GEOL 04/25/16 Last Lecture

Basic understanding of scientific method

Principle processes involved in earth evolution

Fundamental concepts of:

Plate tectonics

Rock cycle

Geologic Time

Appreciation of impact of Earth science on society in a daily basis

Lots of i-clicker questions today.

Scientific Method

Observations / Experiments / Chance -> Hypothesis -> Theory -> Scientific Model

Plate Tectonics

Convergent ( -> | <- ), Divergent(<- | ->), Transform plate boundaries ( ^\ | /down)

Variables of State

All matter exists as either

Solid

Liquid

Gas

Temperature – increases with depth

Pressure – increases with depth

Composition – combination of elements

The Rock Cycle

Igneous, Sedimentary, Metamorphic

Igneous – formed from magma, intrusive vs extrusive

Sedimentary – only formed on earth’s surface

Metamorphic – rocks that are recrystallized while still in solid state

First Quarter Material

Scientific Method

Plate Tectonics

Minerals and Rocks

Earth System

Etc

New lithosphere is created at\_\_\_\_\_\_\_ (C)

A In deep sea trenches

B In subduction zones

C At mid ocean ridges

D Along transform faults

Isotopes of an element have different numbers of \_\_\_\_\_\_\_ (C)

A Protons

B electrons

C neutrons

D all of the above

The main difference between intrusive and extrusive igneous rocks is\_\_\_\_\_\_\_ (B)

A silica composition

B where they solidify

C viscosity

D all of the above

Most common rock forming minerals are\_\_\_\_\_\_\_ (C)

A carbonates

B oxides

C silicates

D sulfides

What type of sediments are accumulations of **solid fragments** produced by weathering\_\_\_\_\_\_\_ (B)

A biochemical sediments

B clastic sediments

C chemical sediments

D all of the above

2nd quarter material

Metamorphic rocks and processes

Mountain building

Deformation – faults and folds

Geologic time – parent daughter isotopes

History of planets and continents

Geobiology

Volcanoes and volcanism

What is an orogeny?\_\_\_\_\_\_\_ (B)

A broad exposure of deformed metamorphic and igneous rocks

B a general term for mountain building processes

C a special type of reverse fault

D a theory that explains the uplift of the continents after large ice sheets melt

The principle of superposition states that\_\_\_\_\_\_\_ (D)

A A fault is younger than the rock it cuts

B sediements are deposited as essentialy horizontal layers

C the present is the key to the past

D undisturbed sedimentary layers get progressively younger from bottom to top

The absolute age of a geologic event in the rock record is\_\_\_\_\_\_\_ (A)

A # of years that have elapbsed btwen event and present day

B amount of time that has elapsed between event and start of earth history

C # ofyears that have elapsed btwn event and start of human civilization

D amt of time that has elapsed btwn event and another similar event

Based on the fossil record, current diversity of life on earth represents less than 0.1% of total # of species which have existed here in geologic past. A

A True

B False

3rd quarter

Earthquakes

Earth’s interior

Climate system

etc

Which of the following makes up the bulk of the earth\_\_\_\_\_\_\_ (C)

A crust

B inner core

C mantle

D outer core

Which layer in the earth does not transmit S waves\_\_\_\_\_\_\_ (D)

A crust

B inner core

C mantle

D outer core

Milankovitch cycles are depended on Earth’s\_\_\_\_\_\_\_ (D)

A orbital eccentricity

B precession

C angle of tilt on the rotation axis

D all of the above

4th quarter

Hydrologic cycle

Groundwater – hydrologic cycle, water stored in ground, primary source of water we use

Streams and floods – surface water, floods are single largest factor in loss of life on earth

Deserts – less than 1 inch of water = desert, no bearing on temperature (1/5 of land surface)

Coasts and oceans – 75% of us populate lives within km of coastline tides, waves, currents

Earth and society / energy resources

The process by which surface water becomes groundwater is called\_\_\_\_\_\_\_ (C)

A Discharge

B Evaporation

C Infiltration

D Transpiration

Suspended load includes all material includes\_\_\_\_\_\_\_ (B)

A rolling along bottom of stream

B temporarily or perm. Suspended in flow

C deposited on the bottom of stream

D rolling along bottom and suspended in the flow

Which of the following particles is most easily eroded from the bed of a stream\_\_\_\_\_\_\_ (D)

A boulders

B cohesive clay

C pebbles

D sand

10 year flood question

Layers that transmit groundwater are called\_\_\_\_\_\_\_ (C)

A unsaturated zones

B influent streams

C aquifers

D aquicludes

How deep is the deepest part of the ocean\_\_\_\_\_\_\_ (B)

A About 1 km deep

B 10 km deep

C 3 km deep

D 30 km deep

Skipped a few iclicker questions

### Ripped from Online Exam:

### Question 1

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Which of the following sequences describes the metamorphic changes in a shale with increasing metamorphic grade? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | slate → schist → gneiss | |  |  |  |

