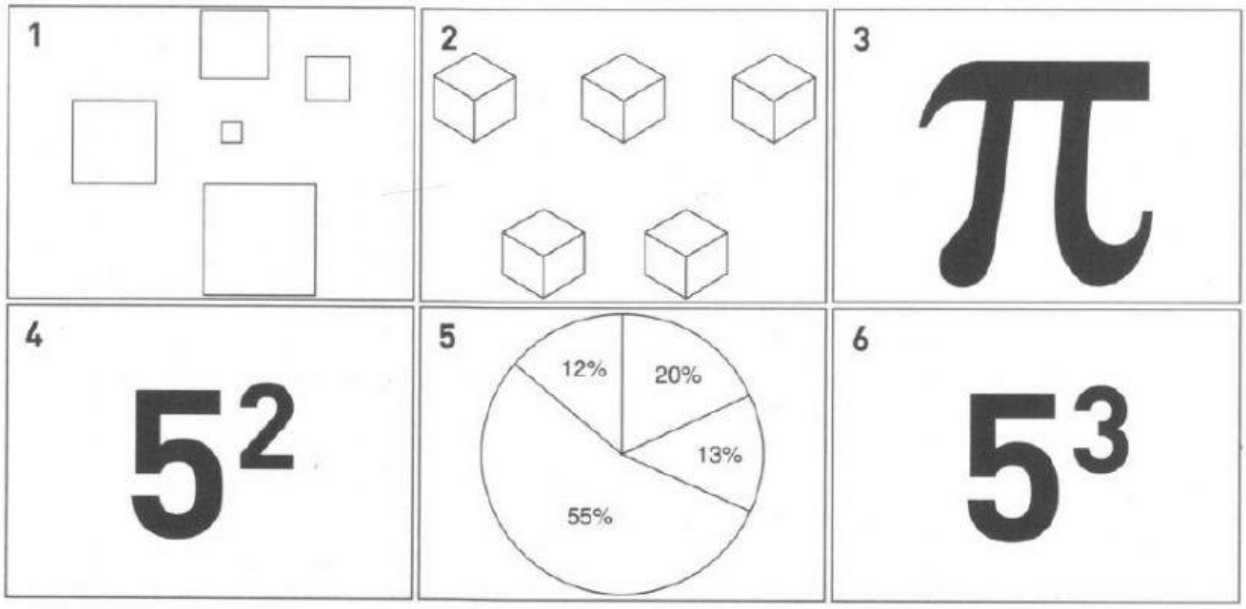
6 Scientists at work

Exam focus: Completing sentences and diagram labels
Aims: Understanding the meaning of words | Skim-reading to find information
Representing information visually | Recognising paraphrase

Part 1: Vocabulary



1 **Match the pictures 1–6 above with the words a–f.**

a pi ____
b a pie chart ____
c 5 cubed ____
d 5 cubes ____
e 5 squared ____
f 5 squares ____

2 **Draw a table like the one below and put these words into the correct group, depending on the word ending.**

acoustics
anatomy
astronomy
ballistics
biology
botany
cartography
chemistry
computing
ecology
economics
electronics
engineering
genetics
geography
geology
geometry
mathematics
mechanics
meteorology
optometry
palaeontology
pharmacology
physics
statistics
zoology

-logy	-metry	-graphy	-ics	-ing	other

3 Many scientific terms are made up of parts that derive from Greek. Knowing the meaning of the parts of a word can help you understand the meaning of the word as a whole.

Look at the table below which gives the meaning of some Greek word parts. Then match the words 1–12 with the definitions a–l.

Greek word or word part	Meaning	Greek word or word part	Meaning
astron	star	-nomy	the arranging of
bios	life	oikos	house or home
botanikos	of herbs (plants)	on	being or creature
ge	the earth or land	palaios	old
-graphy	the writing or drawing of	pharmakon	medicine or drug
-logy	the science or study of	physis	nature
-meteoron	of the atmosphere	zoo	animal
-metry	the measuring of		

1 anatomy ____	a the scientific study of animals
2 astronomy ____	b the branch of medicine concerned with the bodily structure of living beings, as revealed by the separation of parts
3 biology ____	c the branch of science concerned with fossils (= the remains of prehistoric plants or animals embedded in rock)
4 botany ____	d the branch of science which deals with stars, space, etc.
5 ecology ____	e the branch of medicine concerned with the uses and effect of drugs
6 geometry ____	f the branch of biology that deals with the relations of organisms to one another and to their physical surroundings
7 palaeontology ____	g the scientific study of plants
8 pharmacology ____	h the branch of mathematics concerned with the properties and relations of point, lines, solids, etc.
9 physics ____	i the study of living organisms
10 meteorology ____	j the branch of science concerned with the atmosphere, especially as a means to forecasting the weather
11 geology ____	k the science which deals with the physical structure and substance of the earth
12 zoology ____	l the branch of science concerned with the nature and properties of matter and energy

4 Which of the subjects in Exercise 2 have you studied yourself?

5 The noun for a person who practises a particular science or art often ends in *-er* or *-ist*. What do you call a person who ...

