Specialized Science 12 – Astronomy

Course Outline

Course Overview

Specialized Science 12 – Astronomy explores the universe. It covers topics you hear about in the news, including our solar system and exoplanets, the Sun and neutrinos, stars and stellar evolution, black holes and gravity waves, galaxies and dark matter, The Big Bang and the structure of the universe, and space exploration. The course focuses on four big ideas: astronomy seeks to explain the origins of the universe and interactions of celestial bodies (Earth Science). An object's motion can be predicted, analyzed, and described (physics 11). Forces interact within fields and cause linear and circular motion (physics 12). Elements and compounds have specific properties (chemistry 11). Astronomy is designed with a number of hands-on labs and projects to help students connect with the distant universe. Many models are also used to allow students to understand space through everyday life connections.

Course Content and Suggested Timelines

Getting Started! (Suggested time: 1-2 hours)

In this unit you will print out the course outline and formula sheet. Go through the About This Course Lesson and the EBUS Student Integrity Policy. There are two assignments. The All About You Assignment allows me to meet you and learn more about your learning style and the Opening Assignment is about the Online Integrity Policy at EBUS.

Math Tools for Astronomy 12 Success! – Optional (Suggested time: 5 – 6 hours)

In this unit, you may review some important math skills so you can be successful in this course. These include scientific notation, unit conversions, graphing, algebra, and trigonometry.

Unit 1 – Introduction to Astronomy (Suggested time: 10 -12 hours)

This unit covers a wide range of material starting with the night sky and storytelling as that is where the study of astronomy truly began. This unit also discusses a brief history of western astronomy, the properties of light and waves, optical telescopes, and astronomy in all wavelengths. This unit deals with the science required to do astronomy at the research level. How do scientists learn about the sky and what is in it? This unit has a mandatory coding project where students will learn how research telescopes gather data and create those amazing images, we all love to see from space.

Unit 2 – Solar System and Exoplanets (Suggested time: 12 – 14 hours)

This unit starts with our Solar System as we know it best. In this unit students will learn about how the planets move around the Sun using Kepler's Laws and Newton's Laws. Circular motion is studied in terms of planetary orbits as well. This unit is not all about motion however, Students will compare the eight planets of our Solar System to find trends between terrestrial and Jovian planets. Students will learn about other members of our Solar system such as asteroids, comets, meteorites, moons, and dwarf planets. Finally, students will take this model of our Solar System out into the galaxy and compare what has been found beyond our Solar System and what it means for a theory about the formation of all planetary systems in the galaxy.

Unit 3 – The Sun (Suggested time: 8 - 10 hours)

This unit covers our closest star and the giver of energy in our Solar System. Students will learn about the different layers and features of the Sun. How the Sun produces energy and how we know what is happening deep inside a star. Students will model solar neutrino experiments to help understand the importance of this discovery and our understanding of solar physics. Finally, students will learn about the Sun's atmosphere, what effects that has on Earth and how the atom can explain so much about the Sun and distant stars.

Unit 4 – Stars and Stellar Evolution (Suggested time: 14 – 16 hours)

In this unit students will discover how stars are classified by colour and the spectrum they give off. Students will also study how stars are formed and how their evolution depends on the mass they were born with. The Hertzsprung Russell Diagram will be studied in detail to show the relationships between stars masses, brightness, lifetime, evolution, etc. Finally, students will learn about the bizarre fates of stars at the end of their lives including supernovae, white dwarfs, neutron stars, pulsars, and black holes.

Unit 5 – Black Holes and Gravity Waves (Suggested time: 8 – 10 hours)

As black holes are such an impressive topic that are found as stellar sized objects as well as supermassive black holes at the heart of spiral galaxies this topic will be covered in more detail in its own unit. Gravity around massive objects in the universe including black holes has interesting effects so a look into the detection of gravity waves and what they come from will also be discussed in this unit.

Unit 6 – Galaxies and Dark Matter (Suggested time: 10 – 12 hours)

There are 100s of billions of galaxies in our universe. In this unit students will learn about our own Milky Way galaxy and its structure and how that compares to other galaxies in the universe. Our own galaxy shows evidence for the existence of Dark Matter. This fascinating topic has scientists divided as to its nature. Students will look at the possible explanations and model the motion of stars in our galaxy to explain the reason for Dark Matter.

Unit 7 – The Birth and Death of the Universe (Suggested time: 10 – 12 hours)

This unit covers the entire timeline of the universe. Starting with the Big Bang theory and the creation of the universe, through its infancy to the formation of stars, galaxies, and the large-scale structure of the universe we see today. Students will also learn about the possible fates of the universe and how it may one day end. There is a particularly interesting option that only came about recently with the discovery of the Higgs Boson.

