AP® EUROPEAN HISTORY
2009 SCORING GUIDELINES

Question 7

Analyze how Galileo, Descartes, and Newton altered traditional interpretations of nature and challenged traditional sources of knowledge.

9–8 Points

- Thesis is explicit and addresses both traditional interpretations of nature and challenges to sources of knowledge (themes).
- Organization is clear, consistently followed, and effective in support of the argument.
- Essay is well balanced and identifies and explains contributions of the three men toward BOTH interpretations of nature and sources of knowledge.
- Contributions of each individual (Galileo, Descartes, and Newton) are supported and fully substantiated by several specific pieces of relevant evidence (three individuals = five to six specifics total).
- May contain errors that do not detract from the argument.

7–6 Points

- Thesis is explicit and responsive to the question. Discusses either interpretation of nature OR sources of knowledge without development.
- Organization is clear in support of the argument.
- Essay is balanced and identifies and explains contributions of the three individuals. Two or three individuals must be linked to either interpretations of nature OR sources of knowledge, and both themes must be addressed at some point. Links to interpretations or sources are clearly demonstrated.
- Contributions of each individual are partially supported by specific evidence with at least one specific piece for each individual (three individuals = three to four specifics).
- May contain minor errors that detract from the argument (including linking Descartes with observational science).

5–4 Points

- Thesis is explicit but not fully responsive to the question (may not clearly identify interpretations of nature or sources of knowledge).
- Organization is clear and effective in support of the argument but not consistently followed.
- Each individual must be addressed, but a clear lack of balance may be evident.
- Several pieces of specific, relevant evidence (two to three) that address at least two of the individuals are included.
- Contains a limited discussion of the two themes (traditional interpretations of nature or sources of knowledge) or a thorough discussion of one.
- Weaker essays may contain major errors.

3–2 Points

- Does not contain an explicit thesis, or the thesis merely repeats/paraphrases the question.
- Organization is unclear and ineffective; it does not support analysis.
- Essay shows serious imbalance; themes demanded by the question are neglected.
- May only mention themes (interpretations of nature or sources of knowledge) without discussion or analysis.
- Does not discuss one of the three individuals, and those that are discussed are supported only by generic evidence; discussion may ramble.
- Weaker essays may contain major errors that detract from the argument.

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Question 7 (continued)

1–0 Points

- No discernable attempt at a thesis, or thesis is off task.
- No discernable organization.
- One or none of the major themes (interpretations of nature and sources of knowledge) suggested by the question is mentioned.
- Typically may contain a single specific valid reference to an individual.
- May mention some or all of the individuals without correct supporting evidence or attempted explanations.
- May contain numerous errors that detract from the argument.

Note: Traditional interpretations of nature include a geocentric world (Aristotle/Ptolemy), superstitions, and religious views (perfection of natural world). Traditional sources of knowledge include the Church, the Bible, classical authors, and scholastics.

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Question 7 Historical Background

This question was intended to elicit students' knowledge of the Scientific Revolution as exemplified by the work of three of the most important figures of the age. The prompt suggests two themes. A discussion of alterations to traditional interpretations of nature should include some account of how the work of Galileo, Descartes, and Newton differed from earlier constructions of the cosmos and humanity's place in it. A discussion of challenges to traditional sources of knowledge should include some consideration of how the three broke with the well-established methods and principles of science.

Two of the predominant issues of the times are suggested by the themes of the prompt: altered traditional interpretations of nature and challenges to traditional sources of knowledge. These themes are in fact not completely separable, although most students made an attempt to do so.

Alterations of traditional interpretations: Common to all three was a challenge, whether implicit or explicit, to the Aristotelian and classical worldview espoused by scholastic philosophers and endorsed by the Catholic Church. Galileo explicitly challenged the classical model of a geocentric universe, which in the version endorsed by the Church encompassed moral as well as physical dimensions. Galileo also challenged the notion of a separation between the unchanging perfect heavens and the unstable, imperfect sublunary world. Newton systematized Galileo's insight about the fundamental unity of the earthly and the celestial realms and raised the possibility of a purely mechanistic universe driven by predictable laws.

