

# Physical Science 101

Earth Science: Geology, Oceanography, Meteorology, Astronomy



*What is Earth Science?*

*Astronomy*  
*Geology*  
*Climatology*  
*Paleoclimatology*  
*Glaciology*  
*Oceanography*  
*Environmental Science*  
*Mineralogy*  
*Seismology*  
*Geology*  
*Volcanology*  
*and more...*

What is the name of the science that deals with earthquakes?

- A. Volcanology
- B. Meteorology
- C. Geology
- D. Seismology
- E. Oceanography



What is the name of the science that deals with weather?

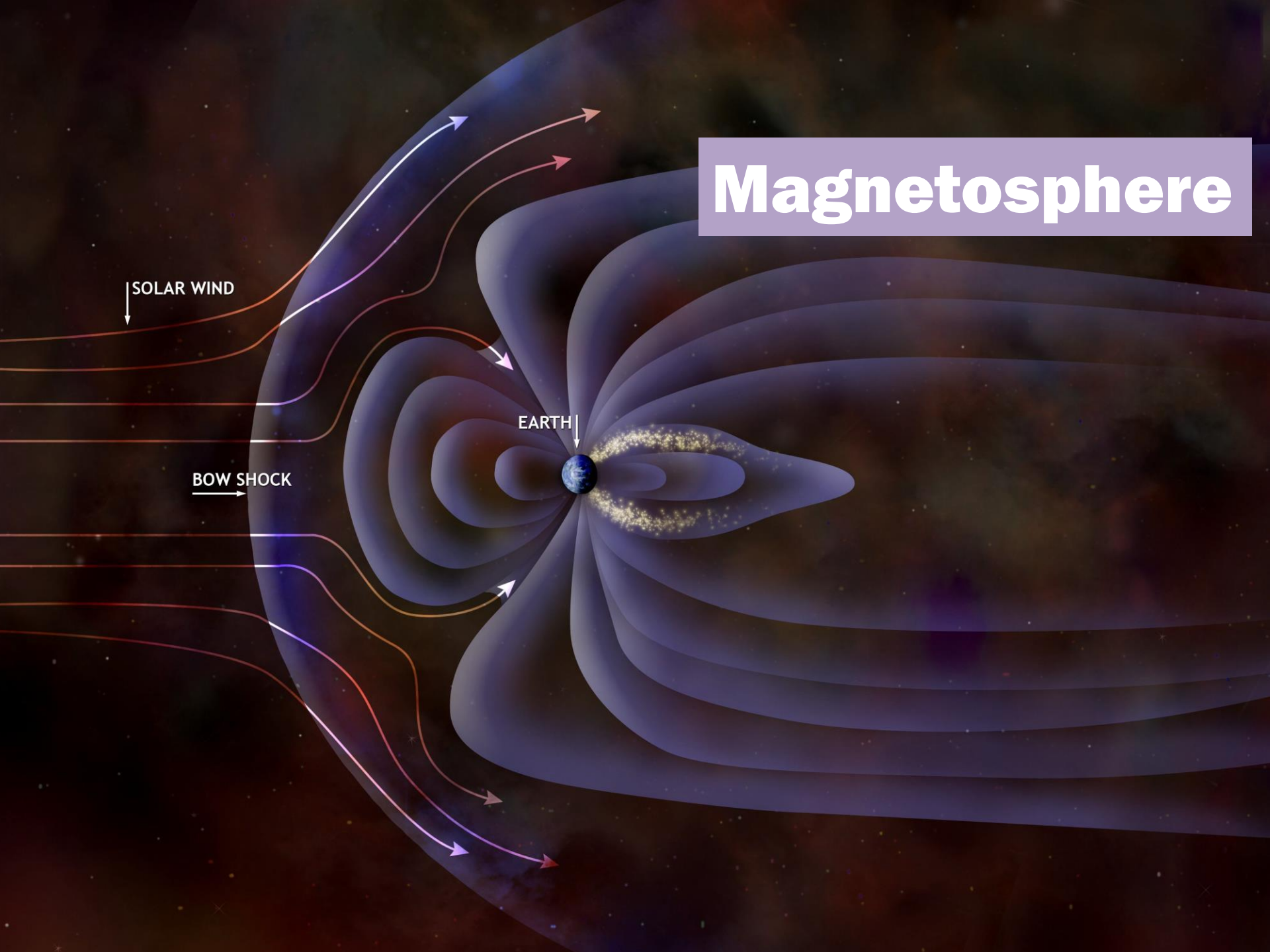
- A. Volcanology
- B. Meteorology
- C. Geology
- D. Seismology
- E. Oceanography

What does the prefix paleo mean?

What does the suffix –ology mean?

# *Earth's Spheres*

# Magnetosphere



SOLAR WIND

BOW SHOCK

EARTH

# Atmosphere







**Cryosphere**





**Geosphere**



A wide waterfall cascading over a rocky ledge, with water mist rising from the base. The water is a deep blue-green color, and the surrounding landscape is rocky and sparsely vegetated.

