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

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
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

**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

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)

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\(^{st}\) degree
X) 2\(^{nd}\) degree
Y) 3\(^{rd}\) degree
Z) 4\(^{th}\) degree

ANSWER: Y) 3\(^{rd}\) DEGREE

BONUS

8) GENERAL SCIENCE Short Answer In a 2\(^{nd}\) 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)

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

TOSS-UP

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

W) \( -(\neg k)^3 \) Read as: negative - open parenthesis - negative k - closed parenthesis - to the third power  
X) \( -{}^{\neg}k^3 \) 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) \( -(\neg k)^3 \)

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

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

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 18th 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: \(10x^3y^2\)

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

---

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

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

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