

## ROUND 13

### TOSS-UP

1) EARTH SCIENCE *Multiple Choice* A research project called *Cosmic* plans to use GPS satellites for weather forecasting to give data on temperature, pressure and water vapor in the atmosphere. Today, these data are typically gathered by which of the following:

- W) Doppler radar
- X) sonar
- Y) laser interferometry
- Z) radiosonde (read as: RAY-de-oh-sond) balloons

ANSWER: Z) RADIOSONDE BALLOONS

### BONUS

1) EARTH SCIENCE *Multiple Choice* After the Sumatran earthquake, a seismograph stationed on the opposite side of the epicenter half-way around the Earth would have detected which of the following:

- W) nothing because seismic waves cannot pass through the Earth
- X) both P-waves and S-waves
- Y) only P-waves
- Z) only S-waves

ANSWER: Y) ONLY P-WAVES

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### TOSS-UP

2) MATH *Short Answer* Add and simplify the following 2 polynomials, giving your answer in standard form:  $(9x^3 + 6x^2 + 10x) + (-3x^3 + 9x - 10x^2)$

ANSWER:  $6x^3 - 4x^2 + 19x$

### BONUS

2) MATH *Short Answer* Give the height, to the nearest whole meter, of the triangle that has an area of 54 square meters and whose base is 4-times its height:

ANSWER: 5

**TOSS-UP**

3) GENERAL SCIENCE *Multiple Choice* Which of the following forms of coal typically has the HIGHEST BTU value per pound:

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

ANSWER: X) ANTHRACITE

**BONUS**

3) GENERAL SCIENCE *Multiple Choice* MTBE or methyl tertiary butyl ether, is a:

- W) gasoline additive
- X) organic dye
- Y) food preservative
- Z) plant alkaloid

ANSWER: W) GASOLINE ADDITIVE

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**TOSS-UP**

4) LIFE SCIENCE *Multiple Choice* Which of the following is the BEST example of how evolution progresses:

- W) animals learn to survive through experience and teach their offspring
- X) certain mutations improve an organism's offspring's chances to survive and reproduce in different environments
- Y) animals develop certain strengths and weaknesses through experience and pass the knowledge down by example
- Z) an animal that is successful at hunting will be more likely to survive

ANSWER: X) CERTAIN MUTATIONS IMPROVE AN ORGANISM'S OFFSPRING'S CHANCES TO SURVIVE AND REPRODUCE IN DIFFERENT ENVIRONMENTS

**BONUS**

4) LIFE SCIENCE *Short Answer* Order the following from the part nearest to the START of the human digestive system to the part nearest the END: ileum; esophagus; duodenum; jejunum

ANSWER: ESOPHAGUS; DUODENUM; JEJUNUM; ILEUM

### TOSS-UP

5) PHYSICAL SCIENCE *Multiple Choice* Which of the following BEST describes the following reaction:  $2\text{CaO} \rightarrow 2\text{Ca} + \text{O}_2$

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

ANSWER: X) DECOMPOSITION

### BONUS

5) PHYSICAL SCIENCE *Short Answer* Order the following 3 particles from the one with the LEAST mass to the one with the MOST mass: electron; neutron; photon

ANSWER: PHOTON; ELECTRON; NEUTRON

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### TOSS-UP

6) EARTH SCIENCE *Multiple Choice* Which of the following is TRUE:

- W) pyroclastic flows dominate Hawaiian volcanoes
- X) granitic magma contains less silica than basaltic magma
- Y) peridotite is rock found within the Earth's mantle and some meteorites
- Z) plutons are large masses of basalt

ANSWER: Y) PERIDOTITE IS ROCK FOUND WITHIN THE EARTH'S MANTLE AND SOME METEORITES

### BONUS

6) EARTH SCIENCE *Multiple Choice* Which of the following is TRUE about Earth's atmosphere:

- W) the upper mesosphere is the coldest region of the Earth's atmosphere
- X) the stratopause lies just below the stratosphere
- Y) moist air weighs more than dry air at the same temperature
- Z) the tropopause is higher at the South Pole than at the equator

ANSWER: W) THE UPPER MESOSPHERE IS THE COLDEST REGION OF THE EARTH'S ATMOSPHERE

**TOSS-UP**

7) MATH *Short Answer* Add the following radicals, giving your answer in simplest radical form:  
 $3\sqrt{3} + \sqrt{12}$

ANSWER:  $5\sqrt{3}$

**BONUS**

7) MATH *Short Answer* Solve the following inequality for  $x$ :  $|2x - 3| < 9$  (read as: open absolute value,  $2x$  minus 3, close absolute value, is less than 9)

ANSWER:  $-3 < x < 6$  (ACCEPT:  $X$  IS GREATER THAN  $-3$  AND LESS THAN 6)

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**TOSS-UP**

8) GENERAL SCIENCE *Multiple Choice* Which of the following is a type of burn in which the outer layer of keratin in the skin and the dermis are damaged and is referred to as a full-thickness burn:

- W) 1<sup>st</sup> degree
- X) 2<sup>nd</sup> degree
- Y) 3<sup>rd</sup> degree
- Z) 4<sup>th</sup> degree

ANSWER: Y) 3<sup>rd</sup> DEGREE

**BONUS**

8) GENERAL SCIENCE *Short Answer* In a 2<sup>nd</sup> degree burn, what is the name of the fluid that quickly forms beneath the blister?

ANSWER: SERUM (ACCEPT: SEROUS FLUID)

### TOSS-UP

9) LIFE SCIENCE *Short Answer* What cellular organelle most directly functions to help match the tRNA to the correct place on the mRNA and allows the growing of a protein?

ANSWER: RIBOSOME

### BONUS

9) LIFE SCIENCE *Short Answer* The basic parts of ribosomes are manufactured in what specific part of a eukaryotic cell?

ANSWER: NUCLEOLUS (DO NOT ACCEPT: NUCLEUS)

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### TOSS-UP

10) PHYSICAL SCIENCE *Multiple Choice* Which of the following is NOT true about boiling liquids:

- W) all boiling liquids are too hot to touch
- X) the boiling point of pure water at standard pressure is 373.15 kelvin
- Y) the boiling point of a liquid depends on the surface pressure above the liquid
- Z) adding a handful of table salt to a quart of boiling water will change its boiling point

ANSWER: W) ALL BOILING LIQUIDS ARE TOO HOT TO TOUCH

### BONUS

10) PHYSICAL SCIENCE *Short Answer* How many grams of sodium chloride are in 300 grams of a 20% solution, if the atomic masses of sodium and chloride are 23 and 35, respectively?

ANSWER: 60

**TOSS-UP**

11) EARTH SCIENCE *Multiple Choice* Which of the following is the BEST reason why the Earth's inner core is solid and the outer core is not:

- W) greater depths yield cooler temperatures
- X) greater depths yield higher pressures
- Y) inner core is further removed from the influence of hot magma
- Z) they have different mineral contents

ANSWER: X) GREATER DEPTHS YIELD HIGHER PRESSURES

**BONUS**

11) EARTH SCIENCE *Multiple Choice* Coral reefs capture about half of all calcium flowing into the ocean every year by fixing it into:

- W) calcium carbonate
- X) calcium fluoride
- Y) calcium oxalate
- Z) quartz

ANSWER: W) CALCIUM CARBONATE

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**TOSS-UP**

12) MATH *Multiple Choice* If  $k$  is an integer greater than 1, which of the following is greater than 1:

- W)  $-(-k)^3$  Read as: negative - open parenthesis - negative  $k$  - closed parenthesis - to the third power
- X)  $-(k)^3$  Read as: negative - open parenthesis -  $k$  - closed parenthesis - to the third power
- Y)  $(k)^{\frac{1}{3}}$  Read as: open parenthesis -  $k$  - closed parenthesis - to the negative one-third power
- Z)  $-|k|^3$  Read as: negative - open absolute value -  $k$  - closed absolute value - to the third power

ANSWER: W)  $-(-k)^3$

**BONUS**

12) MATH *Short Answer* Giving your answer in the simplest form, what is the slope-intercept equation of the line passing through the points (3, 8) and (2, 3)?

