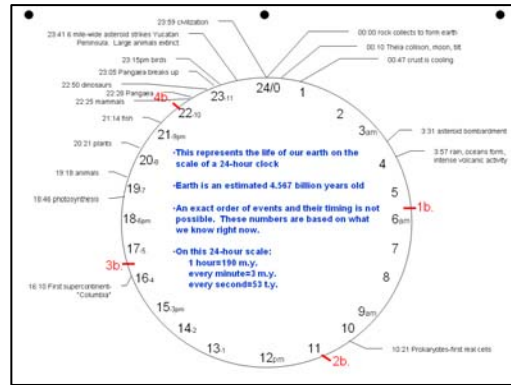


Teacher Notes- “Earth Clock-A Timeline, Past To Present”

Would you believe that teaching earth history can be fun for your students? This lesson reaches back to the beginning of earth, some 4.567 billion years ago, and presents its entire life, up to now, on the scale of a 24-hour clock. The activity initially looks difficult because of the math, but the process is simple and repetitive. Every kind of student can do this, even those who struggle with math.

This activity is broad in perspective, so it can easily adapt to cover several kinds of chapters, like plate tectonics, volcanoes, and adaptations. We even left you some room in the activity for you to add in your own things.



Materials per student:

- 1-bowl, or round object that can be traced around, to make the face of the clock;
5½ “- 6 ½ “ around (a small group of students can share one bowl)
- 1-blank sheet of copy paper, punched with holes along the side
- 1-Student Handout
- 1-calculator

Additional Teacher Materials:

PowerPoint

Beforehand:

- Print extra copies of slide 1 for students who can't read small print on overhead.
- About a week before you plan on doing this, start gearing your mind up for this activity. This is not a lesson you want to do “cold”. Look through your current chapter and find connections. Another good reading is <http://wikipediaondvd.com/nav/art/a/e/5.html> . You'll notice that on this activity we intentionally steered away from the most controversial topics because we didn't want to lose the main point of the lesson- a very general overview of our earth's history.
- If you'd like to add more events to the list, you can write those in the 2 spare boxes at the bottom of the Student Handout. You could also write them on your chalkboard.
- You'll want to do the math yourself two days before this activity so you know exactly what your students will be doing and feeling. If you get a little

confused at some point, that tells you to be that much more clear and deliberate when explaining that part to your students.

- This activity as-is takes about 55-60 minutes to do. That includes having students draw and number the clock face, calculating the times of the events, and putting them on the clock. If you have 45 minute classes then you have 2 options. You could take 10-15 minutes at the end of a class period for students to set up their clock face, and then do the rest the next day. Or, you could do what you can in one class period, and send the remaining calculations and work home with students to finish. That's a little more risky, depending on how mathematically able your students are, but it takes less class time.
- Copy the Student Handout (list of events) for students, and punch holes along the top. There are 2 reasons for these holes- referring to them on the PowerPoint makes it easy to orient the paper during the activity ("See the holes at the top kids? Turn your papers that way."). And if your students keep a science folder, the paper can go immediately in there.

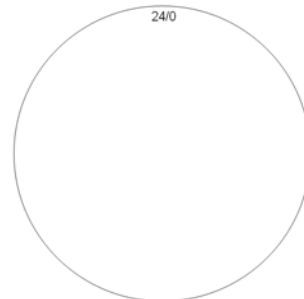
ANSWERS-Earth Clock				
Billions of years	Event	Time (Divide yrs. by 100)	Convert minutes	Hr : Min
03	"Theia" collides, debris forms moon, earth tilts 23 1/2°	$03 \div 100 = 0.03$	$0.03 \times 60 = 1.8$	00 : 10
.15	Crust is cooling	$.15 \div 100 = 0.15$	$0.15 \times 60 = 9$	00 : 47
.667	Asteroid bombardment	$.667 \div 100 = 0.667$	$0.667 \times 60 = 40.02$	03 : 31
.75	Rain, oceans, intense volcanic activity	$.75 \div 100 = 0.75$	$0.75 \times 60 = 45$	03 : 57
1.967	Prokaryotes-first real cells	$1.967 \div 100 = 19.67$	$19.67 \times 60 = 1180.2$	10 : 21
3.07	First supercontinent-"Columbia"	$3.07 \div 100 = 30.7$	$30.7 \times 60 = 1842$	18 : 10
3.567	Photosynthesis	$3.567 \div 100 = 35.67$	$35.67 \times 60 = 2140.2$	18 : 48
3.667	First animals	$3.667 \div 100 = 36.67$	$36.67 \times 60 = 2200.2$	18 : 18
3.867	Plants	$3.867 \div 100 = 38.67$	$38.67 \times 60 = 2320.2$	20 : 21

