BAA Astronomy 11

District Name: Coquitlam

District Number: SD #43

Developed by: Teena Delia

Date Developed: April 2004

School Name: Terry Fox Secondary

Principal's Name: Dan Derpak

Board/Authority Approval Date: April 20, 2004

Board/Authority Signature 

Course Name: Astronomy

Grade Level of Course: 11

Number of Course Credits: 4

Number of Hours of Instruction: 120 hours

Prerequisite(s): Science 10

Special Training, Facilities or Equipment Required: a computer lab

Course Synopsis:
This course is an introduction to astronomical processes, theories and features in the universe. Techniques and tools of the astronomer are included. Topics covered include concepts in: astronomical techniques for observation, solar system components, stellar and planetary formation, evolution and classifications of stars, star clusters and nebula, galaxy structure and formation, structure and origin ofthe universe, extraterrestrial life and astronomical concepts in science fiction. Laboratory work is included to provide observational examples ofthe above topics.

Rationale:

An educator's goal is to encourage students to desire life-long learning and to strive for excellence. If the students are particularly interested in Astronomy and it is not offered then the school system is not providing them with that avenue of learning. The online aspect of the course will teach the students (if they don't already know) that the Internet can be an excellent learning resource for the rest of their lives. Excellence is attained especially easily if a person is interested in what they are learning as is the case here, based upon the feedback -received regarding the possibility of Astronomy being offered.

Organizational Structure:

Unit/Topic	**Title**	**Time**
Unit 1	**The History of Astronomy**	10 hours
Unit 2	**Telescopes**	15 hours
Unit 3	**Observing Our Sky**	15 hours
Unit 4	**The Solar System**	15 hours
Unit 5	**Our Galaxy**	15 hours
Unit 6	**Our Universe**	10 hours
Unit?	**The Space Program**	15 hours
Unit 8	**Extra Terrestrial Life**	10 hours
Unit 9	**Science Fiction**	15 hours
	Total Hours	120 hours

Unit/Topic/Module Descriptions:

Unit 1 - The History of Astronomy **10 hours**

Overview:

History is studied, in part, so that humanity can understand past mistakes and attempt to avoid repeating them in the future. In Astronomy, a similar philosophy applies except it is expanded. Not only do astronomers want to avoid mistakes, but they also want to learn from past experts so they don't unintentionally "reinvent the wheel" in their research. As a result, the first curricular unit will be to review the history of this most interesting field.

Curriculum Organizer - Historical Context

It is expected that students will:

- identify who the early astronomers were.
- identify where early astronomers lived.

Curriculum Organizer - Critical Analysis

It is expected that students will:

- demonstrate an understanding of the context of when early astronomers lived.
- demonstrate an understanding of why early astronomers studied the heavens.
- describe the beliefs of the time and the conflict that resulted.
- evaluate the acceptability of the co-existence of science and religion.

Curriculum Organizer-Technology

It is expected that students will:

- identify who first designed the telescope.
- describe what was seen by the first telescopes.

Unit 2 - Telescopes **15 hours**

Overview:

In this unit students will learn about telescopes. They will study the different types, other equipment that can be attached to them, where the best location is for a telescope to be, and the optics of reflector and refractors. Ultimately, they will build a simple telescope using lenses and cardboard tubes in an in-class lab. The class will visit several telescopes as well.

Curriculum Organizer - Technology

It is expected that students will:

- compare the differences between types of telescopes.
- demonstrate the uses of a spectroscope.

Curriculum Organizer - Critical Analysis

It is expected that students will:

- analyze simple spectroscope data.
- demonstrate an understanding of why a telescope in space is better.
- demonstrate an understanding of how lenses and mirrors work in creating a magnified image.

Curriculum Organizer - Current Knowledge

It is expected that students will:

- identify the locations of the important earth-based telescopes.

Curriculum Organizer - Application

It is expected that students will:

- demonstrate observation techniques with a telescope.
- design a telescope using lenses and mirrors.
- build a simple telescope.

Unit 3 - Observing Our Sky **15 hours**

Overview:

Now that students have each built a telescope, they will have a chance to use it. To prepare for observing students will be trained in the art of finding their way around the night sky so they will know what they are looking at. This unit will be dedicated to that goal.

Curriculum Organizer - Historical Context

It is expected that students will:

- relate meteor showers to the extinction of the dinosaurs.

Curriculum Organizer - Current Knowledge

It is expected that students will:

- identify common constellations.
- identify the locations of several nebula and what they are.
- identify the locations of several galaxies and the types that exist.
- identify the locations of several star clusters.
- compare the differences between star clusters, galaxies and constellations.

Curriculum Organizer - Critical Analysis

It is expected that students will:

- demonstrate an understanding of how the planets move around the night sky.
- demonstrate an understanding of when, how often and why solar and lunar eclipses happen.
- demonstrate an understanding of where, when and why meteor showers happen.
- demonstrate an understanding of what causes the aurora borealis.