# Hydrosphere

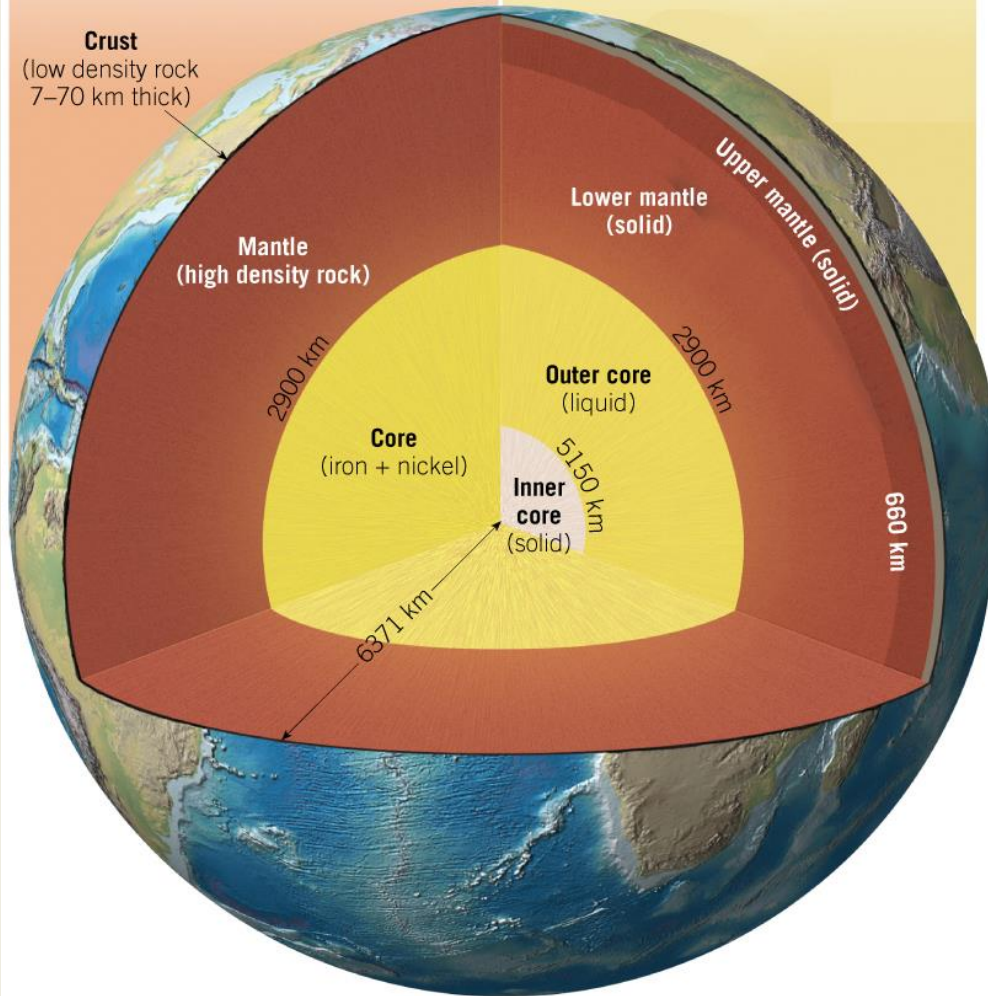


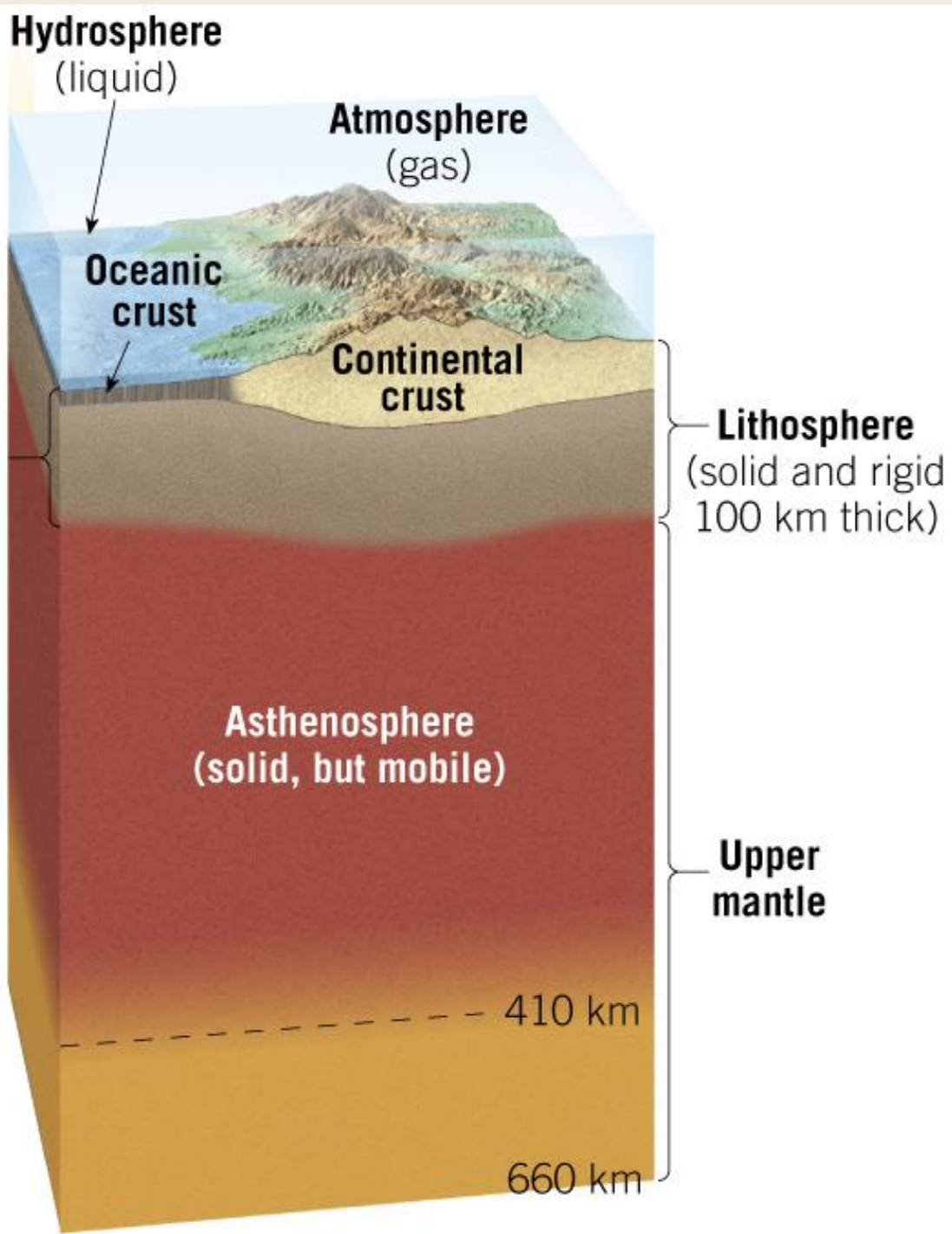
Layering by  
Chemical Composition

The left side of this cross section shows that there are three different layers based on differences in composition.

Layering by  
Physical Properties

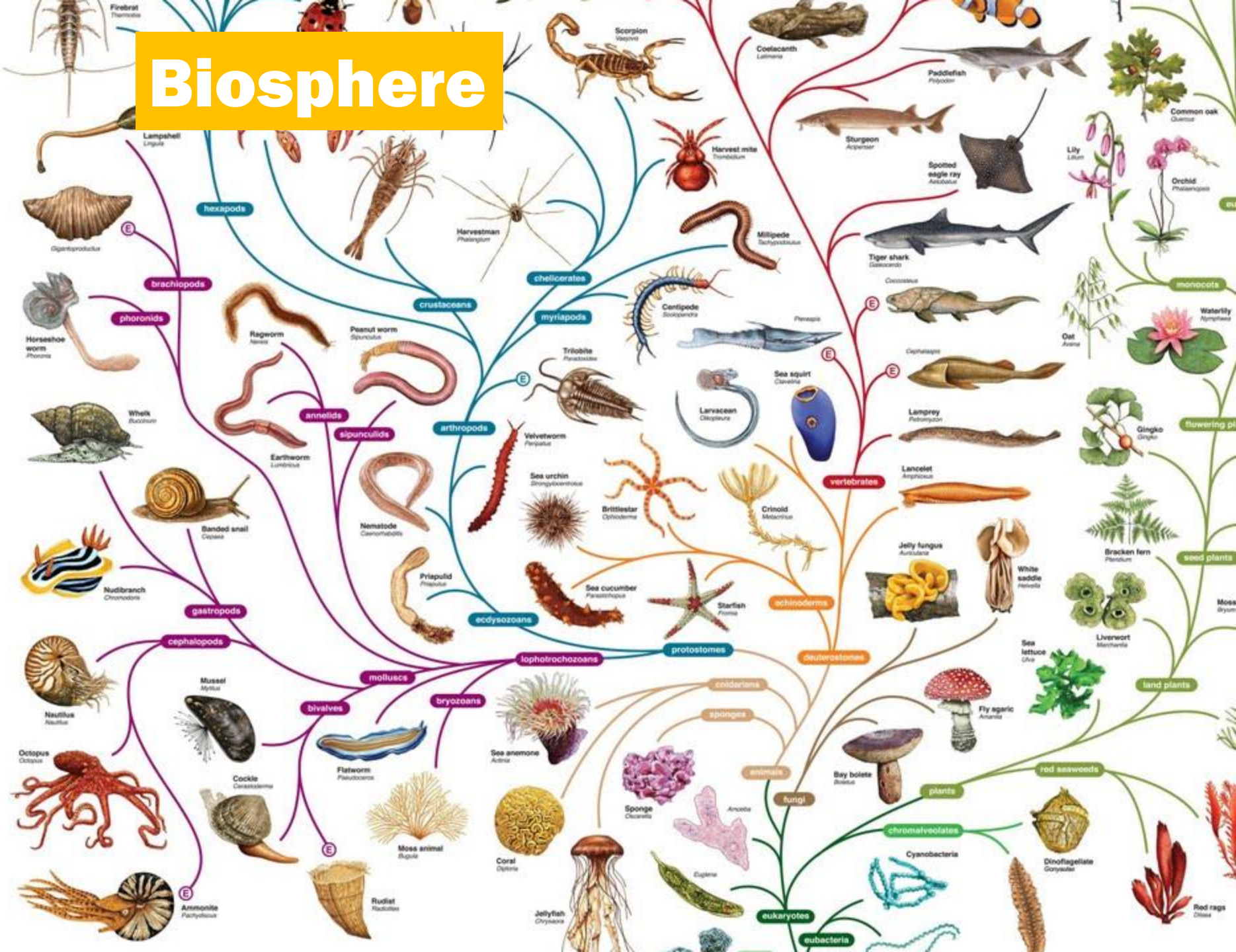
Layers on the right side are based on factors such as whether the layer is liquid or solid, weak or strong.







# Biosphere







# Anthrosphere



What is the name of the sphere that deals with glaciers?

- A. Lithosphere
- B. Cryosphere
- C. Atmosphere
- D. Magnetosphere
- E. Anthrosphere

In what sphere would you place each of the following?

Amazon River

Antarctic Continent

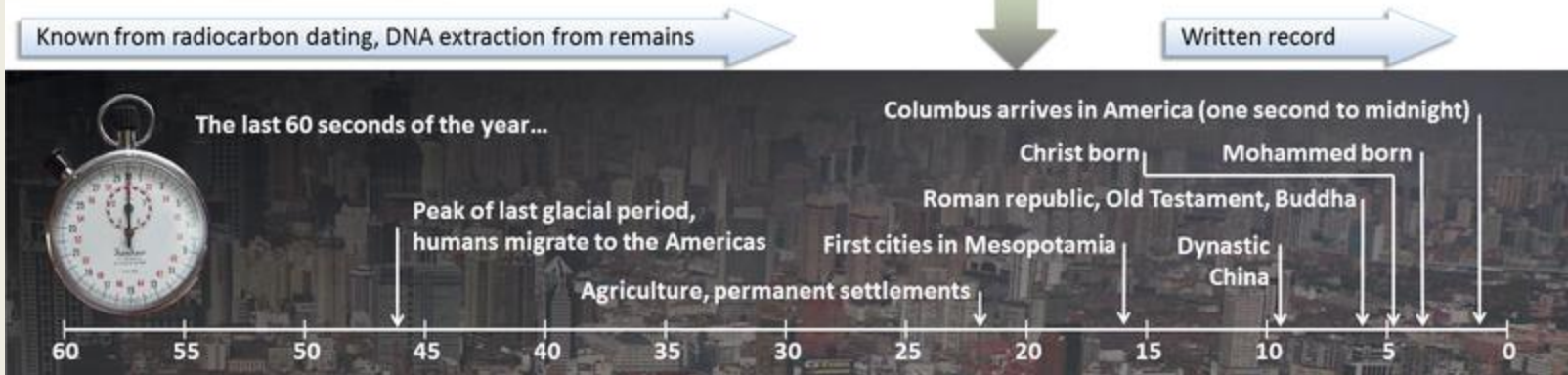
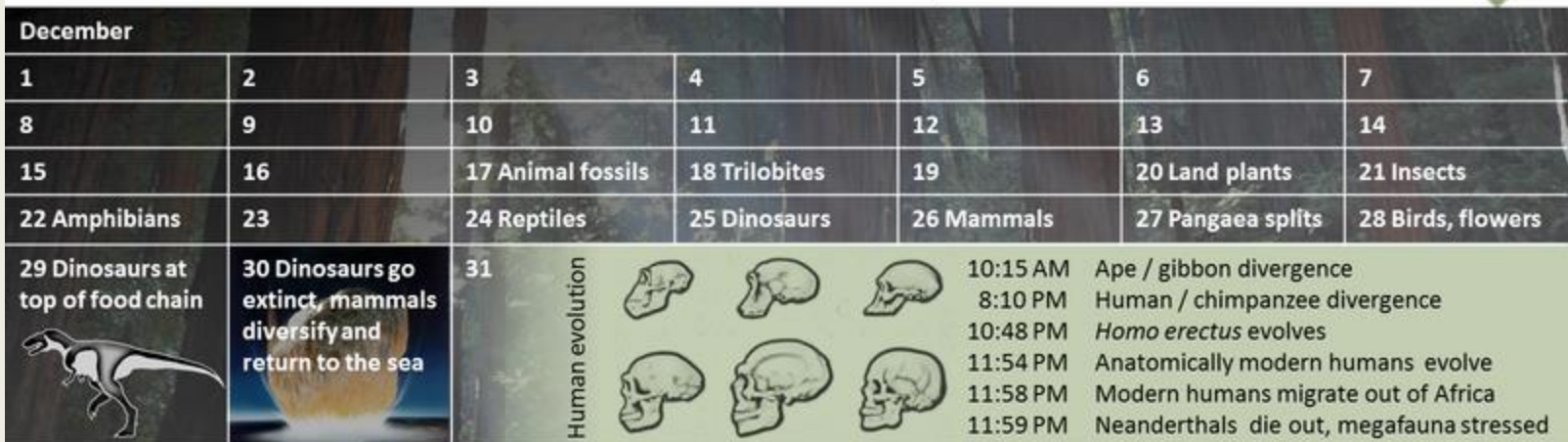
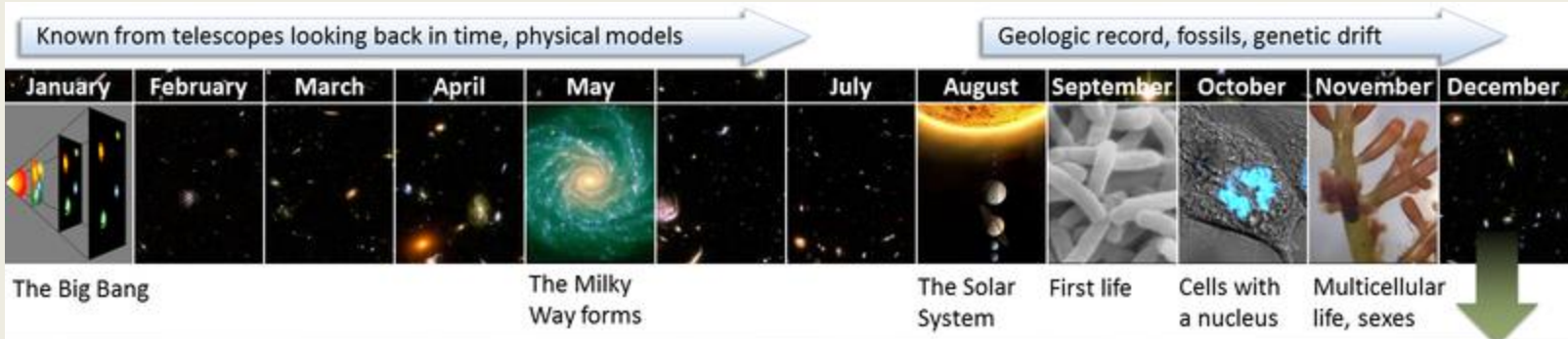
You and Me

