

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

TOSS-UP

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 $\neq 0$:

$\frac{x^3 + 2x^2y + xy^2}{x^2 + yx}$ (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 NH_3 ?

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: 2π

TOSS-UP

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)

TOSS-UP

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-ZŌE-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 12π cubic meters and its base has a radius of 2 meters. In terms of π square meters, what is the surface area of the cylinder?

ANSWER: 20π

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