Stephen Hawking
Physicist, 1942 –

Stephen Hawking was fascinated by science and the sky from a young age. When he was 21, Hawking was diagnosed with Amyotrophic Lateral Sclerosis (ALS, also known as Lou Gehrig's disease). Despite his illness, which confines him to a wheelchair, he has done ground-breaking work in physics and cosmology. He has written several books that make science accessible to a broad audience. He has made important contributions to the science of cosmology—the study of the origins, structure, and space-time relationships of the universe. When asked about his goals, Hawking said in 1995, "My goal is a complete understanding of the universe, why it is as it is and why it exists at all."

Stephen William Hawking was born on January 8, 1942, in Oxford, England, on the 300th anniversary of Galileo's death.

Stephen Hawking was born into a family of thinkers. The Hawkings were what people might consider *eccentric*: they often ate dinner in silence, with each of them absorbed in a book. The family car was an old London taxi. They kept bees in their basement, and made fireworks in the greenhouse. His mother earned her way into Oxford University in the 1930s, a time when few women considered attending university. In fact, she was one of the college's first female students. Hawking's father was a well-known expert on tropical medicine, and he wanted his son to go into medicine as well. Stephen, however, was more interested in mathematics and physics.

At school, although Stephen was bright, he was not a very good student. At one point he was third from the bottom in his class. Stephen preferred to concentrate on things outside of school. Do you like board games? Stephen did, and he invented new ones with his friends. When he was 16, Stephen and some friends built a computer out of spare parts that was able to solve basic mathematical problems.

Mathematics was Hawking's first love, but Oxford didn't offer degrees in mathematics. So Hawking studied physics instead, specializing in cosmology. Hawking was not the hardest-working student in the world. He says that he focused on his studies for about an hour a day. Apparently that was all it took: in 1962, he graduated with honors and moved to Cambridge University for a Ph.D. in cosmology.

Not long after his 21st birthday, Hawking was diagnosed with Amyotrophic Lateral Sclerosis (ALS or Lou Gehrig's disease). Basically, the nerves that controlled his muscles were turning off. Doctors gave him two years to live. Hawking's disease may have helped him become the noted scientist he is today, though. Before the diagnosis, Stephen Hawking had not worked hard. "I was bored with life before my illness," he said. After his 1963 diagnosis, Hawking realized that he might not live long enough to earn his Ph.D. That sense of mortality motivated him to work harder on his work and research.

Around this time Roger Penrose, another young cosmologist, was doing pioneering work on stars and the creation of black holes. His work clicked with Hawking's fascination with the

universe and its origins. Because of Penrose, Hawking started doing research that soon changed how scientists think about black holes and the universe.

Many physicists, cosmologists and astronomers have done important work in the study of quantum gravity and cosmology, but Stephen Hawking's contributions stand out. His work on black hole thermodynamics is his most famous, but he has also made major contributions to the study of singularity theorems in general relativity, black hole uniqueness, quantum fields in curved spacetime, Euclidean quantum gravity, the wave function of the universe and more.

Hawking's studies focus on the basic laws that govern the universe. Between 1965 and 1970, Hawking worked with Penrose to show that Einstein's General Theory of Relativity suggested a **Big Bang** singularity. They demonstrated that our universe had its origins in a singularity. According to their theory, in the beginning all the matter in the universe was compressed down to a single very small and very dense point, or singularity. Ten to twenty billion years ago, they say, that body exploded in a big bang. That was the start of time, and of the universe. Hawking produced astrophysical research to support the big bang theory over the competing steady-state theory.

Between 1970 and 1974, Hawking studied *black holes*. He combined quantum mechanics with general relativity into the theory of Hawking Radiation in 1974. Scientists used to believe that nothing could escape the gravitational force of a black hole, which would mean that science could, basically, learn nothing about them. In 1974, Stephen Hawking showed that this was wrong. He showed that matter, in the form of radiation, could escape from a collapsed star (black hole). The expression “Hawking Radiation” refers to this discovery.

In 1983 Hawking and Jim Hurtle of the University of California at Santa Barbara suggested that there is no edge for **space and time** though they are finite. This would mean that the laws of science could determine how the universe began. Remember what Hawking said in 1995? "My goal is a complete understanding of the universe, why it is as it is and why it exists at all."

Hawking’s ideas have revolutionized the scientific world. They made Hawking a scientific celebrity. His career has brought him fame, honors, important positions and titles. He was named a fellow of the Royal Society at the age of 32. He was given the prestigious Albert Einstein Award. In 1975 he received the Pius XI Gold Medal for Science from Pope Paul VI.

Hawking is also an important teacher. He taught at Caltech at Pasadena, California. He taught at Gonville & Caius College in Cambridge, England. In 1979 he was named the Lucasian Professor of Mathematics at Cambridge University, one of the most prestigious posts in teaching. The position dates back to 1663, and has been held by just 14 other teachers in that time, including another famous physicist, Sir Isaac Newton.

