ROUND 4

TOSS-UP

1) PHYSICAL SCIENCE  *Multiple Choice*  At the surface of the Earth, the acceleration due to gravity is g. At an elevation of twice the Earth’s radius, which of the following best represents the acceleration due to gravity?

W) g/4  
X) g/9  
Y) g/16  
Z) g/25

ANSWER: X) g/9

BONUS

1) PHYSICAL SCIENCE  *Short Answer*  Atlas and Hercules each lift 200 kilogram barbells off the ground. Atlas lifts his in 1 second and Hercules lifts his in 3 seconds. Which hero does more work?

ANSWER: NEITHER (ACCEPT: THEY DO THE SAME AMOUNT OF WORK)

TOSS-UP

2) EARTH AND SPACE SCIENCE  *Short Answer*  During what era in the geologic time scale did the majority of life exist in the Earth’s oceans?

ANSWER: PALEOZOIC

BONUS

2) EARTH AND SPACE SCIENCE  *Short Answer*  Providing your answer in degrees to the nearest tenth, what is the most northerly latitude at which the Sun can be seen directly overhead?

ANSWER: 23.5 (ACCEPT: 23.4)
TOSS-UP

3) PHYSICAL SCIENCE  Short Answer  How many joules of potential energy does a 1000-newton boulder have at the top of a 5-meter ledge, relative to the bottom of the ledge?

ANSWER: 5000

BONUS

3) PHYSICAL SCIENCE  Short Answer  A honeydew melon weighing 2 kilograms is flying through the air at 20 meters per second. How much kinetic energy in joules does it have?

ANSWER: 400

_______________________________________________________

TOSS-UP

4) ENERGY  Multiple Choice  Which of the following kinds of power plants is BEST suited for peak load demands?

W) Nuclear
X) Coal-fired
Y) Hydroelectric
Z) Gas turbine

ANSWER: Z) GAS TURBINE

BONUS

4) ENERGY  Short Answer  What is the term for the difference in electric potential between the interior and exterior of a cell?

ANSWER: MEMBRANE POTENTIAL (ACCEPT: TRANSMEMBRANE POTENTIAL)
TOSS-UP

5) MATH  Short Answer  Consider the graph of a normal distribution. To the nearest percent, what is the probability that a datum lies within two standard deviations of the mean?

ANSWER: 95%

BONUS

5) MATH  Short Answer  A city has an area of 250 square miles. If 14% is covered with trees, and a separate 11% is covered with water, providing your answer as a decimal to the nearest tenth, how many square miles are covered with trees or water?

ANSWER: 62.5

TOSS-UP

6) EARTH AND SPACE SCIENCE  Short Answer  As Earth rotates, Ursa Major, Ursa Minor, and other constellations in the northern sky appear to circle around what star?

ANSWER: POLARIS (ACCEPT: NORTH STAR)

BONUS

6) EARTH AND SPACE SCIENCE  Multiple Choice  With regard to the existence of life, which of the following ocean zones is the harshest?

W) Hadal (read as: HAY-dahl)
X) Neritic (read as: neh-RI-tik)
Y) Pelagic
Z) Bathyal (read as: bah-thee-ahl)

ANSWER: W) HADAL
TOSS-UP

7) PHYSICAL SCIENCE  Short Answer  What is the net magnetic force on a compass needle?

ANSWER: 0

BONUS

7) PHYSICAL SCIENCE  Short Answer  What is the average applied force in newtons required to keep a crate of apples moving if it takes 60 joules to move the crate 5 meters across a floor?

ANSWER: 12

TOSS-UP

8) EARTH AND SPACE SCIENCE  Multiple Choice  The spectrum of electromagnetic energy emitted by a black body is determined by which of the following?

W) Material  
X) Temperature  
Y) Size  
Z) A combination of material and size

ANSWER:  X) TEMPERATURE

BONUS

8) EARTH AND SPACE SCIENCE  Short Answer  Early 1800’s scientist Luke Howard first classified what natural atmospheric phenomenon?

ANSWER: CLOUDS
9) ENERGY  Short Answer  To the nearest integer, one horsepower is equal to how many watts?

ANSWER: 746

BONUS

9) ENERGY  Multiple Choice  Which of the following is NOT true of plug-in hybrid electric vehicles?

W) They can drive using only electricity for between 10 and 40 miles
X) They are powered both by a battery and an internal combustion engine
Y) Inductive charging equipment is systematically used to recharge the batteries
Z) They mostly utilize lithium-ion batteries

ANSWER:  Y) INDUCTIVE CHARGING EQUIPMENT IS SYSTEMATICALLY USED TO RECHARGE THE BATTERIES

TOSS-UP

10) LIFE SCIENCE  Multiple Choice  Of the following, which level of taxonomic classification is the most specific?

