

READING PASSAGE 2

You should spend about 20 minutes on **Questions 14-26**, which are based on Reading Passage 2 on the following pages.

Questions 14–18

Reading Passage 2 has five sections, **A–E**.

Choose the correct heading for each section from the list of headings below.

Write the correct number, **i–viii**, in boxes 14–18 on your answer sheet.

List of Headings

- | | |
|-------------|---|
| i | The need for skill and care |
| ii | Choosing the richest asteroid |
| iii | The safest way to protect an asteroid |
| iv | Obtaining support for the project |
| v | An achievable goal, not an impossible dream |
| vi | The need for global cooperation |
| vii | Beginning with a less challenging task |
| viii | Practical, economic and research justifications |

14 Section **A**

15 Section **B**

16 Section **C**

17 Section **D**

18 Section **E**

The plan to bring an asteroid to Earth

*Moving in orbit around our Sun are millions of rocks known as asteroids.
Now scientists have plans to capture one.*

- A** Send a robot into space, catch an asteroid and bring it back to Earth's orbit. This, say scientists and engineers at the California Institute of Technology (Caltech), could be feasible. A four-day workshop was dedicated to investigating the feasibility of capturing a near-Earth asteroid, bringing it closer to our planet and using it as a base for future manned space-flight missions.

This is not something the scientists are imagining could be done someday in the future. It is possible with the technology we have today and could be accomplished within a decade. A robotic probe could anchor to an asteroid with simple magnets or grab it with specialised claws. Alternatively, a large spacecraft could use its gravitational field to shift the orbit of a larger asteroid, sending it towards Earth.

'Once you get over the initial reaction — *You want to do what?!* — it actually starts to seem like a reasonable idea,' says engineer John Brophy, who helped organise the workshop. In fact, many of these ideas have been on the drawing board for years as part of NASA's planetary-defence programme against large space-based objects that might threaten Earth. And there's no shortage of potential targets: NASA estimates there are 19 500 asteroids at least 100 metres wide within 45 million kilometres of Earth.

- B** Though rearranging the heavens may seem an excessive undertaking, this US mission has its merits. The US already has plans to send astronauts to a near-Earth asteroid, a mission that would mean confining them in a tiny capsule for three to six months and would involve all the risks of a deep-space voyage. Instead, robots could bring an asteroid close enough for them to get there in just a month.

An asteroid would provide a stationary base from which to launch missions further into space. There are several advantages to this. For one, launching missions carrying materials from Earth requires a lot of power, fuel and, consequently, money, because of our planet's strong force of gravity. Since this would be far weaker on an asteroid, materials mined there could be more easily taken off the asteroid and shuttled around the solar system.

Many asteroids have a lot to offer. Some are rich in metals, which can be mined and used to build space-based habitats, or brought back to Earth. Others are up to one-quarter water, which could be used for life-support or broken down into hydrogen and oxygen to make fuel. Astronomers would also have the chance to get a close-up look at one of the solar system's earliest relics, generating important scientific data. 'Executing the asteroid-retrieval plan would help demonstrate and greatly expand mankind's space-based engineering capabilities,' says engineer Louis Friedman, another co-organiser of the Caltech workshop. For instance, the mission would teach engineers how to capture an unco-operative target, which could be useful practice for planetary-defence missions in the event of a threat from a meteoroid or comet approaching our planet,' he adds.

- C** Former astronaut Rusty Schweickart, co-founder of the B612 Foundation, an organisation dedicated to protecting Earth from asteroid strikes, points out that although it would be technically feasible, shifting such a hefty and substantial target would not be easy: 'You're moving the largest mother-lode imaginable,' he says.

Engineers would need to be absolutely certain they could control such a potentially dangerous object. 'It's the opposite of planetary defence; if you do something wrong you have a Tunguska event,' says engineer Marco Tantardini from the Planetary Society, referring to the powerful 1908 explosion above a remote Russian region thought to have been caused by a meteoroid or comet.

- D** Still, these obstacles only add to the appeal of the project for engineers, who love to go over every potential difficulty in order to solve it. And if the challenges posed by a large asteroid seem too daunting, researchers could always start with a smaller asteroid, perhaps two to ten metres across. Last year, Brophy helped conduct a study to look at the feasibility of bringing a two-metre, 1 000-kilogram asteroid — of which there might conceivably be millions — to the International Space Station. The study suggested the asteroid could be captured robotically in something as simple as a large bag. Of course, such a small object might not have the same emotional impact as a larger target. 'NASA isn't going to want to go to something that is smaller than our spaceships,' says engineer Dan Mazanek from NASA's Langley Research Center.

- E** No matter the size of the asteroid, these plans would require hefty investments. Even capturing a small asteroid would consume at least a billion dollars. Convincing taxpayers to foot such a bill could be difficult. However, private industry might be interested in getting involved. One possibility would be to push the asteroid into near-Earth orbit and then invite anyone who wants to develop the capabilities to reach and mine the object.

