TOSS-UP

1) Energy – Multiple Choice  What state has the largest geothermal power generation capacity?

W) Arizona  
X) California  
Y) Idaho  
Z) Utah  

ANSWER: X) CALIFORNIA

BONUS

1) Energy – Short Answer  What derived SI unit is used to measure electric potential?

ANSWER: VOLT

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TOSS-UP

2) Life Science – Multiple Choice  Which of the following is true of virus genomes [JEE-nomes]?

W) They are always composed of DNA  
X) They are always circular  
Y) They may be composed of either DNA or RNA  
Z) They are diploid  

ANSWER: Y) THEY MAY BE COMPOSED OF EITHER DNA OR RNA

BONUS

2) Life Science – Multiple Choice  You are using a light microscope to look at cells stained with a dye that detects chromatin [KROH-mah-tin] and can see densely-colored regions that you recognize as chromosomes. Which of the following must be true?

W) The cell is undergoing mitosis [my-TOW-sis]  
X) The genome [JEE-nome] is diploid [DIH-ployd]  
Y) The genome is haploid [HA-ploid]  
Z) The cell is in interphase  

ANSWER: W) THE CELL IS UNDERGOING MITOSIS
TOSS-UP

3) Math – Short Answer What is the area of a circle inscribed in a square of side 14?

ANSWER: $49\pi$

BONUS

3) Math – Short Answer What is $\frac{3}{7}$ divided by $\frac{8}{21}$ divided by $\frac{15}{4}$?

ANSWER: $\frac{3}{10}$ (ACCEPT: 0.3)

TOSS-UP

4) Physical Science – Multiple Choice Which of the following instruments does not primarily rely on a lens?

W) Refracting telescope
X) Reflecting telescope
Y) Binocular
Z) Monocular

ANSWER: X) REFLECTING TELESCOPE

BONUS

4) Physical Science – Short Answer What principle of fluid mechanics describes the buoyant force?

ANSWER: ARCHIMEDES PRINCIPLE
5) Life Science – Multiple Choice Which of the following magnifications is most appropriate for viewing bacteria through a light microscope?

W) 5 times  
X) 50 times  
Y) 500 times  
Z) 5000 times  

ANSWER: Y) 500 TIMES

BONUS

5) Life Science – Multiple Choice After a signaling molecule binds to a receptor, what enzymes often set off a cascade of phosphorylation \([\text{faws-four-il-AY-shun}]\) events?

W) Kinases [KYE-nayses]  
X) Phosphatases [FAWS-fa-tases]  
Y) Amylases [AM-ill-aces]  
Z) Lipases [LYE-paces]  

ANSWER: W) KINASES

TOSS-UP

6) Earth and Space – Multiple Choice Which of the following is the group of minerals formed when metals combine with a halogen element such as iodine, chlorine, bromine, or florine?

W) Halides  
X) Halites  
Y) Tretrahalogens  
Z) Halogens  

ANSWER: W) HALIDES

BONUS

6) Earth and Space – Multiple Choice Hurricanes are rated by categories on what five-point scale?

W) Fujita scale  
X) Richter scale  
Y) Torino scale  
Z) Saffir-Simpson scale  

ANSWER: Z) SAFFIR-SIMPSON SCALE
TOSS-UP

7) Math – Short Answer  What is $50^3$?

ANSWER: 125,000

BONUS

7) Math – Short Answer  What is the maximum possible number of intersection points of a circle and a rectangle?

ANSWER: 8

TOSS-UP

8) Life Science – Multiple Choice  Which of the following groups of organic compounds in the human body are the most diverse in size, shape, and function?

W) Carbohydrates
X) Lipids
Y) Proteins
Z) Nucleic acids

ANSWER: Y) PROTEINS

BONUS

8) Life Science – Multiple Choice  Which of the following is a sex-linked trait in humans?

W) Eye color
X) Skin tone
Y) Color blindness
Z) Freckles

ANSWER: Y) COLOR BLINDNESS
9) Physical Science – *Multiple Choice*  Which of the following is an example of a radiation detector?

W) Geiger [*GYE-gur*] counter  
X) Anemometer  
Y) LCR meter  
Z) Refractometer

**ANSWER:** W) GEIGER COUNTER

**BONUS**

9) Physical Science – *Multiple Choice*  If an object experiences a change in its velocity, which of the following statements must be TRUE about its acceleration?

W) It is positive  
X) It is negative  
Y) It is non-zero  
Z) It is constant

**ANSWER:** Y) IT IS NON-ZERO

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10) Math – *Multiple Choice*  For which of the following $x$-values is $x^3$ greater than or equal to $x^2$?

W) $-2$  
X) $-\frac{1}{2}$  
Y) $\frac{1}{2}$  
Z) 2

**ANSWER:** Z) 2

**BONUS**

10) Math – *Short Answer*  Express the following in scientific notation rounded to two significant digits: the fraction with numerator $4.5 \times 10^5$ and denominator $3.5 \times 10^-2$.

**ANSWER:** $1.3 \times 10^7$
TOSS-UP

11) Energy – Multiple Choice  Commercially available photovoltaic [photo-vawl-TAY-ik] cells are primarily made of what element?

W) Germanium [jer-MAYN-ee-um]
X) Arsenic
Y) Carbon
Z) Silicon

ANSWER: Z) SILICON

BONUS

11) Energy – Short Answer  What nonrenewable fuel source represents the largest percentage of US energy consumption?

ANSWER: PETROLEUM (ACCEPT: OIL)

TOSS-UP

12) Earth and Space – Multiple Choice  The inshore marine environment, from the surface to the sea floor, where water depths do not exceed 200 meters, is known as which of the following?

