Earth and Space Science
Project #1

Introduction: What better way to begin the year with a science project by focusing on the content we have been discussing during class time. We have covered instructional lessons about stars as well as information about our host star, the Sun. Stars begin as a star forming nebula of gas and dust in space, which can eventually turn into a star on the main sequence and ending up as some catastrophic event for exoplanets revolving around their host star, or perhaps a catastrophic event that can happen for planet Earth. These catastrophic events are linked to the matter that is fusing within the star's core as a result of nuclear fusion.

Here are your choices for the 1st marking period project:

1. **Creation of an infographic on Big Bang evidence**
   - Description: Research the key pieces of evidence supporting the Big Bang Theory, such as redshift of galaxies, abundance of light elements, cosmic microwave background radiation. Please design an infographic that visually explains each piece of evidence and its significance.
   - Goal: Synthesize and present complex information in a clear, visual format that demonstrates an understanding of how scientific evidence supports the Big Bang Theory.
2. **Time-Lapse of star evolution using the H-R diagram**
   - Description: Create an animated time-lapse (using a video editor) that shows how a star moves across the H-R Diagram throughout its life cycle. The animation should highlight key evolutionary stages for Sun-like, massive, and red dwarf stars ***and*** explain why the star changes position on the diagram over time.
   - Goal: Visualize the dynamic nature of stellar evolution and demonstrate how stars shift across the H-R Diagram as they age and undergo physical changes.
3. **Stellar nucleosynthesis timeline**
   - Description: Students create a timeline that shows the progression of nucleosynthesis over the lifespan of a massive star. The timeline needs to include events like hydrogen fusion, helium fusion, and the creation of heavier elements prior to supernova events. Students should indicate where Sun-like stars and red dwarf stars terminate on the timeline.
   - Goal: Show the chronological order of element formation in stars, demonstrating how different fusion processes dominate at different stages of a star's evolution.
4. **Sunspots Debate – Do They Affect Climate?**
   - Description: Research the potential connection between sunspots and Earth's climate, focusing on historical events like the Little Ice Age and then create a report, presentation, or documentary video discussing the scientific evidence for and against sunspot influence on climate.
   - Goal: Explore the potential effects of solar activity on Earth's climate and develop critical thinking skills regarding scientific data.
5. **"Science Report" Video: The Andromeda Collision Is Coming!**
   - Description: Students script and film a short 2- to 3-minute video pretending to be space scientists or news reporters covering the "upcoming" collision of the Milky Way and Andromeda. Students must include the meaning behind blue shift, why Andromeda is moving toward the Milky Way, and what might happen in 4- to 5-billion years.

Rubric: Big bang Infographic

Criteria	4-Advanced	3-Proficient	2-Developing	1-Beginning
Comprehension of Big Bang Evidence	Demonstrates a deep understanding of the key evidence supporting the Big Bang Theory (e.g., redshift, cosmic microwave background, and element abundance). Accurately explains each piece of evidence with depth and insight.	Shows a solid understanding of key evidence supporting the Big Bang Theory. Accurately explains most pieces of evidence, with minor omissions or simplifications.	Displays a basic understanding of the evidence supporting the Big Bang Theory. Explanations are present but lack depth, with some inaccuracies or incomplete information.	Shows little to no understanding of the evidence supporting the Big Bang Theory. Explanations are vague, incorrect, or missing.
Clarity and Visual Organization	Infographic is exceptionally well-organized, visually appealing, and easy to follow. Information is presented logically, with strong visual aids (charts, diagrams) that enhance understanding of each piece of evidence.	Infographic is well-organized and visually clear. Visual aids are used appropriately, though some areas could benefit from further refinement or clarity.	Infographic has some organization, but sections may be unclear or difficult to follow. Visual aids are present but may not fully support the information.	Infographic is disorganized or difficult to follow. Visual aids are poorly used or absent, making the information hard to understand.
Synthesis of Information	Effectively synthesizes complex scientific information, making it accessible and understandable. Key points are summarized concisely while maintaining scientific accuracy.	Synthesizes scientific information clearly, though some points may be oversimplified or lacking in depth. Information is mostly accurate.	Attempts to synthesize information but may struggle to present it clearly or accurately. Some key points are missing or oversimplified.	Fails to synthesize information effectively. Infographic lacks coherent presentation of key points or contains significant inaccuracies.
Creativity and Design Quality	Infographic is highly creative, with engaging design elements that enhance the presentation of scientific content. Layout, colors, and visuals are carefully chosen to highlight key ideas.	Infographic shows creativity and thoughtful design. Layout and visuals are appropriate and contribute to the overall clarity and engagement, though not exceptional.	Infographic shows some creativity, but design elements are basic or inconsistent. Layout may be cluttered, and visuals may not strongly support the content.	Infographic lacks creativity and thoughtful design. The layout is poorly constructed, and visuals, if present, do not support the content or are of low quality.

