WESTMINSTER COLLEGE
TEACHER EDUCATION PROGRAM

NSC 305 The History of Science

Jim Concannon, Ph.D.
Assistant Professor – Education
242 Westminster Hall
jim.concannon@westminster-mo.edu
573-592-5201
573-864-3145

COURSE

Winter 2015
NSC 305 (3 cr.)
History of Science

COURSE DESCRIPTION

History of Science (NSC 305) is a Tier 3 course offered this summer on-line. This course is a chronological study of science, science figures, and science and technology in warfare beginning approximately 2000 BC. The history of science course covers a variety of content areas including astronomy, biology, chemistry, mathematics, and physics.

The purpose of this course is for students to learn science content and how science progresses and changes over time. Historically, the study of science has enabled successive generations to achieve an increasingly and comprehensive and reliable understanding of the human species and its environment. The means used to develop these ideas are particular ways of observing, thinking, experimenting, and validating. These ways represent a fundamental aspect of the nature of science and reflect how science tends to differ from other modes of knowing (Science for All Americans, p. I).

Students in this course are required to read two books from a three book series called The Story of Science by Joy Hakim. Students are required to turn in ten reading responses and write two essays.

REQUIRED TEXT:

Hakim, J. (2004). *The Story of Science: Aristotle Leads the Way*. Washington and New York: Smithsonian Books.

Hakim, J. (2005). *The Story of Science: Newton at the Center*. Washington and New York: Smithsonian Books.

Watson, J. D. (1968). *The double helix*. New York: Atheneum.

ASSIGNMENTS

Assignment	Points	Due
Reading 1	50	Dec 17
Reading 2	50	Dec 18
Reading 3	50	Dec 21
Reading 4	50	Dec 22
Reading 5	50	Dec 23
Reading 6	50	Dec 28
Reading 7	50	Dec 29
Reading 8	50	Dec 30
Video Reaction 1	10	Dec 17
Video Reaction 2	10	Dec 18
Video Reaction 3	10	Dec 21
Video Reaction 4	10	Dec 22
Video Reaction 5	10	Dec 23
Video Reaction 6	10	Dec 28
Video Reaction 7	10	Dec 29
Essay	100	Jan 3

Assignment Deadlines

Assignments are due by **5:00 pm**. Any assignment received after 5:00pm will be counted late. Each additional day an assignment is late reduces the assignment by one letter grade.

Letter Grades

92-100%	A	Below 60%	F
90-91.9%	A-		
88-89.9%	B+		
82-87.9%	B		
80-81.9%	B-		
78-79.9%	C+		
72-79%	C		
70-71.9%	C-		
68-69.9%	D+		
62-69%	D		
60-61.9%	D-		

READINGS

ARISTOTLE LEADS THE WAY
READING 1 pp 1-72

1. How did the Sumerians depict the universe?

2. In ancient civilizations, how did scientists seek answers?

3. How did Greeks explain the beginning of the universe and of life?

4. How do scientists seek answers today? What are some differences between science and pseudoscience?

5. How did ancient Chinese civilizations explain the beginning of the universe? How is this different from the Egyptian depiction?

6. How did the Sumerians develop the 12-month calendar? How was this different from the Egyptian calendar?

7. What is a "Theory"?

8. Where did the names for the 7 days of the week come from?

9. Who was Thales? What were his contributions to science? How was his way of perceiving natural phenomena different from former Greek and Chinese civilizations?

10. What was Anaximander's depiction of the universe? How was Anaximenes' depiction different?

11. Who did Anaxagoras teach? What explanation did Anaxagoras have for the sun, moon, and stars?

12. During the times of Anaxagoras, did political leaders support "real" science endeavors? What happened to Anaxagoras?

13. What idea, stemming from Empedocles, persisted until the 1700s?

14. How did Pythagoras become so fortunate to study with Thales?

ARISTOTLE LEADS THE WAY
READING 2 pp 73-114

Type your responses on a separate document.

1) What did Pythagoras mean by, “All is number?”

2) Do you think Pythagoras was a lunatic? Why or why not.

3) What revolutionary idea did Pythagoras have for describing the center of our universe?

4) What are some examples of irrational numbers?

5) Where was Democritus born? What year was Democritus born?

6) Read “Ode to an Atom” on pages 92 and 93. What characteristics of the “atom” described by Leucippus was Lucretius skeptic about?

7) Plato was plagued by his obsession with “perfection”. In Plato’s mind, what was a perfect number? What are some perfect numbers?