1 draws maps? _____
2 studies biology? _____
3 studies genetics? _____
4 studies plants? _____
5 studies physics? _____
6 studies palaeontology? _____
7 studies ecology? _____
8 studies astronomy? _____
9 studies geology? _____

6 The words 1–5 below are from Exercise 2. Match the words with the fields of study they relate to a–e.

1 acoustics _____	a maps
2 ballistics _____	b circuits (closed systems that electric current can flow around)
3 cartography _____	c motion (movement)
4 electronics _____	d sound
5 mechanics _____	e bullets and guns

7 In the following text, underline:

a words related to scientific study, activity or topics
b words related to scientific equipment

Use your dictionary if necessary.

Last month the Institute of Cell and Molecular Science (ICMS) was opened, giving an insight into the traditionally secret world of the scientist.

When the project was being planned, classes of schoolchildren were asked to describe how they saw scientists. They all gave details of white middle-aged men with glasses and beards. Only one girl chose to describe a female scientist, but even she had a beard. When the children were asked about cells, they thought of prison cells, even battery cells, but never the cells that make up all of us.

Visiting schoolchildren will be able to watch scientists at work among the test tubes, flasks, microscopes and centrifuges of a state-of-the-art research facility. They can then enter The Centre of the Cell – the 'embryo' pod – where they can learn about the basics of cell biology, disease and genetics. After seeing the scientists at work, children enter the pod where interactive screens will give them a theatrical taste of everything from cell division and tooth decay to cancer, cloning and gene therapy.

8 Find words in the text in Exercise 7 that collocate with the words 1–5. To help you, the definitions of the words you are looking for are given in brackets.

1 _____ an insight (offering)
2 _____ details (provided)
3 _____ equipment (the best available because it has been made using the most modern techniques and technology)
4 tooth _____ (the state or process of being gradually destroyed by a natural process)
5 gene _____ (the treatment of illness without the use of drugs or operations)

Part 2: Practice exercises

Exam information: Completion tasks (2)
Completion tasks assess your ability to find and understand detailed or specific information in a text.

- **Completing a diagram or picture**
  You will be asked to read a description in a passage and use words from it to complete labels on a diagram or picture.
  The answers will often come from the same part of the text, but may not be in the same order as the questions.
- **Completing sentences**
  You will be asked to complete sentences with words from a passage.
  The answers will be in the same order as the questions: you should be able to find the answer to question 1 before the answer to question 2, and so on.

In both types of task you will be told how many words to use, e.g. NO MORE THAN TWO WORDS, ONE WORD ONLY, NO MORE THAN TWO WORDS AND A NUMBER, NO MORE THAN THREE WORDS OR NUMBERS.

- If you use more words, you will not get a mark.
- Numbers can be written in numbers (e.g. *5*) or words (e.g. *five*).
- Hyphenated words count as one word (e.g. *state-of-the-art* counts as one word).

1 **Skim-read the passage and find the sections that refer to:**
a size, weight or other physical properties of brains
b intelligence

Dolphins have been declared the world's second most intelligent creatures after humans, with scientists suggesting they are so bright that they should be treated as 'non-human persons'.

Studies into dolphin behaviour have highlighted how similar their communications are to those of humans and that they are brighter than chimpanzees. These have been backed up by anatomical research showing that dolphin brains have many key features associated with high intelligence. The researchers argue that their work shows it is morally unacceptable to keep such intelligent animals in amusement parks or to kill them for food or by accident when fishing. Some 300,000 whales, dolphins and porpoises die in this way each year.

'Many dolphin brains are larger than our own and second in mass only to the human brain when corrected for body size,' said Lori Marino, a zoologist at Emory University in Atlanta,

Georgia, who has used magnetic resonance imaging scans to map the brains of dolphin species and compare them with those of primates. 'The neuroanatomy suggests psychological continuity between humans and dolphins and has profound implications for the ethics of human-dolphin interactions,' she added.

