

ROUND 13

TOSS-UP

1) PHYSICAL SCIENCE *Multiple Choice* Which of the following is true?

- W) There is no preferred motionless frame from which to judge all motion
- X) When an object exerts a force on another, an equal amount of force is exerted back on it, except when friction is present
- Y) The change in velocity of an object due to a force is proportional to the mass of the object
- Z) Frictional forces are proportional to the velocity of an object

ANSWER: W) THERE IS NO PREFERRED MOTIONLESS FRAME FROM WHICH TO JUDGE ALL MOTION

BONUS

1) PHYSICAL SCIENCE *Multiple Choice* Which of the following does NOT properly relate force and potential energy?

- W) In a uniform gravitational field, force is directly proportional to negative mass times gravity
- X) Conservative forces push the system toward lower potential energy
- Y) Potential energy for a spring is inversely proportional to force exerted by the spring
- Z) Force is proportional to the negative slope of the potential energy function

ANSWER: Y) POTENTIAL ENERGY FOR A SPRING IS INVERSELY PROPORTIONAL TO FORCE EXERTED BY THE SPRING

TOSS-UP

2) MATH *Multiple Choice* Two perpendicular lines are represented by the equations $2x - 3y = 6$ and $6x + ky = 4$. What is the value of k ?

- W) -4
- X) 4
- Y) -9
- Z) 9

ANSWER: X) 4

BONUS

2) MATH *Short Answer* How many right isosceles triangles with 4 inch legs can be cut from 1 square yard of material?

ANSWER: 162

TOSS-UP

3) EARTH AND SPACE *Multiple Choice* Which of the following planetary characteristics is estimated based on observations of abundance, size, and distribution of craters on the surface of other planets?

- W) Mineralogy
- X) Atmospheric conditions
- Y) Geomorphology [*jee-uh-mawr-FOL-uh-jee*]
- Z) Age

ANSWER: Z) AGE

BONUS

3) EARTH AND SPACE *Short Answer* The largest loess [*LOH-es*] province in the world can be found in what country?

ANSWER: CHINA

TOSS-UP

4) GENERAL SCIENCE *Multiple Choice* Bacteria are responsible for the majority of nitrogen fixation on the planet. Which of the following is also responsible for nitrogen fixation?

- W) Plankton
- X) Plants
- Y) Insects
- Z) Lightning

ANSWER: Z) LIGHTNING

BONUS

4) GENERAL SCIENCE *Multiple Choice* Which of the following is NOT an accurate description of our Sun?

- W) It has a spectral classification of G
- X) Its luminosity has decreased over time
- Y) It has a life span of about 10 billion years
- Z) It will eventually expand to become a red giant

ANSWER: X) ITS LUMINOSITY HAS DECREASED OVER TIME

TOSS-UP

5) ENERGY *Multiple Choice* Which of the following components of the solar irradiance falling on a solar collector is affected directly by the incidence angle?

- W) Albedo
- X) Rate of diffusion
- Y) Beam
- Z) Global horizontal

ANSWER: Y) BEAM

BONUS

5) ENERGY *Multiple Choice* Solar boilers and solar disinfectors both utilize which of the following concepts to raise the temperature of water?

- W) Natural thermosyphon circulation [*thur-muh-CY-fuhn*]
- X) Zig zag collectors
- Y) Autoclave plant
- Z) Cooling screens

ANSWER: W) NATURAL THERMOSYPHON CIRCULATION

TOSS-UP

6) LIFE SCIENCE *Multiple Choice* Somatic mutations are which of the following?

- W) Germline
- X) Acquired
- Y) Inherited
- Z) Always synonymous

ANSWER: X) ACQUIRED

BONUS

6) LIFE SCIENCE *Short Answer* A cell has the genotype AaBBccddEe [**big A little a, big B big B, little c little c, little d little d, big E little e**]. How many different genotypes are possible for gametes from this cell?

ANSWER: 4

TOSS-UP

7) PHYSICAL SCIENCE *Multiple Choice* Which of the following statements about elastic and inelastic collisions is true?

- W) Elastic conserve momentum and kinetic energy; inelastic conserve only momentum
- X) Elastic conserve only kinetic energy; inelastic conserve momentum and kinetic energy
- Y) Elastic conserve only momentum; inelastic conserve only kinetic energy
- Z) Elastic conserve only kinetic energy; inelastic conserve only momentum

ANSWER: W) ELASTIC CONSERVE MOMENTUM AND KINETIC ENERGY; INELASTIC CONSERVE ONLY MOMENTUM

BONUS

7) PHYSICAL SCIENCE *Multiple Choice* For a particular chemical reaction, delta H is negative and delta S is positive. Which of the following is true?