However, although the undertaking might be scientifically exciting and provide great insight into the solar system's formation, this is not enough on its own to justify the expense of bringing an asteroid to Earth. Investigations of asteroids can be done much more cheaply with an unmanned spacecraft, says chemist Joseph A. Nuth from NASA's Goddard Space Flight Center. According to Brophy, ultimately we would be working towards bringing an asteroid closer to Earth in order to help humanity move out into the solar system.

Questions 19 – 22

Look at the following experts (Questions 19 – 22) and the list of statements below.

Match each expert with the correct statement, **A–G**.

Write the correct letter, **A–G**, in boxes 19 – 22 on your answer sheet.

19 Louis Friedman

20 Rusty Schweickart

21 Dan Mazanek

22 Joseph A. Nuth

List of statements

- A** A mistake could have serious consequences for Earth.
- B** It might be difficult to arouse interest in an asteroid of limited size.
- C** The project could be an early step in space exploration.
- D** An asteroid's weight makes the project extremely challenging.
- E** The skill gained could save Earth from future danger.
- F** An asteroid could be a useful landing place for a spaceship.
- G** Capturing an asteroid would not be an efficient method of research.

Questions 23 – 26

Complete the summary below.

Choose **ONE WORD ONLY** from the passage for each answer.

Write your answers in boxes 23 – 26 on your answer sheet.

The merits of the US mission

Capture of an asteroid would reduce the time that astronauts travelling to it needed to spend in space. An asteroid could also act as a **23** _____ for further space travel and exploration. The fact that an asteroid would have weaker **24** _____ would allow easier movement of resources.

These resources include **25** _____ which could be used in space or on Earth, and **26** _____ which could be consumed or used as a source of power.

The mission could provide data on the history of our Sun and planets. It could also be good practice if there was a threat to Earth from a body from space.

Questions 14 – 18 | Matching headings to sections A – E

题号	段落	正确标题	关键定位句 & 解释
14	Section A	v An achievable goal, not an impossible dream	段落从第一句开始强调“科学家认为有可能做到”，“可在十年内完成”，核心是证明计划在现有技术下“可行”，而非遥不可及。
15	Section B	viii Practical, economic and research justifications	该段详细说明把小行星拖近地球的实际好处：缩短航程、降低发射成本、开采金属与水、提供科研价值。整段都是务实、经济与科研三方面的理由。
16	Section C	i The need for skill and care	Schweickart 和 Tantardini 强调“移动如此巨大的目标不易”，“若出错就会出现通古斯卡事件”。主旨是必须极度谨慎、技术精准，并非介绍防御方案本身。
17	Section D	vii Beginning with a less challenging task	段落提出“可先从直径 2–10 米的更小行星练手”，甚至用“大袋子”捕捉；主题是“先易后难”。
18	Section E	iv Obtaining support for the project	讨论“至少 10 亿美元成本”“说服纳税人难”，转而考虑私营企业投资；焦点是如何筹措资金、争取支持。

Questions 19-22 | Matching experts with statements

Q #	Expert	Correct statement	关键定位句 (段落 & 原文)	解释
19	Louis Friedman	E The skill gained could save Earth from future danger.	B 段 “...would teach engineers how to capture an unco-operative target, <i>which could be useful practice for planetary-defence missions in the event of a threat ...</i> ”	他强调这项技术日后可用于行星防御，故选 E。
20	Rusty Schweickart	D An asteroid’s weight makes the project extremely challenging.	C 段 “...shifting such a hefty and substantial target would not be easy: ‘ <i>You’re moving the largest mother-lode imaginable,</i> ’ he says.”	他指出小行星块头巨大、搬动困难，正对应 “weight makes project challenging”。
21	Dan Mazanek	B It might be difficult to arouse interest in an asteroid of limited size.	D 段 “‘NASA isn’t going to want to go to something that is <i>smaller</i> than our spaceships,’ says engineer Dan Mazanek...”	他认为若目标太小，NASA 不感兴趣 → 难以激发关注。
22	Joseph A. Nuth	G Capturing an asteroid would not be an efficient method of research.	E 段 “ <i>Investigations of asteroids can be done much more cheaply with an unmanned spacecraft,</i> says chemist Joseph A. Nuth...”	他主张用更廉价的无人任务，暗示捕获并不高效。

Questions 23-26 | Summary (ONE WORD ONLY)

Q #	Answer	关键定位句 (B 段)	说明
23	base	“An asteroid would provide a stationary base from which to launch missions further into space.”	小行星可作为进一步深空探索的“基地”。
24	gravity	“Since this would be far weaker on an asteroid, materials mined there could be more easily taken off...” 前文提到 our planet’s strong force of gravity 。	句子对比的是地球与小行星的引力强弱。
25	metals	“Some are full of metals , which can be mined and used to build space-based habitats, or brought back to Earth.”	金属既能带回地球，也能在太空使用。
26	water	“Others are up to one-quarter water , which could either be used for life-support or broken down ... to make fuel.”	水可供饮用（消耗）或电解成燃料。