Frogs

Volcanoes

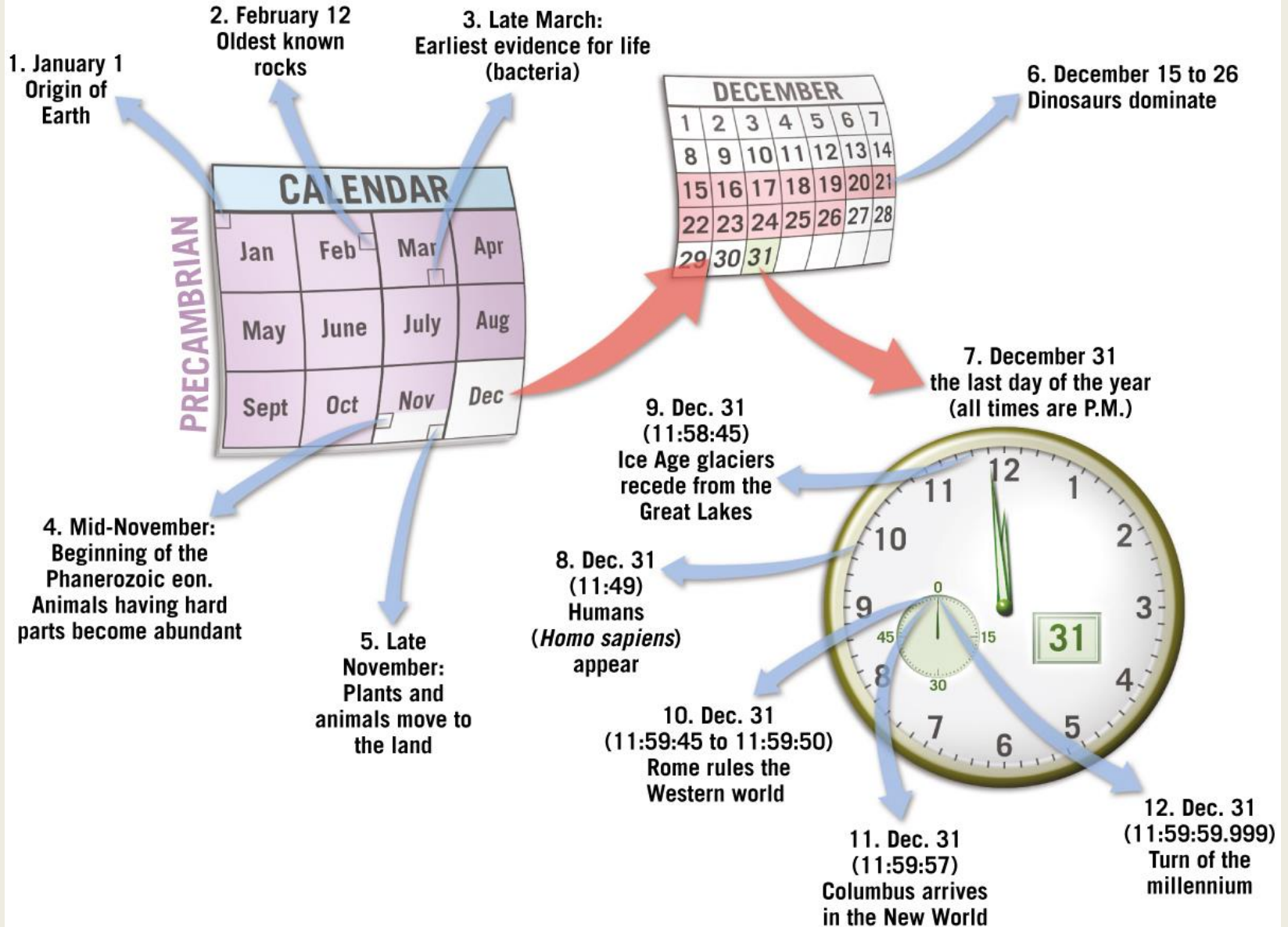
Clouds

*Deep Time*





# What if we compress the 4.6 billion years of Earth history into a single year?



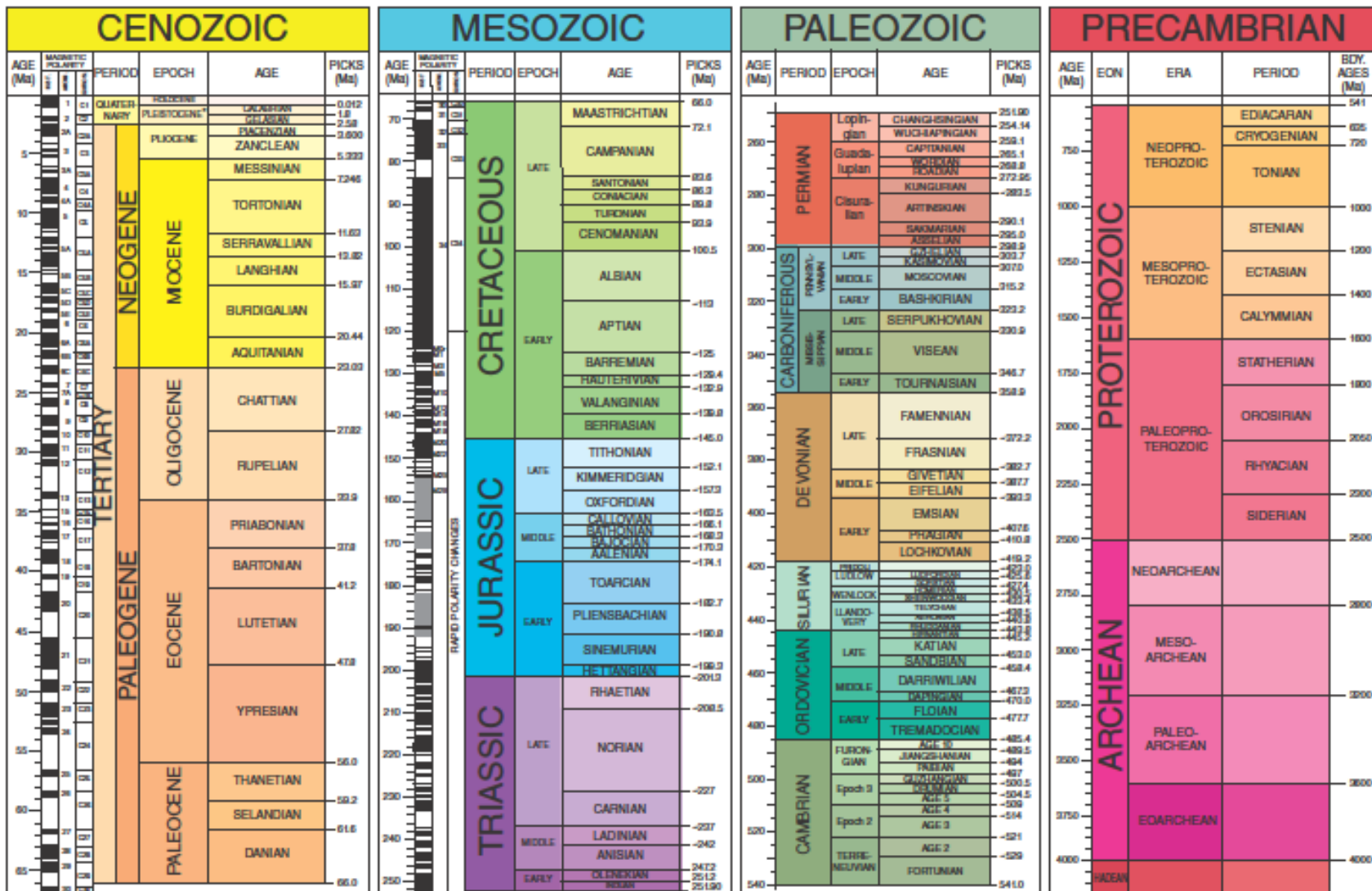
# How old is the Earth?

- A. About 6000 years old
- B. About 400 thousand years old
- C. About 600 million years old
- D. About 4 billion years old
- E. About 13 billion years old

# How old is the Universe?

- A. About 6000 years old
- B. About 400 thousand years old
- C. About 600 million years old
- D. About 4 billion years old
- E. About 13 billion years old

# GSA GEOLOGIC TIME SCALE v. 5.0



Walker, J.D., Galloway, J.W., Browning, S.A., and Babcock, L.E., compilers, 2016, Geologic Time Scale v. 5.0: Geological Society of America, <https://doi.org/10.1130/2016.GT500B/PBC>. ©2016 The Geological Society of America.

\*The Pleistocene is divided into four ages, but only two are shown here. What is shown as Galabrian is actually three ages—Galabrian from 1.80 to 0.791 Ma, Middle from 0.791 to 0.125 Ma, and Late from 0.125 to 0.0117 Ma.