- W) The reaction is spontaneous at any temperature
- X) The reaction is never spontaneous
- Y) The reaction is only spontaneous when the temperature is greater than the heat of the reaction
- Z) The reaction is only spontaneous if the absolute value of delta H is greater than delta S

ANSWER: W) THE REACTION IS SPONTANEOUS AT ANY TEMPERATURE

TOSS-UP

8) MATH *Short Answer* Darla wants to buy a new round card table with folding legs for her game room. The opening in her doorway is 3 feet wide and 7 feet high. To the nearest whole number of feet, what is the diameter of the largest round table she can buy so that it fits through the doorway?

ANSWER: 7

BONUS

8) MATH *Multiple Choice* What is the fourth vertex, K, of parallelogram HIJK, if point H is (-2, -3), point I is (4, 4), and point J is (6, 7)?

- W) (0, 1)
- X) (1, 1)
- Y) (0, 0)
- Z) (-1, 0)

ANSWER: Y) (0, 0)

TOSS-UP

9) EARTH AND SPACE *Multiple Choice* What country has the largest coal reserves on Earth?

- W) China
- X) Russia
- Y) Japan
- Z) United States of America

ANSWER: Z) UNITED STATES OF AMERICA

BONUS

9) EARTH AND SPACE *Multiple Choice* What is the name for rock formed from hot volcanic ash welding together?

- W) Pumice
- X) Rhyolite [**RY-uh-lyt**]
- Y) Obsidian
- Z) Tuff

ANSWER: Z) TUFF

TOSS-UP

10) GENERAL SCIENCE *Multiple Choice* Which of the following is a molecular triatomic compound with a linear molecular shape?

- W) Water
- X) Carbon dioxide
- Y) Calcium chloride
- Z) Hydrogen peroxide

ANSWER: X) CARBON DIOXIDE

BONUS

10) GENERAL SCIENCE *Multiple Choice* Which of the following will most likely produce the Tyndall effect?

- W) Warm ocean currents rising to meet cold ocean currents
- X) A fish creating ripples in a small pond
- Y) Sending sound waves through a homogenous mixture [**hoh-muh-JEE-nee-uhs**]
- Z) Shining light through a heterogeneous mixture [**het-er-uh-JEE-nee-uhs**]

ANSWER: Z) SHINING LIGHT THROUGH A HETEROGENEOUS MIXTURE

TOSS-UP

11) LIFE SCIENCE *Multiple Choice* Plants evolve adaptations to help them survive in different environments. One adaptation is an alternative pathway for photosynthesis. Which of the following is a Crassulacean [*kras-uh-LAY-shuhn*] acid metabolism (CAM) plant?

- W) Sugar cane
- X) Corn
- Y) Pineapple
- Z) Sugar maple tree

ANSWER: Y) PINEAPPLE

BONUS

11) LIFE SCIENCE *Short Answer* Sulfide oxidizers, such as purple sulfur bacteria, dominate at the anoxic-oxic interface in hot springs. They use the hydrogen from hydrogen sulfide to reduce carbon dioxide to organic carbon, which can then be oxidized for energy. This process requires what external source of energy?

ANSWER: SUNLIGHT

TOSS-UP

12) PHYSICAL SCIENCE *Multiple Choice* Which of the following is NOT a true statement about the angular momentum of an isolated system?

- W) It remains constant in magnitude
- X) It remains constant in direction
- Y) It is a vector quantity
- Z) It is determined by dividing moment of inertia by angular velocity

ANSWER: Z) IT IS DETERMINED BY DIVIDING MOMENT OF INERTIA BY ANGULAR VELOCITY

BONUS

12) PHYSICAL SCIENCE *Multiple Choice* Which of the following compounds is NOT used as fuel in a nuclear reactor?

- W) Uranium-233
- X) Uranium-235
- Y) Uranium-236
- Z) Plutonium-239

ANSWER: Y) URANIUM-236

TOSS-UP

13) GENERAL SCIENCE *Multiple Choice* Which of the following statements is NOT true regarding disaccharides [**dy-SAK-uh-ryds**]?

- W) Maltose is composed solely of glucose monomers
- X) Sucrose is composed of glucose and fructose monomers
- Y) Lactose is composed of fructose and galactose monomers
- Z) Cellobiose [**sel-oh-BY-ohs**] is composed solely of glucose monomers

ANSWER: Y) LACTOSE IS COMPOSED OF FRUCTOSE AND GALACTOSE MONOMERS

BONUS

13) GENERAL SCIENCE *Multiple Choice* What determines how cells in a developing embryo will differentiate?

- W) Symmetry after the first division of cells
- X) The location of the cells in the embryo
- Y) The number of cells in the embryo
- Z) The DNA present in the cells of the embryo

ANSWER: X) THE LOCATION OF THE CELLS IN THE EMBRYO

TOSS-UP

14) MATH *Short Answer* Quadrilateral ABCD is inscribed in a circle. If the measure of angle C is $2x$ degrees and the measure of angle A is $3x$ degrees, determine the value of x .