* **Question 2**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | What is an orogeny? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | a general term for mountain-building processes | |  |  |  |

* **Question 3**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | According to the principle of uniformitarianism, \_\_\_\_\_\_\_\_ . |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | geologic processes we observe today have operated in the past | |  |  |  |

* **Question 4**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | The principle of superposition states that \_\_\_\_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | undisturbed sedimentary layers get progressively younger from bottom to top | |  |  |  |

* **Question 5**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | The main difference between intrusive and extrusive igneous rocks is \_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | where they solidify | |  |  |  |

* **Question 6**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | The parent rock of quartzite is \_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | sandstone | |  |  |  |

* **Question 7**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | The presence of water will \_\_\_\_\_\_\_\_ the melting temperature of a rock. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | decrease | |  |  |  |

* **Question 9**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Strains are the forces that act on geologic materials, and stresses are the deformation they produce. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | False | |  |  |  |

* **Question 10**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Continental crust is \_\_\_\_\_\_\_\_ oceanic crust. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | less dense than | |  |  |  |

* **Question 11**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | The average time between large earthquake events along a fault is known as the \_\_\_\_\_\_ interval. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | recurrence | |  |  |  |

* **Question 12**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | When did the Big Bang take place? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | approximately 13.7 billion years ago | |  |  |  |

* **Question 13**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Which of the following can change the rate of radioactive decay? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | none of the above | |  |  |  |

* **Question 14**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | The amount of ground displacement in an earthquake is called the \_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | slip | |  |  |  |

* **Question 15**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | What is the most common type of bonding in minerals? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | ionic bonding | |  |  |  |

* **Question 16**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Organisms that gain energy from feeding directly or indirectly on “producers” are referred to as \_\_\_\_\_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | heterotrophs | |  |  |  |

* **Question 17**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Modern geology has enabled scientists to predict when an earthquake will occur. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | False | |  |  |  |

* **Question 18**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | The four inner planets are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | small, rocky, and relatively lacking in volatile elements. | |  |  |  |

* **Question 19**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | On a map of the seafloor, the boundaries between normally magnetized oceanic crust and reversely magnetized oceanic crust are called \_\_\_\_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | isochrons | |  |  |  |

* **Question 21**

0 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Incorrect | In which of the following regions would you expect to find the thickest sequence of sedimentary rocks? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | on continental platforms | |  |  |  |

* **Question 22**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | The greenhouse effect is caused by \_\_\_\_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | carbon dioxide and water vapor that trap heat radiating from the Earth's surface | |  |  |  |

* **Question 23**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Isotopes of an element have different numbers of \_\_\_\_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | neutrons | |  |  |  |

* **Question 24**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | How old is the Earth? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | approximately 4.5 billion years old | |  |  |  |

* **Question 25**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | The faster a magma cools, the larger the crystals it will contain once it becomes a rock. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | False | |  |  |  |

* **Question 26**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | New lithosphere is created \_\_\_\_\_\_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | at mid-ocean ridges | |  |  |  |

* **Question 27**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | The absolute age of a geologic event in the rock record is \_\_\_\_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | the number of years that has elapsed between the event and the present day | |  |  |  |

* **Question 28**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Ecosystems are composed of \_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_ that function in a balanced manner. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | organisms, geologic components | |  |  |  |

* **Question 29**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Burial of sediments results in \_\_\_\_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | increasing pressure and increasing temperature | |  |  |  |

* **Question 30**

3 out of 3 points

|  |  |  |  |  |
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|  |  | | | |
| Correct | Which of the following concepts was developed earliest? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | continental drift | |  |  |  |

* **Question 31**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Which mineral is commonly used to determine a metamorphic P-T path? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | garnet | |  |  |  |

* **Question 33**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Minerals that form through covalent bonding of elements typically dissolve easily in water. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | False | |  |  |  |

* **Question 34**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | What drives plate tectonics? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | mantle convection | |  |  |  |

* **Question 35**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Which of the following types of tectonic forces causes faulting? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | all of the above | |  |  |  |

* **Question 36**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Which of the following statements is true? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | Cementation and compaction both decrease porosity. | |  |  |  |

* **Question 37**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Which of the following rocks represents the lowest metamorphic grade? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | slate | |  |  |  |

* **Question 38**

0 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Incorrect | If a magma undergoes fractional crystallization, the remaining magma will be \_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | more mafic  more felsic is the correct answer | |  |  |  |

* **Question 39**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | The three domains of life are \_\_\_\_\_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | eukarya, bacteria, archaea | |  |  |  |

* **Question 40**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Abrasion of sediment particles results in which of the following? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | They become smaller and more rounded. | |  |  |  |

