Blizzard Bag Day 2

Here is the lesson that you need to complete for the first calamity day.

I am attaching the notes along with the question to help you with the question. Please try your BEST and answer ALL of the questions. You can print the question pages and mark your answers on them or simply write your answers on a separate sheet of paper.

Solar System Formation

The formation of the solar system began about 4.5 billion years ago, when part of a giant molecular cloud collapsed due to its own gravity.

Since all objects with mass are gravitationally attracted to all other objects with mass in the universe, gravity tends to play a dominant role in the formation of celestial objects such as stars, planets, and galaxies.

Star Formation

The vast distances between stars are not empty. Many areas are occupied by enormous clouds of gas and dust. Gravity acts on these clouds in various ways. Sometimes sections of the clouds become more dense than others and begin to attract more gas and dust by virtue of their gravity. Eventually, a portion of a cloud can become so dense that it collapses under its own gravity to become a nebula. Eventually, a nebula can become so dense that it begins to perform nuclear fusion. This is how a star is born, and it is how our star, the Sun, was born.

All stars and star systems form due to the influences of gravity.

Planet Formation

In the early solar system, the area now occupied by the planets was filled with hot gas, dust, and rocky objects. These materials collided with each other and often stuck together in a process called accretion. As more particles stuck together, they grew larger and collected even larger particles and chunks of molten rock due to their diameter and gravity. This process eventually resulted in the formation of the eight planets of the solar system.

Above is an artist's interpretation of what the solar nebula may have looked like. The planets would have formed out of the disc-shaped material surrounding the Sun.
The Earth

At the end of the planet-forming period, the area now occupied by the planets had cooled and cleared of much of the material that made up the solar nebula. However, the planets were not done evolving. Early in this period, about 50 to 100 Moon-sized objects occupied the inner solar system. These objects often collided. It is believed that one such object collided with the Earth and the leftover material formed the Moon.

Prior to this period in the solar system's history, the region where the Earth formed was too hot for water. From this model, it was unclear to many astronomers how Earth gained its water. To solve this mystery, astronomers carefully investigated other objects in the solar system that might explain Earth’s water. Eventually astronomers found a number of water-heavy asteroids and comets in the asteroid belt. Astronomers reasoned that if more such objects existed in the early solar system, a collision with an asteroid or comet likely delivered water to planet Earth.

Earth Through Time

The age of Earth is calculated to be approximately 4.6 billion years old. Scientists can learn about the history of the Earth by studying rocks and fossils.

Uniformitarianism

The Earth has evolved, or changed, over time. Uniformitarianism is a geological principle stating that processes shaping the Earth today operate the same way and at the same rates as they did in the past. Another way to state uniformitarianism is that the present is the key to the past. For example, geologists assume that volcanoes erupted in Earth's ancient past much the same way they do today. This assumption is supported by the fact that lava flows and volcanic ash layers from Earth's past share many similarities with those forming today. Similar connections exist in the rock record for many other geological processes occurring today, such as plate tectonics, rock metamorphosis, and erosion. Most of the changes that the Earth has undergone have been caused by natural processes. Humans have existed only a very short time relative to the Earth's 4.5-billion year history.

Geologic Time Scale

Scientists learn about Earth's history by studying the rock and fossil record. Based on this record, scientists have learned how Earth and its atmosphere have changed over time, and they have divided Earth's history into distinct intervals of time on the geologic time scale. The geologic time scale, which is shown below, arranges time intervals from oldest (bottom) to most recent (top). The age units to the right are given as "Ma,"
which is a unit equal to 1 million years. Although the geologic time scale begins with the formation of the Earth around 4.54 billion (4540 Ma) years ago, 3.8 billion (3800 Ma) years ago is the approximate time that Earth's crust had become widespread and plate tectonics likely had begun.

The geologic time scale uses a hierarchy of time intervals. The broadest intervals of time (eons) are on the left side of the scale. As you move to the right, time intervals are divided into more specific intervals—eons are divided into eras, eras are divided into periods, and periods are divided into epochs.

