

NASA twins embark on year-long space experiment

Scott Kelly has found an unusual way to maintain a youthful advantage over his twin brother Mark. He is part of the team who are to blast off on a year-long mission on board the International Space Station, a journey that will have one unintended consequence. During his 12 months in space, Scott will age less than his earthbound brother – thanks to the tenets of Einstein's theories of relativity.

"The effect is known as the twin paradox, though it is not actually a paradox, it is a straightforward consequence of the laws of relativity," says Mark, who has also flown on several space missions including two as a space shuttle commander. "Essentially, time will pass slightly more slowly for Scott than for me because he will be travelling at a greater speed relative to me."

For the first time scientists will have an opportunity to study one twin in space while the other stays on Earth and Mark Kelly will undergo medical testing while his brother spends a year in space.

Not that Mark is too worried about the age differential that will develop. The effects of time dilation only become noticeable when spaceships travelling from Earth approach speeds near that of light. By contrast, the space station moves at a sedate 17,000 mph relative to Earth's surface – which means that at the end of Scott's year of space travel, when he returns to Earth in March 2016, he will have aged only about three milliseconds less than Mark who was left behind on Earth. At least, that is what relativity dictates. "Scott and I are identical twins though I am the elder having been born six minutes before him," adds Mark.

"Certainly his spaceflight is not going to make that much difference." Nevertheless, it is intriguing that the Kelly brothers will realise the twins-in-space thought experiment, dreamed up by Einstein and others to illustrate the effects of time dilation, a point that is stressed by Mark. "I cannot imagine that when Einstein came up with that idea that he ever thought there would be twins flying in space at some point in the near future."

In fact, Mark and Scott are the first siblings to fly in space and that certainly makes them special. For good measure, they are identical twins, which makes them even more important to science, for it means that Scott's biological reactions to unearthly phenomena – zero gravity or elevated levels of radiation – can, for the first time, be compared to the responses of a genetically identical individual on the ground.

Source

Adapted from The Observer, 10 February 2015:

<http://www.theguardian.com/science/2015/feb/10/nasa-twins-kelly-space-experiment>

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Reading

1. The correct meaning of the word 'paradox' is:

- a. a typical pattern
- b. a seemingly absurd statement that may in fact be true
- c. two people having the same experience in different places
- d. a puzzle

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2. Is the following statement true or false?

	True	False
The greater the speed at which an astronaut travels, the more quickly time passes for him or her.		

3. According to the article, why are scientists interested in monitoring the twins?

- a. It will be the first opportunity to compare the effects of space travel on genetically identical individuals.
- b. Einstein predicted that twins would travel in space.
- c. Scott Kelly is expected to age significantly less than his brother.
- d. It is the first time that siblings have travelled in space together.
- e. Time dilation has never been studied before.

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4. In your own words explain briefly what is unique and interesting about the Kelly brothers and about Scott Kelly's mission.

In this question you will retrieve information and paraphrase it in your own words.

5. How does the writer of the text adapt the language to suit the audience? Give specific examples from the text.

In this question you will discuss the audience and purpose of the text.

[illegible]

Writing

6. There is an opportunity for one person from your school to participate in a scientific expedition. Write a personal statement persuading the organisers that you should be given the place on the expedition. Write 200-300 words.

Oracy

- ## 7. Topic: Leisure

Prepare and deliver a presentation about a time when you participated in an exciting or challenging experience. Your presentation should last 5-7 minutes including time to answer questions.

8. Topic: The World of Science and Technology; Citizenship

Some people argue that space travel is an expensive luxury and that governments should spend money on alleviating problems on earth rather than travelling to space. Prepare and participate in a discussion on the topic. The discussion should last about 10 minutes and each person in the discussion will be expected to:

- present the information they have found;
- give their own views;
- respond to the views of others.

You might need to undertake some further research. The links below are a starting point:

<http://www.utexas.edu/know/2014/07/21/anniversary-shows-us-that-nasa-and-space-exploration-are-worth-their-costs/>

http://www.nasa.gov/missions/solarsystem/Why_We_01pt1.html