* **Question 41**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Reverse faults form in response to \_\_\_\_\_\_ forces. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | compressive | |  |  |  |

* **Question 42**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Where are the oldest rocks in North America located? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | in the Canadian Shield | |  |  |  |

* **Question 43**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | When tensional forces act on a fault plane they produce \_\_\_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | normal faults | |  |  |  |

* **Question 44**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | The mineral property “cleavage” refers to \_\_\_\_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | the splitting of a mineral along planar surfaces | |  |  |  |

* **Question 45**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | The Milankovitch cycles are dependent on the Earth's \_\_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | all of the above | |  |  |  |

* **Question 46**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Which of the following processes removes carbon from the atmosphere? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | photosynthesis | |  |  |  |

* **Question 47**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | What are the “plates” of plate tectonics made up of? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | lithosphere | |  |  |  |

* **Question 48**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Volcanic processes transport gases and aerosols from the \_\_\_\_\_\_\_ to the \_\_\_\_\_\_\_\_. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | lithosphere; atmosphere | |  |  |  |

* **Question 49**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | The Earth should be considered a closed system, both with respect to matter and energy. |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | False | |  |  |  |

* **Question 50**

3 out of 3 points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | | |
| Correct | Which of the following igneous rocks crystallizes on the Earth's surface? |  |  |  |
| |  |  | | --- | --- | | Selected Answer: | basalt | |  |  |  |

Ripped From Lectures:

According to the principle of uniformitarianism, \_\_\_\_\_\_\_\_ .

A. geologic processes we observe today have operated in the past

B. animals evolved at a uniform rate

C. all of the planets formed from a uniform solar nebula

D. early Earth was covered by a uniform magma ocean

Which of the following statements about the scientific method is false?

A. A scientific theory is never considered finally proved.

B. Data used to generate a hypothesis may come from observations, experiments, and chance findings.

C. A theory that has accumulated a substantial body of experimental support is called a hypothesis.

D. A scientific model represents some aspect of nature based on a set of hypotheses and theories.

The Earth's core is made up primarily of \_\_\_\_\_\_\_\_ . (A)

A. iron

B. lead

C. oxygen

D. silicon

In which of the following subsystems is the Earth's magnetic field generated? (C)

A. climate system

B. hydrologic system

C. geodynamo system

D. plate tectonic system

What powers the Earth's external heat engine? (C)

A. gravitational energy

B. radioactive decay

C. solar energy

D. tidal forces

-14.6 billion years ago – formation of solar system

-65 million years ago – last mass extinction (death of the dinosaurs and many other species)

Which of the following concepts was developed earliest? (A)

A. continental drift

B. plate tectonics

C. seafloor spreading

D. all three concepts were developed at about the same time

The Earth’s lithospheric plates consist of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ . (D)

A) continental crust

B) oceanic crust

C) continental and oceanic crust

D) continental and oceanic crust and uppermost mantle

New lithosphere is created \_\_\_\_\_\_\_\_\_\_\_\_. (C)

A) in deep sea trenches

B) in subduction zones

C) at mid-ocean ridges

D) along transform faults

On a map of the oceanic crust, the boundaries between normally and reversely magnetized oceanic crust are called \_\_\_\_\_\_\_\_\_\_. (B)

A) dipoles

B) isochrons

C) isograds

D) sutures

What drives plate tectonics? (B)

A) magnetic reversals

B) mantle convection

C) solar energy

D) volcanism

Oceanic crust that records negative magnetic anomalies formed when the Earth's magnetic field was \_\_\_\_\_\_\_\_\_\_\_. (C)

A) the same as it is today

B) the same as today except weaker

C) reversed from what it is today

D) the same as today except stronger

Which of the following substances is not considered a mineral? (A)

A) Coal

B) Diamond

C) Gypsum

D) Rock salt

Most of the chemical bonds in common minerals are \_\_\_\_\_\_\_\_\_\_. (C)

A. covalent

B. metallic

C. ionic

D. none of the above

Isotopes of an element have different numbers of \_\_\_\_\_\_\_\_\_\_. (C)

A) electrons

B) protons

C) neutrons

D) electrons, neutrons, and protons

Sodium has an atomic number of 11. How many electrons will the sodium cation Na+ have? (B)

A) 1

B) 10

C) 11

D) 12

Cleavage in a mineral is controlled by the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ . ?

A) ionic arrangement of atoms within the material

B) covalent bonding of molecules

C) shape of the crystal faces

D) hardness of the substance

Any rock type (igneous, sedimentary or metamorphic) can be turned into any other rock type via the processes of the rock cycle. ( A )

A) True

B) False

Which of the following igneous rocks crystallizes at the Earth's surface? (A)

A) Basalt

B) Gabbro

C) Granite

D) Peridotite

Minerals form as a result of: ( D )

A) Crystallization from a magma

B) Recrystallization in the solid state

C) Precipitation from solution

D) All of the above

The two characteristics used to describe a rock are: (C)

A) Texture and hardness

B) Color and taste

C) Hardness and mineralogy

D) Mineralogy and texture

Where would you expect to find the largest crystals in a lava flow? (B)

A) Near the top surface of the flow.