Curriculum Organizer - Application

It is expected that students will:

- participate in an observing evening.
- demonstrate which planets are easily visible.
- demonstrate finding his/her way around the night sky with a star map.
- demonstrate an understanding and be able to demonstrate the phases of the moon.

Unit 4 - Solar System **15 hours**

Overview:

In this unit students will study the solar system. By definition, the solar system consists of all objects that orbit the sun. Unfortunately it is impossible take a field trip to make observations first hand (not yet anyway) so students will do the next best thing by using the most up-to-date information on the internet. Topics include looking at how the solar system formed and then studying each part individually: the sun, the 9 planets and their moons, the asteroid belt and finally comets.

Curriculum Organizer - Historical Context
It is expected that students will:

- demonstrate an understanding of the nebular theory of how the solar system formed.

Curriculum Organizer - Current Knowledge
It is expected that students will:

- describe the sun and its importance to us.
- distinguish between the nine planets based upon size, location, and unique features.
- identify which planets have natural satellites (how many?) and understand, which have none (why?).
- identify the location of the asteroid belt and understand why it's there.
- describe the asteroids.
- identify the orbits of several comets including Halley's.

Curriculum Organizer - Critical Analysis
It is expected that students will:

- demonstrate an understanding ofthe theory of how natural satellites are formed.
- discuss the theories of how our Moon formed.
- demonstrate an understanding of how rings are related to natural satellites.
- demonstrate an understanding of where comets originate.

Curriculum Organizer - Application
It is expected that students will:

- illustrate and label a detailed picture of the structure of a comet.

Unit 5 - Our Galaxy **15 hours**

Overview:

The solar system contains only one of the billions of stars in our galaxy, the Milky Way. Distances in the solar system are amazing (i.e. if the sun is a basket ball, Pluto is half a pinhead about half a mile away!) but distances in the Milky Way are mind boggling! It takes light from a star on the edge thousands of years to travel across this "little" galaxy! As well, each of the stars that compose the galaxy has its own history and future depending on its size. Some of them (maybe all?) have planets in orbit around them but Earth is so far away that it is very difficult to determine.

Curriculum Organizer - Historical Context

It is expected that students will:

- identify the different units used to measure distances in space.

Curriculum Organizer - Current Knowledge

It is expected that students will:

- explain how astronomers determine distances to objects in space.
- outline the dimensions of the Milky Way galaxy and how they were determined.
- recognize how close other galaxies are to us.
- demonstrate an understanding of how other "solar systems" are located.
- identify how many other "solar systems" there are.
- recognize how far away the nearest stars are.
- identify how many stars are in our galaxy and how it was determined.
- describe the different life cycles of various stars.

Curriculum Organizer - Critical Analysis

It is expected that students will:

- discuss the possibility of life in other solar systems.
- demonstrate an understanding of the HR diagram and relate it to stars' life cycles.

Unit 6 - Our Universe **10 hours**

Overview:

No matter what a person believes, the beginning ofthe universe requires a leap of faith! How did it start? What was there before it began? What is beyond the edges of the Universe? All that is really known is that humanity does exist and can observe the objects around Earth. Some of those objects have given scientists clues to the origin and make-up ofthe universe.

Curriculum Organizer - Historical Context
It is expected that students will:

- demonstrate an understanding of the Big Bang Theory and know when it is theorized to have occurred.

Curriculum Organizer - Current Knowledge
It is expected that students will:

- identify the difference between open and closed universe theories.
- discuss evidence for open and closed universe theories.
- describe what a black hole is.
- demonstrate an understanding of what a quasar and gravitational lens are.
- demonstrate an understanding of what the vacuum in-between objects is.
- identify other objects such as: galaxies, neutron stars, nebula, etc.

Curriculum Organizer - Critical Analysis
It is expected that students will:

- discuss other possible beginnings to the universe.

Unit 7 - Space Program **15 hours**

Overview:

People have been enthralled with space for centuries but it has only been in the last century that humans have had the technology to attempt to actually go there. And it has been a race ever since - mostly between the USA and Russia. Putting satellites and people into orbit is a very expensive endeavor which many people argue is a waste. In this unit students will weigh the costs and benefits to decide for themselves whether the space program should continue with its future plans or put all the money into the medical system and eliminating poverty.

Curriculum Organizer - Historical Context

It is expected that students will:

- identify the role NASA has had in the history of the space program.
- discuss the mistakes NASA has made (i.e. Hubble and space shuttle)

Curriculum Organizer - Current Knowledge

It is expected that students will:

- describe Canada's role in space.

Curriculum Organizer - Future

It is expected that students will:

- evaluate future missions (i.e. terraforming, etc.)

Curriculum Organizer - Technology

It is expected that students will:

- compare associated occupations such as: astronauts, astronomers, technicians, etc.
- analyse the electromagnetic wave collection methods used in orbiting telescopes

Curriculum Organizer - Critical Analysis

It is expected that students will:

- demonstrate an understanding of the importance, pros and cons of the space program.
- debate the "moon hoax" issue
- demonstrate an understanding of the politics behind the space race and who has been involved.
- discuss the ethics of spending great sums of money on the space program when people on Earth are starving for example.

