

DISCOVERY OF OXYGEN: QUESTIONS TO PONDER ABOUT

Have you tried guessing the names of the scientists in the 'Hall of Fame' on page 10? Did the clues on page 35 help?

The story of the discovery of oxygen is filled with many interesting examples of the nature and practice of science. Only four such examples have been shared here. Questions related to these examples are aimed at inviting reflection and discussion. Each question can be explored from different angles and with different lenses.

Q1. One of the scientists in this 'Hall of Fame' managed to isolate oxygen in 1771. However, the details of his discovery were published only in 1777. A second scientist made the same discovery in 1774. His findings were published in 1775. A third scientist recognised the significance of this discovery. He proposed that the gas that had been discovered was a chemical element. His experiments to support this proposal were published in 1777.

- Who do you think should be given credit for this discovery? Can you think of some arguments in favour of crediting each of these three scientists? What about arguments against each of their claims?
- How do you think we know that the first of these three scientists had discovered oxygen in 1771? Is it through the records he kept of his experiments and observations? Or through details that he shared in his correspondence with other scientists? If you were asked to verify the time of this discovery, what other ways would you use to do so? Do you think this process of verification would be easier or harder for discoveries made today compared to ones made in the 18th century?

Q2. Some argue that a number of other scientists may have independently discovered oxygen. For example, the Polish alchemist and medical doctor Michael Sendivogius is believed to have discovered oxygen in 1601. Sendivogius proposed that air was a mixture of components, one of which contained a life-giving substance. He also indicated that this component was the same gas that was released when saltpetre (potassium nitrate, KNO_3) was gently heated. Unfortunately, while Sendivogius did publish these discoveries, he chose to write about them in the arcane

language of alchemy and under a variety of pseudonyms (some argue that this was deliberate; Sendivogius wanted to remain anonymous). Others point out that the Dutch engineer and inventor Cornelius Drebbel had, in 1608, reported that heating saltpetre produced a gas. While Drebbel did not identify it, we know that the gas he had observed is oxygen.

- Do you think either of these scientists deserves credit for the discovery of oxygen? What arguments can you think of in favour of and against giving them credit?
- We now know of five scientists who could claim credit for the discovery of oxygen. There may be more that we do not know of at present, but may discover later. Some have argued that credit for a discovery should be assigned to each such scientist. Can you think of some reasons in favour of and against this position?
- The scientific community uses certain conventions to decide who should be credited for a scientific discovery. One of these is called the priority rule. According to this rule, priority is given to the scientist who first shares their discovery with the scientific community. This rule only applies if their findings are considered valid, accurate, and relevant by the scientific community. Why do you think scientists came up with this rule? Can you think of any situations where this rule may give one scientist an unfair advantage over another scientist?
- Are there any other criteria that you think may be useful to consider in assigning credit?

Q3. We learnt that one of the scientists in this 'Hall of Fame' had a mixed reputation. On the one hand, other scientists often wrote to him or met with him to share and discuss their experiments and ideas. On the other hand, the scientific community knew him to be capable of taking credit for the ideas of lesser-known scientists.

- This seems to suggest that the practice of science has an important social aspect. It may not be enough for a scientist to make a claim. Their claims need to be verified and supported by the scientific community.

Who do you think is considered part of the scientific community? How do you think one gains membership to this community? What do you think the incident with this particular scientist reveals about the role of a scientist's reputation in the practice of science?

- Taking credit for someone else's work is an act of academic dishonesty. How do you think such acts would have been discovered at the time? How would they be discovered today? If you were a member of the scientific community, what guidelines would you frame to discourage such instances of dishonesty?
- This scientist claimed credit for the discovery of oxygen. This claim was not taken seriously. He also claimed that oxygen was a unique element. This was taken seriously by the scientific community. In fact, his ideas about oxygen discredited the phlogiston theory—one of the most widely accepted theories of the time. What do you think may have caused the scientific community to treat two related claims by the same scientist in different ways? Would you have done the same?

Q4. We read of how two scientists in this 'Hall of Fame' are known to have used themselves as the subjects of some of their own experiments. These experiments involved chemicals about which little was known at the time. One of these scientists inhaled a 'new' gas. The other scientist was known to taste the chemicals he worked with. Today, science laboratories across the world expect scientists to assess the risks involved in the experiments they perform. They are also

expected to follow work practices that reduce any safety risks to themselves, those they work with, the lab, the public, and the environment.

- How do you think the scientific community develops such safety guidelines?
- If you were a member of the scientific community, would you expect scientists working with new chemicals or organisms as well as those performing risky experiments for the first time to analyse and communicate potential risks and safety practices? What do you think are some of the advantages and disadvantages of this approach?
- How do you think the scientific community ensures that such safety guidelines are followed?
- Some may argue that these safety practices may hamper the pace of new discoveries. How would you respond to this?
- Others may argue that these practices may be necessary to ensure that we do not cause harm to others. However, the choice to experiment on oneself is personal. A scientist should have the right to make an informed choice about taking such risks. What arguments can you think of in favour of and against this position? Can you think of some conditions under which this argument is likely to prevail?

What other aspects of this story would you like to explore more deeply?



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