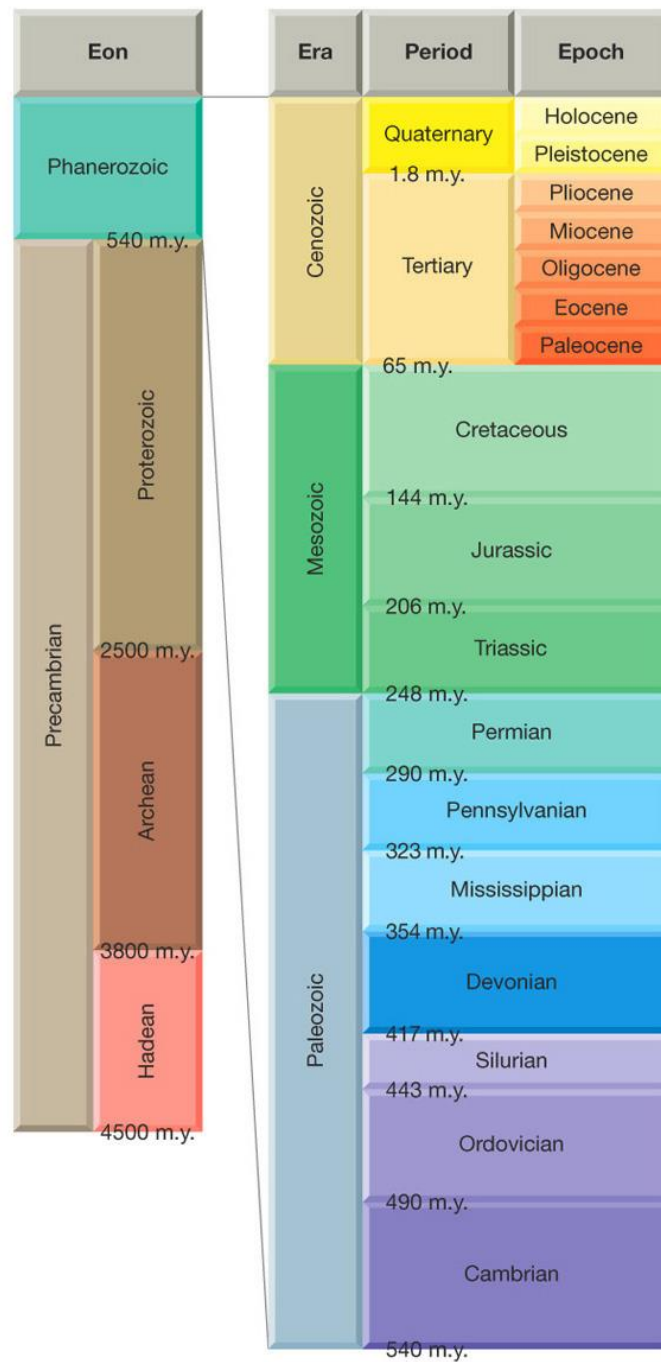
The Cenozoic, Mesozoic, and Paleozoic are the Eras of the Phanerozoic Era. Names of eras and age boundaries usually follow the Gradstein et al. (2012), Cohen et al. (2012), and Cohen et al. (2013, updated) compilations. Numerical age estimates and picks of boundaries usually follow the Cohen et al. (2013, updated) compilation. The numbered epochs and ages of the Cambrian are provisional. A “?” before a numerical age estimate typically indicates an associated error of ±0.4 to over 1.6 Ma.

#### REFERENCES CITED

- Cohen, K.M., Finney, S., and Gibbard, P.L., 2012, International Chronostratigraphic Chart: International Commission on Stratigraphy, [www.stratigraphy.org](http://www.stratigraphy.org) (accessed May 2012). (Chart reproduced for the 34th International Geological Congress, Brisbane, Australia, 5–10 August 2012).
- Cohen, K.M., Finney, S.E., Gibbard, P.L., and Fan, J.-X., 2013, The ICS International Chronostratigraphic Chart: Episodes v. 36, no. 3, p. 199–204 (published 2012, v. 2, <http://www.stratigraphy.org/index.php/ics-chart-timescale>, accessed May 2013).
- Gradstein, F.M., Ogg, J.G., Schmitz, M.D., et al., 2012, The Geologic Time Scale 2012: Boston, USA, Elsevier, <https://doi.org/10.1016/B978-0-444-59425-5.00004-4>.

Previous versions of the time scale and previously published papers about the time scale and its evolution are posted to <http://www.geosociety.org/timescale>.





What is the K-T boundary and what is its significance?

Did dinosaurs and humans coexist?

A. Yes

B. No

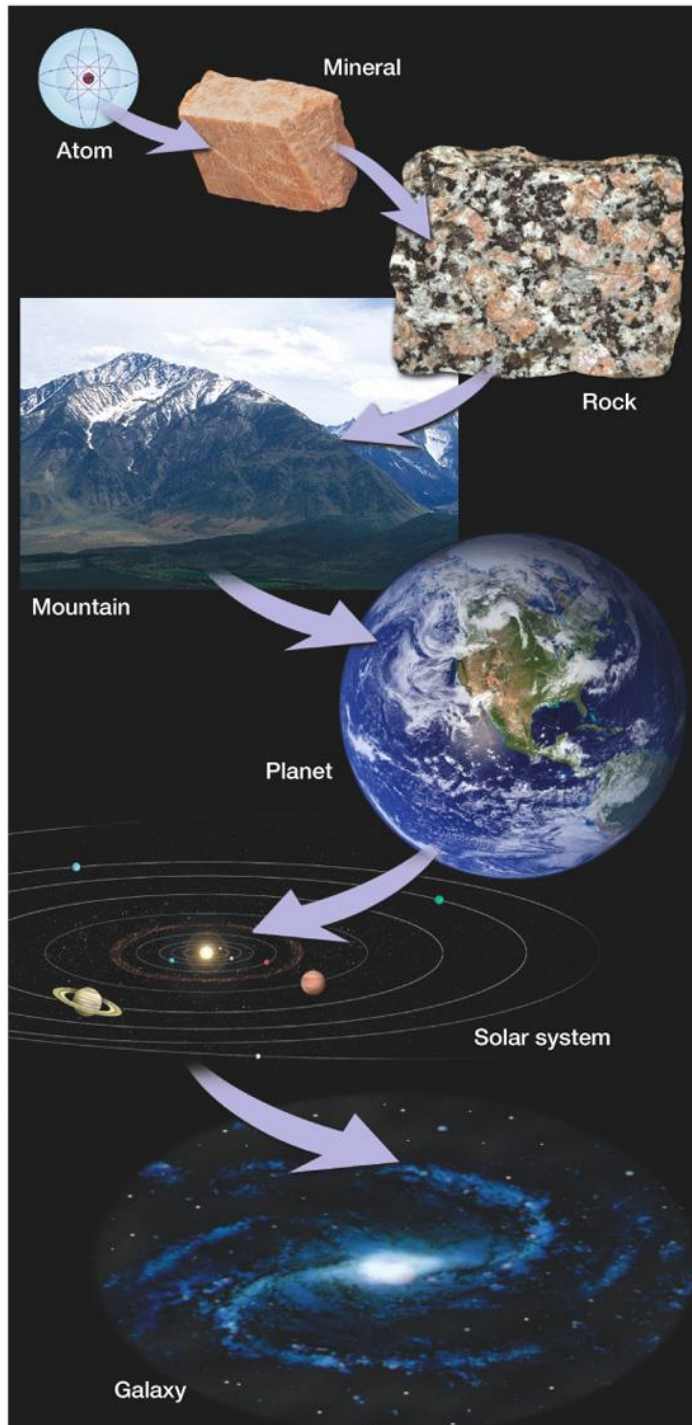




What is an anachronism?



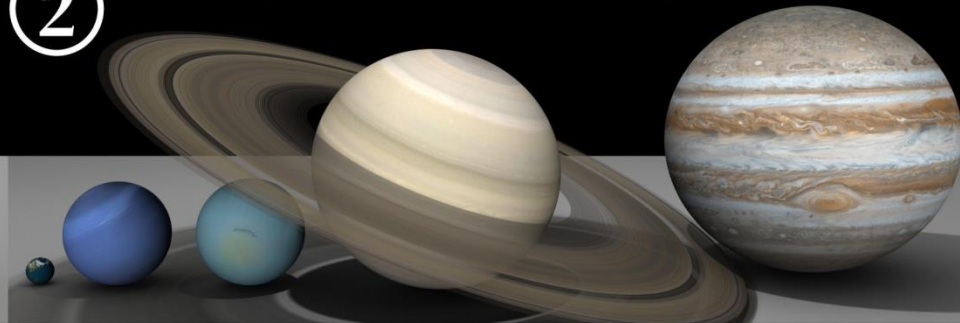
# *Scales of Measurement*



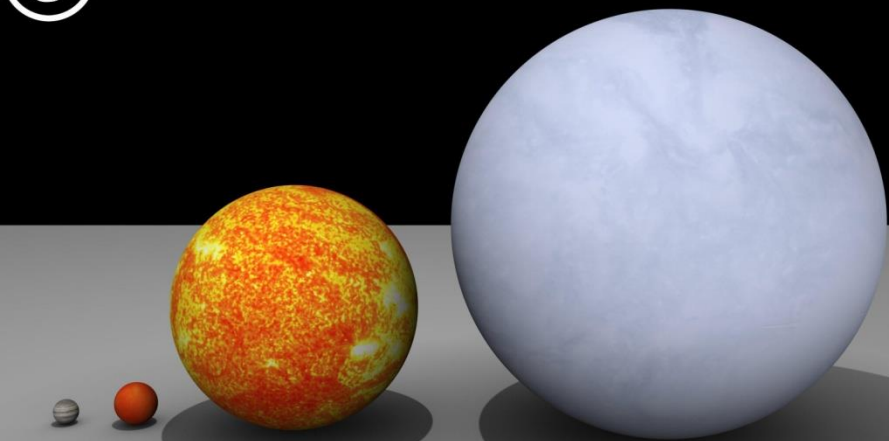
① Mercury < Mars < Venus < Earth



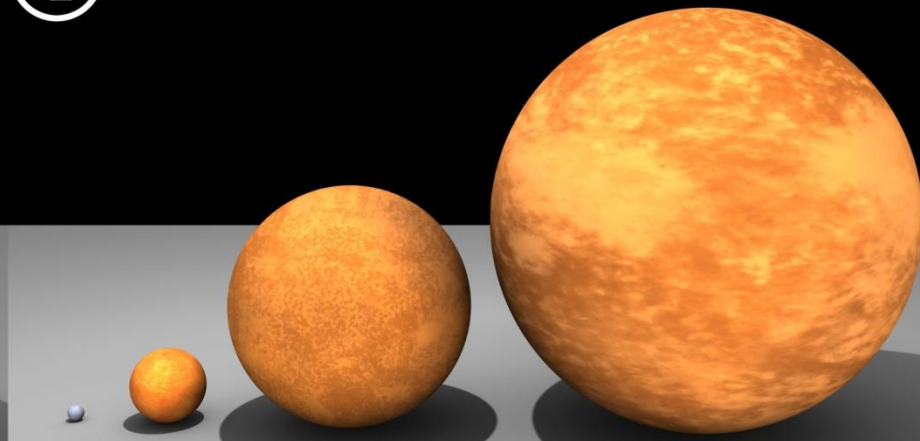
② Earth < Neptune < Uranus < Saturn < Jupiter



