

ROUND ROBIN – ROUND 7

TOSS-UP

1) Energy – *Short Answer* Scientists at Brookhaven National Lab are studying hadrons that are made of a quark and an antiquark. What is the term for these hadrons?

ANSWER: MESONS

BONUS

1) Energy – *Short Answer* Scientists at Oak Ridge National Lab are using neutron spallation to study the structure of chocolate, which contains theobromine [*theo-BROH-meen*], also known as xantheose [*ZAN-the-ohs*]. Identify all of the following three elements that are in theobromine: 1) Nitrogen; 2) Carbon; 3) Bromine.

ANSWER: 1, 2

TOSS-UP

2) Earth & Space – *Short Answer* Carl Seyfert [*SEE-fert*] is known for identifying six objects with unusually bright nuclei. What are these objects?

ANSWER: GALAXIES

BONUS

2) Earth & Space – *Multiple Choice* What prominent August meteor shower is associated with the comet Swift-Tuttle?

W) Lyrids [*LIE-rids*]

X) Orionids [*oh-RYE-oh-nids*]

Y) Geminids [*GEM-in-id*]

Z) Perseids [*PURSE-ee-ids*]

ANSWER: Z) PERSEIDS

TOSS-UP

3) Life Science – *Short Answer* What is the term for an organism that possesses two copies of the same allele for a given gene?

ANSWER: HOMOZYGOUS

BONUS

3) Life Science – *Short Answer* Alveoli [*al-VEE-uh-lye*] are small structures that are adapted for maximizing surface area for gas exchange. In what organ are they found?

ANSWER: LUNGS

TOSS-UP

4) Energy – *Short Answer* Researchers at the National Renewable Energy Lab are developing solar cells composed of a single element often obtained from sand. Of what element are these solar cells composed?

ANSWER: SILICON (ACCEPT: Si)

BONUS

4) Energy – *Multiple Choice* Savannah River National Lab scientists are studying the diversity of macroinvertebrates in local streams. Which of the following animals is a macroinvertebrate they are studying?

- W) Lamprey
- X) Mayfly
- Y) Beaver trout
- Z) Bullfrog

ANSWER: X) MAYFLY

TOSS-UP

5) Math – *Short Answer* What is the number of inches in 3.5 yards?

ANSWER: 126

BONUS

5) Math – *Short Answer* What is $11/15$ minus $19/21$?

ANSWER: $-6/35$

TOSS-UP

6) Physical Science – *Short Answer* A ray of light hits a mirror at an incidence angle of 30 degrees relative to the normal. In degrees, what is the angle of reflection relative to the normal?

ANSWER: 30

BONUS

6) Physical Science – *Multiple Choice* When a roller coaster executes a loop-de-loop, riders do not feel like they are falling out of the seat. From a rider's reference frame, which of the following best explains this?

- W) The outward-directed centrifugal force counteracts gravity
- X) The outward-directed centripetal force counteracts gravity
- Y) The inward-directed centrifugal force counteracts gravity
- Z) The inward-directed centripetal force counteracts gravity

ANSWER: W) THE OUTWARD-DIRECTED CENTRIFUGAL FORCE COUNTERACTS GRAVITY

TOSS-UP

7) Earth & Space – *Multiple Choice* Which of the following best describes the relationship between weather and climate?

- W) Weather describes temperature, precipitation, and wind, climate only describes temperature
- X) Weather and climate are synonyms
- Y) Weather describes day to day conditions, climate describes long-term average conditions
- Z) Weather describes the conditions on a global scale, climate describes the conditions in a particular location

ANSWER: Y) WEATHER DESCRIBES DAY TO DAY CONDITIONS, CLIMATE DESCRIBES LONG-TERM AVERAGE CONDITIONS

BONUS

7) Earth & Space – *Short Answer* The fundamental building block of all silicate [*SILL-ih-kate*] minerals is silicon and oxygen arranged in a shape similar to what platonic solid?

ANSWER: TETRAHEDRON

TOSS-UP

8) Math – *Short Answer* What is 70% of 30 plus 70% of 40?

ANSWER: 49

BONUS

8) Math – *Short Answer* If the area of a circle is numerically four times its circumference, what is the area?

ANSWER: 64π

TOSS-UP

9) Physical Science – *Short Answer* Using an analytical balance, Rishi determines the mass of a sample to be 6.243 grams. How many significant figures are in this measured value?

ANSWER: FOUR

BONUS

9) Physical Science – *Short Answer* Identify all of the following three types of light that are generally unpolarized: 1) Glare from a road surface; 2) Direct sunlight; 3) LCD laptop display.

ANSWER: 2

TOSS-UP

10) Earth & Space – *Multiple Choice* Which of the following is NOT one of the Galilean [*gal-ih-LAY-en*] moons?

- W) Ganymede [*GAN-ih-meed*]
- X) Io [*EYE-oh*]
- Y) Callisto [*kah-LIS-toh*]
- Z) Titan

ANSWER: Z) TITAN

BONUS

10) Earth & Space – *Short Answer* During fusion reactions in the sun, a nucleus with 2 protons and 1 neutron is created. What is the name of this isotope?

ANSWER: HELIUM-3 (ACCEPT: HE-3)

TOSS-UP

11) Energy – *Short Answer* Pacific Northwest National Lab scientists are studying aerosols. Aerosols are an example of what type of mixture in which the solute and solvent are of different phases?

ANSWER: SUSPENSION (ACCEPT: HETEROGENEOUS)

BONUS

11) Energy – *Short Answer* Savannah River National Lab researchers are studying how to manage feral pigs. Pigs are domesticated variants of wild boar that humans purposely selected for desirable traits. What is the term for this type of selection?