W) Class
X) Phylum (read as: FY-luhm)
Y) Family
Z) Order

ANSWER:  Y) FAMILY

BONUS

10) LIFE SCIENCE  Short Answer  Which cellular organelle is responsible for packaging and sending biosynthesized molecules from one cell to another?

ANSWER:  GOLGI APPARATUS
TOSS-UP

11) MATH  Short Answer  In a group of 30 students, 20 take French, 15 take Spanish, and 5 take neither language. How many students take both French and Spanish?

ANSWER: 10

BONUS

11) MATH  Short Answer  Simplify the following expression completely if the denominator ≠ 0: \[
\frac{x^3 + 2x^2y + xy^2}{x^2 + yx}
\] (read as: open parenthesis x cubed plus 2 x squared y plus x y squared close parenthesis over open parenthesis x squared plus yx close parenthesis).

ANSWER: \[x + y\]

TOSS-UP

12) LIFE SCIENCE  Multiple Choice  Which of the following is NOT true about the black-footed ferret?

W) They like to eat prairie dogs
X) They neared total extinction in the 1980s
Y) They like to live in groups
Z) They have one to six young in a litter

ANSWER: Y) THEY LIKE TO LIVE IN GROUPS

BONUS

12) LIFE SCIENCE  Short Answer  What is North America’s largest rodent?

ANSWER: BEAVER
TOSS-UP

13) ENERGY  Multiple Choice  Which of the following statements is NOT true about radon?

W) Radon comes from the natural decay of radium that is found in nearly all rocks and soils
X) Radon migrates into homes through openings in floors and walls
Y) Radon is the second leading cause of lung cancer in the United States
Z) Radon exposure is greatest in homes with basements

ANSWER:  Z) RADON EXPOSURE IS GREATEST IN HOMES WITH BASEMENTS

BONUS

13) ENERGY  Multiple Choice  As of 2008, which of the following states has the highest net generation of energy from nuclear sources?

W) New York
X) Texas
Y) Illinois
Z) Ohio

ANSWER:  Y) ILLINOIS

TOSS-UP

14) PHYSICAL SCIENCE  Short Answer  How many lone pairs of electrons are in NH₃?

ANSWER:  1

BONUS

14) PHYSICAL SCIENCE  Short Answer  Given g as 10 meters per second squared, how long, in seconds, will a pocket calculator travel upwards before starting to fall if thrown vertically with an initial velocity of 20 meters per second?

ANSWER:  2
TOSS-UP

15) EARTH AND SPACE SCIENCE  Multiple Choice  Which of the following rock types is most likely to preserve fossils?

W) Sandstone  
X) Shale  
Y) Marble  
Z) Slate

ANSWER:  X) SHALE

BONUS

15) EARTH AND SPACE SCIENCE  Short Answer  What two planets in our solar system do NOT have a moon?

ANSWER:  MERCURY AND VENUS

TOSS-UP

16) MATH  Short Answer  What is the smallest non-negative integer which is divisible by each of 2, 3 and 4?

ANSWER:  0

BONUS

16) MATH  Short Answer  Providing your answer in terms of $\pi$ and in square units, what is the area of the shape described by the equation $x^2 + y^2 = 2$?

ANSWER:  $2\pi$
17) GENERAL SCIENCE  *Multiple Choice*  Which of the following best describes the shape of a raindrop with a radius of less than one millimeter?

W) Spherical  
X) Similar to a hamburger bun  
Y) Teardrop  
Z) Parachute

**ANSWER: W) SPHERICAL**

**BONUS**

17) GENERAL SCIENCE  *Short Answer*  By name or number, place the following four planets in order from highest to lowest density: 1) Mars, 2) Saturn, 3) Jupiter, 4) Earth.

**ANSWER: EARTH, MARS, JUPITER, SATURN (ACCEPT: 4, 1, 3, 2)**

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18) EARTH AND SPACE SCIENCE  *Multiple Choice*  Given a parcel of air that is saturated with water, which of the following statements is NOT correct?

W) Its relative humidity is 100%  
X) Its dew point is equal to the current temperature  
Y) If you raised the temperature, its relative humidity would decrease  
Z) If you lowered the temperature, its relative humidity would decrease

**ANSWER: Z) IF YOU LOWERED THE TEMPERATURE, ITS RELATIVE HUMIDITY WOULD DECREASE**

**BONUS**

18) EARTH AND SPACE SCIENCE  *Short Answer*  By name or number, put the following three Earth eons in order from most ancient to most recent: 1) Phanerozoic (read as: fah-neh-roh-ZÖE-ik), 2) Archean (read as: ahr-KEE-ahn), 3) Proterozoic.

