# Hamburg Area School District

## Course Guide

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| Name: | The Cosmic Landscape |
| Grade(s): | *10-12* |
| Length: | *Place an X next to the correct option* |
| | Full-Year (180 Sessions) |
| X | Semester (90 Sessions) |
| | Quarter (45 Sessions) |
| | Other (Specify): |
| Text: | None--Supplemental Materials Utilized |
| Approved on: | 2/24/20 |

Course Description:
Can you identify The Big Dipper? Design a rover to explore Mars? Become an astronomer and learn more about the cosmic landscape. In this course, students will learn about “the dark side of the moon”, explore each of the planets, and discuss theories on how the solar system was formed. Explore the cosmic landscape through hands-on activities, internet-based technologies, and project design.

*The Cosmic Landscape*

Unit 1: Foundations of Astronomy
Unit Length: *30 Sessions*

| ESSENTIAL QUESTION-ESSENTIAL CONTENT | VOCABULARY | PERFORMANCE OBJECTIVES | ACTIVITY/ASSESSMENTS |
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| What are the eight planets in our solar system and in what order do they appear?<br><br>What physical characteristics do each of the planets demonstrate?<br><br>What other objects are contained in our solar system and how are they arranged? | Planet, Asteroid, Comet, Orbit, Mercury, Venus, Earth, Moon, Mars, Jupiter, Saturn, Uranus, Neptune, Satellite, Kelvin, Fahrenheit | • Name the planets of our solar system and state them in order.<br>• Describe at least three physical characteristics about each planet in our solar system.<br>• Identify the names of other objects in our solar system and their position. | **Solar System Journals**- Students draw (in order) and describe all 8 planets in our system<br>**Planets Quiz**- Students describe characteristics about each planet. |
| What special units of measurement do astronomers use? | Astronomical Unit (AU), Light Year, Speed of light, Solar Mass | • Describe an astronomical unit and when an astronomer would use it. | **Solar System Scaled Drawing-** Students scale the distances between planets from AUs showing the accurate scale of our solar system. |
| How do astronomers find objects (constellations) in the night sky? | Constellation, Right Ascension, Declination, Azimuth, Altitude, Folk-Lore, Mythology, Asterisms, Celestial Spheres, Daily Motion, Annual Motion, Celestial Poles, Celestial Equator | • Use right ascension and declination given to them to identify an object in the sky.<br>• Identify azimuth and altitude of the sun during class time. | **Constellation Project**- Students research one of the 88 official constellations and report on their findings. They may choose how they report back. Examples include but are not limited to picture, |

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| | | • Describe the significance of constellation in folklore and astronomy. | painting, video, 3D model, etc. No matter their choice, their project must report on the mythological story of the constellation and show the appearance of the constellation |
| How can the amateur astronomer benefit from software like Stellarium or other astronomy technologies? | Stellarium | • Will be able to independently use Stellarium at a basic level.<br>• Will be able to use Stellarium to find objects in the current night sky.<br>• Will be able to use Stellarium to identify future significant astronomical events. | **Stellarium Packet**-<br>Students complete a field guide of starry-night observational objects using the computer software *Stellarium*. |
| | | | **Foundations of Astronomy Unit Test -**<br>Summative assessment- Unit 1 |

Unit 2: The Solar System
Unit Length: *60 Sessions*

| ESSENTIAL QUESTION-ESSENTIAL CONTENT | Key Terms | PERFORMANCE OBJECTIVES | ACTIVITY/ASSESSMENTS |
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| What are the basic components of the solar system? | Solar System, Inner Planets, Asteroid Belt, Outer Planets, Trans-Neptunian Objects, Oort Cloud, Comet, Asteroid, Meteor, Orbital, Tilt, Solar Spectrum, Composition | ● Understand the difference between the inner and outer planets and how they were created.<br>● Identify what the Oort cloud is and how objects move inside of it.<br>● Know the general shape of our solar system and what physical property causes this motion.<br>● Identify planets' tilts.<br>● Explain the elemental composition of the following: The sun, the inner planets, the outer planets. | **Solar System Quiz** - Students answer quiz questions based on the key terms from this topic. |
| What are the theories of the origin of the solar system? | Radioactive Decay Theory, Spectral Lines, Condensation, Accretion Disk, Protostar, Diffuse Cloud, Dense Cloud, Stellar System, Mass Loss | ● Know the estimated age of the earth, the solar system, and the universe.<br>● Understand how radioactive decay gives an estimate for the age of earth.<br>● Explain how astronomers find the age of stars, and our sun from spectral lines.<br>● Be able to draw the life cycle of a solar system and explain each step.<br>● Identify which part of the life cycle our solar system is currently in and how much time we have left in this stage. | **Stellar System Drawing -** Students will create a detailed project of the life cycle of a stellar system which demonstrates descriptions and keywords for each phase. Students may opt to complete the project as a physical drawing, digital artwork, physical model, or other projects left to the discretion of the teacher |

