1. **3**
   One way in which the contributions of Copernicus, Galileo, and Newton are similar is that each
   1. challenged the heliocentric theory of the universe
   2. based his work on Enlightenment principles of social contract
   3. practiced observation and experimentation in his work
   4. supported the work of the Inquisition

2. **4**
   Base your answer to the question on the time line below and on your knowledge of social studies.

Which historical period is most closely associated with these achievements?

1. Pax Romana
2. Age of Alexander the Great
3. European Middle Ages
4. Scientific Revolution
3. **3**
Galileo Galilei and Sir Issac Newton are most closely associated with
1. initiating religious reforms
2. leading political revolutions
3. conducting investigative experiments
4. engaging in foreign conquests

4. **4**
Base your answer to the question on the illustration below and on your knowledge of social studies.

![Planetary System Illustration]

Which individual supported the theory represented in this illustration?

1. Socrates
2. Ptolemy
3. Dante
4. Galileo

5. **1**
- Vasco da Gama discovered an all-water route from Europe to India.
- Ferdinand Magellan’s crew circumnavigated the globe.
- Isaac Newton defined the forces of gravity.

These events relate most directly to
1. revised understandings of natural surroundings
2. questioning the benefits of the mercantile system
3. increased suspicion between different religions
4. development of new manufacturing techniques
6. **2**
Which pair of ideas were central to the Scientific Revolution?
1. social stability and economic self-sufficiency
2. observation and experimentation
3. technology and military expansion
4. scarcity and interdependence

7. **2**
Which statement about the Scientific Revolution in Europe is accurate?
1. The existence of natural laws was rejected.
2. Scientists questioned traditional beliefs about the universe.
3. New ideas supported the geocentric theory of Ptolemy.
4. The Bible was used to justify new scientific findings.

8. **4**
Which period of history had the greatest influence on the Enlightenment ideas of natural law and reason?
1. Pax Romana
2. Middle Ages
3. Age of Exploration
4. Scientific Revolution

9. **2**
Sir Isaac Newton, Galileo Galilei, and Johannes Kepler are all directly associated with the
1. Industrial Revolution
2. Scientific Revolution
3. English Revolution
4. Agricultural Revolution

10. **4**
The heliocentric model, the development of inductive reasoning, and the work of Descartes are all associated with which revolution?
1. Neolithic
2. Agricultural
3. Green
4. Scientific

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**Figure 1**

Base your answer on the quotation and on your knowledge of social studies.

“With sincere heart and unpretended faith I [reject]…, and detest the aforesaid errors and heresies [of Copernicus] and also every other error … contrary to the Holy Church, and I swear that in the future I will never again say or assert … anything that might cause a similar suspicion toward me.”

– Galileo

11. **4**
The historical issue referred to in this quotation is the conflict between
1. privileged upper classes and exploited lower classes
2. 16th-century Protestants and Catholics
3. city-states and nation-states
4. established institutions and new ideas
12. [Refer to figure 1]

The best explanation as to why Galileo made this statement is that he

1. was a strong supporter of Church doctrine
2. feared that the Church might excommunicate him
3. had lost faith in the teachings of science
4. wanted to advance his ideas through the Church

13. __2__

Francis Bacon, Galileo, and Isaac Newton promoted the idea that knowledge should be based on

1. the experiences of past civilizations
2. experimentation and observation
3. emotions and feelings
4. the teachings of the Catholic Church
…At first, the discoveries of Copernicus and Galileo upset many Europeans. Over time, however, a new way of thinking about science emerged. Scientists began to observe the world around them and to develop ideas about why things happened. They did experiments to test these ideas. This new way of thinking was called the scientific method….

14. [Refer to figure 2]

Based on this excerpt and diagram from Guide to the Essentials of World History, what is one way Copernicus, Galileo, and others influenced how scientists work?

Sample Answer:

Examples:

- developing/using the scientific method
- developing ideas about why things happened based on observations/experimentation
- scientists now use experiments to test ideas
- testing a hypothesis
- scientists now publish a conclusion based on collected data and experiments
- publicizing conclusions based on observations about the world
- making others aware of the data from experiments

Source: Guide to the Essentials of World History, Prentice Hall, 1999 (adapted)
This is an excerpt from a letter written by Galileo Galilei in 1615 to the Grand Duchess Christina defending his approach to science.

Some years ago, as Your Serene Highness well knows, I discovered in the heavens many things that had not been seen before our own age. The novelty of these things, as well as some consequences which followed from them in contradiction to the physical notions commonly held among academic philosophers, stirred up against me no small number of professors — as if I had placed these things in the sky with my own hands in order to upset nature and overturn the sciences. They seemed to forget that the increase of known truths stimulates the investigation, establishment, and growth of the arts; not their diminution [lessening] or destruction.

Showing a greater fondness for their own opinions than for truth, they sought to deny and disprove the new things which, if they had cared to look for themselves, their own senses would have demonstrated to them. To this end they hurled various charges and published numerous writings filled with vain arguments, and they made the grave mistake of sprinkling these with passages taken from places in the Bible which they had failed to understand properly, and which were ill suited to their purposes…

Source: Galileo Galilei, “Letter to the Grand Duchess Christina (1615)”

15. [Refer to figure 3]

Which document did Galileo’s opponents use to support their opinions?