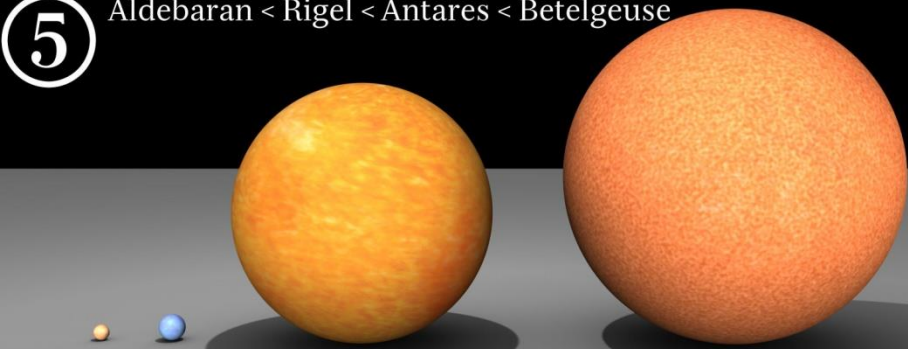
③ Jupiter < Wolf 359 < Sun < Sirius



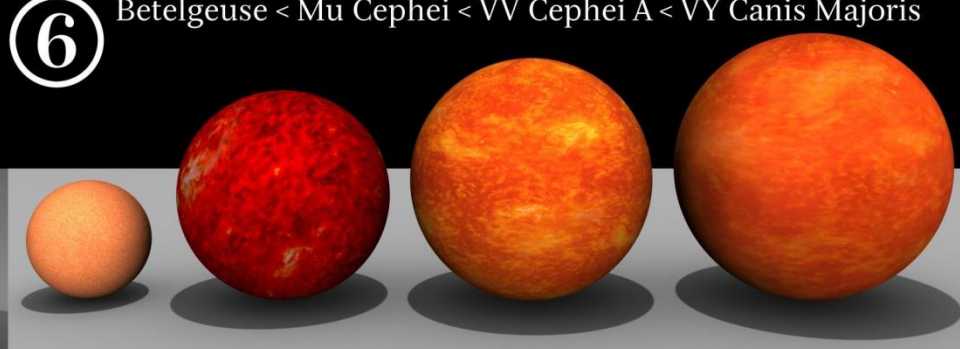
④ Sirius < Pollux < Arcturus < Aldebaran

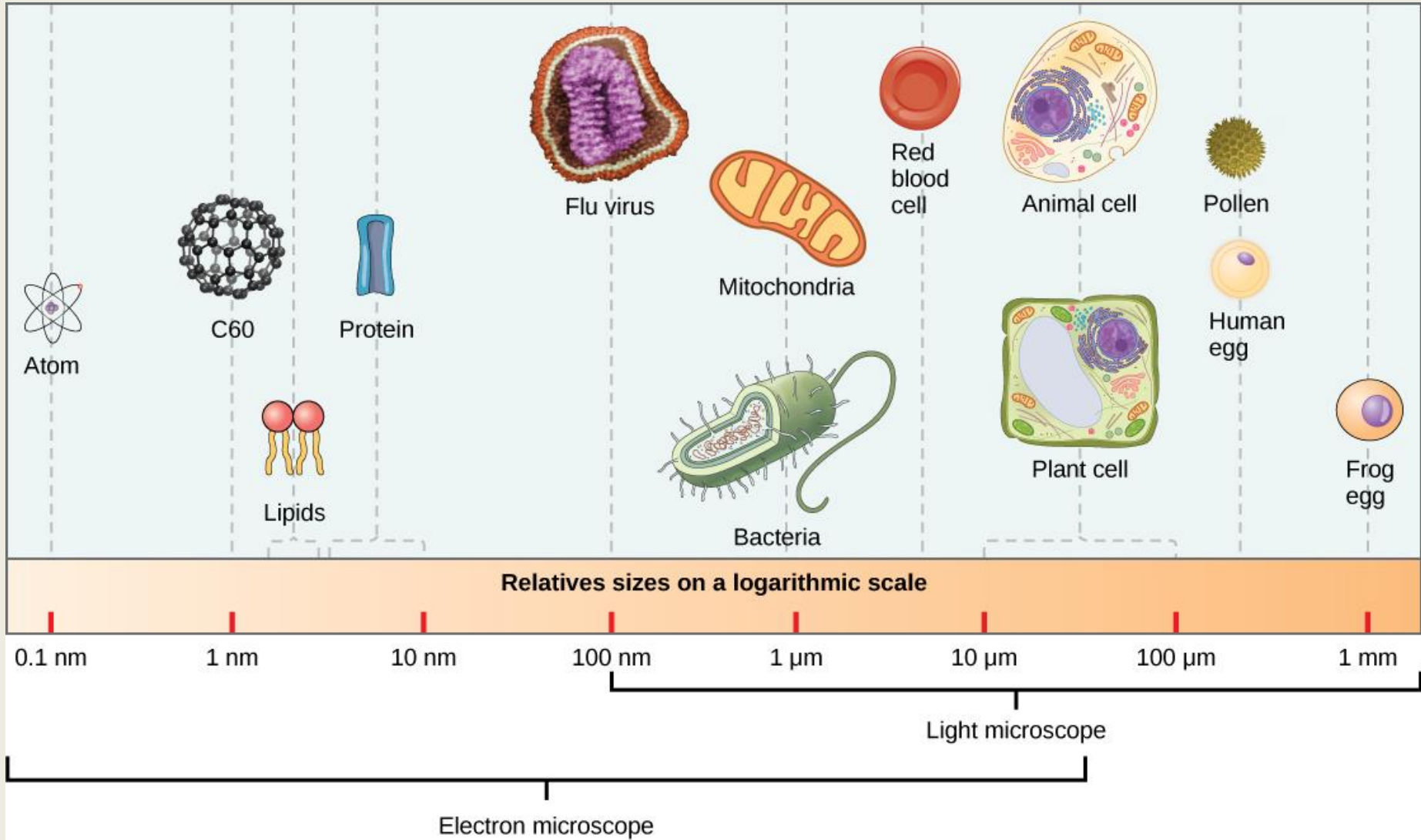


⑤ Aldebaran < Rigel < Antares < Betelgeuse



⑥ Betelgeuse < Mu Cephei < VV Cephei A < VY Canis Majoris



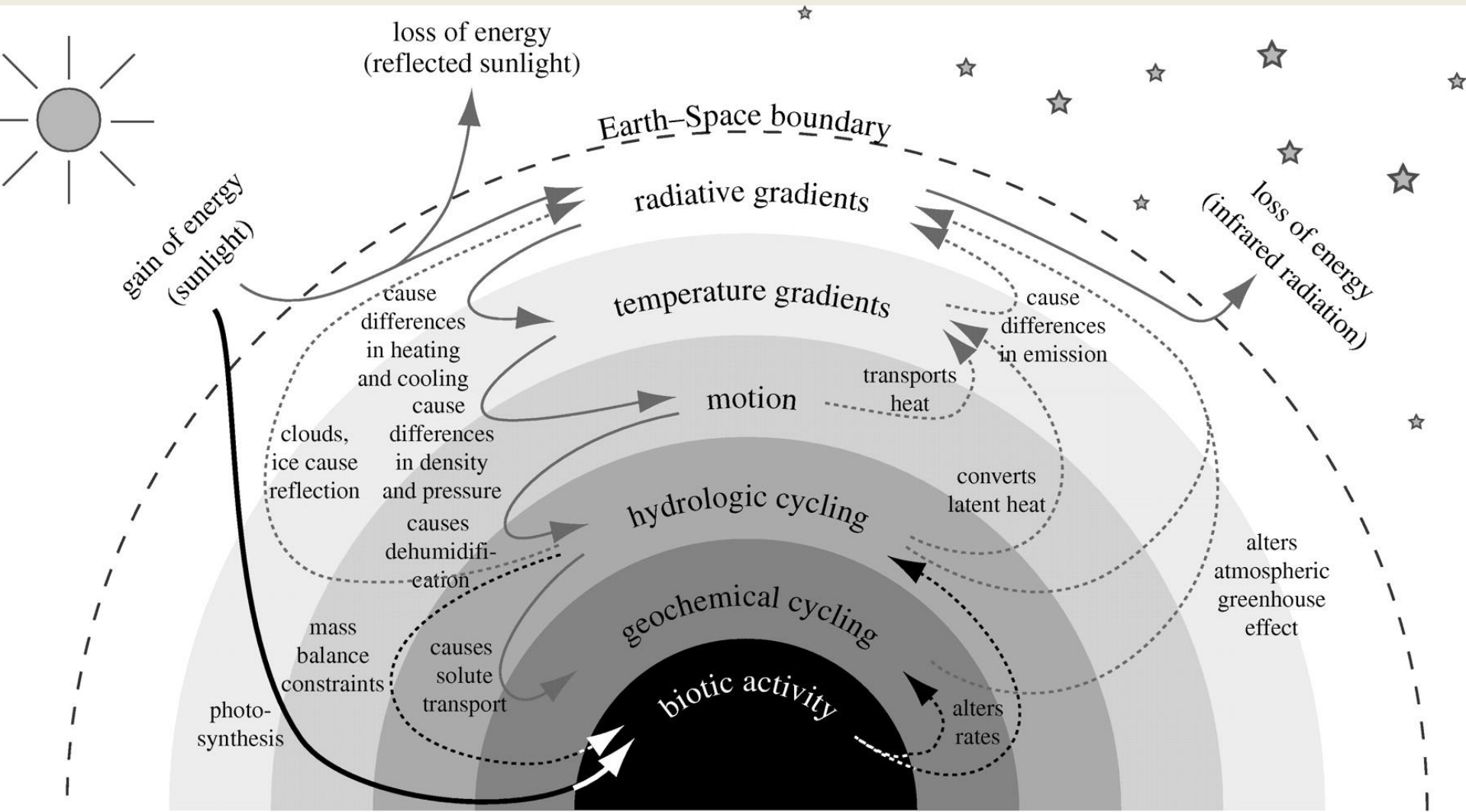


How many nanometers in a meter?