Procedure:

- Check that students have materials: blank sheet with holes, Student Handout listing events and times, calculator, and pencil.
- Give a brief introduction:

“True or false- the earth is old? (true!)
 We all know that’s true, but the word “old” is a relative term. Most of you think that anything older than you is “old”. Well, maybe.

In today’s activity we’re going to look at some of the biggest events in the history of the earth. Like you, it had a beginning, a period when it was undergoing tremendous change, and a present/now. This is information that we all seem to know, yet today, because we’re assembling it on a continuous scale, it will make more sense than ever before. Sort of like to know you is to look at every event in your life and not just one.”
- Begin the PowerPoint. It will lead you and your students through the activity. Slide 1 shows a large circle.
- Have students first trace a circle around the bowl that’s between 5 1/2 and 6 1/2 inches in diameter. Any larger and we won’t be able to fit our labels on the outside. Any smaller and the inner statements won’t fit either.

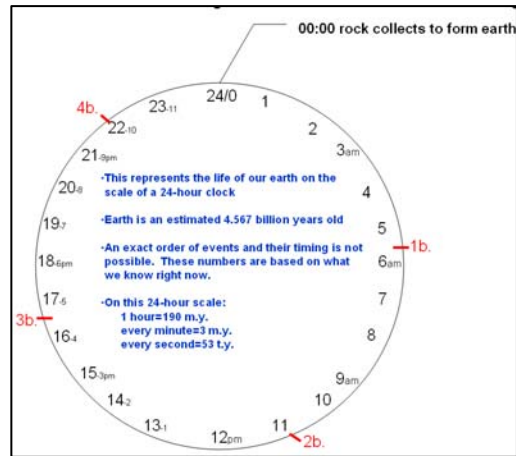


- Advance the PowerPoint to show the “24/0” at the top of the circle and have students put this on theirs.

“Now, we’re used to clocks with hands that go around two times in one day, but this clock is different. This zero represents where the earth first formed. Between it and the 24, notice we’ve just gone around the circle once, is all 24 hours. It might be confusing at first, but this wouldn’t work any other way. Using this clock we get to keep one long continuous scale, while applying it to the unit you’re most familiar with- time.”

- Now have students put the 6, 12, and 18 on. Don’t use rulers or compasses to be exact; that’s not necessary. Next to 18 (and anything on the left side of the clock for that matter) we’ll be putting a small “12 hour real time” that we’re more familiar with. So, next to 18 will be a “6”, as in 6 o’clock pm, and so forth.

- Keep advancing the PowerPoint, adding hours 3, 9, 15, and 21 in between the other numbers, and then finally all the remaining individual numbers. The hours were put on this way because it’s easier to keep things halfway in the right place when thinking in terms of halves and fourths.



- Read aloud the 4 blue statements in the middle and have students copy them.*¹ They are meant to focus everyone, get us all on the same page, and set a serious tone for this activity. The 3rd one (exact time/order) is most important. No, we don’t know anything for sure. But there was a time when early earth was just forming. In between then and now, things have changed. The events on your sheet and their times is our best guess right now.

- Mark the billion year increments at every 5 ½ hrs (shown in red on the PowerPoint).*²

- Advance the slide and have students copy the very first event (00:00 rock collects to form earth) as shown.

- With the clock set up, now turn your attention to the worksheet. Explain the 5 columns.

Earth Clock

Billions of years	Event	Time (Divide yrs ÷ .190)	Convert minutes	Hr : Min
.03	"Theia" collision, debris forms moon, earth tilts 23 ½ °	$.03 \div .190 = \boxed{00}.\boxed{16}$ <small>Hours Hundredths of an hour</small>	$.16 \times 60 = 9.6 = 10$	00 : 10

Column 1- Billions of Years This tells the age at which the event happened, in billions of years. .03 billion years is the same as 30 million years, and .75 billion = 750 million.

