

ROUND 15

TOSS-UP

1) GENERAL SCIENCE *Multiple Choice* Which of the following types of scientists would most likely use the PCR, or polymerase chain reaction, method in their experiments:

- W) nuclear chemist
- X) astronomer
- Y) geneticist
- Z) physicist

ANSWER: Y) GENETICIST

BONUS

1) GENERAL SCIENCE *Short Answer* Giving your answer in grams, add 3000 centigrams to 5000 milligrams:

ANSWER: 35

(Solution: 3000 cg = 30g; 5000 mg = 5g; 30g + 5g = 35 grams)

TOSS-UP

2) LIFE SCIENCE *Short Answer* Oxygen released by plants during photosynthesis originates from what substance?

ANSWER: WATER (ACCEPT: H₂O)

BONUS

2) LIFE SCIENCE *Short Answer* Name all of the following 4 organisms that are considered to have no true tissues: sponges; flatworms; round worms; rotifers

ANSWER: SPONGES

TOSS-UP

3) PHYSICAL SCIENCE *Short Answer* Order the following 3 elements from the one that most easily loses an electron to the one which will be the most difficult to remove an electron from: potassium; fluorine; nitrogen

ANSWER: POTASSIUM; NITROGEN; FLUORINE

BONUS

3) PHYSICAL SCIENCE *Multiple Choice* Which of the following BEST describes the following reaction: $4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$

- W) synthesis
- X) combustion
- Y) single replacement
- Z) double replacement

ANSWER: W) SYNTHESIS

TOSS-UP

4) EARTH SCIENCE *Multiple Choice* Which of the following terms is LEAST related to the action of glaciers:

- W) esker
- X) terminal moraine
- Y) karst topography
- Z) kettle lake

ANSWER: Y) KARST TOPOGRAPHY

BONUS

4) EARTH SCIENCE *Multiple Choice* The Moon is full on September 7, 2006. On which of the following days that month will a last quarter Moon occur:

- W) the 14th
- X) the 21st
- Y) the 28th
- Z) the 29th

ANSWER: W) THE 14TH

TOSS-UP

5) MATH *Short Answer* If 2 fair dice are rolled simultaneously, what is the probability that the 2 dice will show the same number expressed as a fraction in lowest terms?

ANSWER: 1/6

BONUS

5) MATH *Short Answer* If the volume of a rectangular pyramid is 36 cubic meters and its base measures 3 meters in length and 4 meters in width, find its height, in meters:

ANSWER: 9

(Solution: $V = 1/3(l \times w \times h)$; $36 = 1/3(3 \times 4 \times h)$; $h = 9$ m)

TOSS-UP

6) GENERAL SCIENCE *Multiple Choice* Which of the following forms of coal typically has the HIGHEST percent carbon content:

- W) peat
- X) anthracite
- Y) bituminous
- Z) lignite

ANSWER: X) ANTHRACITE

BONUS

6) GENERAL SCIENCE *Multiple Choice* The U.S. contains a vast energy resource that could fuel the nation for several hundred more years at our current rate of consumption if it were not so difficult and expensive to mine. Which of the following BEST describes this resource:

- W) tar sands
- X) deep underground peat beds
- Y) oil shale
- Z) propane

ANSWER: Y) OIL SHALE

TOSS-UP

7) LIFE SCIENCE *Multiple Choice* Which of the following BEST describes why all mammalian nucleated non-sex cells have the same chromosomes but appear and function in greatly different ways:

- W) different cells lose and acquire different genes as they mature
- X) as cells mature they develop different genes
- Y) different genes are turned on and off as cells mature
- Z) cells transport pieces of chromosomes called plasmids to control how different cells will function and appear

ANSWER: Y) DIFFERENT GENES ARE TURNED ON AND OFF AS CELLS MATURE

BONUS

7) LIFE SCIENCE *Short Answer* What would be the number of chromosomes in a normal human skin cell that went through one complete sequence of mitosis and did not go through cytokinesis?