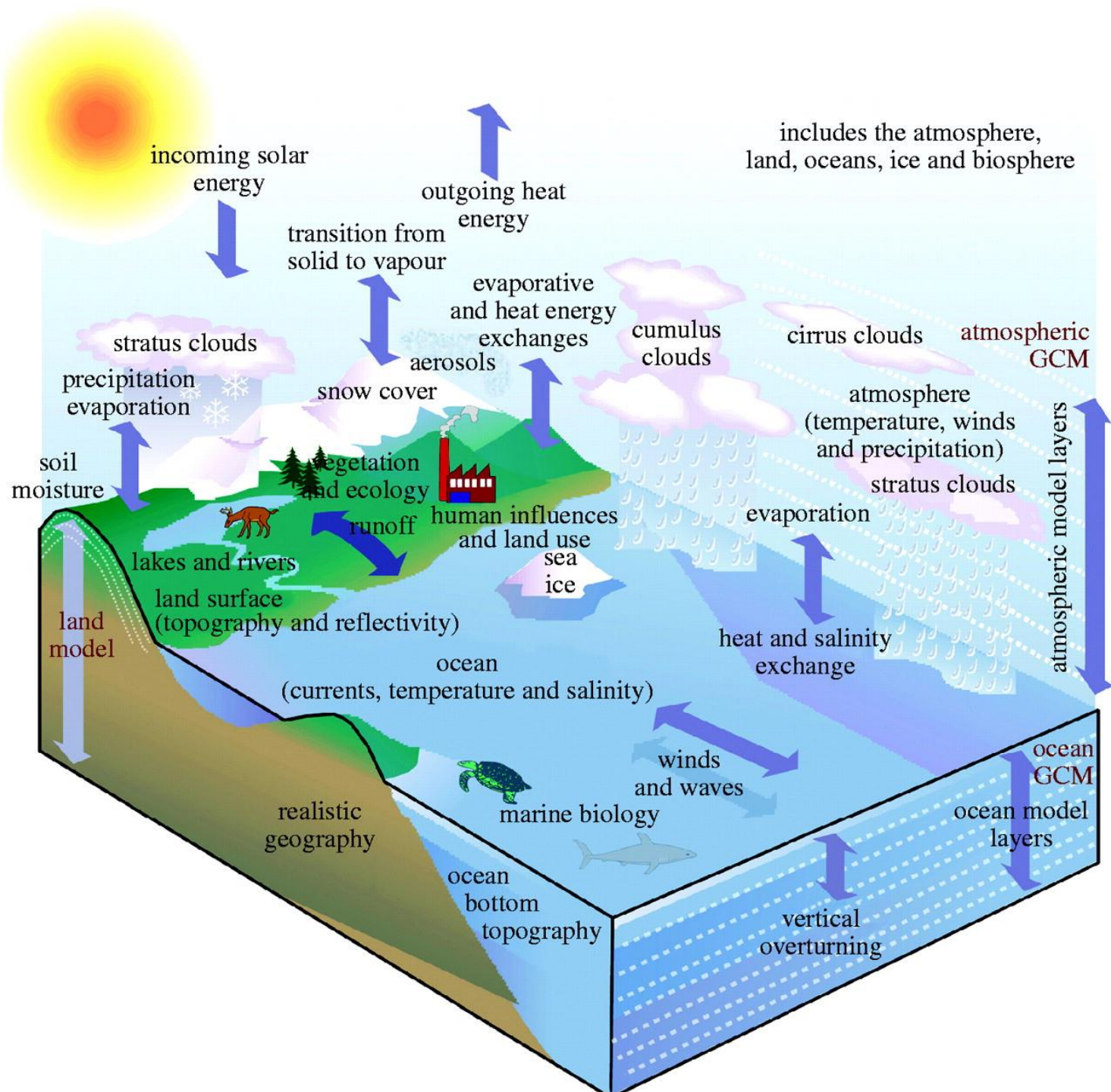
- A. 100 (one hundred)
- B. 1 000 (one thousand)
- C. 1 000 000 (one million)
- D. 1 000 000 000 (one billion)
- E. 1 000 000 000 000 (one trillion)