B) In the center of the flow.

C) Near the bottom surface of the flow.

D) The crystals would be the same size throughout.

Large igneous bodies that form at depth in the Earth's crust are called \_\_\_\_\_\_. (B)

A) dikes

B) plutons

C) sills

D) veins

Andesite is an example of a(n) \_\_\_\_\_\_\_\_\_\_ igneous rock. (A)

A) felsic

B) intermediate

C) mafic

D) ultramafic

Which of the following igneous rocks has the lowest silica content? (A)

A) ultramafic B) mafic C) intermediate D) felsic

What type of rock makes up most of the Hawaiian Islands? (D)

A) peridotite B) granite C) andesite D) basalt

What type of sediments are accumulations of solid fragments produced by weathering? (B)

A) biochemical sediments B) clastic sediments C) chemical sediments D) all of the above

Sedimentary basins are formed by a process called \_\_\_\_\_\_\_\_\_\_\_. (A)

A) subsidence B) diagenesis C) lithification D) subduction

Which of the following tectonic settings will be coolest at 30 km depth? (B)

A) Regions of continental extension B) Stable continental lithosphere C) Volcanic arcs D) The temperature in all three tectonic setting

Metamorphic rocks result from the recrystallization of existing rocks while they are still in a solid state. (A)

A) True B) False

Which of the following rocks represents the highest metamorphic grade? (A)

A) Gneiss B) Phyllite C) Schist D) Slate

A rock exhibiting high-grade metamorphism has experienced high temperatures and/or pressures. (A)

A) True B) False

The parent rock of a quartzite is \_\_\_\_\_\_\_\_\_\_. (A)

A) sandstone B) shale C) granite D) limestone

How old is the Earth? (B)

A) ~4.5 thousand years old. B) ~4.5 billion years old. C) ~4.5 million years old. D) ~4.5 trillion years old.

Which of the following makes up the bulk of the Earth? (C)

A) crust B) inner core C) mantle D) outer core

What do we think drives plate tectonics? (B)

A) magnetic reversals B) mantle convection C) solar energy D) volcanism

The presence of water will \_\_\_\_\_\_ the melting temperature of a rock. (C)

A) increase B) raise C) decrease D) have no effect on

Which of the following statements regarding igneous rocks is false? (D)

A) Extrusive rocks have larger crystals than intrusive rocks. B) Extrusive rocks cool more rapidly than intrusive rocks. C) Intrusive igneous rocks form deep in the crust or upper mantle. D) Intrusive and extrusive igneous rocks have the same range of chemical compositions.

The three main types of sediment are \_\_\_\_\_\_\_\_\_\_\_\_\_\_. (B)

A) bioclastic, chemical, granitic B) clastic, biochemical, chemical C) clastic, fossiliferous, bioclastic D) silicilastic, erosional, ionic

The oldest continental rocks are \_\_\_\_\_\_\_\_\_ than the oldest oceanic rocks. (D)

A) slightly younger B) much younger C) slightly older D) much older

If a magma undergoes fractional crystallization, the remaining magma will be \_\_\_\_\_\_\_\_\_ . (C)

A) less viscous B) exactly the same C) more felsic D) more mafic

The main difference between intrusive and extrusive igneous rocks is \_\_\_\_\_\_\_\_\_ . (C)

A) viscosity B) silica composition C) where they solidify D) all of the above

Which mineral is commonly used to determine a metamorphic P-T path? (B)

A) Calcite B) Garnet C) Muscovite D) Quartz

Stress – force applied to a rock per unit area

Strain – change in shape and/or volume of a rock body as a result of applied stresses

Strains are the forces that act on geologic materials, and stresses are the deformation they produce. (B)

A) True B) False

Reverse faults form in response to \_\_\_\_\_\_ forces. (A)

A) Compressional B) Shearing C) Tensional D) Torsional

The compass direction of a horizontal line in a 3-dimensional plane is called the \_\_\_\_\_\_\_\_. (B)

A) dip B) strike C) nadir D) line of horizontality

In an anticline, \_\_\_\_\_\_\_\_\_\_\_. (A)

A) the oldest rocks occur in the center and the limbs dip away from the center B) the youngest rocks occur in the center and the limbs dip toward the center C) the youngest rocks occur in the center and the limbs dip away from the center D) the oldest rocks occur in the center and the limbs dip toward the center

Upfolds, or arches, of layered rock are called \_\_\_\_\_\_\_\_. (C)

A) unconformities B) synclines C) anticlines D) faults

Which of the following types of tectonic forces tends to squeeze and shorten a rock body?

