

ROUND ROBIN – ROUND 17

TOSS-UP

1) Math – *Short Answer* If the product of two binomials is $h^2 + 4h - 396$ and one factor is $h - 18$, what is the other factor?

ANSWER: $h + 22$

BONUS

1) Math – *Short Answer* Given the arithmetic sequence with first three terms $-10, -3, 4$, what is the 220th term?

ANSWER: 1523

TOSS-UP

2) Earth & Space – *Multiple Choice* An extrusive lava flow erupts at the surface. The resulting igneous rock is partially eroded, at which point alternating layers of shale and limestone are deposited on top. Which of the following features must be present in the resulting formation?

- W) A sill
- X) A nonconformity
- Y) A syncline
- Z) A basin

ANSWER: X) A NONCONFORMITY

BONUS

2) Earth & Space – *Multiple Choice* During which time period did lobe-finned fish begin to adapt to living partially on land?

- W) Devonian [*deh-VOH-nee-an*]
- X) Silurian [*sih-LOOR-ee-an*]
- Y) Ordovician [*OR-doh-VIH-shin*]
- Z) Cambrian [*CAM-bree-an*]

ANSWER: W) DEVONIAN

TOSS-UP

3) Physical Science – *Short Answer* What term describes the tendency of waves to bend around obstacles?

ANSWER: DIFFRACTION (DO NOT ACCEPT: REFRACTION)

BONUS

3) Physical Science – *Multiple Choice* In general, an object's de Broglie [*da-BROY*] wavelength is inversely proportional to which of the following of its properties?

- W) Color
- X) Acceleration
- Y) Momentum
- Z) Impulse

ANSWER: Y) MOMENTUM

TOSS-UP

4) Energy – *Short Answer* Scientists are using the DOE's Environmental Molecular Sciences Laboratory to study soybean root nodules, which are one of the few locations where what gas can be reacted to form ammonia?

ANSWER: NITROGEN (ACCEPT: DINITROGEN, N₂)

BONUS

4) Energy – *Short Answer* Scientists at Fermilab are working with CERN to detect composite particles called glueballs in the Large Hadron Collider. Glueballs are composed of bosons that carry what fundamental force?

ANSWER: STRONG (ACCEPT: STRONG NUCLEAR)

TOSS-UP

5) Life Science – *Short Answer* Water and gas diffuse out of plant leaves through tiny openings called what?

ANSWER: STOMA (ACCEPT: STOMATA, STOMATE, STOMATES)

BONUS

5) Life Science – *Multiple Choice* Neuraminidase [*NOOR-ah-MIN-ih-dase*] is present on the surface of the influenza virus. Which of the following statements best describes the mechanism through which neuraminidase inhibitors, or NAIs, act to limit viral spread?

- W) NAIs inhibit integration of the viral genome into the host genome
- X) NAIs limit replication by preventing the release of virions [*VEER-ee-ons*] from the infected cell
- Y) NAIs directly bind viral RNA sequences to prevent reverse transcription
- Z) NAIs are incorporated into host ribosome complexes and limit translation of viral proteins

ANSWER: X) NAIS LIMIT REPLICATION BY PREVENTING THE RELEASE OF VIRIONS FROM THE INFECTED CELL

TOSS-UP

6) Earth & Space – *Short Answer* Mariner 10, Messenger, and BepiColombo [*behpee-cah-LUM-bo*] are probe missions to primarily study which planet?

ANSWER: MERCURY

BONUS

6) Earth & Space – *Short Answer* When electron degeneracy cannot support the mass of a star, the degeneracy of what particle can prevent the collapse of the star into a black hole?

ANSWER: NEUTRON

TOSS-UP

7) Math – *Short Answer* If p and q are odd integers, identify all of the following three numbers that are always odd: 1) $p + q$; 2) pq ; 3) open parenthesis $p + q$ close parenthesis squared.

ANSWER: 2

BONUS

7) Math – *Short Answer* A right circular cone has volume 72. A second cone has one-third the radius and 4 times the height of the first. What is the volume of the second cone?

ANSWER: 32

TOSS-UP

8) Physical Science – *Short Answer* How many electrons can be held in the fourth energy level of an atom?