Rubric: Time-Lapse of Star Evolution Using the H-R Diagram

Criteria	4-Advanced	3-Proficient	2-Developing	1-Beginning
Accuracy of Stellar Evolution Stages	Accurately depicts all key stages of star evolution (e.g., protostar, main sequence, red giant, supernova). Each stage is clearly marked and correctly placed on the H-R Diagram. Changes in luminosity and temperature are accurately shown at each stage.	Depicts most key stages of star evolution with minor inaccuracies. Stages are correctly placed on the H-R Diagram with only slight errors in luminosity or temperature.	Depicts some stages of star evolution but omits key stages or misplaces them on the H-R Diagram. Luminosity and temperature changes are shown but are often inaccurate.	Depicts few or no stages of star evolution accurately. Stages are either missing or incorrectly placed on the H-R Diagram with significant errors in luminosity and temperature.
Clarity and Quality of Animation	Animation is smooth, visually engaging, and clearly shows the star's movement across the H-R Diagram. Transitions between stages are well-timed, and key changes in the star's evolution are easy to follow.	Animation is clear and mostly smooth, showing the star's movement across the H-R Diagram with only minor timing or transition issues.	Animation is somewhat choppy or unclear, making it difficult to track the star's movement across the H-R Diagram. Transitions between stages are rough.	Animation is unclear, disjointed, and difficult to follow. The star's movement across the H-R Diagram is not easily observable or is entirely missing.
Explanation of Star Movement on H-R Diagram	Provides a thorough and insightful explanation of why the star changes position on the H-R Diagram, connecting the movement to physical changes in the star (e.g., temperature, luminosity, size).	Provides a clear explanation of why the star changes position on the H-R Diagram, with most physical changes correctly explained.	Provides a partial explanation of the star's movement on the H-R Diagram, but some key physical changes are not well explained or are inaccurate.	Provides little to no explanation of the star's movement on the H-R Diagram. Fails to connect the star's position to physical changes accurately.
Creativity and Visual Appeal	Animation is highly creative and visually appealing, with well-chosen colors, fonts, and graphics that enhance understanding. Design elements effectively complement the scientific content.	Animation is creative and visually appealing, with appropriate use of colors, fonts, and graphics that generally support the scientific content.	Animation shows some creativity, but visual appeal is limited. Design elements may be basic or inconsistent and may detract from the content.	Animation lacks creativity and visual appeal. Design elements are minimal or poorly chosen, detracting from the understanding of the content.

Rubric: Stellar Nucleosynthesis Timeline

Criteria	4-Advanced	3-Proficient	2-Developing	1-Beginning
Accuracy of Nucleosynthesis Events	All key nucleosynthesis events (e.g., hydrogen fusion, helium fusion, heavier element creation) are accurately represented on the timeline. The timeline clearly indicates where each element is formed and at which stage of the star's evolution for massive, Sun-like, and red dwarf stars.	Most nucleosynthesis events are accurately represented, with minor omissions or errors. The timeline includes most of the key elements formed during a star's evolution.	Some key nucleosynthesis events are represented, but there are notable inaccuracies. Some elements may be incorrectly placed or missing from the timeline.	Few nucleosynthesis events are correctly represented, with significant omissions or inaccuracies. The timeline lacks proper representation of element formation stages.
Chronological Order and Flow	The timeline follows a clear and logical chronological order, with smooth transitions between stages of nucleosynthesis. Events are appropriately spaced to show the progression of element formation over time.	The timeline generally follows a logical chronological order, though some transitions may be unclear or stages may be slightly out of order. Events are reasonably spaced.	The timeline attempts to follow a chronological order, but there are notable gaps or confusing transitions between stages. Events may be unevenly spaced.	The timeline lacks chronological order or flow, with events placed randomly or out of sequence. The progression of element formation is difficult to follow.
Clarity and Presentation	The timeline is visually appealing and easy to read, with clear labels for each event. Design elements (e.g., colors, fonts, graphics) enhance understanding of the nucleosynthesis process.	The timeline is clear and readable, with appropriate labels. Design elements are functional, though not always enhancing understanding. Some minor adjustments could improve clarity.	The timeline is somewhat unclear or difficult to read. Labels may be inconsistent or confusing, and design elements may detract from clarity.	The timeline is unclear and difficult to read. Labels are missing or confusing, and design elements are minimal or distracting, making the content hard to follow.
Depth of Explanation	The timeline provides detailed explanations of each nucleosynthesis process, showing a deep understanding of how different elements are formed at various stages of a star's evolution.	The timeline includes clear explanations of most nucleosynthesis processes, though some explanations may lack depth or detail. Understanding is generally demonstrated.	The timeline includes some explanations of nucleosynthesis processes, but these may be shallow or incomplete. Some processes are not fully explained.	The timeline provides little to no explanation of nucleosynthesis processes. Understanding of how elements are formed is not demonstrated clearly or accurately.