A common way to organize geologic time is to break it down into four main intervals. The first interval is Precambrian time, which accounts for all of Earth's history before the Paleozoic era. After Precambrian time, Earth's history is divided into three eras, beginning with the Paleozoic era, then the Mesozoic era, and finally the Cenozoic era.

Each of the three eras can be divided into periods. The first period of the Paleozoic era is the Cambrian period. The most recent period of the Cenozoic era, which is still going on today, is the Quaternary period.

Each period can then be divided into epochs. The most recent epoch of the Quaternary period, which is still going on today, is the Holocene epoch.

Ice Core Data
Ice core data is gathered by climate scientists to compare the composition of the atmosphere today to its composition in the past. When snow or ice falls on certain regions on Earth, such as on Greenland, much of it does not melt. It is instead preserved for many thousands of years in layers of ice, with each layer representing one year. Such snow contains information about the atmosphere that it formed in. For example, from the ice cores, scientists can learn the concentrations of different gases in the atmosphere at different times in Earth's history.

Geologic Dating

_Earth is calculated to be about 4.6 billion years old, and life has existed for the last 3.8 billion years. The history of life on Earth can be uncovered by studying fossils._

Rocks provide clues about what was happening on Earth at the time that they formed. Geologists study rocks in order to figure out the Earth's history. A very important part of this process is figuring out the age of different rocks. This enables geologists to determine the order of events in Earth's history and how the Earth has changed over time. There are two broad types of geologic dating—relative dating and absolute dating.

Relative Dating

**Relative dating** is a method in which the age of an object or event is determined relative to some other object or event. For example, a scientist may determine that one fossil is older than another fossil based on their positions relative to each other in a sequence of rock layers.

Fossils are most commonly found in sedimentary rock, which forms as layers of material settle upon each other, press together, and harden over time. As time passes, new layers form upon the older layers, and fossils are buried deeper and deeper in the ground. Therefore, fossil age increases with depth.

New rock layers are deposited in horizontal layers on top of older rock layers. Therefore, fossils found in lower layers are older than fossils found in the layers above.

The clues found in fossil layers provide valuable information about how Earth's organisms and the Earth itself have changed over time. The image above shows many layers of rock containing fossils. Some of the oldest layers contain fossils of organisms that appear similar to fish. This would suggest that a long time ago, this area was covered in water.

Absolute Dating

**Absolute dating** is a method in which the age of an fossil is estimated in years. Whereas relative dating provides a sequence of events, this method provides a numerical age. Geologists determine absolute age by examining the chemical content of the rock.
Radioactive materials have very large, unstable nuclei, and they breakdown over time to create simpler substances. This process is called radioactive decay. The original material is known as the parent isotope, and the product is the daughter isotope. The age of a fossil can be calculated based on the ratio of parent isotopes to daughter isotopes present in the sample and the rate at which the radioactive material decays. This process is called radioactive dating, or radiometric dating.

The half-life of a radioactive material is the amount of time that is required for half of the atoms in a given sample to decay. Scientists measure the percentage of the radioactive material that has decayed and compare that to the known half-life. Together, these two pieces of information can allow scientists to determine when a rock or fossil formed.

Interpreting Geologic Maps

Geologic features on Earth can be identified and visually modeled through the use of geologic maps.

Geologic maps are maps that are used by geologists to share information about the rocks in an area.

The colors on the map represent the type of rock that is at the surface. Different colors and patterns are used on geologic maps to show different types or ages of rocks. The geologic events in an area and the weathering and erosion that has taken place will determine what types and ages of rock are present.

Geologic maps can be very specific, showing many types of rocks and using shorter age distinctions, or they can be more general, showing only broad age differences over billions of years.

The key on a geologic map tells which colors and patterns are used on the map. For example, in the map and key shown above, areas colored red represent granite rock from the Mesozoic era. The key gives the reader the information needed to interpret the colors on a geologic map.

In addition to the types and ages of rocks, geologic maps will sometimes include symbols to mark other geologic features such as fault lines. In the map above, faults are labeled with solid black or dotted black lines.
Here are the Questions:

1. A geologist is studying an area where stream erosion and deposition are the dominant surface processes. He notices that all of the rock layers in the shallow streambeds have dune features preserved throughout them. Knowing that dunes are formed by the wind in desert settings, what can the geologist conclude about the geologic history of this area?