Dolphins have long been recognised as among the most intelligent of animals. Recently, a series of behavioural studies has suggested that dolphins, especially species such as the bottlenose, whose brains weigh about 5lb, could even be brighter than chimps, which some studies have found can reach the intelligence levels of three-year-old children. The studies show how dolphins have distinct personalities, a strong sense of self and can think about the future.

It has also become clear that they are 'cultural' animals, meaning that new types of behaviour can quickly be picked up by one dolphin from another. In one study, Diana Reiss, professor of psychology at Hunter College, City University of New York, showed that bottlenose dolphins could recognise themselves in a mirror and use it to inspect various parts of their bodies, an ability that had been thought limited to humans and great apes. In another, she found that captive animals also had the ability to learn a rudimentary symbol-based language.

Other research has shown dolphins can solve difficult problems, while those living in the wild co-operate in ways that imply complex social structures and a high level of emotional sophistication. In one recent case, a dolphin rescued from the wild was taught to tail-walk while recuperating for three weeks in a dolphinarium in Australia. After she was released, scientists were astonished to see the trick spreading among wild dolphins who had learnt it from the former captive. There are many similar examples, such as the way dolphins living off Western Australia learnt to hold sponges over their snouts to protect themselves when searching for spiny fish on the ocean floor. Such observations, along with others showing, for example, how dolphins could co-operate with military precision to round up shoals of fish to eat, have prompted questions about the brain structures that must underlie them.

Size is only one factor. Researchers have found that brain size varies hugely from around 7oz for smaller cetacean species such as the Ganges River dolphin to more than 19lb for sperm whales, whose brains are the largest on the planet. Human brains, by contrast, range from 2lb–4lb, while a chimp's brain is about 12oz. When it comes to intelligence, however, brain size is less important than its size relative to the body. What Marino and her colleagues found was that the cerebral cortex and neocortex of bottlenose dolphins were so large that 'the anatomical ratios that assess cognitive capacity place it second only to the human brain'. They also found that the brain cortex of dolphins such as the bottlenose had the same convoluted folds that are strongly linked with human intelligence. Such folds increase the volume of the cortex and the ability of brain cells to interconnect with each other. 'Despite evolving along a different neuroanatomical trajectory to humans, cetacean brains have several features that are correlated with complex intelligence,' Marino said.

'Marino and Reiss will present their findings at a conference in San Diego, California, next month, concluding that the new evidence about dolphin intelligence makes it morally repugnant to mistreat them. Thomas White, professor of ethics at Loyola Marymount University, Los Angeles, who has written a series of academic studies suggesting dolphins should have rights, will speak at the same conference. 'The scientific research . . . suggests that dolphins are "non-human persons" who qualify for moral standing as individuals,' he said.

Glossary

oz: an ounce in weight (1oz = 28g)

lb: a pound in weight (1lb = 454g = 16oz)

Exam tip: When you read texts, think about how you would represent information in a visual way.

2 Use the text on pages 53–54 to complete the diagrams below.

Diagram 1: Brain size

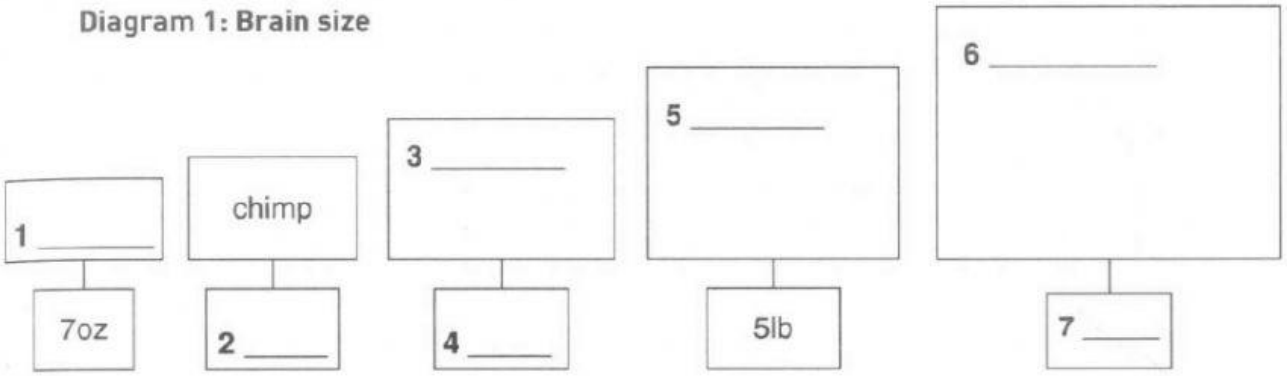
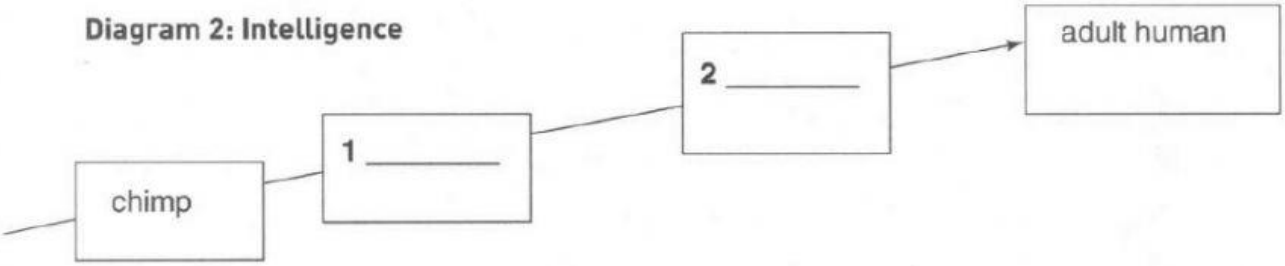


