

# **Activity 1: Module 1 Readings**

## **Chapter 1 - The Cosmic Calendar in Dragons of Eden by Carl Sagan**

### **What is a cosmic calendar?**

The cosmic calendar is a concept introduced by Carl Sagan that helps the reader put into perspective the vastness of the amount of time that has passed since the big bang, the earliest event which humanity has a record of. The entire history of the universe was condensed into as single year, with the Big Bang happening on January 1st, with the first humans walking the earth at 10:30 PM of December 31st. It then follows that the course of human history happens in the span of 1 hour and 30 minutes.

### **How were they able to date important cosmic events?**

While the dates in the cosmic calendar are rough estimates serving a metaphorical purpose rather than accuracy, several techniques are mentioned in the first chapter such as:

- Geological stratification and radioactive dating - provided information on archaeological, paleontological, and geological events
- Astrophysical theory
  - provided data on the ages of planetary surfaces, stars, and the Milky Way Galaxy
  - estimate of the time that has elapsed since the Big Bang

Beyond this, we also know of recorded history, oral or written, fossil records of ancient creatures, and more specific methods which fall under the blankets provided by the previously mentioned ones.

## **Chapter 1.3 - The structures of the world in basic physics edited by Kenneth W. Ford**

### **What are the parts of the physical world as explained in this reading?**

The author discusses the frontiers of Physical science being:

- Macroscopic World
  - The human-sized world
- Submicroscopic world
  - subatomic particles
- Cosmological World
  - collection of galactic clusters

The author also displays in a table the objects or parts of the physical world in increasing size by powers of ten, which are:

- Elementary particles
- Atomic nucleus
- Atom
- Molecule
- Giant Molecule
- Solids
- Liquids
- Gases
- Plants and Animals
- The Planet Earth
- Star
- Galaxy
- Galactic cluster
- The Known universe

## **Which parts of the physical world are studied by physics? by chemistry? by geology?**

- The table also described special associated branches of science, starting with Physics:
  - Particle physics - Elementary Particle
  - Nuclear physics - Atomic nucleus
  - Atomic physics - Atom
  - Solid-state Physics - Solids
  - Hydrodynamics - Liquids
  - Aerodynamics - Gases
  - Astrophysics - Galaxy
  - Astronomy and Cosmology - Galaxy, Galactic Clusters, and the Known universe
- Chemistry
  - Chemistry - Molecules
  - Biochemistry - Giant Molecules
  - Biology - Plants and Animals
- Geology
  - Geology - Planet Earth

## **Chapter 1.5 - Theory and Experiment in Science and Basic Physics edited by Kenneth W. Ford**

### **How does experiment complement theory?**

As the book put it - theory and experiment have developed side by side through mutual cross-fertilization. Experiments provide the facts and theories tie-in the facts and gives us a description

of the world that is testably correct to a certain degree. However, experiments can only go so far as proving the most crucial aspects of a theory due to the limitations of scientists, which is further pushed forward by new discoveries and theories. This is the unbreaking loop of scientific discovery.

## **How does scientific knowledge develop?**

The chapter provides an idealized version of scientific progress, in the specific order of:

- Experimental Facts
- Laws tying the facts together
- Hypothesis
- Test of the hypothesis against past facts
- Prediction of new facts and further tests
- Theory
- Elaboration and application

However, the book also admits that there is no set pattern realized in the development of any theory. As proven in history of science such as the atomic model, the discovery of the solar system, and many more, fresh ideas and concepts as well as advances in experimentation methodology allow us to discover new facts which allows us to more correctly account for the laws that connect the facts together.

## **Chapter 4 - Public Attitudes Towards Science in Stephen Hawking's Black Holes and Baby Universes and Other Essays**

### **How does science affect society?**

Science has changed the way we live has changed a great deal in the last hundred years, today we live more comfortably and relatively safer in our day to day environment. Modern society has access to reliable healthcare, clean water, consistent food supply, global communication via computers and the internet, there is a new development almost everyday. This safety is illusory however, since we have also acquired the means to completely wipe life off the face of the planet. Be it slowly through climate change, food shortages, or in a blink of an eye through nuclear war. There is also the looming fear of AI being the undoing of humanity, but for now it remains a doomsday conspiracy.

### **What are the contributions of science to society?**

The chapter describes and implies several major contributions of scientific breakthroughs to society:

- Modern medicine
- Decreased risk of childbirth
- Quality of life improvement (amazing Earth v2 patch update)

- Nuclear weapons
  - By extension, Nuclear power
- Green house gas emissions (This counts as a contribution)
- Computers and the Internet
- Molecular Biology and Genetic Engineering

Science has completely changed the way we lived, our means of production, what we consider product, and has significantly increased the scale of human activity.

## **What are the attitudes of society towards science and what accounts for its attitudes?**

The chapter has several descriptions of society's views towards science and its breakthroughs:

- Some people would like to stop changes and go back to what they see as a purer and simpler age
- In the time of writing, the public is described to have an ambivalent attitude towards science - expecting an increase in the standard of living due to developments coupled with distrust, as evident in the popular description of a cartoon mad scientist creating a Frankenstein.
  - It is also noted that at the time of writing, the public had great interest in astronomy and science fiction (Back to the future and Star Wars come to mind).
- At the time of writing, science is dry and uninteresting in school due to children being taught to simply pass examinations. The children do not see the relevance of what they are learning to the world around them.
- At the time of writing, Television, popular books, and magazine articles were the main channels of science communication. In contrast, today we have popular YouTube channels such as Vsauce and Veritasium amongst many more, communicating science to millions of viewers around the world.