# *Earth's Systems*

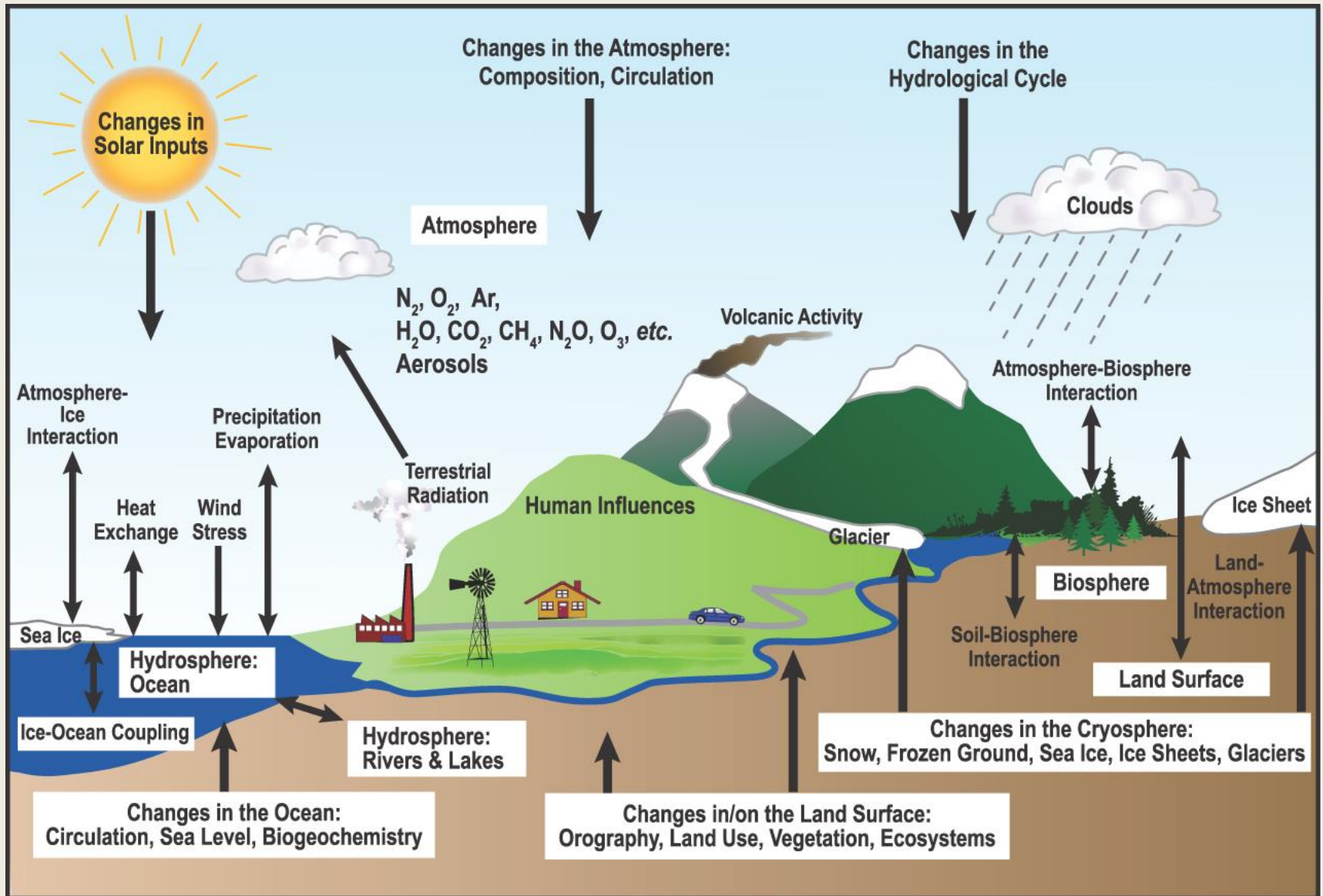




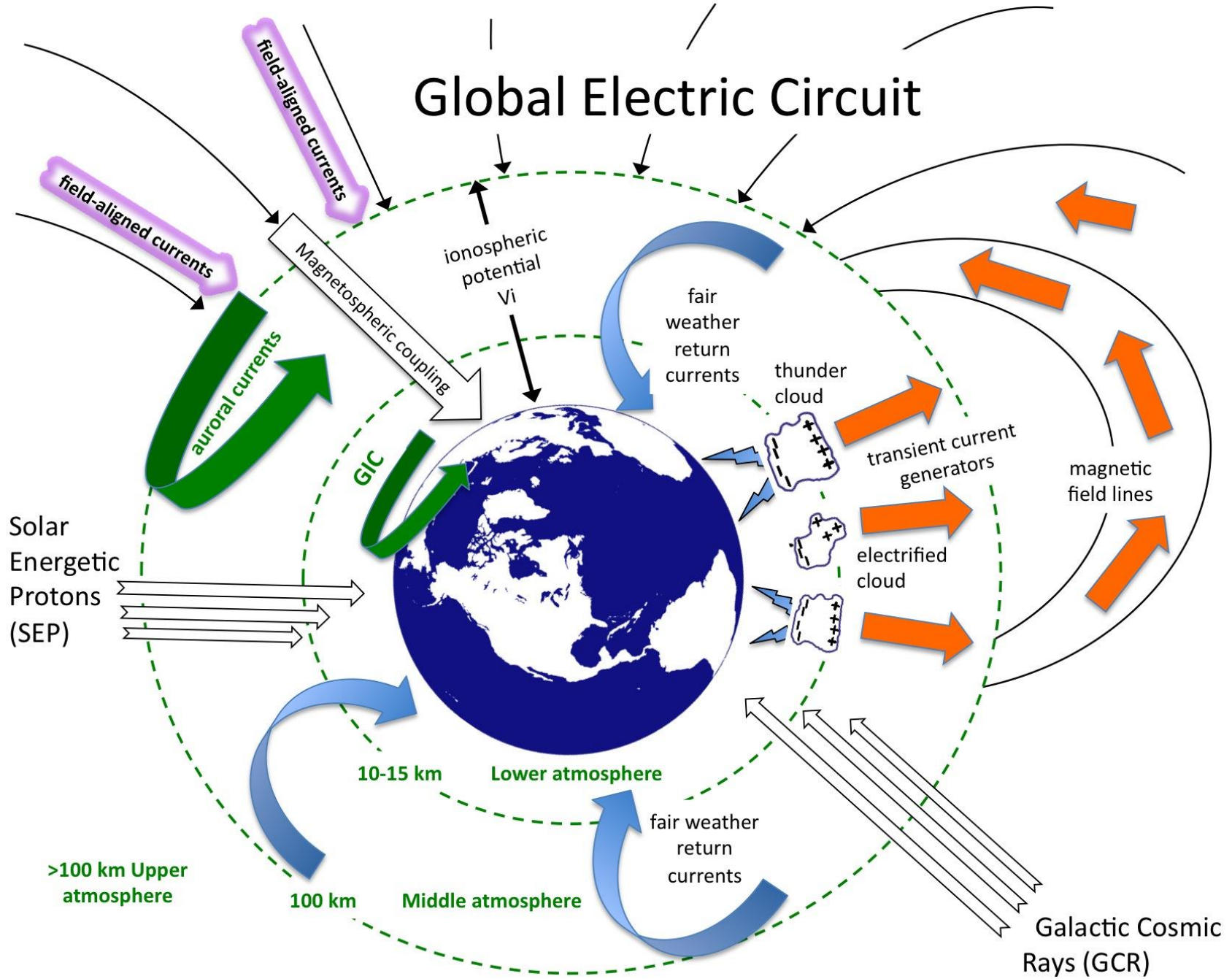
the Earth system

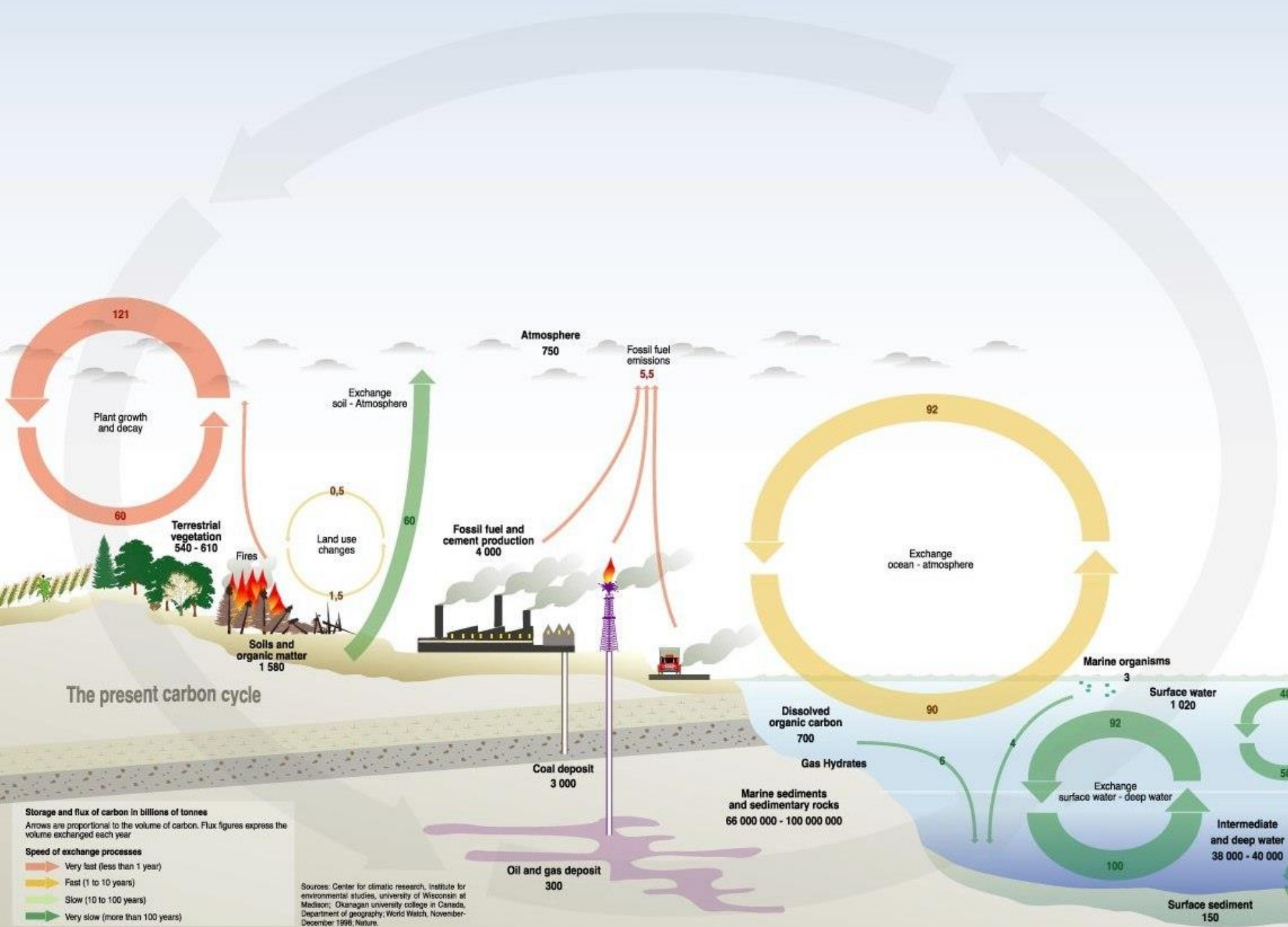




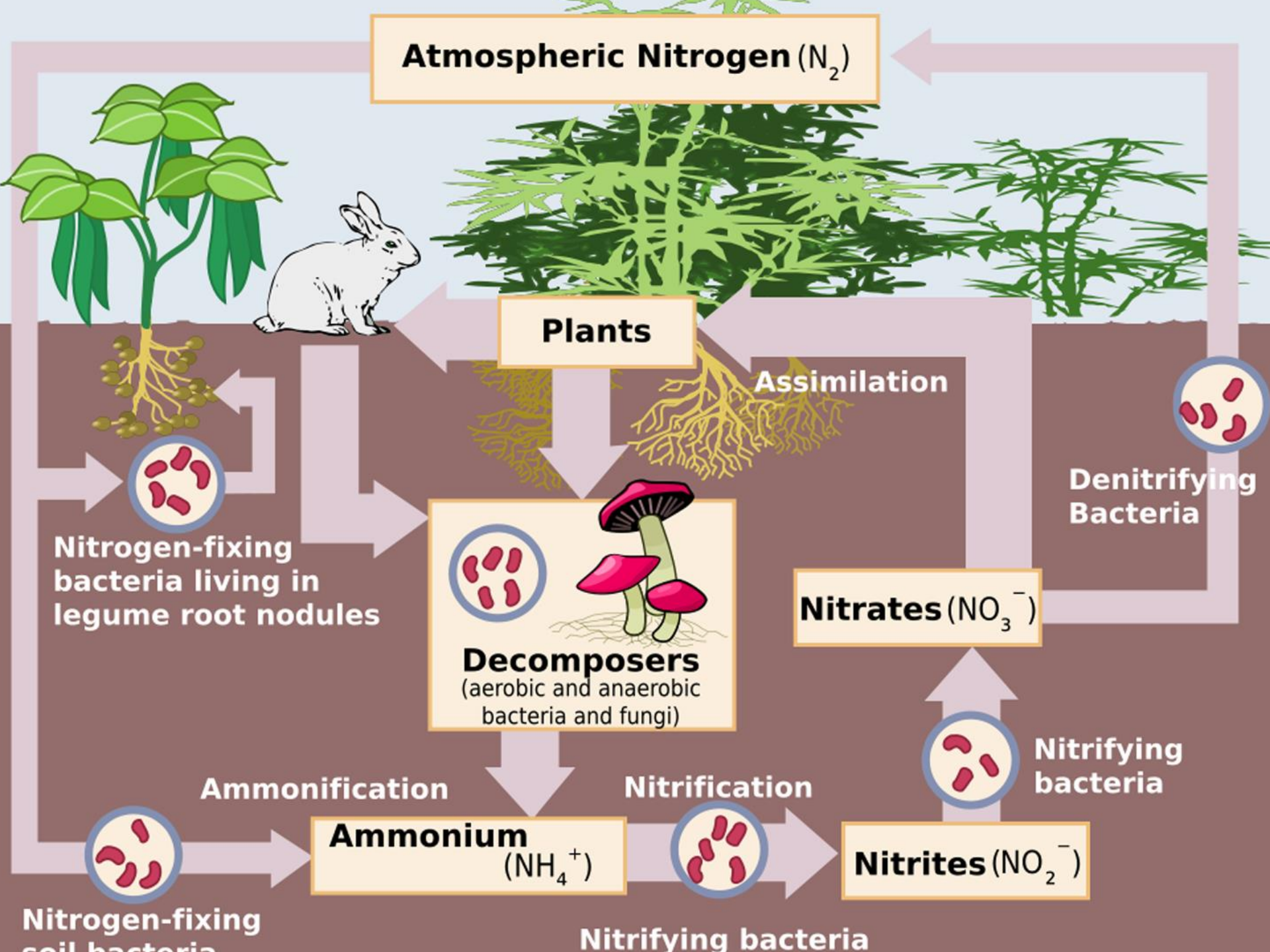


# Global Electric Circuit









Can Earth's systems be understood by learning only one discipline e.g. geology?

