"The Scientific Revolution and the Emergence of Modern Science"

Chapter 16 Reading Guide *Western Civilization - 10th Ed. - Spielvogel*

**Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period:\_\_\_\_\_\_\_\_\_\_\_\_**

**MAJOR THEMES / BIG QUESTIONS: (as you work through the chapter, bear these questions in mind)**

* How was the medieval view of the universe, man, and man’s place in nature changed by the discoveries of Copernicus, Galileo, and Newton? (OS-5)
* How did the view of the human body change due to the discoveries of physicians and scientists? (OS-5)
* How did deductive and inductive reasoning change the way scientific inquiry was carried out? (OS-5)
* What effect did new scientific discoveries have on the religious views of elites and lower classes? (SP-10)
* In what ways were women both participants in and subjects of discussion during the Scientific Revolution? (IS-1, IS-4, IS-9)
* To what extent did the Scientific Revolution affect the lives of the lower classes? (Key Concept 1.5.V)
* In what ways and to what extent did monarchs of the period promote science as a way of adding to their political power? (SP-2)
* In what ways were the new scientific theories and methods of the seventeenth and eighteenth centuries a continuation of Renaissance thought, and to what extent were they a complete break? (OS-1, OS-4)1.)

1. Read the blue section on p 472-473, although this was not a quick and bombastic revolution, how was the Scientific Revolution, indeed, revolutionary?

**16.1 Background to the Scientific Revolution**

2.) What role did Aristotle, Ptolemy, and Galen play in the medieval mind and the Renaissance? How did their influence and roles change at the outset of the Scientific Revolution?

3.) What was the nature of the relationship between mathematics, technology and the Scientific Revolution?

**16.2 Toward a New Heaven: A Revolution in Astronomy**

4.) What is the Ptolemaic, or geocentric, view of the universe? How influential was its role in the average mind of a person living in the medieval and Renaissance eras?

5.) Who is Nicolaus Copernicus, what did he write, and what was his major contribution to the Scientific Revolution?

6.) What was the major contribution of Tycho Brahe to the Scientific Revolution?

7.) Why was Johannes Kepler such an important figure of the Scientific Revolution?

8.) Why was Galileo such a threat to the Catholic Church? What ideas were they most threatened by? What was his most famous work entitled?9.) In addition to his advancements in mathematics and astronomy, Galileo was concerned with mechanics. Describe his major contributions to this field.

10.) Isaac Newton may be the greatest thinker of all time. What did he invent? Why was he called the “last magician” by John Maynard Keynes?

11.) What is Principia? Why is it probably the most important book of all time?

12.) What was Newton’s “world-machine” view? How long did it remain influential? What eventually caused its decline?

**16.3 Advances in Medicine and Chemistry**

13.) Who was Galen? When did he live? Why was he so influential? What were the four humors?

14.) Who was Paracelsus? How did Paracelsus’s ideas contradict the works of Aristotle, and especially Galen?

15.) Who was Andreas Vesalius? What was the title of his most famous publication? What was the book all about?

16.) How did William Harvey’s work deal a severe blow to the theories of Galen?

17.) Who was Robert Boyle? What were his contributions to the scientific revolution?

**16.4 Women in the Origins of Modern Science**

18.) How did women pursue an education in the sciences? Was it available to all? What was humanism’s role? Did all men believe women should be educated?

19.) Who was Margaret Cavendish and what were her contributions?

20.) What did Maria Merian contribute to the scientific revolution?

21.) Who was the most famous female astronomer in Germany? How did she pursue an education and what were the obstacles she, and other women, faced at this time?

22.) What influence, if any, did the intellectual advancements going on have on the role of women in society? What were some commonly held beliefs about women during this era?

23.) To what extent did the scientific revolution change the overarching theme of patriarchy, previously substantiated by the Roman Catholic Church?

**16.5 Toward a New Earth Descartes, Rationalism and a New View of Human Kind**

24.) Rene Descartes, next to Newton, may be the most important thinker of his time. Who was he? What was his most famous work entitled? What is Cartesian dualism?

25.) Descartes is considered the father of modern rationalism. What is this? Why didn’t Descartes care for skepticism (hint, you may have to do some outside searches on google to answer this one…)

26.) Descartes and an English philosopher named Francis Bacon are both considered to have played a role in the formulation of the Scientific Method. What is this? And what were the contributions of each?

