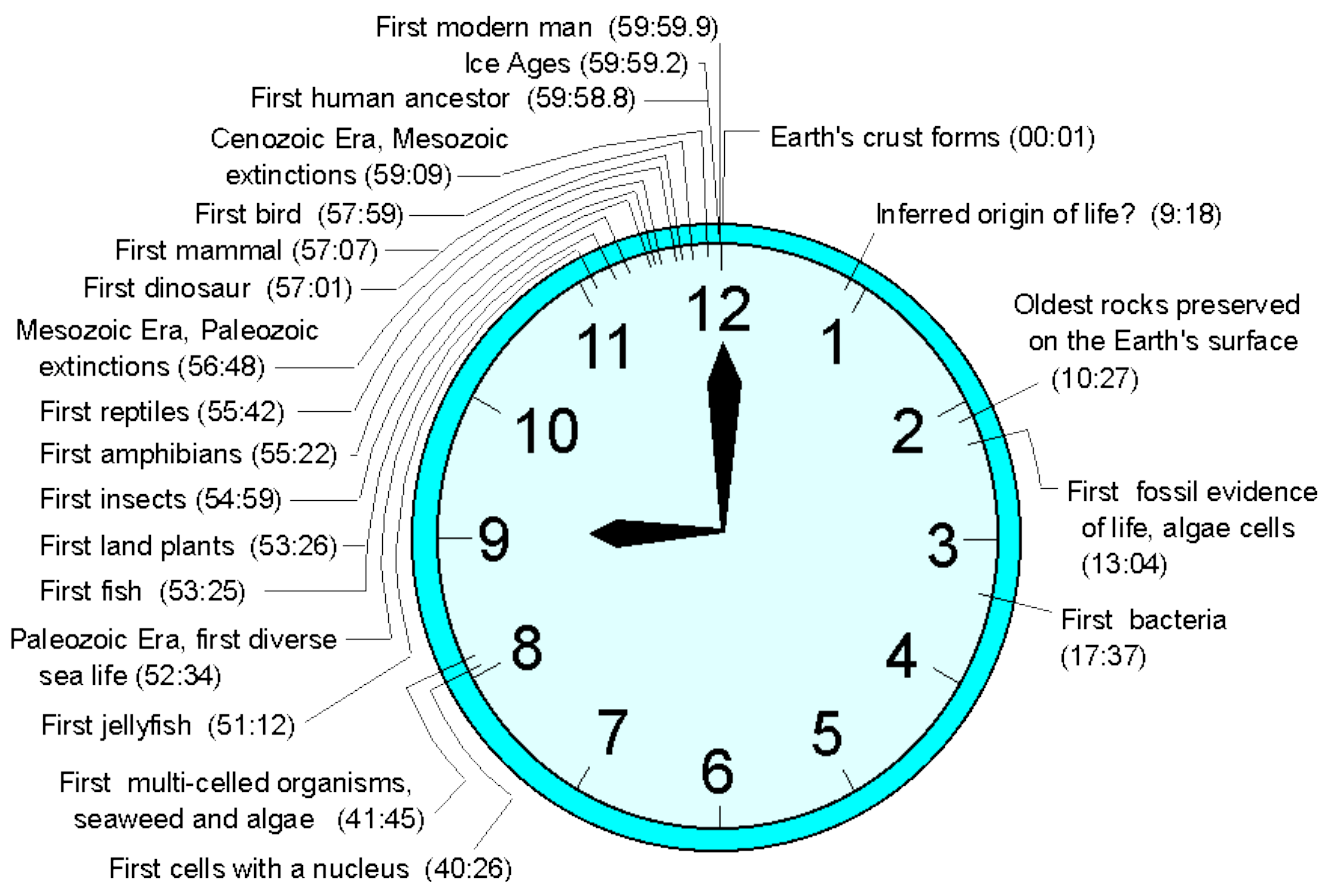# Time Clocks

An exercise assembled by Dr. Stephen Greb, Kentucky Geological Survey to demonstrate changes in the Earth through time, and the length of time it took to make many of the changes.

Materials

- A wall clock or watch
- Paper, colored pencils or crayons, or other materials to draw or make costumes of ancient animals and plants

Activity

Although time lines are traditionally demonstrated with adding machine paper, why not demonstrate time with time? You can demonstrate changes in Earth history through time using the clock in your classroom. Time conversions for important dates in Earth history are shown here for 1 hour (a typical class period). To show 4.6 billion years in one hour, (the age of the Earth) each minute equals 76.7 million years, and each second equals 1.3 million years.