A) tensional forces B) compressional forces C) shearing forces D) all of the above

Stresses are the forces that act on geologic materials, and strains are the deformation they produce. A) True B) False

There is a general correspondence of fault type with tectonic environment. A) True B) False

Brittle deformation (faulting) will be favored over ductile deformation by \_\_\_\_\_\_\_\_\_\_\_. A) lower temperatures B) higher rates of strain C) lower pressures D) all of the above

Which of the following is the best statement of the principle of original horizontality? A. Igneous intrusions form horizontal layers B. Metamorphic isograds are horizontal before deformation C. Sediments are deposited as horizontal layers D. Most igneous, metamorphic, and sedimentary rocks in the Earth’s crust form horizontal layers

The study of the layers in sedimentary rock is known as \_\_\_\_\_\_\_\_\_. A) Stratigraphy B) Paleontology C) Sedimentation D) Geochronology

Based on the concept of half-life in radioactive decay, after three half-lives, the amount of a parent isotope remaining will be \_\_\_\_\_\_\_\_ of the original amount. ν A) ½ ν B) 1/3 ν C) ¼ ν D) 1/8

The principle of superposition states that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. A) a fault is younger than the rocks it cuts B) undisturbed sedimentary layers get progressively younger from bottom to top C) the present is the key to the past D) sediments are deposited as essentially horizontal layers

The hypothesis that explains the formation of the solar system is referred to as the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. A) Big Bang hypothesis B) Origin hypothesis C) Nebular hypothesis D) Planetesimal hypothesis

The four inner planets are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. A) mostly hot, with heavy, dense atmospheres. B) all similar to the Earth in size, atmosphere, and density. C) larger and less dense than the outer planets. D) small, rocky, and relatively lacking in volatile elements (gases).

Which of the following statements about the age of the Earth and Moon is true? A. The Earth is approximately 3 billion years older than the Moon. B. The Earth and Moon are approximately the same age. C. The Earth is approximately 1.5 billion years younger than the Moon. D. The Earth is approximately 4.5 billion years younger than the Moon.

What caused dust and condensing material to accrete into planetesimals? A. Gravitational attraction and collisions B. Heating of gases C. Nuclear fusion D. Rotation of the proto-sun

When is it thought that the Big Bang took place? A) approximately 4.5 million years ago B) approximately 14 million years ago C) approximately 4.5 billion years ago D) approximately 14 billion years ago

What mountain chain runs along the eastern margin of North America? A) the Andes B) the Appalachians C) the Caledonides D) the Cordillera

What is meant by the tectonic age of a region? A) the oldest rocks in the region B) the oldest major deformation event in the region C) the youngest rocks in the region D) the youngest major deformation event in the region

What is orogeny? A) a broad exposure of deformed metamorphic and igneous rocks B) a general term for mountain-building processes C) a special type of reverse fault D) a theory that explains the uplift of continents after large ice sheets melt

Which of the following can change the rate of radioactive decay? A) chemical reactions B) changes in pressure C) changes in temperature D) none of the above

Where do basins form? A) where tensional forces stretch the crust B) where thick sequences of sediment are deposited C) where a part of the crust has been heated and subsequently cools and contracts D) all of the above

The study of geobiology is defined as \_\_\_\_\_\_\_\_\_. A) the study of ancient life forms on Earth B) the study of how organisms influence and are influenced by Earth's environment C) the study of the Earth's environmental changes throughout time D) the study of the organisms lost during mass extinction events

Organisms that produce their own energy are referred to as \_\_\_\_\_\_\_\_\_\_\_\_. A) autotrophs B) chemotrophs C) phototrophs D) heterotrophs

The pathway through which a chemical element or molecule moves between the biologic and environmental components of an ecosystem is called a \_\_\_\_\_\_\_. A) biogeochemical cycle B) biomicrobial cycle C) geometabolic cycle D) geosynthesis cycle

Sedimentary features that form from the interaction of microbes with their environment are called \_\_\_\_\_\_\_\_\_\_. A) nodules B) stromatolites C) branching columns D) laminations

Ecosystems are composed of \_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_ that function in a balanced manner. A) multicellular organisms, single-celled organisms B) plants, animals C) organisms, plants D) organisms, geologic components

Organisms that gain energy from feeding directly or indirectly on “producers” are referred to as \_\_\_\_\_\_\_\_\_\_\_. A. autotrophs B. chemotrophs C. phototrophs D. heterotrophs

What is molten rock beneath the Earth's surface called? A) Granite B) Magma C) Lithosph D) Lava

What is the name for a basaltic lava flow that has a ropy, folded surface? A) A’a B) Breccia C) Pahoeh D) Tuff