ANSWER: 92

TOSS-UP

8) PHYSICAL SCIENCE *Multiple Choice* A litmus paper test is used to determine:

- W) whether a solution is acidic or basic
- X) simple metallic elements
- Y) rates of reactions
- Z) bacterial counts in drinking water

ANSWER: W) WHETHER A SOLUTION IS ACIDIC OR BASIC

BONUS

8) PHYSICAL SCIENCE *Multiple Choice* A carboxyl group is the functional group in which of the following classes of compounds:

- W) ester
- X) organic acid
- Y) halocarbon
- Z) hydrocarbon

ANSWER: X) ORGANIC ACID

TOSS-UP

9) EARTH SCIENCE *Multiple Choice* Which of the following is the most immediate driving force of surface ocean currents such as the North Pacific Drift and Gulf Stream currents:

- W) tides
- X) centripetal force of the oceans
- Y) daily temperature variations
- Z) winds

ANSWER: Z) WINDS

BONUS

9) EARTH SCIENCE *Multiple Choice* Looking at a weather map of the Northern Hemisphere, which of the following BEST describes the circulation of air around a low pressure system, designated with an “L”:

- W) a counterclockwise flow of air into the center
- X) a counterclockwise flow of air out of the center
- Y) a clockwise flow of air into the center
- Z) a clockwise flow of air out of the center

ANSWER: W) A COUNTERCLOCKWISE FLOW OF AIR INTO THE CENTER

TOSS-UP

10) MATH *Short Answer* Solve the following radical equation for x , when x is a real number:

$$\sqrt[4]{(x-2)} = 2$$

ANSWER: 18

BONUS

10) MATH *Short Answer* If the surface area of a right rectangular prism is 188 cubic centimeters and its length is 6 centimeters and its height is 7 centimeters, find its width, to the nearest whole centimeter:

ANSWER: 4

TOSS-UP

11) GENERAL SCIENCE *Multiple Choice* Which of the following is a polymer commonly used to manufacture plastic bottles, toys and indoor/outdoor carpeting:

- W) polyvinyl chloride
- X) polystyrene
- Y) polypropylene
- Z) nylon

ANSWER: Y) POLYPROPYLENE

BONUS

11) GENERAL SCIENCE *Multiple Choice* Beeswax is BEST described as a:

- W) protein with small amounts of sugar
- X) petroleum derivative
- Y) short-chain carbohydrate
- Z) long-chain hydrocarbon

ANSWER: Z) LONG-CHAIN HYDROCARBON

TOSS-UP

12) LIFE SCIENCE *Short Answer* What is the term for the front transparent covering of the human eye through which light travels first?

ANSWER: CORNEA

BONUS

12) LIFE SCIENCE *Short Answer* Order the following 4 human vertebral bone types from UPPERMOST to the LOWERMOST in the vertebral column: sacral; lumbar; cervical; thoracic

ANSWER: CERVICAL; THORACIC; LUMBAR; SACRAL

TOSS-UP

13) PHYSICAL SCIENCE *Multiple Choice* Which of the following statements is NOT true:

- W) neutral pH solutions have small but equal numbers of hydronium and hydroxide ions
- X) when an acid is added to water it will increase the solutions concentration of hydronium ions
- Y) strong acids dissociate almost completely in water
- Z) strong bases do not dissociate in water

ANSWER: Z) STRONG BASES DO NOT DISSOCIATE IN WATER

BONUS

13) PHYSICAL SCIENCE *Multiple Choice* If the work input remains the same and there is an increase in the output of a simple machine, there would also have to be an increase in the machine's:

- W) power
- X) efficiency
- Y) friction
- Z) effort force

ANSWER: X) EFFICIENCY

TOSS-UP

14) EARTH SCIENCE *Multiple Choice* Which of the following is NOT true about rocks:

- W) corundum is harder than quartz
- X) pyrite is also known as 'fool's gold'
- Y) halite occurs as a perfect cubic crystal
- Z) felsic rocks contain large amounts of magnesium and iron

ANSWER: Z) FELSIC ROCKS CONTAIN LARGE AMOUNTS OF MAGNESIUM AND IRON

BONUS

14) EARTH SCIENCE *Short Answer* Of the following 4 tectonic plates, name the LARGEST and the SMALLEST: the Pacific plate; the North American plate; the Juan de Fuca plate; the African plate

ANSWER: LARGEST = PACIFIC PLATE; SMALLEST = THE JUAN DE FUCA PLATE

TOSS-UP

15) MATH *Multiple Choice* Which of the following equations has a graph that is a circle:

W) $x^2 + y^2 = 25$

X) $4y = 3x + 2$

Y) $y = x^2$

Z) $x - 3 = 0$

ANSWER: W) $x^2 + y^2 = 25$

BONUS

15) MATH *Short Answer* Find the distance between and give the coordinates of the midpoint between the following points: (12, 8) and (18, 8)

ANSWER: DISTANCE = 6; MIDPOINT = (15, 8)

(Solution: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$; $\sqrt{(18 - 12)^2 + (8 - 8)^2} = 6$);

midpoint $x = (x_1 + x_2)/2 = (12 + 18)/2 = 15$; midpoint $y = (y_1 + y_2)/2 = (8 + 8)/2 = 8$)

TOSS-UP

16) GENERAL SCIENCE *Short Answer* Name all of the following 5 substances that are NOT derived from petroleum: amber; kerosene; asphalt; latex; paraffin

ANSWER: AMBER; LATEX

BONUS

16) GENERAL SCIENCE *Short Answer* Of the following 5 choices, which is the poorest conductor of electricity: sulfuric acid solution; copper wire; pure aluminum; salt solution; pure water

ANSWER: PURE WATER

TOSS-UP

17) LIFE SCIENCE *Multiple Choice* Which of the following types of nucleic acid carries a complementary copy of a gene from the DNA to the cytoplasm to instruct the order in which amino acids will be made into a protein:

- W) transfer RNA
- X) messenger RNA
- Y) ribosomal RNA
- Z) DNA

ANSWER: X) MESSENGER RNA

BONUS

17) LIFE SCIENCE *Short Answer* What cellular organelle functions to modify and package proteins it received from the rough endoplasmic reticulum and will typically prepare them for exporting outside the cell?

ANSWER: GOLGI (ACCEPT GOLGI BODY OR GOLGI APPARATUS)

TOSS-UP

18) PHYSICAL SCIENCE *Multiple Choice* Which of the following is the BEST evidence that light travels as a wave:

- W) a metal that is heated produces different colors
- X) passing light through two pinholes can produce an interference pattern
- Y) light has a constant speed in a vacuum
- Z) high frequencies have short wavelengths

ANSWER: X) PASSING LIGHT THROUGH TWO PINHOLES CAN PRODUCE AN INTERFERENCE PATTERN

BONUS

18) PHYSICAL SCIENCE *Multiple Choice* Which of the following is NOT true:

- W) weight decreases as you move away from the Earth's surface
- X) mass times gravitational acceleration is weight
- Y) gravitational potential energy increases with increasing height
- Z) kinetic energy can only decrease when potential energy decreases

ANSWER: Z) KINETIC ENERGY CAN ONLY DECREASE WHEN POTENTIAL ENERGY DECREASES

TOSS-UP

19) EARTH SCIENCE *Multiple Choice* Which of the following is NOT true about glaciations:

- W) the land under the West Antarctic Ice Sheet is being pushed down below sea level by the weight of the ice above
- X) most of the icebergs found in the North Atlantic come from the Iceland coast
- Y) current ice sheets can be nearly 2 miles thick
- Z) glaciers can form near the equator at high altitude

