

## ROUND ROBIN – ROUND 16

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### TOSS-UP

1) Earth & Space – *Short Answer* The visible stars in the Milky Way galaxy do not orbit the center of the galaxy in a Keplerian fashion. This is likely due to the galaxy being surrounded by a halo of what?

ANSWER: DARK MATTER

### BONUS

1) Earth & Space – *Short Answer* Identify all of the following three statements that are true regarding the asteroid belt: 1) The inner edge contains mostly C-type asteroids; 2) The outer edge contains mostly C-type asteroids; 3) The asteroid belt likely did not accrete into a single planet due to the tidal forces of Mars.

ANSWER: 2

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### TOSS-UP

2) Math – *Short Answer* Besides itself, what is the largest integer factor of 425?

ANSWER: 85

### BONUS

2) Math – *Short Answer* A pyramid with 86 edges has how many faces?

ANSWER: 44

### TOSS-UP

3) Energy – *Multiple Choice* Oak Ridge National Lab scientists are studying perovskites [*purr-OFF-skytes*], which are a class of minerals that have the general formula  $ABO_3$ , where A is usually an alkaline earth element and B is a d-block transition metal. Which of the following elements could NOT be found as B in this formula?

- W) Cesium [*SEE -zee- um*]
- X) Titanium
- Y) Zirconium [*zur-KOH-nee-um*]
- Z) Vanadium [*vah-NAY-dee-um*]

ANSWER: W) CESIUM

### BONUS

3) Energy – *Multiple Choice* SLAC [*slack*] National Accelerator Lab scientists are studying trimethylamine [*try-methil-ah-MEEN*] with photo-dissociation [*photo-disso-see-AY-shun*] spectroscopy. When they excite trimethylamine with 200 nanometer light, which of the following atomic orbitals is the excited electron most likely to occupy?

- W) 6p
- X) 1s
- Y) 3p
- Z) 2p

ANSWER: Y) 3p

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### TOSS-UP

4) Earth & Space – *Multiple Choice* Which set of terms best describe the headwaters region of a stream?

- W) High gradient, wide floodplain, meanders, large cross-section, high discharge
- X) Low gradient, wide floodplain, meanders, large cross-section, lower discharge
- Y) Low gradient, wide floodplain, no meanders, small cross-section, high discharge
- Z) High gradient, no floodplain, no meanders, small cross-section, lower discharge

ANSWER: Z) HIGH GRADIENT, NO FLOODPLAIN, NO MEANDERS, SMALL CROSS-SECTION, LOWER DISCHARGE

### BONUS

4) Earth & Space – *Short Answer* Order the following three stages of coral reef development around a subsiding volcanic island in chronological order: 1) Atoll; 2) Fringing reef; 3) Barrier reef.

ANSWER: 2, 3, 1

**TOSS-UP**

5) Physical Science – *Short Answer* What physical quantity measures the product of a force on an object and the object's displacement in the direction the force was applied?

ANSWER: WORK (DO NOT ACCEPT: ENERGY)

**BONUS**

5) Physical Science – *Short Answer* A screeching hawk is flying directly toward you with a speed of 40 meters per second. What is the ratio of the frequency of the screech you hear to its original frequency?

ANSWER: 17/15 (ACCEPT: 1 2/15)

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**TOSS-UP**

6) Life Science – *Short Answer* How many types of cone cells are in the human eye?

ANSWER: THREE

**BONUS**

6) Life Science – *Short Answer* Identify all of the following three statements that are true regarding sugars: 1) Glucose, fructose, and galactose are structural isomers; 2) Glucose, fructose, and galactose are hexose sugars; 3) Lactose is a disaccharide [*dye-SAK-ah-ride*] composed of glucose and galactose.

ANSWER: ALL

**TOSS-UP**

7) Earth & Space – *Multiple Choice* Which of the following is a consequence of the R-process?

- W) A star transitions onto the main sequence
- X) A star is no longer capable of hydrogen fusion
- Y) A protostar is formed
- Z) Heavy elements are made

ANSWER: Z) HEAVY ELEMENTS ARE MADE

**BONUS**

7) Earth & Space – *Short Answer* Order the following four natural satellites in terms of increasing distance from the Sun: 1) Europa [*your-OH-pah*]; 2) Triton; 3) Phobos [*FOH-bose*]; 4) Titan.

