Wallingford Public Schools - HIGH SCHOOL COURSE OUTLINE

Course Title: Astronomy I	**Course Number**: A 2113
Department: Science	**Grade(s)**: 10-12
Level(s): Academic	**Credit**: 1/2

Course Description

This course emphasizes the seasonal changes observed in the night sky including constellations, galaxies, stars, planets, and the sun and the moon. Instrumentations such as satellites, telescopes and spectroscopes will be studied along with techniques used to measure the size and distance of astronomical objects. Historical developments in astronomy will be explored.

Required Instructional Materials	**Completion/Revision Date**
• No required text • Information technologies – internet and library resources • Current and sufficient laboratory materials and equipment for each of the learning strands • Appropriate safety equipment – goggles, aprons, eyewash, safety shower, etc.	Adopted by Board of Education April 25, 2005

Mission Statement of the Curriculum Management Team

The mission statement of the Science Curriculum Management Team is to promote scientific literacy emphasizing the process, content, and interdisciplinary nature of science.

Enduring Understandings for the Course

- Inquiry is the integration of process skills, the application of scientific content and critical thinking to solve problems.
- Science is the method of observation and investigation used to understand our world.
- The stars of the night sky were grouped long ago by human imagination into patterns called Constellations.
- Astrology and mythologies offer an understanding of the historical development of modern astronomy.
- The study of constellations provides a means to better recognize and predict the movement (rotation and revolution) of the Earth.
- The celestial coordinate system is the means by which astronomers plot, locate and predict the positions of celestial objects.

• What we see with our eyes is a partial picture; the entire EM spectrum is needed for a complete picture of the universe.
• Human understanding of the universe is changing as knowledge is acquired through the use of modern technologies.

LEARNING STRAND

1.0 Scientific Reasoning and Communication Skills

NOTE: This learning strand should be taught through the integration of the other learning strands. This learning strand is not meant to be taught in isolation as a separate unit.

ENDURING UNDERSTANDING(S)

- Inquiry is the integration of process skills, the application of scientific content and critical thinking to solve problems.
- Science is the method of observation and investigation used to understand our world.

LEARNING OBJECTIVES The student will:

1.1 Generate questions or topics to be investigated.
1.2 Apply appropriate instruments needed to collect data with required accuracy.
1.3 Analyze experimental design and data so as to question validity, identify variables, and improve experimental design.
1.4 Develop conclusions based on critical data analysis identifying further investigations and/or questions based on the results.
1.5 Organize data in tables and graphs.
1.6 Utilize graphs and/or data tables in order to determine patterns and make predictions.
1.7 Apply computer-based tools to present and research information.
1.8 Gather information using a variety of print and non-print sources.
1.9 Support scientific arguments using a variety of print and non-print sources.
1.10 Present scientific information orally.
1.11 Present scientific information in an expository format so that it adheres to standard forms of grammar and mechanics.

INSTRUCTIONAL SUPPORT MATERIALS

- Sufficient laboratory instrumentation

SUGGESTED INSTRUCTIONAL STRATEGIES

- Performance tasks
- Inquiry / Open-ended labs
- Modeling
- Hands-on, minds-on lab activities
- Computer created spreadsheets and graphs
- See other learning strands for integration

SUGGESTED ASSESSMENT METHODS

- Lab reports
- Open-ended questions
- Teacher observations
- Essays and/or compositions
- Excel spreadsheets and graphs
- Research based projects
- Computer created spreadsheets and graphs
- See other learning strands for integration

LEARNING STRAND

2.0 The Celestial Sphere

ENDURING UNDERSTANDING(S)

- The stars of the night sky were grouped long ago by human imagination into patterns called Constellations.
- Astrology and mythologies offer an understanding of the historical development of modern astronomy.
- The study of constellations provides a means to better recognize and predict the movement (rotation and revolution) of the Earth.

LEARNING OBJECTIVES – The student will:

2.1 Recognize constellation patterns.
2.2 Determine circumpolar constellations as a function of latitude.
2.3 Predict the visibility of constellations based on the earth sun relationship. (seasonal)
2.4 Research examples mythologies associated with the constellations and astrology (horoscopes and astrological signs).

INSTRUCTIONAL SUPPORT MATERIALS

- Library research, Internet research
- Star maps and charts (Illustrated)
- Celestial sphere models / planetarium
- Astronomy, Wiley, 2000.
- www.homeplanet.com, www.NASA.com, www.jpl.com, www.astronomy.com

INSTRUCTIONAL STRATEGIES/APPROACHES

- Student presentations of traditional mythologies (summarize)
- Student presentations of personal mythologies with assigned constellations – oral and written presentation
- Analyze star charts and maps for brightness, distance, coordinates, seasonal variations, etc.
- Draw models of Earth's revolution with the night's sky in the background
- Use star charts and related data to predict the position of other celestial objects
- Distinguish between zodiacal constellations, seasonal constellations, and circumpolar constellations
- Plot constellations on a grid using celestial coordinates
- Question, answer and discussion
- Demonstrations of constellation patterns and apparent motion
- Homework assignments using the night sky to observe celestial objects and constellations
- Modeling
- Cooperative group activities

	ASSESSMENT METHODS/TOOLS • Demonstrate plotting on a star map/chart/grids • Identify a mythology associated with a constellation • Oral and written presentations • Rubrics • Homework • Constructed response or open-ended questions • Written analysis/summaries/conclusions • Illustrations or models

LEARNING STRAND

3.0 Applications of the Celestial Sphere

ENDURING UNDERSTANDING(S)

- The celestial coordinate system is the means by which astronomers plot, locate and predict the positions of celestial objects.