Unit 8 - Extra Terrestrial Life **10 hours**

Overview:

The existence of extra terrestrial life has been heatedly debated over the years. Some people claim to have been abducted, probed and returned to earth. There are many reports of UFO sightings and even a place called "Area 51" that is reported to be a top secret US site where there is a UFO and aliens! In this unit students will study extra terrestrial life in the micro-organism form as well as the full grown. There have been claims of Martian fossils, DNA strands in space and possible life under the ice on Europa. If any of these turn out to be true it certainly lends credibility to the possibility of other life in the Universe!

Curriculum Organizer - Historical Context
It is expected that students will:

- demonstrate an understanding of why ancient astronomers believed there was life on Mars (seasons, canals).
- describe what Martians were believed to look and act like (Orson Wells).

Curriculum Organizer - Current Knowledge
It is expected that students will:

- identify the evidence that has been found of DNA strands floating in space.
- describe UFO sightings/abductions that have been reported.

Curriculum Organizer - Critical Analysis
It is expected that students will:

- evaluate the likelihood of life under the ice on Europa.
- estimate the probability of other life forms (aliens) elsewhere in the universe.
- evaluate the credibility level of reported sightings/abductions based upon available evidence.

Unit 9 - Science Fiction **15 hours**

Overview:

Most ofthe course is spent studying the scientists version of astronomy. The last unit takes a look at the science of the imagination in the form of science fiction. Students will have a look at the predictions made in science fiction and how accurately science is portrayed. They will be reading several short stories and watching several movies so that they can critique them in terms of how realistic they are.

Curriculum Organizer - Future

It is expected that students will:

- study various samples of fiction where the imagination predicted scientific advances. For example:
    - o Breaking the sound barrier.
    - o Man landing on the moon.
    - o Exceeding the speed of light, Einstein, Warp Speed.

Curriculum Organizer-Technology

It is expected that students will:

- analyze current literature and movies for scientific accuracy (i.e. Star Trek).

Curriculum Organizer - Critical Analysis

It is expected that students will:

- display an understanding of a good cross-section of science fiction material including:
    - o Orson Wells' radio broadcast
    - o Isaac Asimov short stories
    - o 2010

Instructional Component:

- Independent instruction
- Direct instruction
- Indirect instruction
- Interactive instruction
- Modeling
- Research projects
- Brainstorming
- Group work
- Videotapes
- Cassette tape
- Field trips
- Observation evenings

Assessment Component:

- Effective formative assessment via:
    - Clearly articulated and understood learning intentions and success criteria
    - Questions posed by students, peers and teachers to move learning forward
        - Discussions and dialogue
    - Feedback that is timely, clear and involves a plan
    - Students are resources for themselves and others – peer and self-assessment
    - Student ownership

Formative assessment used to adapt learning experiences and inquiry plans on an on-going basis to meet specific learning goals.

Development, awareness and action, based upon metacognition intended to lead to learner independence and self-coaching.

Summative Assessment:

Summative assessments will be determined as students demonstrate proficiency/mastery toward particular learning outcomes. Summative assessments and final grades will reflect the following:

- Students will work collaboratively with the teacher to determine summative achievement on assignments and letter grades based upon dialogue, and evidence of learning
- Behaviour and work habits will NOT be included when determining letter grades
- Marks will not be deducted for late work
- Extra credit and bonus marks will not be awarded
- Plagiarizing will not result in reduced marks/grades –the student will be required to demonstrate their learning authentically
- Attendance will not be considered toward letter grade
- Only individual learning demonstrated –no group marks – will be used to determine grades
- Letter grades will reflect learning towards the learning outcomes articulated above
- Letter grades will be based upon criteria provided/agreed upon toward the learning outcomes
- Letter grades will be determined in relation to the learning outcomes – not in comparison to the achievement of other students
- Poor work will not be assessed towards grades – students will only be assessed on quality work
- Professional judgment and evidence will be used to determine final letter grade in consultation with the student
- Zeros will not be assigned to missed assignments – all required assignments must be completed
- Formative or practice towards learning outcomes will not be included in final grade assessment
- Most recent evidence toward learning outcomes will be used to assign letter grades – learning is not averaged over time

Learning Resources:

- Access to the Internet for research/resources/online lessons and assignments
- Books
  - *Sky News* A Canadian Astronomy Magazine
  - *Sky and Telescope* An American Astronomy Magazine
- Video Resources
  - *The Astronomers* video series
  - *Contact* the movie
  - *Star Trek* episode
  - Other videos dependent on student input
- Cassette Resource
  - *War of the Worlds*, Orson Welles, Radio Play, Mercury Theatre, October 30, 1.938
- Field Trips
  - Osoyoos: Observatory B&B and Dominion Astrophysical Radio Observatory
  - Maple Ridge: UBC's Liquid Mirror Telescope
- Multiple Astronomical Observing evenings on the field at Terry Fox

Additional Information:

This course has been offered in the school district since 2001.