8) What are some examples of how “Aristotle had it wrong?”

9) How did Aristotle depict the universe?

10) Would you say Aristotle did a good job of explaining retrograde motion? Why or why not?

ARISTOTLE LEADS THE WAY
READING 3 pp. 115-174

Type your responses on a separate document.

1. Who was Heracleides? Is it possible that he knew Aristotle? What did Heracleides propose that contradicted Aristotle's ideas about the earth and the sun?

2. Who taught Alexander the Great? How was Alexander the Great described? What happened to Alexander the Great?

3. Who was Ptolemy?

4. What countries (in today's geographic location) did Alexander the Great conquer?

5. Who was Hero of Alexandria? What were his accomplishments?

6. What natural phenomenon did scholars depend upon to determine the distance to the moon or the distance between two cities?

7. What were some of Archimedes inventions? What were these inventions used for?

8. How did Eratosthenes measure the circumference of the earth?

9. When did the Roman Empire rise (what time frame)?

10. Who was Octavian in relation to Julius Cesar?

11. Who was the ruler of the Roman Empire when Joshua (Jesus) was born?

12. What year was the library in Alexandria burned?

ARISTOTLE LEADS THE WAY
READING 4 pp. 174-216

1. What was Eudoxus known for?

2. Did Hipparchus side with Aristotle's or Aristarchus' description of our solar system?

3. Did Ptolemy follow Aristarchus' work? Why or why not?

4. When Christianity was spreading, what was the state of Rome?

5. What factors cause the loss of interest in math and science throughout the Roman Empire?

6. How did Augustine impact Christianity and science?

7. What turning point in history did the "Dark Ages" begin? Why is it called the "Dark Ages"? Do you think it is better described as the "Great Interruption"? Why or why not?

8. How did science survive through the "Dark Ages"?

9. In the year 1000, what city could be considered the "New Alexandria" of scholarship? What religion dominated this city?

10. How did Europe retrieve much of the Greek knowledge that was lost during the "Dark Ages"?

11. In 1236, the Christian Crusades conquered Spain. What do the Crusaders find (bottom of 216)? Stop Reading at this Point.

NEWTON AT THE CENTER
READING 5 pp. 1-90

1) What year was the beginning of the Renaissance?

2) At the beginning of the Renaissance, what were the "facts" of astronomy?

3) How did scholars explain the "variable events of the world" (ex. Earthquakes)?

   What actually causes retrograde motion?

4) Visit this website to examine the different explanations for retrograde motion.

   Who had it right, Copernicus or Ptolemy?

   http://www.lasalle.edu/~smithsc/Astronomy/retrograd.html

5) What name was Copernicus born with? Why do you think he changed it?

6) What were some of Leonardo daVinci 's accomplishments?

7) Copernicus arguable caused a scientific revolution. How did Copernicus develop his idea of a Sun-centered universe?

8) Describe the four characteristics of Copernicus' model.

9) Do you think that Copernicus' model was accepted immediately? Why or why not? What would need to happen for it to be accepted?

10) What did Martin Luther think of Copernicus?

11) Describe Tycho Brahe's personality.

12) What was life like on Hven for Tycho? How was did he come to live on Hven?

13) Describe the Tychonian model.

14) Who eventually became Tycho's partner?

15) What did Galileo use a pendulum for?

16) What did Galileo invent after studying Archimedes' ideas?

17) How was Galileo as a professor?

18) What were Bruno's thoughts on the universe? Were they accepted?

19) What did Galileo have to build to study acceleration?

20) What did Galileo have to invent to measure velocity and acceleration?

21) What is the law of inertia?

22) How does Galileo explain relativity? What is the Principle of Relative Motion?

23) Did society accept Galileo's work with projectile motion? Why or why not?

NEWTON AT THE CENTER
READING 6 pp. 90-188

1) What turned Galileo into a serious astronomer?

2) Explain the life and the death of a sun-sized star.

3) How strong was Galileo's first telescope?

4) What did Galileo observe when viewing Jupiter? How about the sun?

5) What must Galileo need to do in order for his book *Dialogue Concerning the Two Chief World Systems* to be published?

6) What did Benedetto Castelli suggest Galileo to do to study Copernicus' theory?

7) What is the main difference between religion and science?

8) Who does Tycho Brahe turn his life's work over to?

9) What was the topic of Kepler's book in 1604?

10) Does earth travel around the sun in nearly a perfect circle?

11) When was Descartes born?