**16.6 The Scientific Method and the Spread of Scientific Knowledge**

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| --- | --- |
| **Scientific Method:** | |
| **Contributions from Bacon** | **Contributions from Descartes** |
|  |  |

27.) Why might monarchs (like Charles II of England and Louis XIV of France) have been keen on using state funding to support the establishment of scientific communities? What were the names of these societies in England and France?

28.) On page 493, Spielvogel asserts a few key premises to the argument as to why science became so central to European thought and accepted relatively quickly. What are they and what evidence does he use to support his premises?

First Premise:

Second Premise:

Third Premise:

29.) Perhaps the most difficult obstacle to embracing a scientific world view was the still incredibly pervasive role of religion during the 16th and 17th centuries. How did modern philosophers of the time try to solve the problem of such fundamental differences between these two views? In other words, how did they call themselves “both scientific and religious”?

30.) How did Baruch de Spinoza, or as the book calls him “Benedict,” disagree with Cartesian ideas? What were Spinoza’s beliefs?

31.) What efforts did Blaise Pascal make to keep science and religion united? Why did this ultimately fail?

32.) In your own words, summarize this chapter. What major changes did the scientific revolution bring about? What conflicts were either created or solved during this era? How can the phrase “challenging authority” be applied to this time?

DISCUSSION QUESTIONS FOR THE PRIMARY SOURCES (BOXED DOCUMENTS)

1. N/A

2. “On the Revolutions of the Heavenly Spheres”: What major new ideas did Copernicus discuss in this selection? What was the source of these ideas? Why might one say that European astronomers finally destroyed the Middle Ages? Why were the ideas of Copernicus so controversial? (page 476)

3. “Kepler and the Emerging Scientific Community”: What does the correspondence between Kepler and Galileo reveal about the agents and diffusion of European scientific inquiry? What other notable achievements must European society have reached even to make this exchange of letters possible? What aspects of European material culture made the work of these scientists easier? Why was Galileo initially more cautious than Kepler about publicizing his scientific discoveries? (page 478)

4. “The Starry Messenger”: What was the significance of Galileo's invention? What impressions did he receive of the moon? Why were his visual discoveries so stunning and how did he go about publicizing them? Why would these irrefutable discoveries have been so controversial and so threatening to clergymen of all faiths? (page 479)

Opposing Viewpoints: Page 481 – Questions in box

5. “Newton's Rules of Reasoning”: What are Newton's rules of reasoning? Do they appear “modern”? If so, how? How important were they to the development of the Scientific Revolution? How would following these rules change a person's view of the world, of European religious traditions, and of ancient “science”? (page 483)

6) Margaret Cavendish: “The Education of Women”. Page 487; Questions in box

7. “The Father of Modern Rationalism”: Describe Descartes' principles of inquiry and compare them to Newton's rules of reasoning. What are the main similarities between these systems of thinking? How might either or both sets of rules for the mind change how individual thinkers thought of themselves, about others, about politics, and about existing systems of European power politics and police of society? (page 490)

8. “Pascal: ‘What is a Man in the Infinite?’”: Why did Pascal question whether human beings could achieve scientific certainty? Does Pascal seem to argue that the Copernican Revolution, with its vastness, was a proof of the existence of God? What does the sheer scale of Pascal's thought (and disquiet) tell you about the impact of the Scientific Revolution on the consciousness and conscience of Europeans?

(page 495)

**Key Terms and Identifications:**

1. natural philosophers”

2. Aristotle

3. geocentric universe

4. Nicolaus Copernicus

5. On the Revolutions of the Heavenly Spheres

6. heliocentric universe

7.Tycho Brahe

8. Johannes Kepler

9 Galileo Galilei

10. The Starry Messenger

11. the Inquisition

12. Isaac Newton

13. Principia

14. universal law of gravitation

15. Paracelsus

16. Andreas Vesalius

17. On the Fabric of the Human Body

18. William Harvey

19. On the Motion of the Heart and Blood

20. Robert Boyle

21. Antoine Lavoisier

22. Margaret Cavendish

23. Maria Sibylla Merian

24. Maria Winkelmann

25. Rene Descartes

26. Discourse on Method

27. Descartes’ deductive method

28. Francis Bacon’s inductive method

29. Benedict de Spinoza’s pantheism

30. Ethics Demonstrated in the Geometrical Manner

31. Blaise Pascal

32. English Royal Society

33. French Royal Academy of Sciences