ANSWER:  $y = 5x - 7$

**TOSS-UP**

13) GENERAL SCIENCE *Short Answer* From what continent do more than 80% of the weather systems originate which become tropical storms or hurricanes that reach the U.S. eastern and southern shores?

ANSWER: AFRICA

**BONUS**

13) GENERAL SCIENCE *Multiple Choice* It is believed that the heavy elements in Earth's crust primarily originated from:

- W) comets
- X) asteroids
- Y) meteorites
- Z) exploding stars called supernovae

ANSWER: Z) EXPLODING STARS CALLED SUPERNOVAE

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**TOSS-UP**

14) LIFE SCIENCE *Short Answer* What structure of the human eye is primarily responsible for regulating the amount of light that enters the eye?

ANSWER: PUPIL

**BONUS**

14) LIFE SCIENCE *Short Answer* In the human eye, what type of light receptor is most densely populated at the fovea (read as: FOE-vee-ah)?

ANSWER: CONES

### TOSS-UP

15) PHYSICAL SCIENCE *Multiple Choice* Which of the following is MOST commonly used to separate substances based on solubility differences:

- W) centrifugation
- X) autoclaving
- Y) paper filtration
- Z) paper chromatography

ANSWER: Z) PAPER CHROMATOGRAPHY

### BONUS

15) PHYSICAL SCIENCE *Short Answer* Name all of the following 3 pairs of elements that would be chemically bonded by a covalent bond: carbon and carbon; magnesium and chlorine; silicon and oxygen

ANSWER: CARBON AND CARBON; SILICON AND OXYGEN

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### TOSS-UP

16) EARTH SCIENCE *Multiple Choice* Which of the following BEST explains why there is typically less temperature variation along the coasts of continents versus inland climates at the same latitude:

- W) land surfaces of the planet can store more heat than the oceans
- X) the friction between waves and the shore add heats to the area
- Y) water can absorb and release large amounts of heat with very little change in temperature
- Z) surface ocean currents along shorelines typically carry warm water

ANSWER: Y) WATER CAN ABSORB AND RELEASE LARGE AMOUNTS OF HEAT WITH VERY LITTLE CHANGE IN TEMPERATURE

### BONUS

16) EARTH SCIENCE *Multiple Choice* Surface bedrock in British Columbia often has long, parallel scratches called striations. Which of the following is most likely TRUE about these markings:

- W) they were caused by seasonal freeze-thaw cycles
- X) a glacier once moved in the direction of these scratches
- Y) a swift river once ran through these areas
- Z) the area was once a pluvial lake

ANSWER: X) A GLACIER ONCE MOVED IN THE DIRECTION OF THESE SCRATCHES

**TOSS-UP**

17) MATH *Multiple Choice* Which of the following is equivalent to the radical expression,  $\sqrt{(18^{18})}$  Read as: square root of open parenthesis 18 to the 18<sup>th</sup> power closed parenthesis

- W)  $3^3$
- X)  $9^9$
- Y)  $18^3$
- Z)  $18^9$

ANSWER: Z)  $18^9$

**BONUS**

17) MATH *Short Answer* Give the third term in the binomial expansion of the following:  $(x + y)^5$

ANSWER:  $10x^3y^2$

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**TOSS-UP**

18) GENERAL SCIENCE *Multiple Choice* The majority of sulfuric acid produced in the U.S. today is used to make which of the following:

- W) fertilizers
- X) glass
- Y) paint
- Z) plastics

ANSWER: W) FERTILIZERS

**BONUS**

18) GENERAL SCIENCE *Short Answer* Fertilizers typically have 3 numbers such as 5, 10, 5. What are the chemical elements that represent these numbers, in any order?