Column 2- Event A brief description of what happened

Column 3- Time Here students will divide the time from column 1 by .190. That converts billions of years to hours.

Column 4- Convert Minutes In this column students will multiply the hundredths of hours (the decimal only from the previous answer) by 60 to convert to real minutes.

Column 5- Hr : Min Where students put their final time they computed.

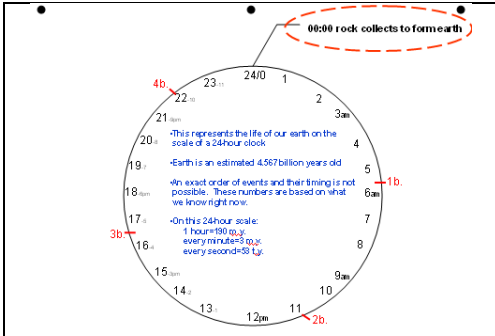
12. It's finally time to do some math! Have everyone grab a calculator. No calculator, no help later.

"Students, if you give me your complete attention for the next 5 minutes, I'll give you all the help you need later. If you get stuck, I'll stay with you and help you until you understand. If you don't, and I'll be watching to see who stays with me, then I won't be able to help you. I say that because if you don't pay attention, it WILL confuse you when you try and do it without any instructions, and there are other people who were paying attention who need help, so they are the ones I will help."

(end of Teacher Notes preview)

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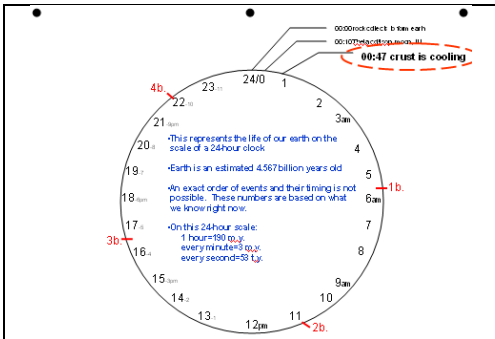


Earth Clock

Billions of years	Event	Time (Divide yrs ÷ 190)	Convert minutes	Hr : Min
.03	"Theia" collision, debris forms moon, earth tilts 23 1/2 °	$.03 \div .190 = 0.16$	$16 \times 60 = 9.6 = 10$	00 : 10
.15	Crust is cooling			:
.667	Asteroid bombardment			:

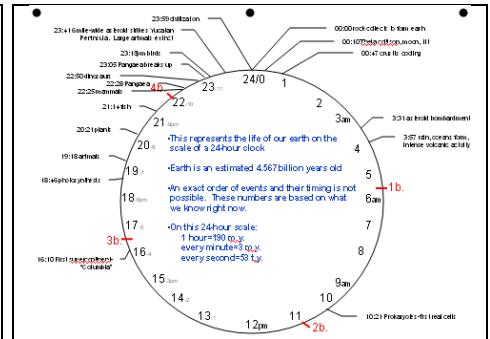
Earth Clock

Billions of years	Event	Time (Divide yrs ÷ 190)	Convert minutes	Hr : Min
.03	"Theia" collision, debris forms moon, earth tilts 23 1/2 °	$.03 \div .190 = 0.16$	$16 \times 60 = 9.6 = 10$	00 : 10
.15	Crust is cooling	$.15 \div .190 = 0.79$	$79 \times 60 = 47.4$	00 : 47
.667	Asteroid bombardment			:



Earth Clock

Billions of years	Event	Time (Divide yrs ÷ 190)	Convert minutes	Hr : Min
.03	"Theia" collision, debris forms moon, earth tilts 23 1/2 °	$.03 \div .190 = 0.16$	$16 \times 60 = 9.6 = 10$	00 : 10
.15	Crust is cooling	$.15 \div .190 = 0.79$	$79 \times 60 = 47.4$	00 : 47
.667	Asteroid bombardment	$.667 \div .190 = 3.51$	$51 \times 60 = 30.6$	03 : 31