Sample Answer:

Galileo’s opponents used the Bible to support their opinions.

16. [Refer to figure 3]

According to Galileo, why is the search for truth important?

Sample Answer:

Examples:

- increasing known truths stimulates the investigation/establishment/growth of the arts
- can lead to new discoveries
The Copernican Model: A Sun-Centered Solar System

The Earth-centered Universe of Aristotle and Ptolemy held sway on [governed] Western thinking for almost 2000 years. Then, in the 16th century a new idea was proposed by the Polish astronomer Nicolai Copernicus (1473–1543).

The Heliocentric System

In a book called *On the Revolutions of the Heavenly Bodies* (that was published as Copernicus lay on his deathbed), Copernicus proposed that the Sun, not the Earth, was the center of the Solar System. Such a model is called a heliocentric system. The ordering of the planets known to Copernicus in this new system is illustrated in the following figure, which we recognize as the modern ordering of those planets….

Source: The Copernican Model: A Sun-Centered Solar System, Department of Physics & Astronomy, University of Tennessee

17. [Refer to figure 4]

Based on this document, how was Copernicus’s theory of heliocentrism different from Ptolemy’s ideas about the universe?

**Sample Answer:**

**Examples:**

- Ptolemy believed the universe was Earth-centered and Copernicus believed that the Sun was the center of the solar system
- Copernicus proposed that the Sun, not Earth, was the center of the solar system
As in Mathematicks, so in natural philosophy, the investigation of difficult things by the method of analysis [scientific method], ought ever to precede the method of composition. This analysis consists in making experiments and observations, and in drawing general conclusions from them by induction [reason], and admitting of no objections against the conclusions, but such as are taken from experiments, or other certain truths. For hypotheses [theories] are not to be regarded in experimental philosophy. And although the arguing from experiments and observations by induction be no demonstration of general conclusions; yet it is the best way of arguing which the nature of things admits of, and may be looked upon as so much the stronger, by how much the induction is more general. And if no exception occur from phenomena [facts], the conclusion may be pronounced generally. But if at any time afterwards any exception shall occur from experiments, it may then begin to be pronounced with such exceptions as occur. By this way of analysis we may proceed from compounds to ingredients, and from motions to the forces producing them; and in general, from effects to their causes, and from particular causes to more general ones, till the argument end in the most general. This is the method of analysis [scientific method]: and the synthesis [combination of parts] consists in assuming the causes discovered, and established as principles, and by them explaining the phenomena proceeding from them, and proving the explanations. . .

Source: Sir Isaac Newton, *Opticks*, 1718

18. [Refer to figure 5]

According to this document, why is the scientific method important?

**Sample Answer:**

*Examples:*

- helps to investigate problems (difficult things)
- draws conclusions by using reasoning
- makes experiments and observations
- explains phenomena and proves explanations
Document 5

. . . Assumptions

1. There is no one center of all the celestial [heavenly] circles or spheres [planets].

2. The center of the earth is not the center of the universe, but only of gravity and of the lunar sphere.

3. All the spheres [planets] revolve about the sun as their mid-point, and therefore the sun is the center of the universe. . . .

— Nicholas Copernicus, *The Commentariolus*, (1510)


State *one* scientific belief of Copernicus that is being described in this passage.

Sample Answer:

*Examples:*

- all the planets (spheres) revolve around the Sun
- the heliocentric theory
- the Earth is not the center of the universe
- Sun is the center of the universe
- the Earth is the center of the lunar sphere (Moon) and of gravity
Gradually scientists came to challenge more and more what the ancients [past civilizations] taught. They came to develop new, better methods of finding out how things worked. Mathematical knowledge increased and helped them to reason. They began to think up experiments to check on their ideas in a methodical way. The scientific revolution had begun.

Many men were needed to bring this about. These men came from every part of Europe. They wrote books to explain their ideas. The printing press made it possible to produce thousands of copies which found their way all over Europe. Scientists were able to learn from one another and give one another new ideas. So the Scientific Revolution was not the work of Englishmen, or Frenchmen, or Italians alone. It was the work of Europeans. And, as we have seen, even they did not do it all by themselves. The Chinese, the Indians, the Persians, and the Arabs all gave something before it came about. Today this is not hard to understand, because men and women from all over the world add to scientific knowledge and so help one another . . .


20. **[Refer to figure 7]**

Based on this document, state **two** changes resulting from the Scientific Revolution.

**Sample Answer:**

**Examples:**

- people challenged what the ancients taught
- people used experiments to check their ideas
- scientists used the printing press to spread their ideas throughout Europe
- books written to explain new ideas
- mathematical knowledge increased and helped people reason
- new and/or better methods developed to find out how things worked
- scientists learned from one another and shared their ideas

21. **3**

One way in which the Scientific Revolution and the Enlightenment are similar is that both

1. led to increased power for royal families in Europe
2. sought to reconcile Christian beliefs and science
3. questioned traditional values and past practices
4. promoted nationalistic revolutions in eastern Europe

22. **1**

New scientific knowledge and understandings that developed during the Scientific Revolution were most often based on

1. observation and experimentation
2. church law and faith
3. superstition and ancient practices
4. geometric formulas and astrology