**The year of life**



The oldest rocks on Earth are approximately 4.4 billion years old.

This evidence makes scientists think that the Earth is approximately 4.5 billion years old.

Imagine if that 4.5 billion years was compressed into one single year.

In this imaginary year:

* The Earth was formed on **1st January**.
* The present day is at the very end of   
  **31st December**.

The oldest fossils ever discovered are of organisms that lived approximately 3.5 billion years ago.

This fossil evidence makes scientists think that the first living organisms appeared on Earth approximately 3.8 billion years ago. In our imaginary year, this would be **25th February**.

We could use fossil evidence to add other events from the history of life to our imaginary year.

**To talk about in your group**

Your teacher will give you some events from the history of life on Earth.

1. Where in the imaginary year would you put each event from the history of life?
2. What are your reasons for putting each event where you did?

**The year of life**



**1st January**

The Earth is formed.

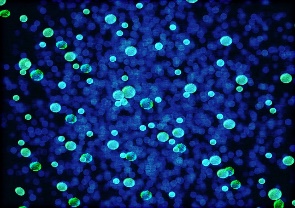
*(4.5 billion years ago)*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| JANUARY | FEBRUARY | MARCH | APRIL | MAY | JUNE |

**25th February**

The first organisms appear. They are single living cells.

*(3.8 billion years ago)*



**.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| JULY | AUGUST | SEPTEMBER | OCTOBER | NOVEMBER | DECEMBER |

**31st December**

*11:59 p.m.*

The present day.

*(0 years ago)*



*Biology> Big idea BVE: Variation, adaptation and evolution > Topic BVE1: Variation > Key concept BVE1.2: Changes in species over time – fossil evidence*

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| **Response activity** |
| **The year of life** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | The fossil record provides evidence that species change over time, but it is incomplete and there are limitations to the conclusions that can be drawn from it. |
| Observable learning outcomes: | Recall that fossils provide evidence about organisms from long ago and their habitats.  Recall that fossils are between ten thousand and billions of years old. |
| Activity type: | Challenge to thinking, discussion |
| Key words: | fossils, life, evolution |

This activity can help develop students’ understanding of the relative ages of fossils and the organisms from which they are formed. It can be used in response to misunderstandings revealed by the following diagnostic questions:

* Diagnostic question: How do we know?
* Diagnostic question: How old are fossils?

**What does the research say?**

Learning about fossils and evolution requires students to appreciate the timescales involved, but the timescales involved can be so vast that students can struggle to comprehend them (Ingram, 2011). For example, at the time of writing, the oldest fossils ever discovered are thought to be approximately 3.5 billion years old (Tyrrell, 2017).

Studies have found that children understand relative time (including the concepts of ‘before’ and ‘after’) long before they understand absolute time (e.g. historical dates) (Ault, 1982; Barton and Levstik, 1996).

Research has suggested that children at age 10-11 find it difficult to appreciate the absolute ages of fossils and the species they relate to; for example, one study found that when children of this age were asked to estimate when dinosaurs lived, answers ranged from “1000 years ago” to “millions of years ago”, and this could be down to guessing due to the children’s limited understanding of large numbers (Trend, 1998).

Another study found significant differences between the abilities of 14-18 year-olds and 12-14 year-olds to use diachronic thinking (i.e. to place an object or event in time and then to think about how it changes over time) within geological timescales (Dodick and Orion, 2003).

Note: Historically, a billion was defined using the ‘long scale’ in British English as one million million   
(1000000000000, or 1012), while American English has always used the ‘short scale’ definition of one thousand million (1000000000, or 109). The UK government has used the ‘short scale’ definition since 1974, and it is this definition that is used here.

**Ways to use this activity**

Students should complete this activity in pairs or small groups. The focus of the activity should be on group discussion to reach a consensus on where to put each event on the timeline. It is through the discussions that students can check their understanding and develop their explanations. Listening in to the conversations of each group will often give you insights into how your students are thinking.

After their discussions, each group should be prepared to report the key points of their discussion to another group, or to the class.

Students could use the ‘event cards’ cut out from the end of this document, to be placed onto the timeline on the worksheet. Alternatively, a larger scale timeline could be mapped out around the classroom walls or across the playground.

Pictures of the various organisms, or fossils of the organisms, could be added to make the timeline more visual.

*Differentiation*

Some events could be omitted to simplify the task. Alternatively, some students could be prompted to arrange the events *relatively* (e.g. in terms of ‘before’ and ‘after’), before or instead of trying to place them at specific points on the timeline.

As an extension, some groups could be asked to discuss whether they think there is any significance to the sequence of increasing complexity of organisms shown by the completed timeline (and ideas about evolution could be drawn out).

The quality of the group discussions can be improved with a careful selection of groups; or by allocating specific roles to students in each group. For example, you may choose to select a student with strong prior knowledge as a scribe, and forbid them from contributing any of their own answers. They may question the others and only write down what they have been told. This strategy encourages contributions from more members of each group.

**Expected answers**

|  |  |  |
| --- | --- | --- |
| **Event** | **Years ago\*** | **Position in imaginary year** |
| The Earth is formed | 4.5 billion | 1st January |
| First single-celled living organisms | 3.8 billion | 25th February |
| The oldest fossils ever found are formed | 3.5 billion | 21st March |
| First cells with a nucleus | 2.1 billion | 14th July |
| First fungi | 1.5 billion | 1st September |
| First land plants | 850 million | 24th October |
| First mammals | 200 million | 15th December |
| Extinction of the dinosaurs | 66 million | 22nd December |
| First modern humans (*Homo sapiens*) | 350 thousand | 31st December, 11:19 p.m. |
| The youngest fossils ever found are formed | 10 thousand | 31st December, 11:58 p.m. |
| Present day | 0 | 31st December, 11:59 p.m. |

\*All dates are approximate, based on reported estimates.

**Equipment**

For each pair/group or for the class:

* timeline template (e.g. printed from the student worksheet, or enlarged to whatever size you wish)
* events to be sorted onto the timeline (e.g. ‘event cards’ printed and cut out from the last page of this document, or enlarged as appropriate to fit the timeline you are using)

**Acknowledgments**

Developed by Alistair Moore (UYSEG), from an idea described by Ingram (2011).

Images: calendar – adapted by UYSEG from pixabay.com/Kaz (316814); Earth – NASA; oldest fossil - J. William Schopf; bacteria – pixabay.com/geralt (808751); street scene – pixabay.com/Free-Photos (1082252)

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**Print and cut out ‘event cards’**

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|  |  |  |  |
| --- | --- | --- | --- |
| The oldest fossils ever found are formed | First cells with a nucleus | First fungi | First land plants |
| First mammals | Extinction of the dinosaurs | First modern humans (*Homo sapiens*) | The youngest fossils  ever found are formed |

✁

|  |  |  |  |
| --- | --- | --- | --- |
| The oldest fossils ever found are formed | First cells with a nucleus | First fungi | First land plants |
| First mammals | Extinction of the dinosaurs | First modern humans (*Homo sapiens*) | The youngest fossils  ever found are formed |