◆ Student Handout

Earth Clock

Billions of years	Event	Time (Divide yrs ÷ 190)	Convert minutes	Hr : Min
.03	"Theia" collision, debris forms moon, earth tilts 23 1/2 °	$.03 \div 190 = 0.16$	$16 \times 60 = 9.6 = 10$	00 : 10
.15	Crust is cooling	$.15 \div 190 = 0.79$	$79 \times 60 = 47.4$	00 : 47
.667	Asteroid bombardment	$.667 \div 190 = 3.51$	$51 \times 60 = 30.6$	03 : 31
.75	Rain, oceans, intense volcanic activity			:
1.967	First cyanobacteria cells			:
3.07	First supercontinent "Columbia"			:
3.567	Photosynthesis			:
3.667	First animals			:
3.867	Plants			:
4.037	Fish			:
4.257	Mammals			:
4.267	Fungus			:
4.337	Dinosaurs			:
4.387	Fungus breaks up			:
4.417	Birds			:
4.502	6 mile-wide asteroid strikes Yucatan Peninsula. Large animals extinct			:

◆ Answers to handout

ANSWERS-Earth Clock

Billions of years	Event	Time (Divide yrs ÷ 190)	Convert minutes	Hr : Min
.03	"Theia" collision, debris forms moon, earth tilts 23 1/2 °	$.03 \div 190 = 0.16$	$16 \times 60 = 9.6 = 10$	00 : 10
.15	Crust is cooling	$.15 \div 190 = 0.79$	$79 \times 60 = 47.4$	00 : 47
.667	Asteroid bombardment	$.667 \div 190 = 3.51$	$51 \times 60 = 30.6$	03 : 31
.75	Rain, oceans, intense volcanic activity	$.75 \div 190 = 3.95$	$39 \times 60 = 57$	03 : 57
1.967	First cyanobacteria first cells	$1.967 \div 190 = 10.35$	$10.35 \times 60 = 21$	10 : 21
3.07	First supercontinent "Columbia"	$3.07 \div 190 = 16.16$	$16 \times 60 = 30$	16 : 10
3.567	Photosynthesis	$3.567 \div 190 = 18.77$	$77 \times 60 = 46$	18 : 46
3.667	First animals	$3.667 \div 190 = 19.30$	$30 \times 60 = 18$	19 : 18
3.867	Plants	$3.867 \div 190 = 20.35$	$35 \times 60 = 21$	20 : 21
4.037	Fish	$4.037 \div 190 = 21.24$	$24 \times 60 = 14$	21 : 14
4.257	Mammals	$4.257 \div 190 = 22.41$	$41 \times 60 = 25$	22 : 25
4.267	Fungus	$4.267 \div 190 = 22.46$	$46 \times 60 = 28$	22 : 28
4.337	Dinosaurs	$4.337 \div 190 = 22.83$	$83 \times 60 = 50$	22 : 50
4.387	Fungus breaks up	$4.387 \div 190 = 23.09$	$9 \times 60 = 05$	23 : 05
4.417	Birds	$4.417 \div 190 = 23.25$	$25 \times 60 = 15$	23 : 15
4.502	6 mile-wide asteroid strikes Yucatan Peninsula. Large animals extinct	$4.502 \div 190 = 23.69$	$69 \times 60 = 41$	23 : 41
4.559	Civilization	$4.559 \div 190 = 23.99$	$99 \times 60 = 59$	23 : 59

◆ Drawings & Pictures

◆ Quick Notes

Teacher *Quick Notes*- "Earth Clock"

Materials per student:

- 1-bowl, or round object that can be traced around, to make the face of the clock;
- 5 1/2" x 8 1/2" string (a small group of students can share one bowl)
- 1-blank sheet of copy paper, punched with holes along the side
- 1-Student Handout-Earth Clock (in the *Resources* folder)
- 1-calculator

Procedure:

1. Check that students have a blank sheet with holes, Student Handout listing events and times, calculator, and pencil.
2. Have students trace a circle around the bowl.
3. Add times to the circle, as shown on the PowerPoint.
4. Copy the 4 blue statements in the middle.
5. Mark the billion year increments at every 5 1/4 hrs.
6. Copy the very first event label (00-00 rock collects to form earth).