   - [ ] A. The depositional environment has changed from stream-dominated in the past to wind-dominated today.
   - [ ] B. The depositional environment has changed from wind-dominated in the past to stream-dominated today.
   - [ ] C. Wind must still be the dominant factor shaping the surface today.
   - [ ] D. Dunes must also form from streams, at least in this area.

2. Which of the following is most accurate in helping pinpoint a time period on the geologic time scale during which a rock layer was formed?

   - [ ] A. sandstone
   - [ ] B. index fossils
   - [ ] C. heat flow
   - [ ] D. cave deposits

3. Early in the Earth’s history, its surface was covered with an ocean of molten rock. Over time, the molten rock cooled to form a solid crust.

   Of the following processes that can be observed today, which is most similar to the formation of Earth’s early crust?

   - [ ] A. Heat and pressure cause the formation of metamorphic rocks.
   - [ ] B. Lava from volcanic eruptions cools to form new islands.
   - [ ] C. Water vapor in the upper atmosphere cools and condenses into rain.
   - [ ] D. Ice crystals within glaciers slide over each other causing glacial movement.
4. A geologist studying rocks in a desert found a special kind of deposit called varves. Varves are thin, alternating layers of dark and light sediment that typically form in glacial lakes.

Because she knows that there are no glacial lakes in her hot, dry field area today, the geologist determines that there was likely a glacial lake there in the past. Based on this drastic change in surface features, what can be determined about the local climate history?

☐ A. No local climate changes have occurred in this area.

☐ B. The local climate was likely hotter and drier in the past.

☐ C. The local climate was likely hotter and wetter in the past.

☐ D. The local climate was likely colder and wetter in the past.

5. Image courtesy of the USGS
The diagram above suggests that

- A. the Earth has not changed over geologic time.
- B. geologic eras occur in repeating cycles.
- C. the Earth has changed over geologic time.
- D. geologic time periods occur in repeating cycles.

6. Shortly after the Earth first formed, intense heat built up and large portions of the planet became molten. What happened to the Earth over time?

- A. Parts of the Earth cooled into solid rock.
- B. Earth's crust evaporated to form an atmosphere.
- C. Parts of the Earth exploded during the Big Bang.
- D. Earth's core changed into liquid water.

7. The diagram above shows a cross section of a hillside. Four rock units are shown in the cross section. Which of these units is the youngest?

- A. igneous unit
- B. shale unit
- C. sandstone unit
- D. limestone unit
8. The diagrams below represent rock layers found in two different locations by two different scientists. The scientist at Location X used letters to label his rock layers, while the scientist at Location Y used roman numerals to label her layers. Examine these diagrams, and then answer the question that follows.

The scientists both used the same colors and patterns to represent different types of rocks. They also used the same set of black-and-white symbols to represent specific types of fossils in the layers. By correlating layers based on fossils and rock types, the two scientists have discovered that certain rock layers are present in both locations.

Which layers are the same?

- A. Layers T and U are the same as layers I and II.
- B. Layers T and U are the same as layers VI and VII.
- C. Layers P, Q, R, and S are the same as layers IV, V, VI, and VII.
- D. Layers P, Q, R, and S are the same as layers I, II, III, and IV.

9. One method that scientists use to study the Earth's climate history is to dig deep into glaciers and compare the composition of the fallen snow and ice from previous time periods to the snow and ice that falls today. They also compare the composition of tiny air bubbles in the ice to air today. Scientific information that is gathered in this manner is known as ________.

- A. snow gauge data
- B. ice flow data
- C. rain gauge data
- D. ice core data
10. The diagram below shows a sequence of rock layers. Examine the diagram, and answer the question that follows.

Using radiometric dating, scientists have determined that Layer M is 110 million years old. Based on this information and the principle of superposition (younger layers lie above older layers),

- A. Layer T is younger than 110 million years, and Layers R, X, and G are older than 110 million years.
- B. Layers T, R, X, and G are all younger than 110 million years.
- C. Layer T is older than 110 million years, and Layers R, X, and G are younger than 110 million years.
- D. Layers T, R, X, and G are all older than 110 million years.

