

**2024 Earth and Space Scrimmage**

**Single Elimination 1**

**August 17th, 12:00 - 1:00 PT**

### **TOSS-UP**

1) Earth science – *Multiple Choice* In which season are atmospheric CO<sub>2</sub> concentrations generally highest?

- W) Spring
- X) Summer
- Y) Fall
- Z) Winter

ANSWER: W) Spring

### **BONUS**

1) Earth science – *Short Answer* What term describes alternating bands of light and dark ice that form due to the lengthening of a valley glacier?

ANSWER: Ogives [**OH-jives**] (ACCEPT: Forbes bands)

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### **TOSS-UP**

2) Space science – *Short Answer* Order the following three methods of astronomical distance measurement in terms of increasing distance at which they can be used effectively: 1) Type Ia [**one-A**] supernovae; 2) Cepheid [**SEH-fee-id**] variables; 3) Hubble's law.

ANSWER: 2, 1, 3

### **BONUS**

2) Space science – *Short Answer* Identify all of the following three statements that are true regarding active galactic nuclei or AGN's: 1) AGN radiation originates from the accretion of matter into a black hole; 2) Most AGN radiation is obscured by the accretion disk; 3) AGN radiation has been observed in every band of the electromagnetic spectrum.

ANSWER: 1 and 3

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### **TOSS-UP**

3) Earth science – *Multiple Choice* The presence of which of the following features would be most indicative of tectonic displacement?

- W) Chatter marks
- X) Arroyos [**uh-ROY-ohs**]
- Y) Slickensides
- Z) Splays

ANSWER: Y) Slickensides

### **BONUS**

3) Earth science – *Multiple Choice* Which of the following seismic discontinuities can be found closest to Earth's surface?

- W) Conrad
- X) Gutenberg
- Y) Lehmann
- Z) Repetti [**ray-PEH-tee**]

ANSWER: W) Conrad

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### **TOSS-UP**

4) Space science – *Multiple Choice* Which of the following best describes the internal structure of a giant star as it enters the asymptotic giant branch?

- W) Carbon-oxygen core surrounded by a helium shell
- X) Carbon-oxygen core surrounded by a hydrogen shell
- Y) Helium core surrounded by a carbon-oxygen shell
- Z) Helium core surrounded by a hydrogen shell

ANSWER: W) Carbon-oxygen core surrounded by a helium shell

## **BONUS**

4) Space science – *Multiple Choice* Which of the following best describes the bottom-up theory of the formation of the universe?

- W) Small structures such as globular clusters form, then multiple bodies accrete to form galaxies
- X) Protogalaxies form from large-scale gas clouds, then simultaneous collapse
- Y) Matter orbits around dense regions that slowly grow into clouds of gas, then galaxies
- Z) Dark matter forms, then transforms back into normal matter after recombination

ANSWER: W) Small structures such as globular clusters form, then multiple bodies accrete to form galaxies

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## **TOSS-UP**

5) Earth science – *Multiple Choice* Which of the following sediments generally has the highest porosity?

- W) Gravel
- X) Sand
- Y) Silt
- Z) Clay

ANSWER: Z) Clay

## **BONUS**

5) Earth science – *Short Answer* Identify all of the following three factors related to the flow rate of a glacier that increase with increased glacial thickness: 1) Shear stress; 2) Bed temperature; 3) Plastic flow.

ANSWER: All

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**TOSS-UP**

6) Earth science – *Multiple Choice* Which of the following sources of water is most likely to produce hard water?

- W) Groundwater extracted from deep underground
- X) Groundwater extracted from near the surface
- Y) Ocean water filtered using reverse osmosis
- Z) Unfiltered river water

ANSWER: W) Groundwater extracted from deep underground

**BONUS**

6) Earth science – *Multiple Choice* At which of the following times are katabatic winds most likely to occur?

- W) Sunrise
- X) Noon
- Y) Sunset
- Z) Midnight

ANSWER: Y) Sunset

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**TOSS-UP**

7) Space science – *Short Answer* What term is given to long thrust faults on Mercury that formed from stresses caused by planet-wide thermal contraction?

ANSWER: Lobate scarps

**BONUS**

7) Space science – *Short Answer* A planet acting as an ideal blackbody has a temperature of 300 Kelvin. The planet is then partially covered by clouds that perfectly reflect incoming radiation but are transparent to outgoing radiation. What fraction of its surface would need to be covered by these clouds for its temperature to drop to 150 Kelvin?

ANSWER: 15/16

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**TOSS-UP**

8) Space science – *Multiple Choice* Which of the following Galilean moons does NOT have liquid water in its interior?

- W) Callisto
- X) Europa
- Y) Ganymede
- Z) Io

ANSWER: Z) Io

**BONUS**

8) Space science – *Short Answer* Identify all of the following four particles that are released in the proton-proton chain: 1) Neutrino; 2) Gamma ray; 3) Electron; 4) Positron.