Challenges to traditional sources of knowledge: The alteration of traditional interpretations of nature carried with them an implicit or explicit refutation of the authorities that had helped form those interpretations. Galileo's account of the universe conflicted with both the Bible and classical authorities such as Aristotle and Ptolemy. Descartes's concentration on reasoning based on empirical observation and deduction from first principles left no room for revelation. Descartes's and Newton's creation of mathematical descriptions of natural phenomenon established a new scientific practice that would generate knowledge not from established authorities but from careful experimentation, observation, and formulation of new mathematically grounded descriptions.

The following is a select listing of the type of information students could be expected to know based on general textbooks currently in use.

Galileo Galilei, 1564–1642

- Telescope, 1609.
- Moon was rough, imperfect, like the Earth, hence not composed of some perfect celestial substance.
- Leaning Tower Trial (1591) showed that objects fall toward the Earth at equal rates regardless of weight.
- Experimental method.
- *Two New Sciences.*
- Law of Inertia.
- Discovered four moons of Jupiter.
- *Sidereus Nunicus* (*Starry Messenger*) examines the moon.
- Pope Urban VIII allowed Galileo to write *Dialogue on the Two Chief Systems of the World,* 1632.
- Galileo's trial became symbol of conflict between religious belief and scientific thinking.

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Question 7 Historical Background (continued)

- Heliocentric proponent.
- Discovered that Venus has phases, as the moon does, implying that it revolves around the sun.
- "It still moves."
- Use of inclined planes for motion study.

René Descartes, 1596–1650

- Created coordinate geometry.
- *Discourse on Method,* 1637.
- "*Cogito ergo sum.*"
- "Cartesian Dualism."
- "Give me motion and extension and I will build you the world."
- Wrote tracts urging honesty in religion.
- Analytic geometry.
- Deductive reasoning from self-evident principles.
- Father of modern rationalism.
- Applied science to philosophy.
- Wrote in vernacular to show modernism.
- Materialism shows humanity can live independently from God.

Sir Isaac Newton, 1642–1727

- Development of calculus.
- Combined Kepler and Galileo on motion.
- *Mathematical Principles of Natural Philosophy* (1687) known as *Principia.*
- Humans no longer center of universe.
- Wrote tracts urging honesty in religion.
- Universal Law of Gravity.
- Three Laws of Motion.
- World machine—operates in time and space.
- Connected to founding of Deism.
- Promoted scientific experiment.
- Found density of earth to be five times greater than water.
- Electrical impulses trigger nervous system.
- 1671, light can be mathematically described.
- Rejected Descartes's theory that world is made totally of matter.

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Write in the box the number of the question you are answering on this page as it is designated in the exam.

Part C

Galileo, Descartes, and Newton were among the thinkers responsible for a shift in scientific understanding. Before, science in Europe did little ~~[illegible]~~ without reliance on the Church, but these thinkers set the stage for a new scientific paradigm that separated the physical from the spiritual and set out to learn the natural laws that governed the physical world. Each of these men, through their varying pursuits, helped Europe to envision a world that was not necessarily godless, but could operate autonomously under constant natural laws.

Galileo, lauded for his use of the telescope, propogated (with his own observations and measurements) the Copernican model of a Heliocentric system of the universe. This was a direct opposition to Ptolemy's geocentric model, which was supported by the Church, because Earth man's home) was naturally assumed to be placed in the center of the universe to show God's priority. By speaking out against the Church, Galileo made an enemy of what was arguably the most powerful entity in Europe at the time, but by using empirical evidence to support a theory, he was utilizing the new scientific mindset to change the way people think.

"Cogito ergo sum," which translates to "I think, therefore

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Part C 1.

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"I am" sums up Descartes's thought that the spiritual did not need to define the physical. The fact that he can observe the reality around him is sufficient reason to do so. Far from renouncing God, he postulated separate physical and ~~spiritual worlds~~ spiritual worlds, stating that the physical is governed by natural laws and not by occurances in the spiritual. Knowledge, rather than coming from ~~God~~ spiritual authority, should stem from observation of the world.

Like the other two, Newton dealt with his universe through observation. Newton's significance however, came from the observations he made. The Newtonian laws of physics: motion, thermodynamics but most especially gravity, explained interaction in the natural world. Suddenly, everything from the motion of astronomical bodies to ~~people~~ things falling to the ground could be explained without God's orchestration. Through observation and experimentation, he asserted his theories.

In conclusion, these three men all believed that they themselves, through observation, could learn the workings of the natural world that did not rely on the spiritual. Descarte

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Part C

~~those~~ offered a mindset, & Galileo observed the skies though this new paradigm, and Newton proposed ~~the~~ reasons for why things do what they do. These men and those like them allowed science to begin to separate from the church and draw meaningful conclusions about the world.

