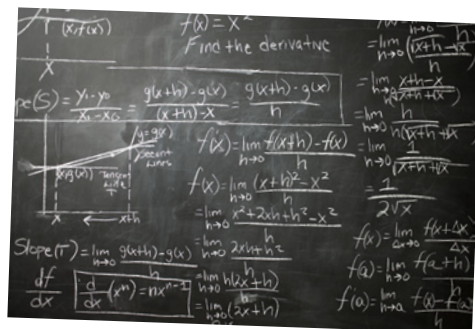


Science has no borders

1 Work with a partner. Look at the pictures and discuss what they have in common.



2a Read the magazine article about multiple discoveries. What is the meaning of the term 'multiple discoveries'?

Investigating inventions

When talking about inventions it's easy to picture a stereotypical scientist holed up in a laboratory while they come up with a new idea alone and out of nothing. The reality is somewhat different. A lot of 'Eureka' moments have come about as scientists make the final connection in a series of discoveries that have occurred universally over decades. As a result, it is not surprising that multiple discoveries or inventions occur. This can be seen simply by looking at the list of Nobel Prize winners, which often includes two or three names for one discovery: Marconi and Braun; Bloch and Purcell; Fleming, Chain and Florey, to name a few. Alternatively, think of inventions such as planes, jet engines, crossbows, and telephones, which have several inventors. Let's look at three multiple discoveries in more detail.

Oxygen

Up until the 1700s, air wasn't thoroughly investigated – partly because no one believed it worth studying, but also because there was no specialist equipment to study it. This changed in the eighteenth century, and in the late 1700s, Scheele (a German-Swedish man), Priestley (in the UK) and Lavoisier (in France) came up with similar theories. Lavoisier actually gave air the name 'oxygen'. Although at first it seems surprising that three men in different countries should come up with similar theories independently, it isn't actually so much of a coincidence. It is more that the conditions, background information and timing coincided to make the discovery inevitable. Once the idea of air being made up of different gases became accepted, it was only a matter of time before several scientists would work out what the different gases were.

eventually sold his sample to a paper specialist and the idea of making paper from wood took off. Separated by an ocean, these two men came up with similar ideas at the same time because they were both trying to solve the problem of a high demand for paper and a short supply of raw material; essentially they were meeting the needs of their cultures.

Paper

In the nineteenth century, paper was made using old rags of linen and cotton. However, the supply of old rags was struggling to keep up with the increasing demand for paper. In Canada, in 1844, Charles Fenerty experimented in making paper from wood pulp and sent a sample to a newspaper. Unfortunately, little attention was given to his sample and he didn't pursue his invention further. Around the same time, in Germany, Friedrich Keller invented a machine that could extract fibre from trees to make paper. He

Calculus

In the 1600s various mathematicians in Europe were investigating the problems of variable quantities. In the 1760s Newton began to make considerable headway on this matter and it culminated in the theory of calculus. However, at the same time, Gottfried Leibniz in Germany was also looking at this subject but from a different angle, and his findings, published in 1675, also form the theory of calculus. They had both seen the need for a better system in one particular area of mathematics, and they had also both added to knowledge built up previously by other mathematicians. By contrast, Da Vinci is a famous example of someone who was ahead of his time with his ideas, as everyone around him believed them to be impossible and so no one pursued them. Newton and Leibniz wouldn't have been able to advance their theories a century earlier, but the bank of knowledge already in existence from the work of others allowed their flashes of inspiration to become an important part of mathematics today.

In conclusion, it would appear that discoveries and inventions are inevitable in any culture when the time is right and there is a need for it.

2b Read the article again and decide if the sentences are True (T) or False (F). Correct the false sentences.

- 1 A lot of scientists have made important discoveries after working alone for decades. T / F
- 2 The content of air wasn't investigated before the eighteenth century because it wasn't deemed to be important. T / F
- 3 Paper used to be made out of old rags. T / F
- 4 In the nineteenth century a German invented a method of making paper from wood. T / F
- 5 Newton and Leibniz both came up with exactly the same formula for calculus. T / F
- 6 Successful discoveries and inventions occur when there is a need for it. T / F

2c Read the article again and choose the best alternative to answer the questions.

- 1 Why did scientists study air in the 1700s?
 - a It became essential to know exactly what air was.
 - b Specific equipment became available which enabled them to study air.
- 2 Why did three men in different countries come up with the same theory about air?
 - a They were competing against each other to become the first to discover the properties of air.
 - b Their studies reached similar conclusions as they all built on the same existing knowledge and beliefs.
- 3 Why did a Canadian and a German come up with similar ideas for making paper using wood?
 - a They both wanted to resolve the problems of supply and demand of paper.
 - b They both worked in the wood industry and wanted to find new markets for their product.
- 4 Why were Newton and Leibniz's theories successful at that particular time?
 - a Because they were necessary to solve certain mathematical problems.
 - b Because they were the next logical step, built on a bank of knowledge from other mathematicians.
- 5 Leonardo Da Vinci is famous
 - a for having ideas that were considered unbelievable at the time.
 - b for inventions that changed people's beliefs at the time.

Gateway to culture

3a Work with a partner. Read the quotes, discuss their meaning and decide if you agree or disagree with them.

“There is a single light of science, and to brighten it anywhere is to brighten it everywhere.”

Isaac Asimov

“Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world.”

Louis Pasteur

“A man can no more be completely original ... than a tree can grow out of air.”

George Bernard Shaw

PROJECT

3b You are going to work on a presentation about multiple discoveries. Think about a discovery or invention that has multiple inventors. Read the questions and prepare your research.

- 1 Work in groups and brainstorm different discoveries or inventions with multiple inventors.
- 2 Choose one and find out more about it. Answer the following questions:
 - When were the similar discoveries/inventions made? What was their cultural importance?
 - Where were the different inventors from?
 - Why do you think the discovery/invention came about at this time?
 - Can you find any examples of similar inventions in your own country?

3c In your groups, use your notes to give a presentation to the rest of the class on your discovery/invention. Make sure you include reasons why the discovery/invention came about in more than one place at the same time. Your presentation should be around three minutes long.