11. Which of the following can help scientists estimate geologic time?

- A. comparing fossils
- B. observing rock sequences
- C. radiometric dating
- D. all of these

12. According to the law of superposition, younger layers of rock are generally found above older layers of rock. However, there are locations where older layers are found above younger layers. Which of the following can cause this to happen?

- A. Rock layers can overturn as they are folded.
- B. Older rock layers can slide above younger rock layers along faults.
- C. During uplift, rock layers can tilt enough to overturn.
- D. all of these
13. The Earth, the Sun, and the rest of the solar system are almost unimaginably old when viewed on a human time scale. While modern humans first evolved approximately 200,000 years ago, the age of the Earth, the Sun, and the rest of the solar system is approximately _______ years.

- A. 4.6 billion
- B. 200,000
- C. 100,000
- D. 4.6 million

14. A geologist is studying an ancient stack of rock layers. Most of the layers contain fossils of shallow marine creatures (clams, corals, etc.), suggesting the layers formed in a shallow ocean environment. But at the top of the stack, there is a layer that could only have been deposited by a river.

What does this drastic change in rock layers tell the geologist about Earth's history in the area where these layers formed? (Assume the layers have not changed position since they formed.)

- A. A mass extinction caused a river system to form where there used to be a shallow ocean setting.
- B. A volcanic eruption must have occurred nearby, which scared the sea creatures away.
- C. The environment changed suddenly from a river system to a shallow ocean setting.
- D. The environment changed suddenly from a shallow ocean setting to a river system.

15. Mildred collects a sample of fossilized plant material. She takes it back to her lab to run some tests on it.

Mildred is able to measure the amount of carbon-14 in her sample and compare this to the amount of carbon-12 in it. She uses this information to calculate that the fossil is 4,500 years old.

The process that Mildred used is known as _______.

- A. indexing
- B. superposition
- C. radiocarbon dating
- D. faulting
16. One way that scientists can peer into the Earth's past is by taking ice core samples. An ice core sample is, essentially, a long cylinder of ice that is dug deep out of ancient ice in Arctic and Antarctic regions on Earth. These cylinders contain layers of ice, with each layer corresponding to one warming and cooling period, or one year. With these samples, scientists can count the number of layers under the surface to determine when a layer was made. They can also analyze a layer to tell what chemicals were abundant in the Earth's atmosphere when that layer was made.

If scientists find an ice core from 30,000 years ago that contains chemicals radically different than the chemicals that are around today, they would likely conclude that _______.

- A. these chemicals are abundant today.
- B. the number of layers they counted was incorrect.
- C. the atmosphere never changes its composition.
- D. the atmosphere 30,000 years ago was different than our atmosphere today.

17. The Law of Superposition is most relevant when studying which type of rock?

- A. metamorphic
- B. sedimentary
- C. igneous
- D. granite
18. The timeline below covers the entire interval of Earth's history, from the formation of the Earth and solar system nearly 4.6 billion years ago to the present day. Examine the timeline, then answer the question that follows.

Recorded human history accounts for

- A. a very small portion of the Earth's history.
- B. only the last 100 million years of Earth's history.
- C. about half of the Earth's history.
- D. all of the Earth's history.

19. Scientists are studying a layer of sedimentary rock and discover what appears to be ripples made by running water preserved in the rock. When comparing those ripples to some made in mud at a present day location, they notice that the effects are identical.

Based on the observations, which of the following is most likely to be true?

- A. The environment and conditions of both areas are exactly the same.
- B. Events that occurred in the past were dramatically different from those of today.
- C. The mud at the present day location is actually from the same time period as the rock.
- D. Some events that occurred in the past are similar or identical to events in the present.
20. Periods in geologic history have different names. The geologic map above labels the rocks in central California by their historical period.

Rocks found in an area colored as blue would be from which period?

- A. Devonian
- B. Paleogene
- C. Quaternary
- D. Jurassic