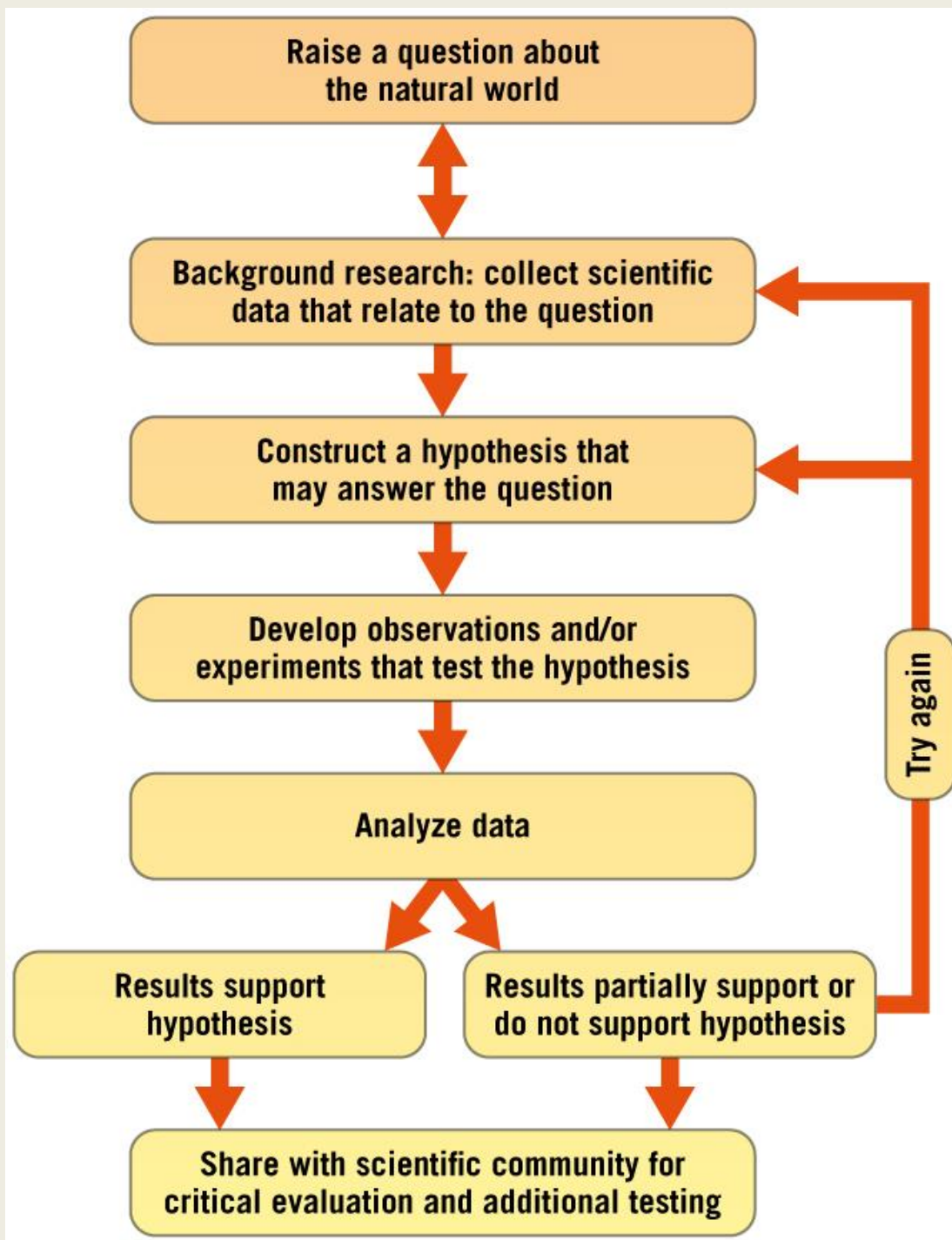
A. yes

B. no

*The point?*

*Earth's systems are complex and if  
you metaphorically pluck a string  
the entire Earth will ring...*

*The Nature of Scientific Inquiry*  
*The Scientific Method*





What is the difference between a hypothesis and a theory?

Describe the problem with the word theory regarding today's usage.

# *My Journey With Earth Science*



























SPRING CREEK RD































		<b>B</b> Boron 1081100 1081100	<b>C</b> Carbon 12.011 12.011	<b>N</b> Nitrogen 14.007 14.007	<b>O</b> Oxygen 15.999 15.999	<b>F</b> Fluorine 18.998 18.998	<b>Ne</b> Neon 19.992 19.992		
<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>		
<b>Al</b> Aluminum 26.9815386 26.9815386 In Loving Memory of Marty Meyer, of Marty, Shari, Julie, Red, Dottie, Scott, John, Tori, Ann, Heidi, Jean, Mark, Jan, Cathy	<b>Si</b> Silicon 28.086 28.086	<b>P</b> Phosphorus 30.974 30.974	<b>S</b> Sulfur 32.06 32.06	<b>Cl</b> Chlorine 35.45 35.45	<b>Ar</b> Argon 39.948 39.948	<b>K</b> Potassium 39.098 39.098	<b>Ca</b> Calcium 40.078 40.078	<b>Kr</b> Krypton 83.80 83.80	
<b>31</b>	<b>32</b>	<b>33</b>	<b>34</b>	<b>35</b>	<b>36</b>	<b>37</b>	<b>38</b>	<b>39</b>	<b>40</b>
<b>Ga</b> Gallium 69.723 69.723 ANALYTICAL SOL INC A TRIBUTE TO BEN WENSINK-MENTOR MICHAEL STRIZICH	<b>Ge</b> Germanium 72.64 72.64 The People's Republic of China Fengshan Geological Museum	<b>As</b> Arsenic 74.922 74.922 In Honor of P. J. C. Harris of P. J. C. Ray & Associates P. J. C. Harris and Associates P. J. C. Harris and Associates	<b>Se</b> Selenium 78.96 78.96 KRISHNA & NATALE RAJ, RAHUL, ARUN THE WAHL FAMILY	<b>Br</b> Bromine 79.904 79.904 DUDLEY MC KEENE THE COMPANY AFTER WORK Since 1969	<b>Kr</b> Krypton 83.80 83.80	<b>Rb</b> Rubidium 85.468 85.468	<b>Sr</b> Strontium 87.62 87.62	<b>Y</b> Yttrium 88.906 88.906	<b>Zr</b> Zirconium 91.224 91.224
<b>48</b>	<b>49</b>	<b>50</b>	<b>51</b>	<b>52</b>	<b>53</b>	<b>54</b>	<b>55</b>	<b>56</b>	<b>57</b>
<b>Cd</b> Cadmium 112.411 112.411 DEDICATED TO ALL U.S. ARMY NUCLEAR WEAPONS WARRANT OFFICERS 1948-1992	<b>In</b> Indium 114.818 114.818 Herman E. Roser Grand Master of Masons New Mexico, 1980 Grand Lodge of NM AF&M	<b>Sn</b> Tin 118.710 118.710 HERM ROSER, A Great Boss "Herm's Gang" Norma R, Ned M, Earl W, Hank W, Janet & Bill L, Tom J, Bob Mc, Ron H	<b>Sb</b> Antimony 121.757 121.757 URANIUM ASSOCIATES OF NEW MEXICO Baldwin URANIUM ASSOCIATES OF NEW MEXICO	<b>Te</b> Tellurium 127.60 127.60 J. T. C. S. Co. IN MEMORY OF DONALD E. CARR AND HIS FAMILY DONALD E. CARR AND HIS FAMILY	<b>I</b> Iodine 126.905 126.905 MEMORIAL ASSOCIATES OF BIRMINGHAM QUARTERMASTER SINCE 1950	<b>Xe</b> Xenon 131.29 131.29 MEMORIAL ASSOCIATES OF BIRMINGHAM QUARTERMASTER SINCE 1950	<b>Ba</b> Barium 137.33 137.33	<b>La</b> Lanthanum 138.905 138.905	<b>Ce</b> Cerium 140.12 140.12
<b>80</b>	<b>81</b>	<b>82</b>	<b>83</b>	<b>84</b>	<b>85</b>	<b>86</b>	<b>87</b>	<b>88</b>	<b>89</b>
<b>Hg</b> Mercury 200.59 200.59 NUCLEAR WEAPONS AMERICA'S DEFENCE SHIELD	<b>Tl</b> Thallium 204.3833 204.3833 "Herm's Gang" Dave S, Vic B, Ray & Sandy S, Jim C, Charley Mc, Wm F, Jim S, ALC, Fred B, Vince V, Jim & Vicky B, Ken B	<b>Pb</b> Lead 207.2 207.2 "Herm's Gang" con't. Mary & Troy W, Sam P, Jack B, Randy C, Don E, Bob W, Meg & Don O, Tom C	<b>Bi</b> Bismuth 208.98040 208.98040 IN HONOR OF THE BRAVE PATRIOTS WHO WON THE WAR CARTER ALLOYS COMPANY	<b>Po</b> Polonium (209) 209 DEDICATED TO ALL 1723 WARNER AND JAKE TALSO U.S. ARMY (RETIRED)	<b>At</b> Astatine (210) 210 MEMORIAL OF MRS DONALD E. CARR AND HIS FAMILY MARY P. CARR DONALD E. CARR	<b>Rn</b> Radon (222) 222	<b>Fr</b> Francium (223) 223	<b>Ra</b> Radium (226) 226	<b>Ac</b> Actinium (227) 227
<b>112</b>	<b>113</b>	<b>114</b>	<b>115</b>	<b>116</b>	<b>117</b>	<b>118</b>	<b>119</b>	<b>120</b>	<b>121</b>
<b>Cn</b> Copernicium (285) 285	<b>Nh</b> Nihonium (286) 286	<b>Fl</b> Flerovium (289) 289	<b>Mt</b> Moscovium (290) 290	<b>Lv</b> Livermorium (293) 293 Roger Hornby Dixie Homby Linda and Dave Shogren Paul Hornby	<b>Ts</b> Tennessine (294) 294	<b>Og</b> Oganesson (294) 294			















































**OPALS OF THE WORLD**

Handwritten label: *Black Opal*

Handwritten label: *Black Opal*

Handwritten label: *Black Opal*

Handwritten label: *Orange Opal*

Handwritten label: *Orange Opal*

Handwritten label: *Orange Opal*

Handwritten label: *Purple Opal*

Handwritten label: *Purple Opal*

Handwritten label: *Green Opal*

Handwritten label: *Green Opal*









































<https://www.youtube.com/watch?v=T20RT0GgOB4>

4:44 minutes