ANSWER: 32

BONUS

8) Physical Science – *Short Answer* In SI base units, what is the momentum of a 30-kilogram boulder traveling at 4 meters per second?

ANSWER: 120 (ACCEPT: 120 KILOGRAM-METERS PER SECOND)

TOSS-UP

9) Energy – *Short Answer* Scientists at SLAC [*slack*] National Accelerator Lab are studying substances that accelerate chemical reactions without being consumed. What is the term for such substances?

ANSWER: CATALYSTS

BONUS

9) Energy – *Multiple Choice* Scientists at Lawrence Berkeley National Lab are studying the carboxysome [*car-BOX-ih-sohm*], a bacterial microcompartment containing RuBisCO [*roo-BIS-koh*]. The function of the carboxysome is most analogous to the function of what eukaryotic organelle?

- W) Nucleus
- X) Mitochondria
- Y) Ribosome
- Z) Chloroplast

ANSWER: Z) CHLOROPLAST

TOSS-UP

10) Earth & Space – *Short Answer* Cygnus [*SIG-nus*] X-1 was one of the first X-ray binaries to be observed. What type of object is the more compact member of this system?

ANSWER: BLACK HOLE

BONUS

10) Earth & Space – *Multiple Choice* Which of the following mountain belts is a result of upwarping, forming a near-circular dome?

- W) Adirondacks
- X) Rockies
- Y) Cascades
- Z) Appalachians

ANSWER: W) ADIRONDACKS

TOSS-UP

11) Life Science – *Short Answer* Some fossils are very useful because they are from organisms that existed over a vast region of the Earth, but for a relatively short period of time. What is the term for this type of fossil?

ANSWER: INDEX FOSSIL

BONUS

11) Life Science – *Multiple Choice* Which of the following mutations in a coding region would cause the LEAST damage to the rest of the translated protein?

- W) Deletion of 1 base
- X) Insertion of 3 bases
- Y) Insertion of 2 bases
- Z) Insertion of 1 base

ANSWER: X) INSERTION OF 3 BASES

TOSS-UP

12) Energy – *Multiple Choice* Scientists at Lawrence Berkeley National Lab have made inorganic crystals of germanium sulfide that are arranged in a helical stack of thin sheets. How did they determine the structure of these crystals?

- W) By shooting a beam of neutrons at the crystals
- X) By accelerating charged particles and beaming the emitted radiation toward the crystals
- Y) By using an electron microscope with ultra-relativistic electron beams
- Z) By using a tiny probe to visualize the surface of the crystals

ANSWER: X) BY ACCELERATING CHARGED PARTICLES AND BEAMING THE EMITTED RADIATION TOWARD THE CRYSTALS

BONUS

12) Energy – *Short Answer* Scientists at Idaho National Lab use the Advanced Test Reactor to produce plutonium-238, which undergoes alpha decay to form what isotope?

ANSWER: URANIUM-234

TOSS-UP

13) Earth & Space – *Multiple Choice* Astronauts on the Apollo missions collected samples of breccias [**BREH-chahs**] from the surface of the moon. What process is thought to be primarily responsible for the creation of rock fragments that were later cemented into breccias?

- W) Plate tectonics
- X) Meteor impacts
- Y) Surface cracks that formed as the Moon cooled
- Z) Early rivers on the Moon's surface

ANSWER: X) METEOR IMPACTS

BONUS

13) Earth & Space – *Short Answer* Identify all of the following three statements about comets that are true: 1) Comets may have a density as low as 10 percent that of water at STP; 2) Most long-period comets are thought to have originated in the Kuiper [**KYE-pur**] belt; 3) It is hypothesized that comets make on average 1000 trips around the sun before being destroyed or ejected from the solar system.

ANSWER: 1, 3

TOSS-UP

14) Physical Science – *Short Answer* What type of solid does not have a crystal structure, such as glass and plastic?

ANSWER: AMORPHOUS

BONUS

14) Physical Science – *Short Answer* A certain transformer has 120 windings on the input side and 180 windings on the output side. If the input voltage is 60 volts, then, in volts, what is the output voltage?