**ANSWER: ARCHEAN, PROTEROZOIC, PHANEROZOIC (ACCEPT: 2, 3, 1)**
TOSS-UP

19) GENERAL SCIENCE  Multiple Choice  Cell membranes are described as fluid mosaic models consisting of proteins embedded in a bilayer of phospholipids. Which of the following components of a plant cell do NOT contain two of these bilayers?

W) Chloroplast
X) Mitochondria (read as: my-toh-KOHN-dree-ah)
Y) Endoplasmic reticulum (read as: ri-TI-kyuh-luhm)
Z) Nucleus

ANSWER: Y) ENDOPLASMIC RETICULUM

BONUS

19) GENERAL SCIENCE  Short Answer  What is the name of the phenomenon created when seawater seeps into cracks in the ocean floor, is heated by molten magma, and expelled back into the ocean?

ANSWER: HYDROTHERMAL VENT

_______________________________________________________

TOSS-UP

20) LIFE SCIENCE  Short Answer  What is the name of the mechanism by which macrophages engulf bacteria?

ANSWER: PHAGOCYTOSIS

BONUS

20) LIFE SCIENCE  Short Answer  What human organ is composed of the following four lobes: right, quadrate, caudate (read as: KOH-dayt), and left?

ANSWER: LIVER
TOSS-UP

21) GENERAL SCIENCE  Multiple Choice  A balance and a spring scale are taken to the top of Mount Everest. When measured there, the spring scale reads 10 newtons, while the balance reads 1 kilogram. The measurements are then taken again at sea level. How would these measurements differ at sea level?

W) They would not differ at sea level
X) The spring scale would record a weight of less than 10 newtons, while the balance would record a mass of 1 kilogram
Y) The spring scale would record a weight of greater than 10 newtons, while the balance would record a mass of greater than 1 kilogram
Z) The spring scale would record a weight of greater than 10 newtons, while the balance would record a mass of 1 kilogram

ANSWER: Z) THE SPRING SCALE WOULD RECORD A WEIGHT OF GREATER THAN 10 NEWTONS, WHILE THE BALANCE WOULD RECORD A MASS OF 1 KILOGRAM

BONUS

21) GENERAL SCIENCE  Short Answer  By number, identify all of the following three traits that are TRUE for all mammals, birds, fish, plants, and insects: 1) the female has an XX genotype; 2) the female produces the larger gamete; 3) the female carries the young.

ANSWER: 2

TOSS-UP

22) MATH  Multiple Choice  Which of the following statistical values is least affected by outliers?

W) Median
X) Mean
Y) Range
Z) Standard deviation

ANSWER: W) MEDIAN

BONUS

22) MATH  Short Answer  The volume of a closed right circular cylinder is $12 \pi$ cubic meters and its base has a radius of 2 meters. In terms of $\pi$ square meters, what is the surface area of the cylinder?

ANSWER: $20 \pi$
TOSS-UP

23) PHYSICAL SCIENCE  Short Answer  Moving down the group on the periodic table from fluorine to astatine, what happens to the electronegativity?

ANSWER: IT DECREASES

BONUS

23) PHYSICAL SCIENCE  Short Answer  When a glycosidic bond is formed to make sucrose, what is the other resulting product?

ANSWER: WATER

TOSS-UP

24) LIFE SCIENCE  Short Answer  What is the name of an inflammation or infection of the transparent membrane that lines your eyelid and part of your eyeball, causing small blood vessels to become more prominent?

ANSWER: CONJUNCTIVITIS (ACCEPT: PINK EYE)

BONUS

24) LIFE SCIENCE  Multiple Choice  Which of the following breeds of dogs would be least likely to be trained as a seeing eye dog?

W) Chinese shar-pei
X) German shepherd
Y) Labrador retriever
Z) Golden retriever

ANSWER: W) CHINESE SHAR-PEI
TOSS-UP

25) GENERAL SCIENCE  *Multiple Choice*  Two pure tones are played in succession and at equal volumes. The first tone is lower in frequency than the second. Therefore, which of the following statements describes the first tone in comparison with the second tone?

W) It has a shorter wavelength  
X) It has a longer wavelength  
Y) It has a smaller amplitude  
Z) It has a larger amplitude

**ANSWER: X) IT HAS A LONGER WAVELENGTH**

**BONUS**

25) GENERAL SCIENCE  *Short Answer*  What rock was created from the dissolved carbon dioxide in the primordial atmosphere?

**ANSWER: LIMESTONE**