LEARNING OBJECTIVES: The student will:

3.1 Demonstrate the use of right ascension and declination in plotting celestial objects.
3.2 Predict the movement or location of objects on the celestial sphere.
3.3 Plot the ecliptic given data on the sun.
3.4 Determine the altitude of the noon sun based on date and attitude.
3.5 Demonstrate, using a globe, the relationship between the axial tilt, orbital position, and the length of day and night.

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INSTRUCTIONAL SUPPORT MATERIALS

- Star charts/maps/grids (R.A. & Dec.)
- Celestial Sphere models (planetarium)
- Globes, light source
- Astronomy, Wiley, 2000.

INSTRUCTIONAL STRATEGIES/APPROACHES

- Activity to demonstrate the length of day and night showing the sun's apparent position
- Calculate the altitude of the sun based on the date and latitude
- Calculate the right ascension of the sun
- Model/draw/plot and explain the phases of the moon
- Illustrate the configuration of the sun, moon, and Earth as it relates to the tides, phases of the moon, and eclipses
- Use the celestial coordinates to predict the visibility of objects in the sky

ASSESSMENT METHODS/TOOLS

- Demonstrate plotting on a star map/chart/grids
- Oral and written presentations
- Rubrics
- Homework
- Constructed response or open-ended questions
- Written analysis/summaries/conclusions
- Illustrations or models

LEARNING STRAND

4.0 Instrumentation

ENDURING UNDERSTANDING(S)

- Human understanding of the universe is changing as knowledge is acquired through the use of modern technologies.
- What we see with our eyes is a partial picture; the entire EM spectrum is needed for a complete picture of the universe.

LEARNING OBJECTIVES – The student will:

4.1 Provide examples of how telescopes enhance our knowledge and understanding of the universe.

4.2 Describe how instruments such as telescopes and spectroscopes are used to gather data.

4.3 Relate various regions of the EM spectrum as applied to astronomical research (radio, radar, microwave, infra red, visible, ultra violet, x-ray, and gamma ray astronomies).

4.4 Interpret spectrums for information on chemistry, temperature and Doppler effects.

4.5 Understand how modern technologies work to collect data. (ex. Satellites such as Hubble telescope, CHANDRA, IRAS, COBE, Cassini, etc.) (ex. Mars Rovers such as Spirit and Opportunity, etc.)

4.6 Summarize the past, present, and future of astronomical instruments.

INSTRUCTIONAL SUPPORT MATERIALS

- Lenses/mirrors (flat, concave and convex), prisms
- Telescopes
- Spectroscopes
- Color filters
- Spectrum tubes, spectrum charts
- Astronomy, Wiley, 2000.
- www.NASA.com, websites on EM spectrum
- Video – *Contact*

INSTRUCTIONAL STRATEGIES/APPROACHES

- Make student telescopes and spectroscopes and make and interpret observations
- Investigate how changing magnification and observe the apparent brightness, resolution and field of view.
- Model/Measure draw objects as seen in the field of view
- Labs involving the reflection, refraction and diffraction of light
- Investigate different kinds of mirrors
- Investigate how telescopes work
- Internet research on satellites and their research across the EM spectrum (radio, radar, microwave, infra red, visible, ultra violet, x-ray, and gamma ray astronomies)
- Use color filters and observe different color objects and discuss observations
- Determine the approximate distance based on size distance ratios
- Illustrate the properties of reflections and refraction
- Print and electronic research
- Demonstrations and modeling
- Cooperative activities

	• Videos on topics such as Hubble telescope, EM spectrum **ASSESSMENT METHODS/TOOLS** • Oral and written presentations • Rubrics • Homework • Constructed response or open-ended questions • Written analysis/summaries/conclusions • Illustrations or models • Lab reports • Lab practicals

LEARNING STRAND

5.0 Cosmology

ENDURING UNDERSTANDING(S)

- Human understanding of the universe is changing as knowledge is acquired through the use of modern technologies.

LEARNING OBJECTIVES – The student will:

5.1 Discuss theories related to the origin of the universe.
5.2 Explain theories related to the Big Bang.
5.3 Describe the location of the solar system and different components of the Milky Way Galaxy. (ex. hub, disc, distribution of globular clusters, spiral arms, stellar populations one and two, etc.)
5.4 Compare and contrast different types of galaxies.
5.5 Recognize the relationship between the apparent size and brightness of galaxies and their distance.
5.6 Analyze deep space images of the universe.

INSTRUCTIONAL SUPPORT MATERIALS

- Steven Hawking's Astronomy Video Series

INSTRUCTIONAL STRATEGIES/APPROACHES

- Doppler analysis (measurements of the red shift)
- Compare and contrast stellar populations for color, size, age, chemistry, location, motion and connections to life
- Research and present different theories related to the origin of the universe
- Print and electronic research
- Videos on topics such as black holes, dark matter, creation of the universe, stellar evolution, etc.
- Modeling note taking skills and strategies
- Cooperative group activities

ASSESSMENT METHODS/TOOLS

- Oral and written presentations
- Rubrics
- Homework
- Constructed response or open-ended questions
- Written analysis/summaries/conclusions
- Illustrations or models
- Lab reports involving the analysis of data