ANSWER: 3, 1, 4, 2

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**TOSS-UP**

8) Math – *Short Answer* An item is originally priced at 20 dollars. Discounts are based on the current marked price. In two consecutive sales, the price is reduced by 20%, then 40%. In dollars and cents, what is the final price of the item?

ANSWER: \$9.60

**BONUS**

8) Math – *Short Answer* Sixty students at the Science Academy play tennis or soccer. If 12 play both and 31 play tennis, how many play soccer but not tennis?

ANSWER: 29

### TOSS-UP

9) Life Science – *Short Answer* During the light-dependent reactions of photosynthesis, absorption of light drives a series of electron transfer events resulting in the production of ATP and what reduced energy-carrying product?

ANSWER: NADPH (ACCEPT: REDUCED NICOTINAMIDE ADENINE DINUCLEOTIDE PHOSPHATE; DO NOT ACCEPT: NADP, NADP+)

### BONUS

9) Life Science – *Short Answer* Consider blood entering the human heart from the vena cava. Place the following three locations the blood will pass through in chronological order: 1) Right ventricle; 2) Pulmonary vein; 3) Left atrium.

ANSWER: 1, 2, 3

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### TOSS-UP

10) Energy – *Multiple Choice* Scientists at Oak Ridge National Lab are studying nightshades. Which of the following chemicals is a characteristic product of certain nightshades?

- W) Capsaicin [*cap-SAY-ih-sin*]
- X) Taxol
- Y) Cisplatin [*sis-PLAT-in*]
- Z) Penicillin

ANSWER: W) CAPSAICIN

### BONUS

10) Energy – *Short Answer* Scientists at the Joint Genome Institute are studying the compounds made by the eucalyptus tree. Identify all of the following three statements that are true of the eucalyptus:  
1) It is an angiosperm; 2) It is a dicot [*DIE-cot*]; 3) It produces oil.

ANSWER: ALL

**TOSS-UP**

11) Math – *Short Answer* In order, four points on a circle are named *A, B, C,* and *D.* If angle *BAC* measures 23 degrees and angle *CAD* measures 34 degrees, what is the degree measure of arc *BCD*?

ANSWER: 114

**BONUS**

11) Math – *Short Answer* A 5-digit positive integer has 5 different digits and is divisible by 9. What is the smallest such number?

ANSWER: 10,278

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**TOSS-UP**

12) Life Science – *Short Answer* Many enzymes in signaling cascades are called kinases [*KYE-nases*], because they move what inorganic group usually from ATP onto substrates?

ANSWER: PHOSPHATE (ACCEPT:  $PO_4^-$ )

**BONUS**

12) Life Science – *Multiple Choice* Which of the following best explains why estrogen in the blood is typically found attached to globular [*GLAW-byoo-lur*] proteins?

- W) It is not water-soluble
- X) It needs to be transported in an inactive form
- Y) It is quickly broken down when unbound
- Z) It is produced attached to these proteins

ANSWER: W) IT IS NOT WATER-SOLUBLE

**TOSS-UP**

13) Physical Science – *Short Answer* What phase of matter is most likely to have atoms located at fixed distances away from each other?

ANSWER: SOLID

**BONUS**

13) Physical Science – *Short Answer* Identify all of the following diatomic species that contain covalent bonds: 1) Potassium chloride; 2) Molecular chlorine; 3) Sodium fluoride.

ANSWER: 2

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**TOSS-UP**

14) Math – *Short Answer* Calculate the sum of the following three fractions:  $\frac{1}{5}$ ,  $\frac{1}{6}$ , and  $\frac{1}{30}$

ANSWER:  $\frac{2}{5}$  (ACCEPT: 0.4)

**BONUS**

14) Math – *Short Answer* What is the polynomial with least degree, integer coefficients, and leading coefficient one that has  $5 - \sqrt{7}$  as a zero?

ANSWER:  $x^2 - 10x + 18$

**TOSS-UP**

15) Energy – *Multiple Choice* Researchers at SLAC [*slack*] National Accelerator Facility are using the Linac Coherent Light Source to demagnetize a magnet extremely quickly. Which of the following processes would also likely demagnetize a magnet?

- W) Attaching the magnet to a 9-volt battery
- X) Running an alternating current through the magnet
- Y) Submerging the magnet in aqueous solution
- Z) Cooling the magnet with liquid nitrogen

ANSWER: X) RUNNING AN ALTERNATING CURRENT THROUGH THE MAGNET

**BONUS**

15) Energy – *Multiple Choice* Scientists at Lawrence Berkeley National Lab are developing new polymerizable [*paw-lim-ur-EYE-zah-bul*] linkages to produce plastics that can be recycled. What type of linkage is present in proteins?