First modern man (59:59.9)
Ice Ages (59:59.2)
First human ancestor (59:58.8)
Cenozoic Era, Mesozoic extinctions (59:09)
First bird (57:59)
First mammal (57:07)
First dinosaur (57:01)
Mesozoic Era, Paleozoic extinctions (56:48)
First reptiles (55:42)
First amphibians (55:22)
First insects (54:59)
First land plants (53:26)
First fish (53:25)
Paleozoic Era, first diverse sea life (52:34)
First jellyfish (51:12)
First multi-celled organisms, seaweed and algae (41:45)
First cells with a nucleus (40:26)

Earth's crust forms (00:01)
Inferred origin of life? (9:18)
Oldest rocks preserved on the Earth's surface (10:27)
First fossil evidence of life, algae cells (13:04)
First bacteria (17:37)

4.6 billion years in one hour

Click here to get gif image of above clock that can be printed at page size.

A list of Important Dates in Earth History is provided that contains the dates of the events shown on the time clock, and more. The teacher can pick events from the list of key events and calculate, or have students calculate the time for the key events you wish to use.

To calculate the time of an event when you are going to show 4.6 billion years in one hour:

Event (millions of years ago) / 76.7 = minutes ago the event occurred

The number calculated will show the minutes from the end of the hour at which the event occurred. You will usually want to calculate the minutes from the beginning of the hour.

60 - minutes ago = minutes from the beginning of the hour. The minutes will be in decimal form. For accuracy, if you wish to calculate seconds from the decimal number (this will be important when you get to man's place in Earth history):
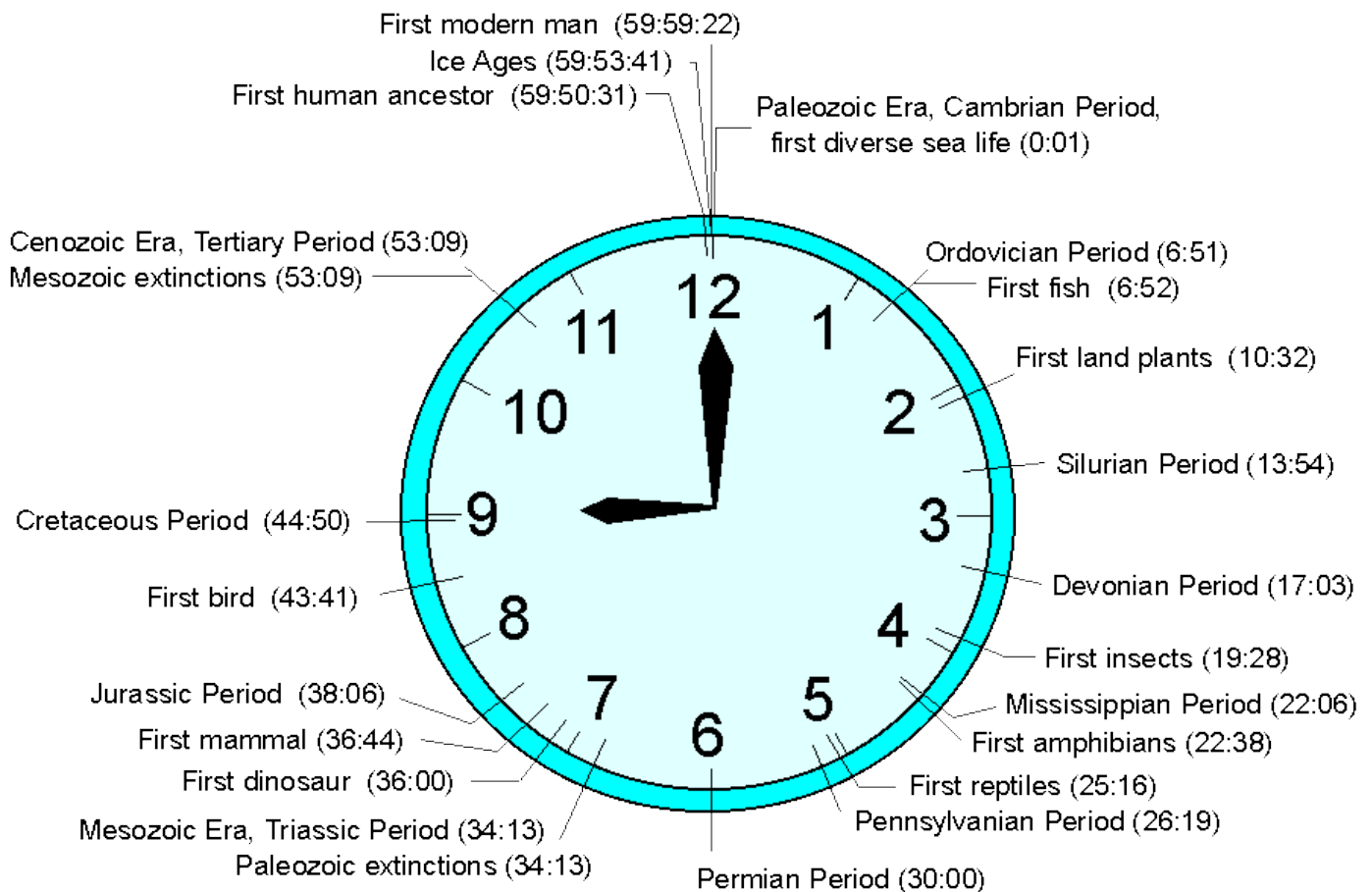
decimal part of the number x 60 = number of seconds.

```
Example:  The Cretaceous extinction occurred 65 million years ago.
     65/76.7=0.847
     60 - 0.874 = 59.153 minutes past the hour
     0.153 x 60 = 9.18 (round this off to 9 seconds)
     The Cretaceous extinction occurs at 59:09 after the hour.
```