ANSWER: NITROGEN; PHOSPHOROUS; POTASSIUM (ACCEPT: N; P; K)

### TOSS-UP

19) LIFE SCIENCE *Short Answer* What insect is used the most in experiments studying genetics and development?

ANSWER: FRUIT FLY (ACCEPT: DROSOPHILA MALANOGASTER OR DROSOPHILA)

### BONUS

19) BIOLOGY *Multiple Choice* Which of the following is the BEST explanation why fruit flies are popular experimental organisms in genetic studies:

- W) they are true breeding with almost no mutations and have only two chromosomes
- X) they are cheap to maintain, produce many offspring, and have a short time between generations
- Y) they are very safe, carry no human diseases, and have only two chromosomes
- Z) their genes are extra-sensitive to mutation-causing substances, which makes them excellent to observe evolving under stress

ANSWER: X) THEY ARE CHEAP TO MAINTAIN, PRODUCE MANY OFFSPRING, AND HAVE A SHORT TIME BETWEEN GENERATIONS

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### TOSS-UP

20) PHYSICAL SCIENCE *Multiple Choice* Raising a bucket of chicken fat from the floor to 3 meters high off the floor would increase the bucket's:

- W) kinetic energy
- X) chemical energy
- Y) thermal energy
- Z) potential energy

ANSWER: Z) POTENTIAL ENERGY

### BONUS

20) PHYSICAL SCIENCE *Multiple Choice* During normal chemical reactions, although the combinations of atoms that form molecules can change, the total number of atoms must remain the same. This is called:

- W) the law of interchange
- X) the atomic principle
- Y) the law of conservation of matter
- Z) Dalton's law

ANSWER: Y) THE LAW OF CONSERVATION OF MATTER

**TOSS-UP**

21) EARTH SCIENCE *Short Answer* Order the following 4 minerals from the SOFTEST to the HARDEST: fluorite; gypsum; talc; calcite

ANSWER: TALC; GYPSUM; CALCITE; FLUORITE

**BONUS**

21) EARTH SCIENCE *Short Answer* A third quarter moon has what percent of its surface appearing to be illuminated to an observer on Earth?

ANSWER: 50

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**TOSS-UP**

22) MATH *Short Answer* Factor the following polynomial over the integers:  
 $49x^2 - 64$

ANSWER:  $(7x + 8)(7x - 8)$

**BONUS**

22) MATH *Short Answer* Consider a distribution of 7 scores with a median of 20. If the lowest score value is decreased by 4, what will the new median value be for this distribution of 7 scores?

ANSWER: 20

**TOSS-UP**

23) GENERAL SCIENCE *Short Answer* What is the most common name of the object in outer space that has a gravitational field so strong that light cannot escape from it?

ANSWER: BLACK HOLE

**BONUS**

23) GENERAL SCIENCE *Short Answer* Both the Sun and the Gas Giants in our Solar System are composed primarily of what 2 elements?

ANSWER: HYDROGEN AND HELIUM

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**TOSS-UP**

24) LIFE SCIENCE *Short Answer* Bile is produced by what organ of the human body?

ANSWER: LIVER

**BONUS**

24) LIFE SCIENCE *Short Answer* Into what human organ does the gall bladder release bile?

ANSWER: SMALL INTESTINE (ACCEPT: DUODENUM)

### **TOSS-UP**

25) PHYSICAL SCIENCE *Short Answer* Name all of the following 3 choices that affect the speed of sound in a substance: temperature; density; elasticity

ANSWER: TEMPERATURE; DENSITY; ELASTICITY (ACCEPT: ALL OF THEM)

### **BONUS**

25) PHYSICAL SCIENCE *Short Answer* Name all of the following 5 choices that are NOT a form of electromagnetic radiation: radio waves; gamma-rays; cosmic rays; infrared light; ultrasound waves

ANSWER: COSMIC RAYS AND ULTRASOUND WAVES