ANSWER: 36 (answer is unitless)

BONUS

14) MATH *Multiple Choice* Michael's bike has tires that are 26 inches in diameter. Which of the following is closest to the number of revolutions his tires make in traveling one mile?

- W) 676
- X) 726
- Y) 776
- Z) 826

ANSWER: Y) 776

TOSS-UP

15) EARTH AND SPACE *Multiple Choice* The longest-ranging ice core temperature records come from the Dome C ice core recovered in Antarctica. Which of the following is nearest to the number of years covered by the Dome C ice core?

- W) 800,000
- X) 80,000
- Y) 8,000
- Z) 800

ANSWER: W) 800,000

BONUS

15) EARTH AND SPACE *Short Answer* Identify all of the following four islands that are part of the Galapagos: 1) Santiago, 2) Isabela, 3) Santa Fe, 4) Caprolites.

ANSWER: 1, 2, 3 (ACCEPT: SANTIAGO, ISABELA, SANTA FE)

TOSS-UP

16) ENERGY *Short Answer* A standard RC circuit has a time constant of 2 milliseconds, a 1 millifarad capacitor, and a resistor. What is the resistance of the resistor in ohms?

ANSWER: 2

BONUS

16) ENERGY *Multiple Choice* Bio Syngas is a synthetic composition of what pair of gases?

- W) Ammonia and nitrogen
- X) Carbon monoxide and hydrogen
- Y) Carbon dioxide and hydrogen
- Z) Helium and argon

ANSWER: X) CARBON MONOXIDE AND HYDROGEN

TOSS-UP

17) GENERAL SCIENCE *Multiple Choice* Which of the following is a common destiny for vesicles secreted from the Golgi apparatus?

- W) Nucleus
- X) Mitochondrion [*my-tuh-KON-dree-uhn*]
- Y) Lysosome [*LY-suh-sohm*]
- Z) Microtubule

ANSWER: Y) LYSOSOME

BONUS

17) GENERAL SCIENCE *Multiple Choice* A cat on a pier sees a fish below in the water. The actual position of the fish is below and in front of the cat at 45° from the normal. The cat has a pellet gun and excellent marksmanship. He aims for exactly where he sees the fish and shoots. Considering the properties of light, what happens?

- W) The cat hits the fish
- X) The bullet sails over where the fish actually is
- Y) The bullet sails underneath where the fish actually is
- Z) The bullet goes to the left or right of where the fish actually is

ANSWER: X) THE BULLET SAILS OVER WHERE THE FISH ACTUALLY IS

TOSS-UP

18) LIFE SCIENCE *Short Answer* What is the term for the plant photosynthetic tissue, interspersed with veins, that is located between the lower and upper epidermis of a leaf?

ANSWER: MESOPHYLL

BONUS

18) LIFE SCIENCE *Multiple Choice* Which of the following organisms is least likely to perform well in a hypoxic region of the ocean?

- W) Sperm whale
- X) Blue marlin
- Y) Humboldt squid
- Z) Vampire squid

ANSWER: X) BLUE MARLIN

TOSS-UP

19) PHYSICAL SCIENCE *Multiple Choice* Which of the following is NOT true?

- W) Electric field is a vector quantity
- X) Force is a scalar quantity **[SKAY-ler]**
- Y) The force on a negative particle is opposite to the field direction
- Z) Electric field is uniform when magnitude and direction remain unchanged

ANSWER: X) FORCE IS A SCALAR QUANTITY

BONUS

19) PHYSICAL SCIENCE *Multiple Choice* The concept of “static cling,” whereby electrons can be interchanged amongst materials with different degrees of electron affinity, is known as which of the following effects?

- W) Electrostatic
- X) Triboelectric
- Y) Piezoelectric **[py-ee-zoh-i-LEK-trik]**
- Z) Pyroelectric **[py-roh-i-LEK-trik]**

ANSWER: X) TRIBOELECTRIC

TOSS-UP

20) MATH *Short Answer* What is the coefficient of x^2 in the expansion of $(2x - 3)^3$ **[open parenthesis 2 x minus 3 close parenthesis cubed]**?

ANSWER: -36

BONUS

20) MATH *Short Answer* What is the minimum Fahrenheit temperature in degrees that will make the Celsius temperature greater than or equal to 50 degrees?

ANSWER: 122°

TOSS-UP

21) LIFE SCIENCE *Multiple Choice* If you were a pirate in the 15th century, you might very well suffer from scurvy. In order to prevent the disease, which of the following should you consume?