- W) Polycarbonate
- X) Polyester
- Y) Polyamide [*poly-AM-ide*]
- Z) Polystyrene [*poly-STYE-reen*]

ANSWER: Y) POLYAMIDE

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**TOSS-UP**

16) Physical Science – *Short Answer* Vince pushes a block horizontally by applying a 17-newton force, causing it to move 3 meters. In joules, how much work did he do on the block?

ANSWER: 51

**BONUS**

16) Physical Science – *Short Answer* Maggie has two charges of unknown sign and magnitude. She brings them together and finds that they repel each other. Identify all of the following three statements that are reasonable conclusions based on this observation: 1) The charges are both negative; 2) The magnitude of the charges is the same; 3) The charges have opposite signs.

ANSWER: NONE OF THEM



**TOSS-UP**

17) Life Science – *Multiple Choice* Which of the following genetic disorders results from a dominant allele?

- W) Huntington’s disease
- X) Sickle-cell disease
- Y) Hemophilia A
- Z) Tay-Sachs [*TAY-saks*] disease

ANSWER: W) HUNTINGTON’S DISEASE

**BONUS**

17) Life Science – *Short Answer* Abby’s biological parents have type O blood and type AB blood. Identify all of the following three blood types that Abby could have: 1) O; 2) A; 3) AB.

ANSWER: 2

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**TOSS-UP**

18) Earth & Space – *Short Answer* Identify all of the following three pieces of evidence showing that structural uplift occurred: 1) Glacial till deposits in a drumlin; 2) The presence of tektites at the surface; 3) River delta deposits.

ANSWER: NONE

**BONUS**

18) Earth & Space – *Short Answer* The Cambrian and the Jurassic are examples of what sub-division of geologic time?

ANSWER: PERIOD

**TOSS-UP**

19) Math – *Short Answer* What is the constant term in the expansion of open parenthesis  $x + 5$  close parenthesis squared multiplied by open parenthesis  $x - 1$  close parenthesis cubed?

ANSWER: -25

**BONUS**

19) Math – *Short Answer* A set of 11 points has exactly 5 that are collinear. Otherwise, no three points in the set are collinear. How many lines contain at least two of the 11 points?

ANSWER: 46

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**TOSS-UP**

20) Physical Science – *Short Answer* What is the solvent in brass?

ANSWER: COPPER (ACCEPT: Cu)

**BONUS**

20) Physical Science – *Multiple Choice* A unit of voltage multiplied by a unit of charge results in a unit that measures which of the following quantities?

- W) Energy
- X) Force
- Y) Power
- Z) Current

ANSWER: W) ENERGY

**TOSS-UP**

21) Life Science – *Multiple Choice* Which of the following locations functions as the thermostat of the human body?

- W) Hypothalamus
- X) Thalamus
- Y) Pons
- Z) Medulla [*meh-DULL-ah*] oblongata [*awb-lawn-GAH-tah*]

ANSWER: W) HYPOTHALAMUS

**BONUS**

21) Life Science – *Short Answer* Consider the cross of two plants, one of which has red flowers and one of which has white flowers. Given that 50% of their offspring have white flowers and 50% have red flowers and assuming complete dominance and independent assortment, identify all of the following three statements that can be concluded from this cross: 1) The red flower trait is dominant to the white flower trait; 2) One of the plants is homozygous [*homo-ZYE-gus*] for the trait that it possesses; 3) The white-flowered plant is heterozygous [*hetero-ZYE-gus*] for the trait that it possesses.

ANSWER: 2

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**TOSS-UP**

22) Earth & Space – *Multiple Choice* Which of the following Earth-based measurements in parsecs is closest to the distance limit of stellar parallax?

- W) 1
- X) 100
- Y) 1,000
- Z) 10,000

ANSWER: X) 100

**BONUS**

22) Earth & Space – *Short Answer* Place the following three types of stars in chronological order of the Sun's lifecycle: 1) Black dwarf; 2) White dwarf; 3) Red giant.

ANSWER: 3, 2, 1

**TOSS-UP**

23) Physical Science – *Short Answer* How many valence electrons does the sodium plus ion possess?

ANSWER: EIGHT (DO NOT ACCEPT: ZERO)

**BONUS**

23) Physical Science – *Short Answer* What is the value of 86 degrees Fahrenheit in degrees Celsius?

ANSWER: 30