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| How do we observe other planetary systems? | Hubble Space Telescope, Exoplanet, Light Curve, Transit | • Explain some of the uses for the Hubble Space Telescope.<br>• Explain how exoplanets are found using Hubble.<br>• Identify, from a light curve, the relative sizes of exoplanets found by Hubble. | **Light Curve Activity** - Students match information about a planet with a light curve that could have been created by that planet's properties. |
| How can we define earth as a terrestrial planet? | Crust, Mantle, Core, Lithosphere, Mesosphere, Outer Core, Inner Core, Silicates, Density, Earthquake, P-Wave, S-Wave, Tectonic Plate, Volcano, Pangea, Magnetosphere, Northern Lights | • Accurately label the compositional layers of Earth.<br>• Be able to describe why Earth's layers appear different than other celestial bodies.<br>• Understand how astronomers determine the density of Earth and the composition of the core without physically seeing the core.<br>• Identify differences between S and P Waves.<br>• State why Earth's continents currently look the way they do.<br>• Explain the importance of the Earth's magnetosphere.<br>• Explain the events during the switching of Earth's poles.<br>• Describe why Northern Lights are caused by solar storms. | **Composition Project** - Draw the compositional layers of any celestial body. Compare those layers in terms of material and thickness to Earth's layers.<br><br>**Earth Quiz** |
| What are the key components of the Moon? | Crater, Rim, Impact, Maria, "Dark side of the moon", Tidal Lock | • Explain why the moon is grey with black spots.<br>• Identify and explain the origin of the black dots (maria) on the moon.<br>• Understand the causes of craters. | **Crater design project** - Students must replicate a crater of the moon and report on some key facts about their choice including: name, origin of name, age of crater, size of crater. Their project must |

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| | | • Identify why craters are more numerous on the far side of the moon.<br>• Describe the orbital pattern of the moon.<br>• Explain why we only see one side of the moon from Earth.<br>• Explain the origin of the moon and its impact on Earth during creation.<br>• Illustrate the compositional layers of the moon, and identify how it is different than Earth's. | also highlight key terms about the crater including: ridge, shadow, impact site, and crater neighborhood. Students are allowed to pick how they represent their project. Options include but are not limited to physical drawing, digital art, physical model, 3D printed model, video, etc. |
| Mercury | Scarps, Perihelion | • Describe Mercury's orbit around the sun.<br>• Compare and contrast Mercury's appearance to the Earth and the moon.<br>• Explain why Mercury's surface is the shape it is. | **Moon Vs Mercury-** Students work in pairs to identify whether an image is that of the Moon or Mercury using key features in the image. |
| Venus | Aphrodite, Fault, Greenhouse Gasses, Retrograde Spin, Runaway Greenhouse Effect | • Know why Venus is hotter than Mercury.<br>• Explain what led to Venus' runaway greenhouse effect and how it relates to Earth.<br>• Explain the Aphrodite region of Venus' surface and why it is different than other regions on the surface. | **Venus Landing Project-** Students research previous landings on Venus and identify why they all failed. Students work in pairs to design a modern day lander mission using current technology that would potentially work on the surface. Students must defend their creation. |
| Mars | Conglomerate, Deimos, Phobos, laminated Terrain, Olympus Mons, Valles Marineris | • Identify the cause of Mars' signature red color. | **Rover Design Activity** - Students work in pairs to design a rover that would work on Mars. They must |

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| | | • Understand the reasoning behind sending more probes to Mars than any other planet.<br>• Describe the basic land features of Mars - including Olympus Mons and Valles Marineris.<br>• Be familiar with Mars' two moons and know why they look irregular in shape.<br>• Compare and contrast Mars' features with Earth's. | research and determine all parts such as: wheels, eyes, arms, drilling attachments, science equipment, radio equipment, etc. Students must defend all choices against other groups. The class then determines a final rover by putting the best from each group's designs into one rover. |
| Jupiter & Saturn | Aurora,belt, Great Red Spot, Liquid Metallic Hydrogen, Vortex | • Explain why Jupiter and Saturn are more massive than Earth.<br>• Understand how a gas planet can still have a solid core.<br>• Recognize the cause of aurora on gas planets similar to those on Earth.<br>• Explain how the gas planets formed with large volumes of hydrogen.<br>• Describe the flow of gas in a gas planet.<br>• Draw the flow of gas on the surface indicating the reason behind vortex storms. | **Sizes of Jupiter and Saturn PlayDoh activity** - Students following instructions to make the planets to scale using Playdoh. They will see that Jupiter and Saturn are massive, Uranus and Neptune are large, and the 4 inner planets are tiny specks in comparison |
| Uranus & Neptune | Ice Giant, Voyager II | • Explain the process behind discovering distant planets.<br>• Understand the mechanics behind sending a space probe to such a distant world. | **The colors of Uranus and Neptune -** Students add a few drops blue food coloring to a plate of shaving cream and mix it up. The result shows that only a small amount of food |

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| | | • Describe the compositional layers of the outer gas planets and explain these materials' origins. | coloring is needed to make a deep blue color. Students take this knowledge and determine what elements give these planets their signature color. |
| Comets | Coma, Dirty Snowball, Dust Tail, Fluorescence, Halley's Comet, Ion Tail, Kuiper Belt, Meteor, Meteor Shower, Nucleus, Oort Cloud, Radiant, Radiation Pressure, Short-Period Comet, Solar Wind, Sublimate | • Describe in detail the cycle of a comet.<br>• Explain why it is said comets "live" in the Oort cloud despite never stopping their cycle of rotation.<br>• State why comets produce tails in two directions.<br>• Estimate a comet's lifetime from a list of constraints. | **Comet Calculation** - Students will be given a sheet of comets and must calculate the orbital periods of each comet. |
| | | | **The Solar System Unit Test -** Summative assessment- Unit 2 |