At what boundary within the Earth do we believe that mantle plumes (hot spots) originate? A. crust–mantle boundary B. lithosphere–asthenosphere boundary C. mantle–outer core boundary D. outer core–inner core boundary

Which of the following metamorphic rocks is incorrectly paired with it’s parent rock? A) greenstone -- basalt B) quartzite -- granite C) marble -- limestone D) schist – shale

In an anticline, \_\_\_\_\_\_\_\_\_\_\_\_. A) the oldest rocks occur in the center and the limbs dip toward the center B) the oldest rocks occur in the center and the limbs dip away from the center C) the youngest rocks occur in the center and the limbs dip toward the center D) the youngest rocks occur in the center and the limbs dip away from the center

The absolute age of a geologic event in the rock record is \_\_\_\_\_\_\_\_\_\_\_\_. A) the number of years that have elapsed between the event and the present day B) the amount of time that has elapsed between the event and the beginning of Earth history C) the number of years that have elapsed between the event and the beginning of human civilization D) the amount of time that has elapsed between the event and another similar geologic event

The evidence that Mars once had water includes \_\_\_\_\_\_\_\_\_\_\_\_? A) dry river beds and valleys B) large salt deposits from dried-up oceans C) liquid water in current Martian oceans D) water vapor in the Martian atmosphere

Which of the following is not one of the giant outer planets in our solar system? A) Neptune B) Venus C) Uranus D) Saturn

Where are the oldest rocks in North America located? A) in the Appalachian Mountains B) in the Canadian Shield C) in the Basin and Range province D) in the Rocky Mountains

The process whereby continents grow as a result of continental collisions is called \_\_\_\_\_\_\_\_\_\_. A) accretion B) differentiation C) assimilation D) fractionation

The three domains of life are \_\_\_\_\_\_\_\_\_\_. A) bacteria, eukarya, thermotoga B) archaea, eukarya, extremophiles C) eukarya, bacteria, archaea D) eukarya, microbes, archaea

Huge mudflows of wet volcanic debris are called \_\_\_\_\_\_\_\_\_\_\_\_? A) calderas B) diatremes C) lahars D) tuffs

Magma generated in the Earth’s interior rises because it is \_\_\_\_\_\_\_\_ than the surrounding rocks. A) denser B) lower in viscosity C) less dense D) more volatile rich

* Radiometric dating is possible if a rock contains a measurable amount of \_\_\_\_\_\_\_\_\_\_\_.

1. parent atoms
2. both daughter and parent atoms
3. either daughter or parent atoms
4. daughter atoms

* Which of the following sequences describes the Wilson cycle?  
  I. continent-continent collision  
  II. continental rifting  
  III. sea-floor spreading  
  IV. subduction

1. IV – II – III – IV
2. I – IV – II – III
3. III – I – IV – II
4. II – III – IV – I

Volcanic rocks derived from the Yellowstone hot spot get progressively older to the southwest. Based on this information, in which direction is the North American plate moving?

1. Southeast
2. Southwest
3. Northwest
4. Northeast

* The amount of ground displacement in an earthquake is called the \_\_\_\_\_\_.

1. Dip
2. Epicenter
3. Focus
4. Slip

What is the approximate distance from the surface to the center of the Earth? A) 700 km B) 2,900 km C) 6,400 km D) 24,000 km

Which layer in the Earth does not transmit S waves? A) Crust B) Inner core C) Mantle D) Outer core

Which of the following statements about the Moho (Mohorovicic discontinuity) is false? A) The Moho marks the top of the outer core B) The Moho separates denser rocks below from less dense rocks above C) The Moho separates the crust from the mantle D) The speed of seismic waves increases as they pass down through the Moho.

Which of the following is not a greenhouse gas? A) carbon dioxide B) methane C) sulfur dioxide D) water vapor

The Earth's albedo is the fraction of \_\_\_\_\_\_\_\_\_. A) the Earth's surface that is covered by land B) the Earth's surface that is covered by oceans C) solar energy absorbed by the Earth's surface D) solar energy reflected by the Earth's surface

Which of the following do we think has most significantly changed the carbon cycle over the past 150 years? A. burial of organic carbon B. burning of fossil fuels C. deposition of carbon-rich sediments D. volcanism

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How much of the land surface is covered by ice? A) approximately 10% B) approximately 50% C) approximately 30% D) approximately 80%

Which of the following would cause sea level to rise? A) Melting of a very large iceberg B) Melting of the Ross ice shelf C) Melting of the Greenland ice cap D) All of the above

Which of the following is an extremely slow-moving sheet of ice that covers vast land areas? A) an arete B) a continental glacier C) an ice shelf D) a valley glacier