Rubric: Sunspots – Do They Affect Climate?

Criteria	4-Advanced	3-Proficient	2-Developing	1-Beginning
Depth of Research	Thorough and comprehensive research is conducted, including a wide range of scientific studies, historical data (e.g., Little Ice Age), and evidence for and against sunspot influence on climate. Sources are diverse and credible.	Research is solid and includes key scientific studies and historical data, but may miss some lesser-known studies or evidence. Sources are credible but somewhat limited in variety.	Research includes basic scientific studies and some historical data, but lacks depth or critical sources. Some sources may lack credibility or diversity.	Minimal research is conducted, with few or no scientific studies or historical data cited. Sources are limited or not credible.
Historical Analysis (e.g., Little Ice Age)	The report/. presentation/ video provides a clear and nuanced explanation of the scientific evidence for and against the connection between sunspots and Earth's climate. Key concepts, like solar cycles and climate variability, are explained in depth.	The report/ presentation/ video explains the scientific evidence for and against the sunspot-climate connection, but some explanations may lack detail or clarity. Key concepts are covered, though not in great depth.	The report/ presentation/ video touches on some scientific evidence but lacks clarity or depth in explaining key concepts. Some important details may be missing or unclear..	The report/ presentation/ video fails to adequately explain the scientific evidence for or against the sunspot-climate connection. Key concepts are missing or poorly explained.
Historical Analysis (e.g., Little Ice Age)	The historical analysis is well-researched and effectively connected to sunspot activity, drawing strong connections between events like the Little Ice Age and solar activity. Provides a balanced view of the evidence and uncertainties.	The historical analysis is generally sound and mentions key events like the Little Ice Age, with some connections to sunspot activity. Provides some consideration of the evidence and uncertainties.	The historical analysis is minimal, with a weak or unclear connection between events like the Little Ice Age and sunspot activity. Little attention is given to uncertainties in the evidence.	The historical analysis is either absent or inaccurate, with no meaningful connection drawn between sunspot activity and historical climate events.
Presentation and Organization	The report/ presentation/ video is exceptionally well-organized, clearly structured, and engaging. Visual aids, graphs, or charts are used effectively to support the analysis. Information flows logically from one point to the next.	The report/ presentation/ video is well-organized and clear, with appropriate use of visual aids. The structure is logical, though some transitions between ideas may be slightly unclear.	The report/ presentation/ video has some organizational issues, with ideas that may not always flow logically. Visual aids are present but not always effectively used.	The report/ presentation/ video is disorganized and unclear, with little or no use of visual aids. Ideas do not flow logically, making the content difficult to follow.
Critical Thinking and Conclusion	Demonstrates strong critical thinking by analyzing conflicting evidence and drawing a well-supported conclusion about the sunspot-climate connection. The conclusion is thoughtful, balanced, and acknowledges uncertainties.	Demonstrates good critical thinking with a generally well-supported conclusion. Some conflicting evidence is addressed, though the analysis may not be as deep or balanced.	Critical thinking is limited, with a conclusion that is either weakly supported or lacks balance. Conflicting evidence is minimally addressed.	Little to no critical thinking is demonstrated. The conclusion is unsupported, overly simplistic, or fails to address conflicting evidence.

"Science Report" Video: The Andromeda Collision Is Coming!

Criteria	4-Advanced	3-Proficient	2-Developing	1-Beginning
Science Accuracy	All scientific information is accurate and clearly explains blue shift**,** Andromeda's motion**,** and the galactic collision	Most scientific content is accurate, with only minor errors or unclear points	Some science is accurate, but there are a few significant errors or misunderstandings	Many inaccuracies or misconceptions; content shows a lack of understanding
Clarity of Explanation	Concepts are explained clearly and understandably for the audience; difficult terms are broken down well	Explanations are mostly clear, but a few parts may be rushed or confusing	Some effort to explain, but lacks clarity or uses too much technical language without explanation	Little to no attempt to explain key ideas clearly
Creativity & Presentation Style	Presentation is engaging, creative, and clearly resembles a news-style format; strong use of visuals or performance	Presentation shows effort and creativity; some news-style elements used	Presentation is basic with little creativity or engagement	Presentation lacks effort or clarity; not in news-style format.
Completeness & Timing	Video includes all required elements and is within 2–3 minute time frame	Video includes most required elements and is close to the required length	One or more required elements missing; under/over time by a noticeable amount	Missing multiple required elements or significantly too short/long