Diagram 2: Intelligence



3 **The phrases a–e are from the passage in Exercise 1. Match the sentence beginnings 1–5 with the words a–e. The resulting sentences give information in the same order as the information in the passage.**

1 There are reasons to believe that dolphins deserve to be regarded as _____	a morally unacceptable.
2 One of the consequences of this is that using them for entertainment, as we do now, would be _____	b brain structures.
3 In order compare dolphin and human brains, scientists have used _____	c non-human persons.
4 The way dolphins can cooperate and their levels of problem solving have made scientists think again about dolphins' _____	d brain cortex.
5 Scientists have also observed that the intelligence of certain dolphins is suggested by the physical structure of their _____	e imaging scans.

4 **Complete the sentences 1–5 using no more than three words from the passage below. The answers follow the order of the questions. Remember to look for paraphrases in the text.**

1 Jane Goodall has attained global recognition as a role model for _____.
2 Her studies have had far-reaching consequences, one of them being that we might have to accept that some animals should be treated _____.
3 Goodall believed that the main reason why women made good field scientists was their natural capacity _____.
4 _____ have been encouraged to become field scientists by the example of the three sisters in science.
5 Even today, when women are more visible in the field of science, their role is limited and they do not tend to be the _____.

It is 50 years since Jane Goodall first dipped her toes in the waters of Lake Tanganyika, in what is now the Gombe National Park in Tanzania. Since then she has been responsible for the most comprehensive study of wild chimpanzees – and become an idol of contemporary women scientists around the world.

In 1962, at a time when no woman in the world held a PhD in primatology, Goodall started a PhD in ethology – the scientific study of animal behaviour – at the University of Cambridge. Her resulting thesis, *Nest Building Behaviour in the Free Ranging Chimpanzee*, included the observations that chimps use tools and eat meat. Goodall had redefined our understanding of the origins of Man. Louis Leakey, the famous palaeontologist and Goodall's mentor, said of her work: 'Now we must redefine "tool", redefine "Man", or accept chimpanzees as humans.' Goodall's work, and that of two other female pioneers in primatology, Dian Fossey and Biruté Galdikas, was made possible by the example of Leakey. Born to British missionaries in Kenya in 1903, he was the first white baby the Kikuyu people had seen and he spoke their language before he learnt English. He grew up to be an ardent palaeontologist, archaeologist and anthropologist at the University of Cambridge and, later, with his wife Mary Douglas Nicol.

Leakey thought that the attributes that made a good field scientist were innate to women. Because women were pre-programmed to be mothers, he thought, they had three crucial traits: they were patient, they were better able to understand an animal's desires by observing social non-verbal cues and they were less aggressive than men – all beliefs later echoed by Goodall. He also felt that men were more concerned with conquering nature than committing themselves to detailed field studies.

Goodall's career began in the late 1950s, when she worked as secretary to Leakey at the Coryndon Museum in Nairobi, of which he was the director. In 1960, after the 26-year-old Goodall had assisted on a fossil dig at Olduvai Gorge in Tanzania, she was sent by her mentor to study chimpanzees in the wild. At the insistence of the British Government she arrived in Gombe with her mother, Vanne, in tow. Spending day after day among the primates, she became fascinated by their behaviour and began informal studies. But at the insistence of Leakey, who warned that she would need to formalise her work to gain scientific credibility, she applied for a place at Cambridge.