ANSWER: 1, 2, and 4

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**TOSS-UP**

9) Space science – *Multiple Choice* Which of the following minerals or mineral groups primarily composes the light-colored highlands on the Moon?

- W) Quartz
- X) Micas
- Y) Alkali feldspars
- Z) Plagioclase feldspars

ANSWER: Z) Plagioclase feldspars

**BONUS**

9) Space science – *Multiple Choice* Which of the following is the ratio of the length of a solar day on Mercury to the length of the planet's sidereal year?

- W) 1:2
- X) 2:3
- Y) 3:2
- Z) 2:1

ANSWER: Z) 2:1

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### **TOSS-UP**

10) Earth science – *Multiple Choice* Which of the following best describes how the concentrations of oxygen-18 in ocean sediment and ice cores, respectively, change with increasing temperatures?

- W) Increase, increase
- X) Increase, decrease
- Y) Decrease, increase
- Z) Decrease, decrease

ANSWER: Y) Decrease, increase

### **BONUS**

10) Earth science – *Short Answer* Identify all of the following three statements that are true regarding igneous formations: 1) Stoping [**STOH-ping**] involves the disintegration of surrounding host rock into magma; 2) Xenoliths are always younger than surrounding rock; 3) Dikes and sills are both tabular intrusions.

ANSWER: 1 and 3

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### **TOSS-UP**

11) Earth science – *Short Answer* Identify all of the following three types of precipitation that involve supercooled water droplets: 1) Sleet; 2) Graupel [**GRAH-pull**]; 3) Rime.

ANSWER: 2 and 3

### **BONUS**

11) Earth science – *Multiple Choice* Which of the following conditions would NOT be favorable for the formation of a quartz-rich sandstone over arkose?

- W) Sedimentary parent material
- X) Short transport distance
- Y) High-energy transport
- Z) Well-sorted deposition

ANSWER: X) Short transport distance

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### **TOSS-UP**

12) Earth science – *Multiple Choice* Which of the following best explains why a sea breeze forms during the day?

- W) The land is heated less than the sea, which creates low pressure on land
- X) The land is heated more than the sea, which creates low pressure on land
- Y) The land is heated less than the sea, which creates high pressure on land
- Z) The land is heated more than the sea, which creates high pressure on land

ANSWER: X) The land is heated more than the sea, which creates low pressure on land

### **BONUS**

12) Earth science – *Short Answer* Identify all of the following three statements that are true regarding glaciers: 1) There is no ice movement at the terminus of a glacier; 2) The zone of ablation must be smaller than the zone of accumulation in a retreating glacier; 3) Arêtes [**uh-RAYTS**] are generally found near the zone of accumulation.

ANSWER: 3 only

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### **TOSS-UP**

13) Earth science – *Multiple Choice* Which of the following phenomena is LEAST likely to be associated with soil creep?

- W) Breccia [**BRECH-ee-uh**] deposits
- X) Curved tree trunks
- Y) Small scarp
- Z) Soil ridges

ANSWER: W) Breccia deposits

## **BONUS**

13) Earth science – *Multiple Choice* The average speed of an ocean surface current is primarily a function of which of the following quantities?

- W) Total volumetric flux
- X) Slope of sea surface height
- Y) Local temperature anomaly
- Z) Depth of ocean floor

ANSWER: X) Slope of sea surface height

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## **TOSS-UP**

14) Earth science – *Multiple Choice* Which of the following statements is NOT true regarding La Niña?

- W) La Niña brings increased fishing productivity to the coast of Chile
- X) La Niña hinders hurricane development in the Atlantic Ocean
- Y) La Niña creates warmer and drier conditions around Texas
- Z) La Niña causes increased flooding in Southeast Asia

ANSWER: X) La Niña hinders hurricane development in the Atlantic Ocean

## **BONUS**

14) Earth science – *Short Answer* In the phase diagram for alkali feldspars, what line denotes the conditions at which a feldspar solid solution will split into two separate mineral phases?

ANSWER: Solvus

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## **TOSS-UP**

15) Space science – *Short Answer* Identify all of the following three statements that are true regarding star clusters: 1) Globular clusters generally contain younger stars than open clusters; 2) Stars in an open cluster are strongly gravitationally bound; 3) Open clusters are typically found in the disk of a galaxy.

ANSWER: 3 only

## BONUS

15) Space science – *Multiple Choice* Which of the following conditions regarding a type Ia [**one-A**] supernova would most likely result in its luminosity being different from the commonly expected standard value?

- W) Formation from a merger of two stars
- X) Low concentration of metals heavier than oxygen
- Y) Presence of a post-supernova zombie star
- Z) Unusually high rate of mass transfer

ANSWER: W) Formation from a merger of two stars