The following can be cited as evidence that CO2 may not be the driving force of climate: A) Temperature leads CO2 increase B) The troposphere isn’t warming as fast as the Earth’s surface C) Global temperatures fell during the postwar industrial boom D) All of the above

Tsunamis can be generated by \_\_\_\_\_\_\_. A) undersea earthquakes B) the eruption of an oceanic volcano C) undersea landslides D) all of the above

Earthquakes that originate at depths greater than 100 km are associated with \_\_\_\_\_\_ plate boundaries. A) transform B) convergent C) divergent D) convergent, divergent, and transform

S waves do not travel through the outer core because the outer core is a dense fluid. A) True B) False

Approximately how often does the Earth's magnetic field reverse itself? A) every 5000 years B) every 500,000 years C) Every 50,000,000 years D) Every 50 years

The two most common chemical elements in the Earth’s atmosphere are \_\_\_\_\_\_ and \_\_\_\_\_\_\_. A) carbon dioxide and water B) nitrogen and oxygen C) oxygen and carbon dioxide D) water and oxygen

During the peak of the last ice age, sea level was \_\_\_\_\_\_ than sea level today. A) approximately 10 meters lower B) approximately 1000 meters lower C) approximately 1 meters lower D) approximately 100 meters lower

The average time between large earthquake events along a fault is known as the \_\_\_\_\_\_\_\_\_\_ interval. A) Seismic B) Hazard C) Fault slip D) Recurrence

P (or primary) seismic waves travel faster than S (or secondary) seismic waves. A) True B) False

The shape of the Earth is a sphere. A) True B) False

What is the maximum amount of slip on a fault during an earthquake? A) about 1 meter B) about 20 meters C) about 100 meters D) about 200 meters

Earthquakes that originate at depths greater than 100 km are associated with \_\_\_\_\_\_ plate boundaries. A. Convergent B. Divergent C. Transform D. Convergent, divergent, and transform

The Mercalli intensity scale measures \_\_\_\_. A) the amount of destruction caused by an earthquake B) the amount of slip on a fault plane caused by an earthquake C) the amplitude of the surface waves D) all of the above.

The average time between large earthquake events along a fault is known as the \_\_\_\_\_\_\_\_\_\_ interval. A) Seismic B) Hazard C) Fault slip D) Recurrence

The greenhouse effect is caused by \_\_\_\_\_\_\_\_\_\_. A) carbon dioxide and water vapor that trap heat radiating from the Earth's surface B) heating of homes and businesses, which releases excess heat into the atmosphere C) oceans that trap heat radiating from the Earth's seafloors D) too many plants on the surface of the Earth, which prevent cooling of the surface

What is the general process by which rocks are broken down at the Earth's surface? A) Deposition B) Erosion C) Lithification D) Weathering

Which of the following statements about weathering is false? – A. Rocks of different compositions weather at different rates. – B. Heat and heavy rainfall increase the rate of chemical weathering. – C. The presence of soil slows down weathering of the underlying bedrock. – D. The longer a rock is exposed at the surface, the more weathered it becomes.

After the oceans, which of the following reservoirs contains the most water? A) the atmosphere B) lakes and rivers C) glaciers and polar ice caps D) underground water

What powers the hydrologic cycle? ν magnetism ν solar energy ν mantle convection ν radioactive decay

Droughts are periods of time when precipitation \_\_\_\_\_\_\_\_\_\_\_. ν is higher than normal ν equals evaporation ν is non-existent ν is lower than normal

Which of the following statements is true? ν Cool air can hold more water vapor than warm air. ν Warm air can hold more water vapor than cool air. ν Cool air and warm air can hold the same amount of water vapor.

The term “juvenile water” refers to water that A) was brought to Earth by meteorites B) was derived from the mantle C) appeared on the Earth’s surface at the time of condensation D) is very young and childish

Layers that store and transmit groundwater are called \_\_\_\_\_\_\_\_\_\_\_. A) aquicludes B) aquifers C) influent streams D) unsaturated zones

Which of the following unfractured rocks has the highest porosity? A) granite B) sandstone C) schist D) shale

Sinkholes are a possible danger in regions underlain by what type of bedrock? A) granite B) limestone C) sandstone D) shale

The process by which surface water becomes groundwater is called \_\_\_\_\_\_\_\_\_. A) Discharge B) Evaporation C) Infiltration D) Transpiration

Suspended load includes all material \_\_\_\_\_\_. A) rolling along the bottom of the stream B) temporarily or permanently suspended in the flow C) deposited on the bottom of the stream D) rolling along the bottom and suspended in the flow

Which of the following particles is most easily eroded from the bed of a stream? A) Boulders B) Cohesive clay C) Pebbles D) Sand

A 10-year flood is a flood that: A. lasts for 10 years. B. lasts for an average of 10 years. C. occurs every 10 years. D. occurs on an average of every 10 years.