- W) Oranges
- X) Calcium carbonate
- Y) Rice
- Z) Penicillin

ANSWER: W) ORANGES

BONUS

21) LIFE SCIENCE *Multiple Choice* The difference between xylem [**ZY-luhm**] and phloem [**FLOH-em**] is which of the following?

- W) Xylem transports water and dissolved nutrients, while phloem transports dissolved organic materials in an aqueous solution [**AK-wee-uhs**]
- X) Phloem transports water and minerals, while xylem transports sugars
- Y) Phloem is not found in plants, while xylem is only present in plants
- Z) Xylem is not found in plants, while phloem is only present in plants

ANSWER: W) XYLEM TRANSPORTS WATER AND DISSOLVED NUTRIENTS, WHILE PHLOEM TRANSPORTS DISSOLVED ORGANIC MATERIALS IN AN AQUEOUS SOLUTION

TOSS-UP

22) EARTH AND SPACE *Multiple Choice* Which of the following general statements is NOT true regarding the Arctic?

- W) It is a smaller continent than the Antarctic
- X) It is warmer than the Antarctic
- Y) It is at a lower elevation than the Antarctic
- Z) It is less isolated from other landmasses than the Antarctic

ANSWER: W) IT IS A SMALLER CONTINENT THAN THE ANTARCTIC

BONUS

22) EARTH AND SPACE *Short Answer* Rank the following four minerals from hardest to softest: 1) quartz, 2) halite, 3) pyrite, 4) aragonite [**uh-RAG-uh-nyt**].

ANSWER: 1, 3, 4, 2 (ACCEPT: QUARTZ, PYRITE, ARAGONITE, HALITE)

TOSS-UP

23) GENERAL SCIENCE *Multiple Choice* Halogen lights are a special kind of incandescent lamp that has a small amount of a halogen gas added to the glass coating. Which of the following is an example of a chemical from the halogen group?

- W) Iodine
- X) Silver
- Y) Lead
- Z) Carbon

ANSWER: W) IODINE

BONUS

23) GENERAL SCIENCE *Short Answer* A rogue helicopter pilot captures you and drops you in the middle of a desert. All around you is desert and you think all hope is lost. But suddenly, you see a group of trees at the bottom of a valley. You make your way there and find a small pond surrounded by the trees. What type of underground rock formation is providing this beautiful desert oasis?

ANSWER: ARTESIAN

TOSS-UP

24) LIFE SCIENCE *Multiple Choice* Which of the following is NOT an accurate comparison between meiosis [*my-OH-sis*] and mitosis [*my-TOH-sis*]?

- W) During metaphase in mitosis, chromosomes line up at the equator, while during metaphase I, homologous [*huh-MOL-uh-guhs*] pairs line up at the equator
- X) In prophase in mitosis, chromosomes are made of two sister chromatids [*KROH-muh-tids*], while in prophase I, homologous chromosomes form tetrads
- Y) In both anaphase in mitosis and anaphase I of meiosis, sister chromatids separate
- Z) Mitosis produces two identical cells, while meiosis produces four daughter cells

ANSWER: Y) IN BOTH ANAPHASE IN MITOSIS AND ANAPHASE I OF MEIOSIS, SISTER CHROMATIDS SEPARATE

BONUS

24) LIFE SCIENCE *Short Answer* In a normal cell cycle in eukaryotes [*yoo-KAR-ee-ohts*], what two families of proteins are required to permit movement through the cell cycle?

ANSWER: CYCLINS, CYCLIN-DEPENDENT KINASES (ACCEPT: CDKS)

TOSS-UP

25) ENERGY *Multiple Choice* Your teacher asks you to draw a free body diagram of a box being moved by a rope and pulley system. Which of the following should be included?

- W) All forces acting on the box
- X) All forces exerted by the box on itself
- Y) All forces exerted by the box on other objects
- Z) Both forces for all action-reaction pairs

ANSWER: W) ALL FORCES ACTING ON THE BOX

BONUS

25) ENERGY *Multiple Choice* Which of the following is NOT an accurate comparison between Hurricane Katrina and Hurricane Sandy?

- W) Hurricane Katrina's winds were more intense, but they covered less area than Hurricane Sandy's winds
- X) Hurricane Katrina had an asymmetric, broad wind field, but Hurricane Sandy had a compact, symmetrical wind field
- Y) Hurricane Katrina generated a locally higher storm surge, but Hurricane Sandy generated a destructive surge over a longer length of coastline
- Z) Hurricane Katrina's strongest winds were just east of its eye, but Hurricane Sandy's winds were weakest to the east

ANSWER: X) HURRICANE KATRINA HAD AN ASYMMETRIC, BROAD WIND FIELD, BUT HURRICANE SANDY HAD A COMPACT, SYMMETRICAL WIND FIELD