2020 Science English Semester 1 Lesson Plan

Quick Notes

- Each lesson will be divided into two parts: a math part and a physics part. Last year, the first three lessons were math-only lessons and the last four lessons were science-only lessons. I want to combine them so that students can learn how to do the math in English and then how it is applied to astronomy in English during the same lesson.
- This class will use the same textbook as before: GCSE Science: Foundation – P1 The Earth in The Universe; Sections A, B, D, E, C in that order
- I am unsure exactly how many lessons this semester will have so I planned for an extra lesson, Lesson 9.
- Each lesson will have homework. A science article in English will be given to the students to read before the next class. At the start of the next class, students will discuss the article with their partner and answer questions about it.
- Along with each math/science lesson, we will hand out worksheets for the students to fill out as we go along.

Lesson 1 - Introduction

1. Introduction + games, name cards and English Only rules
2. General semester outline
3. Welcome video
4. Introduction to Space slides
5. Nakao-sensei survey
6. Article Homework

Lesson 2 – Math Vocabulary, Numbers, & Basic Astronomy

1. Article discussion
2. MATH SECTION
    a. Operation vocabulary slides and worksheet
    b. Big number practice (scientific notation)
3. SCIENCE SECTION – Section A and B in textbook
    a. Basic numbers and scale of the universe
    b. How we make observations
        i. Telescopes and light: the future of astronomy = large optical lenses
        ii. Where we make observations: light pollution
    c. Basic facts about the solar system, the sun, energy & nuclear fusion
4. Article homework

Lesson 3 – Statistics & The Scale of the Universe

1. Article discussion
2. MATH SECTON
   a. mean, median, mode, range slides and worksheets
   b. data sets, data analysis
   c. science is telling a story with numbers
3. SCIENCE SECTION – Section D in textbook
   a. Review basic size of the universe
   b. Discovery of other galaxies
      i. Hubble's famous Great Dark Spot picture
   c. Examples of statistics in Astronomy
      i. Galaxies and stars: statistics of types and numbers
      ii. Light spectroscopy: breaking light down into numbers
4. Article homework

Lesson 4 – Standard Deviation & The Origins of the Universe

1. Article Discussion
2. MATH SECTION
   a. Standard deviation and % of probability of occurring
      i. Physical meaning
      ii. How to calculate
   b. Outliers: the definition and physical significance, why they are important in science
      i. Either a problem with data or a new phenomenon
3. SCIENCE SECTION – Section E in textbook
   a. The Big Bang theory explanation
      i. Discovery and verification
   b. Heat death of the universe and the Doppler effect
   c. How light is a time machine, Einstein's special relativity and why we will never know the size of the universe
   d. IF TIME: exoplanet statistics and outlier facts
4. Article homework

Lesson 5 – Basic Wave Math, Unit Conversion, & Scientific Research

1. Article Discussion
2. MATH SECTION
   a. Wave / light vocabulary
      i. Parts of wave (period, wavelength, amplitude, frequency, etc)
   b. Units in astronomy & typical wave units
   c. Breakdown of waves into spectrum (spectroscopy)
3. SCEINCE SECTION – Section C
   a. "If light is one of the only things we can observe from space, how can we use it to understand the most about our universe?"
   b. Parallax and apparent brightness
      i. Uses and assumptions
   c. Other properties we can determine by using light
      i. Mass, composition, gravitational waves, etc
      ii. Ex: α-Centari, collision of black holes, etc
4. Article homework

Lesson 6 – Creativity in Science and the Scientific Method

1. Scientific method in academia/astronomy
   a. Peer review, data analysis, fights for telescope time
2. Types of astronomy: theory, applied, etc.
3. Look at example scientific paper
   a. Show students parts of the article: plots and graphs, abstract, methods, conclusion (they don't need to understand the paper, just how it is put together)
4. Modern astronomy: data science, programming, big data
5. The future of astronomy in business, economics, bigger telescopes, better analysis with quantum computing
6. Explanation of egg drop experiment, what to bring, what to think about

Lesson 7 – Egg drop experiment

1. Explanation of procedure
2. Time for building their "Landers"
3. Egg dropping time
4. Clean up

Lesson 8 – Review

1. Review game for final
2. Explanation of what will and will not be on the final so students know what to study

Lesson 9 – Extra Lesson (will happen before the review lesson)

1. Fun Astronomy lesson on a topic of my or the students choosing: nothing in this lesson will be on the final