Since then Goodall and her two sisters in science, Fossey and Galdikas, have paved the way in primatology, a field that is now dominated by women. Gombe is one of the longest running research studies of wild animals anywhere in the world: it has produced 35 PhD theses, more than 30 books and 200 research papers and nine films. Furthermore, according to Julie Des Jardins, the author of *The Madame Curie Complex: the Hidden History of Women in Science*, 78 per cent of all PhDs awarded in primatology in 2000 were awarded to women. Goodall, Fossey and Galdikas have

helped to inspire generations of women to pick up their binoculars and take to the world's fields and forests.

Goodall comes from a dynasty of strong women and describes her mother and grandmother as 'those two amazing, strong women, undaunted'. Goodall's mother did not laugh at her daughter when she said she was going to Africa. 'My mother used to say: "If you really want something and you work hard and never give up, you find a way",' Goodall says. "She was definitely the greatest inspiration that I had.'

If only science's old guard had had the same attitude. Today's scientific community was formalised by men. As a consequence of the scientific 'revolution' of the 17th and 18th centuries, science moved from the home to laboratories, universities and hospitals, establishments to which women were denied access, irrespective of their aptitude or contribution. In most fields of scientific research, most of the big players continue to be men. According to the UKRC (the body responsible for advancing gender equality in science, engineering and technology), in the 2007–08 academic year, in STEM – science, technology, engineering and maths – subjects, about one third of researchers were women. But in the higher reaches of the academic world, the numbers fall away. About a quarter of lecturers and fewer than one in ten professors are female.

Perhaps this under-representation of women in science has in part been caused by a lack of prominent role models. The women who flourished under the guidance of Leakey, however, provide ample proof that if women are given opportunities, they can surpass all expectation. They can tread their own path through the forest and conduct credible research with far-reaching and long-lasting implications.

Jane Goodall still believes that her mother's words about working hard to achieve a goal have the power to inspire young women who dream of becoming scientists. 'I would say to them what Mum said to me,' she says. Clearly, it works.

Part 3: Exam practice

Using NO MORE THAN THREE WORDS from the passage, complete each gap in the diagram below.

Holidaymakers faced disruption yesterday because of new plumes of ash from an Icelandic volcano, which forced the closure of airports in Spain and Portugal.

The cancellations – which mainly affected Ryanair and easyJet services operating out of Stansted and Gatwick – came as scientists produced the first internal map of Eyjafjallajokull's network of magma chambers, which extend 12 miles below the ground.

A new ash cloud has risen 30,000ft into the air and drifted south after a pulse of meltwater and ice poured into the Eyjafjallajokull volcano last week. The water caused huge explosions as it hit the hot lava, generating more ash plumes. European aviation regulators have imposed a maximum safe limit of 0.002 grammes of ash per cubic metre of air, meaning that if levels rise above this, flights cannot enter that airspace.

The map shows how the volcano's tubes plunge deep down through the earth's crust to the start of the mantle, which is made of semi-molten rock. It reveals the huge scale of the eruption and the potential for a far greater one. This is because the magma chamber of Eyjafjallajokull is dwarfed by the much larger one under Katla, a volcano 15 miles to the east. Two of Katla's eruptions, in 1612 and 1821, are thought to have been triggered by those of its neighbour. While Katla is not part of the same underground network of magma channels and chambers, it is close enough to be affected by changes in pressure in Eyjafjallajokull's system. There is also a chance that a horizontal sheet of magma, known as a dike, beneath Eyjafjallajokull could stretch out far enough to penetrate a magma chamber beneath Katla. Hitting the roots of its neighbour would almost certainly trigger an eruption. The three eruptions of Eyjafjallajokull on record have each been associated with a subsequent eruption of Katla. There have, so far, been no signs of turbulence beneath Katla's surface but, having last erupted in 1918, vulcanologists say that a new blast is overdue.

The workings of the volcanoes have been provisionally drawn up by Professor Erik Sturkell, a geologist at the Nordic Volcanological Centre, University of Iceland. Sturkell suggests the Eyjafjallajokull eruption has been building since 1994, when new lava began rising, forming two reservoirs three miles beneath the volcano. A surge of earthquakes under Katla mean it has experienced a similar influx of lava, Sturkell said. 'This suggests the volcano is close to eruption.'