W) Oceanic zone
X) Neritic zone
Y) Intertidal zone
Z) Benthic zone

ANSWER: X) NERITIC ZONE

BONUS

12) Earth and Space – Multiple Choice  Which of the following lists of features is associated with a convergent plate boundary?

W) Primarily shallow earthquakes, rifting, volcanic activity
X) Trench, primarily shallow earthquakes, volcanoes
Y) Hot spots, few earthquakes, trench
Z) Subduction, trench, volcanic activity, shallow to deep earthquakes

ANSWER: Z) SUBDUCTION, TRENCH, VOLCANIC ACTIVITY, SHALLOW TO DEEP EARTHQUAKES
TOSS-UP

13) Life Science – Multiple Choice  Which of the following plant phyla [FYE-lah] has the most extant species?

W) Ginkgophyta [GINK-oh-fitah]
X) Coniferophyta [kaw-nif-er-AW-fih-tah]
Y) Psilophyta [sigh-LAW-fih-tah]
Z) Anthophyta [an-THAW-fih-tah]

ANSWER: Z) ANTHOPHYTA

BONUS

13) Life Science – Multiple Choice  Which of the following cytoskeletal [SIGH-toh-skeletul] components has the largest diameter?

W) Intermediate filaments
X) Keratin filaments
Y) Microtubules [micro-TUBE-yules]
Z) Microfilaments

ANSWER: Y) MICROTUBULES

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TOSS-UP

14) Math – Short Answer  Increasing a number by 200% is equivalent to multiplying it by what number?

ANSWER: 3

BONUS

14) Math – Short Answer  Solve the following equation for \( x \): \( x^2 - 7x - 120 = 0 \).

ANSWER: -8, 15 (must give both answers)
TOSS-UP

15) Physical Science – Short Answer To two significant figures and in meters per second squared, what is the acceleration due to gravity near the Earth's surface?

ANSWER: 9.8

BONUS

15) Physical Science – Multiple Choice Which of the following best illustrates the particle nature of light?

W) Diffraction
X) Interference
Y) Polarization
Z) Photoelectric effect

ANSWER: Z) PHOTOELECTRIC EFFECT

TOSS-UP

16) Earth and Space – Short Answer What is the term for an object that is so massive that gravity prevents light from escaping it?

ANSWER: BLACK HOLE

BONUS

16) Earth and Space – Short Answer What planet was not fully imaged until 2011 when it was visited by the MESSENGER spacecraft?

ANSWER: MERCURY
TOSS-UP

17) Physical Science – Short Answer  What subatomic particle is composed of two up quarks and one down quark?

ANSWER: PROTON

BONUS

17) Physical Science – Multiple Choice  Which of the following is NOT a base unit of measure in the metric system?

W) Meter
X) Second
Y) Gram
Z) Ampere

ANSWER: Y) GRAM

TOSS-UP

18) Energy – Multiple Choice  Which industrial process is used to separate the many components of crude oil into useful petroleum products?

W) Absorption
X) Membrane diffusion
Y) Refrigeration
Z) Distillation

ANSWER: Z) DISTILLATION

BONUS

18) Energy – Multiple Choice  Government agencies and utilities offer various incentives to encourage people to improve the energy efficiency of buildings and vehicles. Which of the following is NOT a typical incentive?

W) Tax credits
X) Loans or loan guarantees
Y) Hardware installation
Z) Rebates

ANSWER: Y) HARDWARE INSTALLATION
TOSS-UP

19) Physical Science  –  *Short Answer*  How many moles of hydrogen gas may be obtained from one mole of water?

**ANSWER:** 1

**BONUS**

19) Physical Science  –  *Multiple Choice*  How many atoms of magnesium are present in two molecules of the compound Mg₃N₂?

- W) 2
- X) 3
- Y) 6
- Z) 8

**ANSWER:** Y) 6

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TOSS-UP

20) Earth and Space  –  *Multiple Choice*  Which of the following degree measures is closest to the angle of repose of cinders in a cinder cone volcano?

- W) 5
- X) 10
- Y) 20
- Z) 30

**ANSWER:** Z) 30

**BONUS**

20) Earth and Space  –  *Multiple Choice*  Which of the following minerals has the same chemical composition as glass?

- W) Halite
- X) Fluorite
- Y) Pyrite
- Z) Quartz

**ANSWER:** Z) QUARTZ
TOSS-UP

21) Life Science – Short Answer  What long, rope-like structure do some bacteria use to move around?

ANSWER: FLAGELLUM

BONUS

21) Life Science – Short Answer  A cell's surface protein pump stops working when ATP is not present. What is the type of transport these protein pumps carry out?

ANSWER: ACTIVE TRANSPORT

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TOSS-UP

22) Earth and Space – Short Answer  Identify all of the following three planets that are considered Jovian: 1) Jupiter; 2) Uranus; 3) Saturn.

ANSWER: ALL (ACCEPT: 1, 2, AND 3)

BONUS

22) Earth and Space – Short Answer  Identify all of the following three minerals that are silicates: 1) Calcite; 2) Halite; 3) Muscovite.

ANSWER: 3 (ACCEPT: MUSCOVITE)
TOSS-UP

23) Math – Short Answer  Giving your answer as a decimal, what is the sum of the three numbers 2, 2/4, and 2/8?

ANSWER: 2.75

BONUS

23) Math – Short Answer  Simplify the fraction with numerator 1 – √3 and denominator 1 + √3.

ANSWER: −2 + √3 (ACCEPT: √3 − 2)