Hawking’s career and fame were growing, but his physical condition was getting worse. By the mid-1970s, his family needed help caring for him. His speech became slurred, so only those who knew him well could understand him. In 1985 he lost his voice permanently after a tracheotomy operation. After that he needed 24-hour nursing care.

Name_____Date_____

Without the ability to speak, Hawking's working life would have been over. A speech program developed in California enabled him to speak by choosing words on a computer screen with a hand-held clicker, which were then spoken by a speech synthesizer. Today Hawking has lost control of nearly all of his muscles, and controls the speech program through a cheek muscle attached to a sensor. Although it may sound cumbersome, the program has made it possible for Stephen Hawking to work and write prolifically, both his research and his famous books for the general public.

In 1988, Hawking shot to international fame with the publication of his book A Brief History of Time, which explained his theories to non-scientists. It was an international bestseller, selling more than 25 million copies around the world. It has been translated into more than 40 languages. In 2001, Hawking wrote an even simpler explanation of cosmology's important theories, The Universe in a Nutshell. In 2005, A Briefer History of Time was published, which he had written to be even easier to understand.

What are Hawking's books about? Basically, they describe his search for an answer to the question of how the universe began. Hawking is on a quest for science's Holy Grail: a single unifying theory that combines cosmology (the study of the big) with quantum mechanics (the study of the small) to explain how the universe began. It's a very ambitious task.

Professor Hawking has twelve honorary degrees. He has received many awards, medals and prizes. He is a Fellow of The Royal Society and a Member of the US National Academy of Sciences. But the real extent of his popularity, which goes beyond the scientific world, is shown by his presence in popular culture, where he has made guest appearances on The Simpsons, Star Trek: The Next Generation, a talk show, and a recorded voice-over on a Pink Floyd song. A documentary about Hawking's life titled A Brief History of Time was released in 1992.

Science/Biography/Physics

Name_____Date_____

Choose the best answer for the questions on this page

1. When was Stephen Hawking born?
   a. 1642
   b. 1942
   c. 1963
   d. 1992

2. What were Hawking's childhood interests?
   a. Mathematics and physics
   b. Board games and computers
   c. All of the above
   d. None of the above

3. How old was Hawking when he was diagnosed with ALS?
   a. 5
   b. 16
   c. 21
   d. 50

4. What has Hawking researched during his career?
   a. The Big Bang
   b. Black holes
   c. Space and time
   d. All of the above

5. Which book did Hawking not write?
   a. The Universe in a Nutshell
   b. The Universe in a Smaller Nutshell
   c. A Brief History of Time
   d. A Briefer History of Time

6. How does Stephen Hawking write his books, and lecture on his theories?
   a. He uses a touch screen computer and a voice synthesizer
   b. His wife speaks and writes for him
   c. He no longer writes of lectures
   d. He uses an I-phone

7. When did Hawking retire?
   a. 1992
   b. 2001
   c. 2004
   d. Stephen Hawking has not retired yet

Science/Biography/Physics

Name_____Date_____

Use complete sentences to answer the questions below.

1. Describe an experience or situation in your life that is somehow similar to Stephen Hawking deciding to study mathematics and physics although his father wanted him to study medicine.

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2. From the way it is used in the article what do you think is the meaning of *accessible*?

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3. Explain why Hawking needs a voice synthesizer.

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4. Imagine Hawking learning of his diagnosis of ALS. Describe how you think he felt.

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5. What do you understand differently after reading about Stephen Hawking? How will you use this information in the future?

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Science/Biography/Physics

Name_____Date_____

WRITING ABOUT *STEPHEN HAWKING*

Stephen Hawking has said that his illness is what motivated him to stop being a lazy student and focus on his studies. On the other hand, he received encouragement and education from his free-thinking family, who introduced him to works of science and nature. He was also an intelligent and curious child. In this way, he has a great deal in common with Albert Einstein. Describe how each of these factors (innate brilliance, curiosity, free-thinking, family support, illness, etc.) may have contributed to his revolutionary work in physics. With these things in mind, can you suggest any ways education of young people could be improved?

Science/Biography/Physics

Name_____Date_____

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Name_____Date_____

Answers to *STEPHEN HAWKING*

Multiple-choice questions

1. b
2. c
3. c
4. d
5. b
6. a
7. d

Short-answer questions

1. Answers will vary. Accept logical, realistic answers.
2. *Accessible* = comprehensible, understandable
3. Answers will vary. Accept logical, realistic answers. (Hawking suffers from ALS, a disease that makes it impossible for him to control his muscles. That resulted in slurred speech. Then, he lost the ability to speak entirely after an emergency tracheotomy.)
4. Answers will vary. Accept logical, realistic answers.
5. Answers will vary. Accept logical, realistic answers.