ANSWER: X) MOST OF THE ICEBERGS FOUND IN THE NORTH ATLANTIC COME FROM THE ICELAND COAST

(Solution: they come from Greenland)

BONUS

19) EARTH SCIENCE *Multiple Choice* In which of the following ways is firn formed on glaciers:

- W) the partial melting and refreezing of snow crystals into ice grains
- X) the polishing of rocks and boulders by abrasion in stream beds
- Y) layers of sand and sediment originating in glaciers that are transported upslope by strong winds
- Z) friction between bedrock along the base of a glacier

ANSWER: W) THE PARTIAL MELTING AND REFREEZING OF SNOW CRYSTALS INTO ICE GRAINS

TOSS-UP

20) MATH *Short Answer* Expand the following expression, giving your answer in standard binomial form: $(4x + 3y)^2$

ANSWER: $16x^2 + 24xy + 9y^2$

BONUS

20) MATH *Short Answer* How many different outcomes are possible if eight hydrogen fuel cars compete in a race for which first, second, and third prizes will be awarded and no ties are possible?

ANSWER: 336

(Solution: $P(8,3) = 8!/(8-3)! = 8!/5! = 336$)

TOSS-UP

21) GENERAL SCIENCE *Short Answer* What is the scientific technique astronomers have most commonly used since the 1800's to analyze stars and other heavenly bodies for the presence of certain elements?

ANSWER: SPECTROSCOPY

BONUS

21) GENERAL SCIENCE *Short Answer* Arrange the following 4 ecological systems in order of increasing or broad level of complexity: population; community; niche; biosphere

ANSWER: NICHE; POPULATION; COMMUNITY; BIOSPHERE

TOSS-UP

22) LIFE SCIENCE *Short Answer* The ability to interbreed and produce sexually competent offspring is a classic characteristic of what taxonomical level of organisms?

ANSWER: SPECIES

BONUS

22) LIFE SCIENCE *Short Answer* Consider a microbial species that lives in the gut of cows and breaks down cellulose. The cow benefits from the microbe predigesting cellulose and the microbe benefits from the cow by having a place to live. What is scientific term for this sort of symbiosis?

ANSWER: MUTUALISM (DO NOT ACCEPT: SYMBIOSIS OR COMMENSALISM)

TOSS-UP

23) PHYSICAL SCIENCE *Short Answer* Arrange the four states of matter in order of INCREASING kinetic energies for a given material:

ANSWER: SOLID; LIQUID; GAS; PLASMA

BONUS

23) PHYSICAL SCIENCE *Short Answer* What is the weight per volume percent concentration of a solution made by mixing 20 grams of glucose with enough water to make 1 liter of solution?

ANSWER: 2%

(Solution: $w/v\% = 20\text{g}/1000\text{ml} \times 100 = 2\%$)

TOSS-UP

24) EARTH SCIENCE *Short Answer* Arrange the following 4 layers of the Earth's atmosphere in order of DECREASING air pressure: stratosphere; exosphere; thermosphere; troposphere

ANSWER: TROPOSPHERE; STRATOSPHERE; THERMOSPHERE; EXOSPHERE

BONUS

24) EARTH SCIENCE *Short Answer* Of the following 4 ocean life zones, name the one that contains the LEAST variety of ocean life and the one that contains the GREATEST variety of ocean life, respectively: intertidal zone; neritic zone; bathyal (read as: bah-thee-ahl) zone; abyssal zone

ANSWER: LEAST = ABYSSAL; GREATEST = NERITIC

TOSS-UP

25) MATH *Short Answer* Evaluate the following radical expression: $-\sqrt{\sqrt{16}}$ (read as: the negative square root of the square root of 16)

ANSWER: -2

BONUS

25) MATH *Short Answer* Simplify the following expression if x represents a negative quantity:

$$-(16x^4)^{\frac{1}{4}}$$

ANSWER: $2x$