ANSWER: ARTIFICIAL (ACCEPT: SELECTIVE BREEDING)

TOSS-UP

12) Life Science – *Short Answer* What is the term for a protein that acts as a catalyst?

ANSWER: ENZYME

BONUS

12) Life Science – *Short Answer* What is the general term for a group of cells within an organ that work together to perform a higher-order function?

ANSWER: TISSUE

TOSS-UP

13) Earth & Space – *Short Answer* What is the minimum number of seismometers needed to determine the location of an earthquake, assuming no stations are at the focus?

ANSWER: 3

BONUS

13) Earth & Space – *Short Answer* Rank the following three reservoirs of ice in order of increasing percentage of Earth's freshwater: 1) Ice sheets; 2) Sea ice; 3) Alpine glaciers.

ANSWER: 2,3,1

TOSS-UP

14) Math – *Short Answer* The point $(4, -7)$ is reflected over the y -axis. In what quadrant does the reflected point lie?

ANSWER: THIRD (ACCEPT: 3)

BONUS

14) Math – *Short Answer* Forty students are in a room, with 23 of them playing in the school band. What is the least number of students that could be added to the room to raise the percentage of band members to at least 70 percent?

ANSWER: 17

TOSS-UP

15) Life Science – *Short Answer* In type 1 diabetes, there is a deficiency of what hormone produced by the pancreas?

ANSWER: INSULIN

BONUS

15) Life Science – *Short Answer* For antiviral drugs, identify all of the following three mechanisms of actions that would be effective for directly inhibiting viral growth: 1) Preventing cross-linking of cell walls; 2) Inhibiting the 70S ribosome; 3) Preventing genome replication.

ANSWER: 3

TOSS-UP

16) Physical Science – *Short Answer* Jan travels a distance 135 meters in 4.5 seconds. In SI base units, what is her average speed during this interval?

ANSWER: 30 (ACCEPT: 30 METERS PER SECOND)

BONUS

16) Physical Science – *Short Answer* A piece of styrofoam has a mass of 50 grams and a volume of 200 cubic centimeters. If it is at rest while floating in water, what fraction of its volume will be above the surface of the water?

ANSWER: 3/4 (ACCEPT: 0.75, 75%)

TOSS-UP

17) Earth & Space – *Short Answer* What event occurs in the Northern Hemisphere when the most intense sunlight on Earth occurs at 23.5 degrees South latitude?

ANSWER: WINTER SOLSTICE

BONUS

17) Earth & Space – *Multiple Choice* Andrew is observing an eclipsing binary system. Which of the following can he directly determine from measuring the relative time between eclipses?

- W) The mass of each star
- X) The total mass of the binary system
- Y) The eccentricity of the stars' orbit
- Z) The distance between the two stars

ANSWER: Y) THE ECCENTRICITY OF THE STARS' ORBIT

TOSS-UP

18) Math – *Short Answer* How many integers are there between –8 and 9, inclusive?

ANSWER: 18

BONUS

18) Math – *Short Answer* Give one of the linear factors of $6x^2 - 7x - 55$.

ANSWER: $3x - 11$ OR $2x + 5$ [*must give at least one*]

TOSS-UP

19) Life Science – *Short Answer* Axons and dendrites are structures found in what type of cell, which is involved in signaling?

ANSWER: NEURON (ACCEPT: NERVE CELL)

BONUS

19) Life Science – *Multiple Choice* The geologic periods where birds and flowering plants emerged are part of what era?

W) Paleozoic

X) Cenozoic [*SEN-oh-ZOH-ik*]

Y) Mesozoic [*MEH-zoh-ZOH-ik*]

Z) Phanerozoic [*fah-NAIR-oh-zoh-ik*]

ANSWER: Y) MESOZOIC

TOSS-UP

20) Physical Science – *Short Answer* The equivalent resistance of two resistors in parallel is 2 ohms. If one of the resistors has a resistance of 4 ohms, then in ohms, what is the resistance of the other one?

ANSWER: 4

BONUS

20) Physical Science – *Short Answer* A microscope lens used to focus light emitted by a sample onto the user's eyes is most likely to have what type of curvature?

ANSWER: CONVEX (ACCEPT: BICONVEX)

TOSS-UP

21) Math – *Short Answer* What is the square of the binomial $x - 11$?

ANSWER: $x^2 - 22x + 121$

BONUS

21) Math – *Short Answer* Determined Dog spots Swifty Squirrel. Swifty quickly runs 16 feet due east, then 6 feet due south. He then runs due west to a hole in the ground 2 feet away. How many feet is Swifty from where he was originally spotted by Determined?

ANSWER: $2\sqrt{58}$

TOSS-UP

22) Life Science – *Short Answer* What organelle in a eukaryotic cell contains the chromosomes?

ANSWER: NUCLEUS

BONUS

22) Life Science – *Short Answer* One of the products of photosynthesis is glucose. From what reactant do the carbon atoms of this glucose originate?

ANSWER: CARBON DIOXIDE (ACCEPT: CO_2)

TOSS-UP

23) Physical Science – *Short Answer* The pitch of a sound wave most directly corresponds to what physical property of the sound wave?

ANSWER: FREQUENCY (ACCEPT: WAVELENGTH)

BONUS

23) Physical Science – *Short Answer* What is the name given to the sum of the numbers of protons and neutrons for a given nuclide?

ANSWER: MASS NUMBER (ACCEPT: NUCLEON NUMBER; DO NOT ACCEPT: ATOMIC MASS)