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During the Scientific Revolution, Galileo, Descartes, and Newton, along with many others, had all contributed to the increased awareness of how things worked. In doing this they had also challenged the traditional sources of knowledge (which had originated from the church), and altered the well accepted traditional interpretations of nature.

Galileo who is well known for his creation of the telescope (which is used to spot things at extensive distances) had completely challenged the church, in studying and publishing information that directly contradicts the church, all of which was the result of him using the telescope to observe the sky. One of the things that Galileo had done was support Copernicus' claim that the universe is heliocentric and not geocentric. This angered the church because for many centuries the church has taught that because God loves the human race so much, that the Earth was the center of the universe and that everything revolves around the Earth. Because Galileo supports the heliocentric theory, the church takes it that he is saying God doesn't love humans as preached because so as the result of this, Galileo is accused of heresy.

Descartes who is famous both for his developpment of the scientific inquiry and for developing the

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Write in the box the number of the question you are answering on this page as it is designated in the exam.

experimental method, had provided a firm basis for one ways in which scientific experiments should be conducted and data/observations gathered.

Newton had made many great contributions but his more notable ones were in the areas of physics and in the development of analytical geometry. Newton had had observed [redacted] the force that pulls things downward and keeps them there. He had called this gravity. The discovery of gravity was such a major feat because it had explained many of the questions that people have had for years. This had also contradicted the church's teachings because; with the church being for many years clueless to how things came down and stayed, it had developed explanations and reasoning for how God and angels are responsible for this.

As you can see, Galileo, Descartes, and Newton had all contributed greatly; though sadly its taken years for their works to be appreciated..

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7

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The Scientific Revolution brought about new ways of viewing the natural world. Three men that challenged traditional interpertations of nature and knowledge were Galileo, Descartes, & Newton. These three men did so through observations and innovations.

Many of use who have studied science have heard of Issa Isaac Newton. Newton discovered the Laws of gravity that affect us every day. But his most important contribution was Principia Matematica where all his two contributions towards Calculas were published.

Galileo also worked on gravity similar things as Newton. He conducted an expirement where he rode a horse around in a circle and dropped balls onto the ground to see whether or not they moved. Galileo also worked on the modern telescope. Though he did not create it, he modified it to the telescope which we use today. Through all his work he faced many difficulties, problems with the church, but he continued with his work.

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Descartes ~~did~~ is known for his empiracal views that led to the scientific method. He viewed things ~~as matter of~~ in two ways, one of which was matter. Descartes ~~beliefes~~ empirical view ~~was~~ emphazied observation.

In conclusion, Newton, ~~De~~ Galileo, & Descartes challenged traditional interpretations of nature & knowledge through innovations and observations. Though the scientific revolution was only about a hundred men, their views were able to change the world.

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AP® EUROPEAN HISTORY
2009 SCORING COMMENTARY

Question 7

Overview
This question required students to demonstrate their knowledge of the Scientific Revolution through a discussion of the achievements of three of the leading figures of the age. The question further guided students to demonstrate how the Scientific Revolution created a distinct change from the way the world (nature) and knowledge had been viewed in earlier ages.

Sample: 7A
Score: 8

This essay has an explicit and thorough thesis. It is well organized and consistent throughout. It contains specific information on Galileo, Descartes, and Newton and links each individual to both themes. This essay did not earn a score of 9 because there is a weakness in the description of Descartes' linkage to the two themes.

Sample: 7B
Score: 5

The thesis is fully responsive to the prompt, and the essay is clearly organized and supported. The discussion of Descartes illustrates a lack of balance, and only one theme is discussed. The essay did not receive a score of 6 because all three individuals are not linked to the themes, and both themes are not addressed. This essay earned higher than a score of 4 because of the specific information mentioned and the strong discussion of one of the themes.

Sample: 7C
Score: 3

The thesis provided is merely a restatement of the question. The essay's organization is clear but does not support the analysis, and the themes are totally neglected. The essay provides some specific information in support of the individuals' contributions but goes no further. There is a vague but failed attempt at the theme of knowledge in the conclusion. The essay did not earn a score of 4 because of its failure to address the themes. It did not receive a score of 2 because of the amount of specificity provided.

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