Which of the following terms measures the total sediment load carried by a stream? A. Capacity B. Competence C. Discharge D. Viscosity

Landforms are the product of \_\_\_\_\_\_\_\_\_\_. – A. erosion – B. sedimentation – C. tectonics – D. all of the above

Which of the following regions has the lowest elevation? A) Atlantic coast B) Dead Sea C) Death Valley D) East African Rift

Elevation is a balance between \_\_\_\_\_\_\_\_\_\_\_\_\_\_. A) erosion and deposition B) tectonic uplift and erosion C) deposition and tectonic uplift D) deposition and isostasy

Which of the following terms describes a curved, coarse-grained sedimentary deposit that forms on the inside bend of a stream? A) Dune B) Point bar C) Oxbow D) Meander

Which of the following processes does not increase the amount of dust in the atmosphere? A) Agriculture B) Deforestation C) Precipitation D) Erosion

From which direction do the trade winds in the tropics blow? A) East B) North C) South D) West

The amount of windblown material that wind can carry does not depend on the \_\_\_\_\_\_\_\_. A) particle size B) surface material C) temperature D) wind strength

Where does most volcanic activity on the seafloor take place? A) abyssal plains B) mid-ocean ridges C) continental shelves D) oceanic trenches

In 1990, 50% of the U.S. population lived within 75 km of a coast. As of 2010, 75% of the U.S. population lived within 75 km of a coast.

How deep is the deepest part of the ocean? A) About 1 kilometer deep B) About 10 kilometers deep C) About 3 kilometers deep D) About 30 kilometers deep

Which of the following currents erode and deposit fine-grained sediments on the continental slope and rise? A. longshore currents B. river currents C. turbidity currents D. tidal currents

Most sediment accumulates \_\_\_\_\_\_\_\_\_\_. A) in rivers and streams B) on continental shelves C) at the base of the continental slope D) on the abyssal plain

Coal forms from \_\_\_\_\_\_\_\_\_\_\_. A) Large accumulations of dinosaur bones B) Large accumulations of plant material C) Large accumulations of coral fragments D) Large accumulations of bacterial matter

Petroleum and natural gas are considered \_\_\_\_\_\_\_\_\_ energy resources. A) Non-renewable B) Renewable C) Geothermal D) Hydrothermal

The main component of natural gas is \_\_\_\_\_\_\_\_. A) nitrous oxide B) methane C) carbon dioxide D) sulfur dioxide

Formation of oil and gas occurs within which part of the Earth? A) Near the surface B) 5-10 km depths C) 10-20 km depths D) 20-30 km depths

Oil and gas deposits can be found in \_\_\_\_\_\_\_\_\_\_\_. A) anticlines B) synclines C) monoclines D) homoclines

New lithosphere is created \_\_\_\_\_\_\_\_ . A) in deep sea trenches B) in subduction zones C) at mid-ocean ridges D) along transform faults

Isotopes of an element have different numbers of \_\_\_\_\_\_\_\_ . A) protons B) electrons C) neutrons D) all of the above

The main difference between intrusive and extrusive igneous rocks is \_\_\_\_\_\_\_ . A) silica composition B) where they solidify C) viscosity D) all of the above

Most common rock-forming minerals are \_\_\_\_\_\_\_\_ . A) carbonates B) oxides C) silicates D) sulfides

What type of sediments are accumulations of solid fragments produced by weathering? A) biochemical sediments B) clastic sediments C) chemical sediments D) all of the above

What is an orogeny? A) a broad exposure of deformed metamorphic and igneous rocks. B) a general term for mountain-building processes. C) a special type of reverse fault. D) a theory that explains the uplift of the continents after large ice sheets melt.

The principle of superposition states that \_\_\_\_\_\_\_\_\_\_. A) a fault is younger than the rocks it cuts B) sediments are deposited as essentially horizontal layers C) the present is the key to the past D) undisturbed sedimentary layers get progressively younger from bottom to top

The absolute age of a geologic event in the rock record is \_\_\_\_\_\_\_\_\_\_\_\_. A) the number of years that have elapsed between the event and the present day B) the amount of time that has elapsed between the event and the beginning of Earth history C) the number of years that have elapsed between the event and the beginning of human civilization D) the amount of time that has elapsed between the event and another similar geologic event

Based on the fossil record, the current diversity of life on Earth represents less than 0.1% of the total number of species which have existed here in the geologic past. A) True B) False

Which of the following makes up the bulk of the Earth? A) crust B) inner core C) mantle D) outer core

Which layer in the Earth does not transmit S waves? A) the crust B) the inner core C) the mantle D) the outer core

Milankovitch cycles are dependent on Earth’s \_\_\_\_\_\_\_\_\_\_? A) orbital eccentricity B) precession C) angle of tilt on the rotation axis D) all of the above

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