Topic: Writing an abstract **Week 8**

The following article appeared in the *Science Daily* magazine on 4 May 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 of Environmental Engineering*.
   Your text should not exceed 200 words (not less than 170 and not more than 230 words).

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

- 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.

New 'key-hole surgery' technique to extract metals from the Earth

Date: May 4, 2021

Summary:
Researchers have developed a new method to extract metals, such as copper, from their parent ore body. The research team have provided a proof of concept for the application of an electric field to control the movement of an acid within a low permeability copper-bearing ore deposit to selectively dissolve and recover the metal in situ.

Scientists have developed a new "key-hole surgery" technique to extract metals from the earth -- which could revolutionise the future of metal mining.

A team of international researchers, including Dr Rich Crane from the Camborne School of Mines, University of Exeter, have developed a new method to extract metals, such as copper, from their parent ore body.

The research team have provided a proof of concept for the application of an electric field to control the movement of an acid within a low permeability copper-bearing ore deposit to selectively dissolve and recover the metal in situ.

This is in contrast to the conventional approach for the mining of such deposits where the material must be physically excavated, which requires removal of both overburden and any impurities within the ore (known as gangue material).

The researchers believe the new technique has the potential to transform the mining industry, because it has the capability to dissolve metals from a wide range of ore deposits that were previously considered inaccessible.

Furthermore, due to the non-invasive nature of the extraction, the research team are hopeful that the study will help usher in a more sustainable future for the industry.

This is urgently required now in order to provide the plethora of metals required to deliver green technology, such as renewable energy infrastructure and electrified vehicles, whilst

limiting any potential environmental damage associated with the mining of such vitally important metals.

The study was recently published in *Science Advances*.
Dr Rich Crane from the Camborne School of Mines, University of Exeter, and co-author of the study, said: "This new approach, analogous to "key-hole surgery," has the potential to provide a more sustainable future for the mining industry, by enabling the recovery of metals, such as copper, which are urgently needed for our global transition to a new Green Economy, whilst avoiding unwanted environmental disturbance and energy consumption."

The central principle behind most modern mining techniques has not fundamentally changed since their original conception, which marked the beginning of the Bronze Age: metals are recovered from the subsurface via physical excavation, i.e., the construction of tunnels to gain access to the deposits, or by creating "open cast" mines.

This technique demands large volumes of surface soil, overburden and gangue material to also be excavated, which can contain millions of tonnes of material -- and can also lead to habitat destruction.

In this new publication, experts from the University of Western Australia, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the Technical University of Denmark and the University of Exeter, have demonstrated that a targeted electric field can be used to dissolve and then recover copper in situ from the ore -- avoiding any requirement to physically excavate the material.

This new technology comprises the construction (drilling) of electrodes directly into an ore body. An electric current is then applied which can result in the transport of electrically charged metal ions, such as copper, through the rock via a process called electromigration. The research team have now provided a Proof of Concept for this new technology at laboratory scale, which has also been verified using computer modelling. They are confident that the idea will work beyond the laboratory-scale.