Once the dates you wish to use have been converted to time, you can decide how you want to present those dates to your class.

(1) The teacher can simply tell the class that in the next hour they are going to be calling out events in time to give the students a sense of how long it took to get to where the class is today. This can be done as a backdrop to whatever else the class is working on that day.

(2) The teacher can make the entire lesson about Earth history. This takes a little bit of timing, but you can talk about each segment of Earth history as it happens. In the first part of class, discuss how the Earth formed, define a cell, the requirements for life, etc. Then get ready to speed up in the last 10 minutes of class as you discuss the evolution of fish to amphibians to reptiles to birds and mammals, etc.

(3) To make the time clocks exciting for the students, the teacher can assign each an Important Date in Earth History a day or two before the class. Let each student go to the library or provide information about the key date so that they can draw a picture, make a mask, or write a short limerick about their key event. For example, if a student was assigned blue-green algae, they might say "I'm blue-green algae, not much more than slime, but I ruled the Earth for a very long time!" For a mask they might make a headdress that looked like sea weed, or drape themselves in green streamers. This will let each student use their own creativity to illustrate the concept of changes in time.

Because most of the life forms on Earth have been on the planet for only the last 570 million years (the last 10 minutes of class), there won't be much time to demonstrate the changes that have led to the children being in the class room that day. You can try to have the students representing key events in the last 570 million years shout out their topics, but there may be less than a minute between key events in the last 5 minutes of class., and this may require some dramatic orchestration. To better demonstrate the changes since the beginning of the Paleozic Era, do the same exercise the second day of class, using only the last 570 million years of time.

First modern man (59:59:22)
Ice Ages (59:53:41)
First human ancestor (59:50:31)

Paleozoic Era, Cambrian Period,
first diverse sea life (0:01)

Cenozoic Era, Tertiary Period (53:09)
Mesozoic extinctions (53:09)

Ordovician Period (6:51)
First fish (6:52)

First land plants (10:32)

Silurian Period (13:54)

Cretaceous Period (44:50)

Devonian Period (17:03)

First bird (43:41)

First insects (19:28)

Jurassic Period (38:06)

Mississippian Period (22:06)

First mammal (36:44)

First amphibians (22:38)

First dinosaur (36:00)

First reptiles (25:16)

Mesozoic Era, Triassic Period (34:13)

Pennsylvanian Period (26:19)

Paleozoic extinctions (34:13)

Permian Period (30:00)

570 million years in one hour

Click here to get gif image of above clock that can be printed at page size.

To show 570 million years in one hour, each minute equals 9.5 million years, and each second equals 158 thousand years. You can pick events from the Important Dates in Earth History list and calculate, or have students calculate the time for their event as above.

To calculate the time of an event when you are going to show 570 million years in one hour:

Event (millions of years ago) / 9.5 = minutes ago the event occurred

The number calculated will show the minutes from the end of the hour at which the event occurred. You will usually want to calculate the minutes from the beginning of the hour.

60 - minutes ago = minutes from the beginning of the hour. The minutes will be in decimal form. For accuracy, if you wish to calculate seconds from the decimal number (this will be important when you get to man's place in Earth history):

decimal part of the number x 60 = number of seconds.

```
Example:  The Cretaceous extinction occurred 65 million years ago.
      65/9.5=6.84
      60 - 6.84 = 53.16 minutes past the hour
```

0.16 x 60 = 9.6 (round this off to 10 seconds)
The Cretaceous extinction occurs at 53:10 after the hour.