ANSWER: 90

TOSS-UP

15) Math – *Short Answer* Giving your answer in base 6, what is ONE-FIVE base 6 plus TWO-THREE base 6?

ANSWER: FOUR-TWO (ACCEPT: 42)

BONUS

15) Math – *Short Answer* Two runners each run a 400-meter race at constant paces, finishing in 51 and 55 seconds, respectively. To the nearest whole number, how many meters separate them when the faster runner finishes?

ANSWER: 29

TOSS-UP

16) Life Science – *Multiple Choice* The seeds of a certain plant are covered in tiny barbs. Which of the following is their likely mode of dispersal?

- W) Furry animals
- X) Wind
- Y) Water
- Z) Insects

ANSWER: W) FURRY ANIMALS

BONUS

16) Life Science – *Short Answer* 200 birds are captured and tagged, and a few weeks later, 60 birds are captured again, of which 15 have tags. What is the best estimate for the number of birds in the population?

ANSWER: 800

TOSS-UP

17) Physical Science – *Short Answer* Consider the reaction of solid silver with hydrogen sulfide gas to form silver sulfide and hydrogen gas. In the balanced form of this equation, what is the sum of the coefficients?

ANSWER: 5

BONUS

17) Physical Science – *Short Answer* Chlorine has an atomic mass of 35.45. Rank the following three chlorine isotopes in increasing order of their natural abundance: 1) Chlorine-35; 2) Chlorine-37; 3) Chlorine-38.

ANSWER: 3, 2, 1

TOSS-UP

18) Earth & Space – *Short Answer* Binary systems where a neutron star accretes mass from its companion result in observable radiation in what part of the electromagnetic spectrum?

ANSWER: X-RAY

BONUS

18) Earth & Space – *Short Answer* Evidence of the asteroid impact that created the Chicxulub [**CHIK-soo-loob**] crater can be found in the enrichment of what element in the K-Pg boundary rock layer?

ANSWER: IRIDIUM (ACCEPT: Ir)

TOSS-UP

19) Life Science – *Short Answer* Hair, horns, and feathers are primarily composed of what structural protein?

ANSWER: KERATIN

BONUS

19) Life Science – *Short Answer* Identify all of the following three statements that are true of flower anatomy: 1) The filament supports the pistil; 2) The stigma is located at the tip of the pistil; 3) The stigma is at the top of a tube called the style.

ANSWER: 2, 3

TOSS-UP

20) Math – *Short Answer* The measure of an exterior angle of a regular polygon is 5 degrees. How many sides does the polygon have?

ANSWER: 72

BONUS

20) Math – *Short Answer* A 5-digit palindrome has 3 different digits and is divisible by 12. What is the largest such number?

ANSWER: 86,568

TOSS-UP

21) Physical Science – *Short Answer* What term refers to the tendency of an object to resist changes in motion?

ANSWER: INERTIA

BONUS

21) Physical Science – *Multiple Choice* Faraday's law of induction most directly states which of the following relationships?

- W) A static magnetic field generates an electric field
- X) A static electric field generates a magnetic field
- Y) A changing magnetic field generates an electric field
- Z) A changing electric field generates a magnetic field

ANSWER: Y) A CHANGING MAGNETIC FIELD GENERATES AN ELECTRIC FIELD

TOSS-UP

22) Life Science – *Short Answer* The same region of DNA results in different mRNA transcripts, depending on the organ in which the gene is expressed. This is an example of what form of RNA processing?

ANSWER: SPLICING (ACCEPT: ALTERNATIVE SPLICING)

BONUS

22) Life Science – *Short Answer* What is the term for the functional units that compose skeletal myofibrils [*my-oh-FYE-brils*]?

ANSWER: SARCOMERES

TOSS-UP

23) Math – *Short Answer* Assuming a gravitational force equal to that on the surface of Earth, what integer is closest to the weight in pounds of a 7-kilogram mass?

Answer: 15

BONUS

23) Math – *Short Answer* Six different 4-digit numbers can be formed from the digits 1, 1, 3, and 3. What is the sum of those 6 numbers?

ANSWER: 13,332