student Reflection on project and eclipse experience | Content Assessment | Reflection on Assessment | Reassessment or Extension Activity |

# Student Work Tracking Checklist / Daily Log (Example)

|  |  |  |
| --- | --- | --- |
| Monday March 4 | Checkpoint: Project Roll Out |  |
| Tuesday March 5 |  |  |
| Wednesday March 6 |  |  |
| Thursday March 7 |  |  |
| Friday March 8 | Checkpoint: Workshop |  |
| Monday March 11 |  |  |
| Tuesday March 12 |  |  |
| Wednesday March 13 |  |  |
| Thursday March 14 |  |  |
| Friday March 15 | Checkpoint: Document Design Process Steps and Progress |  |
| Monday March 18 |  |  |
| Tuesday March 19 |  |  |
| Wednesday March 20 |  |  |
| Thursday March 21 |  |  |
| Friday March 22 | Checkpoint: Document Design Process Steps and Progress |  |
| Monday March 25 |  |  |
| Tuesday March 26 |  |  |
| Wednesday March 27 |  |  |
| Thursday March 28 | Checkpoint: Peer Feedback |  |
| Friday March 29 | Work Time: Make Changes based on Peer Feedback |  |
| Monday April 1 |  |  |
| Tuesday April 2 |  |  |
| Wednesday April 3 | Presentations / Performance Assessment |  |
| Thursday April 4 | Presentations / Performance Assessment |  |
| Friday April 5 | Presentations / Performance Assessment |  |
| Monday April 8: TOTAL SOLAR ECLIPSE DAY! |  |  |
| Tuesday April 9 | Student Reflection on project and eclipse experience |  |
| Wednesday April 10 | Content Assessment |  |
| Thursday April 11 | Reflection on Assessment |  |
| Friday April 12 | Reassessment or Extension Activity |  |

# Performance Summative Assessment Rubric (Example)

Consider adding additional content areas based on the standards that align with the implementation of this PBL in your classroom.

Consider changing the column labels of the rubric to your grading scale.

Consider involving student voice in the creation of the assessment rubric.

Consider using the same rubric for teacher assessment as student self-assessment and/or peer-assessment.

Consider leveraging community partners to assess students against the rubric and asking them to provide feedback for students.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Developing | Mastery / At Standard | Exceeding Mastery |
| Ohio Science Standards | One or more of the Mastery criteria are not met. | * Each student can independently and accurately describe the patterns of motion and positions of the Earth, our moon, and the sun to explain how a total solar eclipse works (7.ESS.4, MS-ESS-1). | * All Mastery criteria are met. * News segment contains a forecast of space weather. * News segment contains one unique space science or eclipse fact (properly cited with a verifiable source) or experiment that no other groups in the class use. |
| Ohio ELA Standards | One or more of the Mastery criteria are not met. | * News segment contains scientific claims justified with evidence for how total solar eclipses work (CCS RI.7.1). * Each student effectively engages in collaborative discussions with my peers and contributed to the group’s work (CCS SL.7.1). | * All Mastery criteria are met. * News segment contains two additional segments connected to science, eclipses, or space weather. |
| Ohio Fine Arts Standards | One or more of the Mastery criteria are not met. | * News segment contains visuals and verbal explanations (7.3PE). * Student group creates a script to use to prepare for the segment broadcast and uses pre-written cue cards to support production (7.1CR, 7.3PE). * News segment is either recorded to play as a video or performed live to the class (7.2PE). * News segment contains a breaking news segment connected to science, eclipses, or space weather (7.4RE). | * All Mastery criteria are met. * News segment contains a third method of communication. * News segment is engaging for the audience. |

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The Ohio Department of Education defines STEM education as a learner-centered approach to teaching providing students with a problem-based, transdisciplinary, and personalized learning experience.  STEM education uses the foundational practices and skills essential to the core disciplines of Science, Technology, Engineering, the Arts and Humanities, and Mathematics. These essential skills challenge students to think critically, design solutions, and make evidence-based explanations through real-world authentic learning experiences. STEM education creates meaningful pathways to post-secondary success for K-12 students through partnerships and career exploration with community entities.  Please contact [STEM@education.ohio.gov](mailto:STEM@education.ohio.gov) to learn more about TPBL and innovative approaches to teaching and learning.

# Student Design Brief