Unit 8 – Space Exploration (Suggested time: 12 – 14 hours)

Where would astronomy be without space exploration? Whether that exploration is manned or unmanned, orbiting satellites, space stations, or planetary probes; humans have started to explore space. In this unit students will look at the history of the Space Race and space exploration as well as what it means for the future. What those technologies do for humanity afterwards and the ethics of space exploration. This unit is competency based allowing students to explore their own views on the topic and how the exploration of space effects all of humanity. A final project on a chosen space exploration topic is the main focus of this unit.

Course Materials

A textbook is not required for this course. There is an online Open-Source Textbook available in the Getting Started section of the course for students who prefer a textbook.

Assessment Information

Show Your Learning	10%
Summaries and Reflections	10%
Assignments	30%
Mini-Labs	25%
Projects	25%

Show Your Learning: (10%)

Show Your Learning assignments are for the Mathy parts of this course. They allow students to show what they have learned and receive feedback to ensure the mathematical concepts have been understood. These assignments are short usually no more than 5 questions covering a range of difficulty levels. These assignments are displayed on the course website and can be accessed directly from there. Students may use their notes and other resources to help them with the assignment. These assignments are to be done on paper so students can show all their work. When the assignment is completed, students will need to either scan them or photograph the pages so they can upload them directly to Moodle. Once the assignments have been marked students can view the mark and feedback in their gradebook.

Summaries and Reflections: (10%)

Summaries and reflections are for conceptual parts of this course. Summaries are a way of checking student understanding of conceptual content. These summaries come in a wide variety of assessments from question answer to drag and drop, image sorts and matching. Reflections allow students to reflect on what is learned and how it relates to them personally or humanity in general. Reflections are competency based where a wide range of opinions are appreciated, and marks are given for the clarity of communication and engagement in the subject.

Assignments: (30%)

Assignments are a more in-depth study of a topic. Students may be doing calculations, graphing, analyzing data or performing at home simulations. All assignments come with discussion questions where students analyze the results of the assignment and write a conclusion to summarize their learning. Assignments are given a suggested length of time in the assignment description in the course. If students feel that the length of time to complete the assignment is inaccurate for them, I encourage them to contact me directly to discuss modifications.

Mini-Labs: (25%)

Mini-Labs are an important part of science and are necessary to build lab-specific skills. This course contains at home interactive labs. These labs help students make connections between the course material and how scientists discover the mysteries of space. In addition, these labs guide students in writing a laboratory report. Please note that all lab materials are common materials, and the lab is safe to perform at home. Suggested time to be spent on the labs is given in the lab description in the course.

Projects: (25%)

There are three projects in this course. Recolouring the Universe project is a coding project that shows students how telescopes produce images as well as how scientists use those images to show the presence of different gases that give us those amazing space images. The Milky Way Model is a hands-on project that allows students to create a scale model of our galaxy and show the location of its major features. The space Exploration project is a competency-based project that allows students to choose a space mission and research its mission objectives as well as assess the meaning of this mission to humanity and the scientific community.

When students are not meeting the learning outcomes/ falling behind

When students fall behind the expected pace or plan, they will be contacted via email or phone and if there is no improvement or response, parents will also be contacted. If deemed necessary,contact with the student's home school may also occur to help determine a solution.

Students are expected to let the course teacher know when they are struggling with course content. In response, the course teacher will provide appropriate help or strategies to support learning. The course teacher will also provide feedback on course work to support learning and help students improve. Parents will be made aware if their child is actively working but strugglingto meet the learning outcomes of the course.

Students falling behind in a manner where it does not appear that they will complete the course within a year will be sent reminder emails. Without a response or renewed efforts in the course, thestudent may be assigned an F or withdrawn. Should they begin actively working in the course, the student may be given an alternate completion date.

Expectations

- Adhere to the EBUS Academic Integrity Policy
- Contact your teacher when help is needed.
- Review feedback from assignments where applicable
- Work to complete the course in a timely manner.
- Communicate respectively.
- Review weekly progress reports.
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Reporting to Parents:

There are 4 term report cards that can be downloaded from the student dashboard. A notice will go out when these report cards are available.

Every week that EBUS is in session the teacher will send out a progress report showing the student's progress.

Contacting Your Teacher:

Your teacher will be available Monday to Friday during regular school hours. If you are having trouble with any concepts, you can contact your teacher, as indicated by the course page.

Stephanie Sedgwick (email): ssedgwick@sd91.bc.ca.
Online one-on-one sessions can be booked with your teacher at: Microsoft Bookings