12) What is "analysis" according to Descartes?

13) What are the "Cartesian Coordinates"?

14) What mistakes did Descartes make?

15) As a boy, what was Isaac Newton like?

16) What is universal gravity?

17) What is the inverse square law?

18) What were Newton's accomplishments in 1666?

19) How did Isaac Newton perceive Robert Hooke?

20) Why did Newton invent calculus?

21) Why does a prism cause a spectrum of light?

22) How does Newton improve upon Galileo's telescope?

23) What is orbital velocity?

24) Describe the three books of Newton's *Principia*.

25) What event in Newton's life occurred in 1705?

NEWTON AT THE CENTER
READING 7 pp. 188-321

1) How did Roemer come to the conclusion that light has a velocity?

2) What are Cassini's accomplishments?

3) What are Andreas Libau's contributions to science?

4) What were the two major quests of alchemists?

5) What did Hennig Brand find? What was he looking for?

6) Who was the first true chemist?

7) Explain Boyle's Law.

8) How did Du Chatelet build upon Newton's ideas?

9) What were Karl Scheele's contributions to science? What was his awful habit?

10) What were Henry Cavendish's contributions to science? What did he eat every night for dinner?

11) What was the purpose of the "Committee of Attraction"? What year was it formed?

12) Describe how Cavendish's torsion balance worked.

13) What were Antoine-Laurent Lavoisier's contributions to science? What did his parents want him to be?

14) Who discovered Uranus? How was it discovered

15) Who was Jean-Paul Marat? What was his connection with Lavoisier?

16) What is the origin and meaning of the word "atom"?

17) What is the origin and meaning of the word "molecule"?

18) How did Avogadro advance Dalton's ideas and contributions to science?

19) What are Robert Bunsen's contributions to explaining the properties of elements?

20) What kind of character is Mendeleyev?

21) What inspired Mendeleyev to arrange the elements?

22) What type of force was Rumford first to publish about?

23) What did Marie Lavoisier's first and second husband have in common?

NEWTON AT THE CENTER
READING 8 pp. 322-431

1) What is the purpose of the Leyden jar?

2) Describe the first battery. Who deserves credit for the battery? What was the advantage of the battery over the Leyden jar?

3) Who was Albert Michelson? What were his contributions to science?

4) Within the book, Newton at the Center, what aspect of the nature of science did you find to be most revealing? Why? Provide a historical account of this aspect of science.

5) Within the book, Newton at the Center, which individual will you explore into more detail for your PowerPoint presentation?

ESSAY

READ:

Watson, J. D. (1968). *The double helix*. New York: Atheneum.

Essay Guidelines: Papers should be word-processed and formatted with 1" margins, double-line spacing, and 12-point font such as Times New Roman. Length will be between 4-5 pages (estimated) depending on how concisely you write. Your analysis should focus on the questions provided below, and link your ideas to those discussed in the course. APA format (see below) should be used for all references and citations. The paper can consist of page responses to each of the eight research questions.

Research Questions to guide your analysis:

1-What factors--personal, technological, cultural, and/or scientific--led this person to the investigation?

2-How was the investigation designed and why was it designed as it was? What data did the investigator collect?

3-How did the investigator interpret the data?

4-How were the investigator's conclusions related to the design of the investigation and to major theoretical or cultural assumptions, if any?

5-How did the investigator try to persuade others? Were the ideas accepted by contemporaries? Are they accepted today? Why or why not?

6-How did the results of this investigation influence the investigator, fellow investigators, and society more broadly?

7-Were there ethical dimensions to this investigation/research? If so, how were they resolved?

8-What element of this episode seems to you most characteristic or most revealing about the nature of science? Why?

TURNING IN ASSIGNMENTS

Please turn your assignments in via e-mail.

ACADEMIC DISHONESTY STATEMENT

Copy and paste from an internet site is considered plagiarism. Any person who is caught copying and pasting even one sentence from the internet will receive a failing grade for the course.

Assignments are not group assignments unless specified by the instructor. If you turn in word-for-word answers as another student, you will fail the course. I understand that some answers will be nearly identical from student to student by the nature of the question. However, identical essays are not allowed. You will receive an F.

ADA

If you are in need of accommodations please notify me as soon as possible.

Week	Reading	Discussion	Assignments and Written Work	Exam	Total Student Time
1	30	6	10		46
2	30	6	10		46
3	30	6	15	4	55

This is an approximate breakdown of the number of hours you will be spending per week on reading, discussion, assignments, and exam.