Topic: writing an abstract – Peer review

In what follows you will see 2 student responses to the task of converting a popular science article into an abstract.

Evaluate the students' responses based on the use of relevant content from the original, suitable structure, language, appropriate research title.

A. The original task

Topic: Writing an abstract

The following article appeared in the *Science Daily* magazine on 4 June 2021. Read it carefully and extracting only relevant and important scientific information:

1. Write the abstract of a research paper (using only information from the following text) to be published in the journal *Physical Review Letters*.
   Your text should not exceed 180 words (not less than 160 and not more than 200 words).

Remember that:

- You should write your text from the point of view of the researchers reported in the popular science article below.
- Your text will have to differ from the popular science article below in terms of both style and structure.
- You should NOT use citations in the abstract.

2. You also need to provide a title for your abstract.

New form of silicon could enable next-gen electronic and energy devices
Date: 4 June 2021
Summary: A team developed a new method for synthesizing a novel crystalline form of silicon with a hexagonal structure that could potentially be used to create next-generation electronic and energy devices with enhanced properties that exceed those of the 'normal' cubic form of silicon used today.

A team led by Carnegie's Thomas Shiell and Timothy Strobel developed a new method for synthesizing a novel crystalline form of silicon with a hexagonal structure that could potentially be used to create next-generation electronic and energy devices with enhanced properties that exceed those of the "normal" cubic form of silicon used today.
Their work is published in *Physical Review Letters*.
Silicon plays an outsized role in human life. It is the second most abundant element in the Earth's crust. When mixed with other elements, it is essential for many construction and infrastructure projects. And in pure elemental form, it is crucial enough to computing that the longstanding technological hub of the U.S. -- California's Silicon Valley -- was nicknamed in honor of it.
Like all elements, silicon can take different crystalline forms, called allotropes, in the same way that soft graphite and super-hard diamond are both forms of carbon. The form of silicon most commonly used in electronic devices, including computers and solar panels, has the same structure as diamond. Despite its ubiquity, this form of silicon is not actually fully optimized for next-generation applications, including high-performance transistors and some photovoltaic devices.
While many different silicon allotropes with enhanced physical properties are theoretically possible, only a handful exist in practice given the lack of known synthetic pathways that are currently accessible.

Strobel's lab had previously developed a revolutionary new form of silicon, called Si24, which has an open framework composed of a series of one-dimensional channels. In this new work, Shiell and Strobel led a team that used Si24 as the starting point in a multi-stage synthesis pathway that resulted in highly oriented crystals in a form called 4H-silicon, named for its four repeating layers in a hexagonal structure.

"Interest in hexagonal silicon dates back to the 1960s, because of the possibility of tunable electronic properties, which could enhance performance beyond the cubic form" Strobel explained.

Hexagonal forms of silicon have been synthesized previously, but only through the deposition of thin films or as nanocrystals that coexist with disordered material. The newly demonstrated Si24 pathway produces the first high-quality, bulk crystals that serve as the basis for future research activities.

Using the advanced computing tool called PALLAS, which was previously developed by members of the team to predict structural transition pathways -- like how water becomes steam when heated or ice when frozen -- the group was able to understand the transition mechanism from Si24 to 4H-Si, and the structural relationship that allows the preservation of highly oriented product crystals.

"In addition to expanding our fundamental control over the synthesis of novel structures, the discovery of bulk 4H-silicon crystals opens the door to exciting future research prospects for tuning the optical and electronic properties through strain engineering and elemental substitution," Shiell said. "We could potentially use this method to create seed crystals to grow large volumes of the 4H structure with properties that potentially exceed those of diamond silicon."

Student reply 1
<u>Title</u>: Silicon – a pathway to the future

<u>Abstract</u>

Silicon is one of the most essential substances used by humans. Recent research led by Carnegie's Thomas Shiell and Timothy Strobe has revealed a new method of synthesizing a novel crystalline form of silicon with a hexagonal structure. For decades, a challenging problem which aroused in this domain was the optimization of the silicon allotropes. None of its forms could perform spotlessly in next-generation technology. Previous studies of Strobel's lab had reported another form of silicon, Si24, which could be processed throughout several stages into its final form : 4H-silicon. It has four layers of hexagonal structure which endow it with great electronic properties which surpass those of the cubic form. A tool called PALLAS created by the same team revealed the structural transition between si24 and 4H-silicon so scientist could fully understand its nature. As a result they could preserve highly oriented product crystals. The contributions made here have wide applicability in the optical and electronic field as they open the door for state of the art technology.

Student reply 2
<u>Title</u>: Developing a pathway for the synthesis of 4H-silicon using Si24 silicon.

<u>Abstract</u>

Hexagonal forms of silicon have been a topic of interest since the 1960s due to their superior performance in relation to the currently used cubic form. However, there are few methods to successfully produce them. In this work, we develop a method to synthesize hexagonally structured silicon, called 4H-silicon, of high quality. To this end, we used the previously developed Si24 type of silicon as the basis in a series of synthetic stages that led to the formation of 4H-silicon. In addition, we used the PALLAS computing tool to simulate and understand the mechanism behind the transition from Si24 to 4H-Si and the stability of the resulting material. This method of reliable synthesis of hexagonally arranged silicon could be used to upgrade existing electronic devices, such as transistors and photovoltaic panels.