

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
ADVANCED GCE**

F504/RB

CRITICAL THINKING

Critical Reasoning

RESOURCE BOOKLET

To be issued with the question paper

WEDNESDAY 15 JUNE 2011: Morning

DURATION: 1 hour 30 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

INSTRUCTIONS TO CANDIDATES

Read and use Documents 1 and 2 to answer the questions.

INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

Do not send this resource booklet for marking; it should be retained in the centre or destroyed.

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BACKGROUND INFORMATION

THE SPACE RACE

The first man landed on the moon in 1969. Since 1972 no human has been to the moon, but the new Millennium has seen the start of a new space race.

In 2004 George Bush, then President of the US, launched a new space initiative. He hoped to put people back on the moon, build a permanent lunar base and eventually send a manned mission to Mars.

In 2010 Barack Obama, President of the US, cancelled the state-funded moon programme and planned to increase the involvement of commercial companies in space transportation.

India's Chandrayaan Programme aims to put an astronaut into space by 2014 and send people to the moon by 2020.

DOCUMENT 1

WHY WE REALLY WANT TO GO BACK TO THE MOON

By Lawrence M Krauss

The year 2009 marked the 40th anniversary of two momentous events related to space exploration. One, the *Apollo 11* moon landing on July 20, 1969, was a hallmark technological achievement. The other, the remarkable movie *2001: A Space Odyssey*, vividly depicted the vision of humans traveling the solar system with abandon.

1

As a 15-year-old, I found the 1969 moon landing enthralling. I also charted the entire Apollo missions, built scale models and dreamed of being the first Canadian astronaut. Humankind's travels promised to propel science forward. But since then, my perception of the proper role for human space exploration has changed.

2

I would still jump at the chance to go into space. But I now recognize that doing so would be for the adventure, not for advancing science. The most scientifically exciting knowledge we can gain about the universe and the solar system will involve unmanned space vehicles, robotic devices and a lot less money than propelling Americans beyond Earth's orbit.

3

Human spaceflight has proved inordinately costly and far more dangerous than the Apollo program's successes led us to believe. Moreover, the associated difficulties are far more mundane than TV and movie science fiction suggest. We are not held back for lack of a warp drive. The chief obstacle to visiting Mars is cosmic radiation. During the 18 months or so that a round-trip journey would take, astronauts would very likely receive a lethal dose of radiation.

4

Our ultimate destiny may be in the stars, but the limitations imposed by physics and our biology suggest that this future probably is to be reserved for our mechanical offspring – robots – or perhaps for computers that can get organic life rebooted on some distant locale.

5

In the near term we still crave adventure, and the desire to travel to, and perhaps to colonize, the moon and maybe Mars seems irresistible, if financially daunting. I am not against sending humans into space for that reason (and would also encourage consideration of one-way missions, which seem to be ultimately more affordable). But we should separate funding for science from the diversion of a costly manned space program.

6

The Apollo program taught us that we may conquer even enormous technological problems. We now face many such challenges, from climate change to energy independence, which we need to tackle while we juggle our hunger for space travel. Maybe there is money to do it all: to send humans into space, to do the best fundamental science we can do and also to address pressing problems here on Earth. But we can only do that if we are honest about the costs, and possible benefits, of science for humanity. And we must not pretend that a base on the moon or Mars is a simple solution for any of our significant problems back home.

7

Source: Scientific American Magazine

DOCUMENT 2

BENEFITS OF SPACE EXPLORATION

The biggest challenges to exploration are the public and politics. Space exploration has always been a capital intensive endeavor requiring vast resources and extensive research. Because of this Governments have been the only organizations big enough to foot the bill. The question that many Americans grumble out is “Why waste the money on space when we can use it down here?” The answer is two-fold.

1

We actually do spend the money down here. It goes to the salaries of the countless workers and scientists that support every mission that NASA does. It also goes to pay major private companies and corporations that play important roles in major sectors of the US economy. For example one of NASA’s contractors for aircraft is Boeing, the same company that makes commercial aircraft for the airline industry. So as you see there are already direct benefits to the economy provided by NASA missions.

2

The less obvious and most important benefit is spin-off technologies. The simple fact is that every new step we make in space exploration advances our knowledge of not just the Universe but the new height human innovation and technology can achieve.

3

We are surrounded every day by technologies developed for space exploration. The artificial heart, for example, resulted from experiments on the Space Shuttle. The hand-held Jaws of Life used to save victims from car wrecks originated from the system used to separate the Space Shuttle from its booster rockets. Even the insulation that keeps our homes warm and energy efficient is based on the technology used to insulate the Space Shuttle.

4

These advances are found in our food, our building materials, medical procedures and the vehicles we drive. So the next time you wonder if it is a waste of time and money to explore space, remember that it is actually an investment that improves the quality of our lives.

5

Source: www.universetoday.com/guide-to-space



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