# Miami-Dade College

## Course Description, Prerequisites, Co-requisites, and Competencies

***ISC 3012***

*History of Science*

*3 credits*

**Course Description:** This course offers a historical perspective of scientific advances from early civilizations to current times. (3 hr. lecture)

**Prerequisites:** None

**Co-requisites:** None

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**Competency 1: The student will demonstrate knowledge of philosophers' contributions made to Greek cosmology and modern-day astronomy by:**

a. Reviewing scientific contributions made by the ancient Egyptians and Babylonians.

b. Comparing and contrast the contributions of each of the following to Greek cosmology: Plato, Eudoxus, Aristotle and Aristarchus by describing the geocentric model developed to explaining the motion of celestial objects, i.e., the sun, moon, planets, and stars about a fixed earth.

c. Applying the Ptolemaic geocentric system by using it to explain the motion of celestial objects about the earth.

d. Applying the heliocentric system of Copernicus by contrasting the success and failure of his system in describing the motion of celestial objects.

e. Describing Johannes Kepler's heliocentric system and explaining the reasons for his rejection of Copernicus' system and his adoption of his three laws of planetary motion.

f. Stating each of Kepler's laws and how each applies to planetary motion.

g. Explaining Galileo's contribution to the scientific method by describing the experiments he performed which led to the conclusion that all free-falling objects accelerate at the same rate.

h. Explaining Galileo's contribution to the scientific method and to astronomy by describing his use of the telescope to discover the moons on Jupiter, the rings on Saturn, craters and mountains on the moon and sunspots on the sun.

**Competency 2: The student will demonstrate knowledge of philosophers' contributions to the development of the laws of motion and the law of gravitation by:**

a. Stating and applying Newton's three laws of motion to everyday life experiences.

b. Applying the theories of Newton and Galileo to the problem of objects in free fall by formulating hypotheses on: 1) the factors which affect the rates of fall of different objects, e.g. feather vs. coin. 2) How these factors affect the rates of fall of these objects, and 3) how the experimental results can be explained by using Newton's law of motion and Galileo's law of inertia.

**Competency 3: The student will demonstrate knowledge of the contributions made by American scientists in the area of electricity by:**

a. Describing Benjamin Franklin's contribution to our knowledge of static electricity by explaining Franklin's kite experiment by which he proved that lightning is a form of static electricity and by describing his one-fluid theory of electricity.

b. Describing the process by which objects can be electrically charged by contact or by induction, in accordance with the law of conservation of charge.

**Competency 4: The student will demonstrate knowledge of the contributions made to the development of chemistry and the periodic table by:**

a. Discussing the developments that lead to the demise of alchemy and the phlogiston theory by describing the experiments performed by Joachim Becher, Georg Stahl, Joseph Black, Joseph Priestley, and Antoine Lavoiser.

b. Sequencing and summarizing the contributions of Dobereiner and Newlands to the development of the periodic table of the chemical elements by describing Newlands law of octaves and Dobereiner's law of triads.

c. Explaining how Dimitri Mendeleev modified the periodic table of the elements.

d. Explaining the contribution of Henry Moseley to Mendeleev's periodic table by describing his experiment, which led to the arrangement of the elements on the basis of atomic number rather than atomic weight.

e. Applying the periodic table by using the periodic table to determine an element's atomic number, atomic weight, family number, and period.

**Competency 5: The student will demonstrate knowledge of the atomic structure and the properties of matter by:**

a. Outline John Dalton's atomic model by discussing the five main points of the model and explaining which points were later corrected or modified.

b. Describing the experiments performed by Wilhelm Roentgen that led to the discovery of X-rays.

c. Describing J. J. Thompson's experiment by describing it and explaining how the conclusions on the charge to mass ratio for an electron led to Thompson's model of the atom.

d. Outlining Rutherford's scattering experiment by describing the apparatus and procedures used in the experiment and the results and conclusions drawn from the experiment.

e. Identifying and listing the contributions to the development of atomic theory made by Niels Bohr, Louis de Broglie, Werner Heisenberg, Erwin Schroedinger, and Max Planck.

**Competency 6: The student will demonstrate knowledge of the development of the gas laws by:**

a. Discussing the contributions made by Robert Boyle, Jacques Charles, and Joseph Gay-Lussac to the universal gas law by describing each scientist's conclusion on the relationship between pressure, temperature, and volume of a gas confined in a closed container.

b. Describing how the changes in temperature, volume, and/or number of moles would affect the pressure of a gas.

c. Applying the kinetic molecular theory of gases by discussing the molecular motion of particles in each of the three states of matter.

**Competency 7: The student will demonstrate knowledge of the contributions made to our current understanding of nuclear chemistry by:**

a. Discussing and explaining the contributions made by Marie Curie, Pierre Curie, and Henri Bequerel to nuclear physics by summarizing the experiments, which led to the discovery of radium and polonium by the Curies and the discovery of alpha, beta, and gamma radiation by Becquerel.

**Competency 8: The student will list at least ten contributions made by women and minorities in science in the fields of biology, chemistry, earth science, mathematics, medicine, and physics.**

**Competency 9: The student will compare the four major historical models of Western science and their cultural (i.e., religious, political, philosophical, economic, etc.) by:**

a. Recognizing parallel and divergent features of scientific models through history.

b. Examining the impact of science on religion and philosophy and on economic, political and social theory, as well as the role of these institutions in shaping the scientific attitudes of the day.

**Competency 10: The student will demonstrate knowledge of the development of biology and its branches by:**

a. Discussing the origin and development of genetics from Mendel to current research on cloning and the human genome project.
b. Analyzing the contributions of Darwin to the theory of evolution and the current controversy of evolution versus creationism.
c. Summarizing the advances in molecular biology.

**Competency 11: The student will demonstrate knowledge of the contributions made to the development of the various branches of earth science by:**

a. Discussing the development of geology.
b. Analyzing modern cosmological theories.
c. Summarizing the advances in oceanography and meteorology.