

ROUND 6

TOSS-UP

1) PHYSICS *Multiple Choice* The emission of helium nuclei refers to which form of radiation?

- W) Alpha
- X) Beta
- Y) Delta
- Z) Gamma

ANSWER: W) ALPHA

BONUS

1) PHYSICS *Multiple Choice* The atomic matter converted into energy by the atomic bomb in World War II at Hiroshima weighed about as much as a:

- W) Penny
- X) Bowling ball
- Y) Refrigerator
- Z) Whale

ANSWER: W) PENNY

TOSS-UP

2) MATH *Short Answer* If the side lengths of a triangle are 3 meters, 4 meters, and 5 meters, then what is the area in square meters?

ANSWER: 6

BONUS

2)) MATH *Multiple Choice* If two angles of a triangle inscribed in a circle are 40° and 110° , what is the degree measure of the arc intercepted by the third angle?

- W) 15
- X) 30
- Y) 60
- Z) 210

ANSWER: Y) 60

TOSS-UP

3) ENERGY *Multiple Choice* Which of the following consumes the most energy?

- W) All Personal vehicles
- X) All Trains
- Y) All Airplanes
- Z) All Buses

ANSWER: W) ALL PERSONAL VEHICLES

BONUS

3) ENERGY *Multiple Choice* Electric vehicles are propelled by electric motors powered by rechargeable battery packs. Which of the following is NOT an accurate battery-related issue for electric vehicles?

- W) They need to be recharged after 100 to 200 miles of use
- X) They are inefficient
- Y) They are expensive
- Z) They are heavy

ANSWER: X) THEY ARE INEFFICIENT

TOSS-UP

4) EARTH AND SPACE *Multiple Choice* Which of the following is NOT a major process for mechanical weathering of rock?

- W) Frost wedging
- X) Oxidation
- Y) Abrasion
- Z) Pressure-release fracturing

ANSWER: X) OXIDATION

BONUS

4) EARTH AND SPACE *Short Answer* If you place a drop of strong acid on a limestone rock, what gas is released?

ANSWER: CARBON DIOXIDE (ACCEPT: CO₂)

TOSS-UP

5) ENERGY *Multiple Choice* Given that nuclear reactions are a great source of energy, which of the following represents one of the main concerns about nuclear energy production?

- W) The expense of building and maintaining safe nuclear power plants
- X) A shortage in uranium
- Y) Waste accumulation
- Z) Lack of knowledge about the technique

ANSWER: Y) WASTE ACCUMULATION

BONUS

5) ENERGY *Multiple Choice* Which of the following is a characteristic of alpha decay?

- W) Alpha decay occurs in heavy nuclei where the electrostatic repulsion between the protons in the nucleus is large
- X) The mass of a nucleus that undergoes alpha decay will be changed by only a small amount
- Y) Neither the mass number nor the atomic number is changed
- Z) The atomic number increases by 1

ANSWER: W) ALPHA DECAY OCCURS IN HEAVY NUCLEI WHERE THE ELECTROSTATIC REPULSION BETWEEN THE PROTONS IN THE NUCLEUS IS LARGE

TOSS-UP

6) MATH *Short Answer* The chairs in a theater are numbered. Robert painted all of the chairs from #25 to #35, inclusive. How many chairs did he paint?

ANSWER: 11

BONUS

6) MATH *Short Answer* Sally plans to sell tickets for the school play. It costs \$150 to print the tickets. If she sells the tickets for \$4 each, how many must she sell to make a profit of at least \$500?

ANSWER: 163

TOSS-UP

7) BIOLOGY *Multiple Choice* Which of the following best describes the flow of energy in an ecosystem?

- W) Sun → heterotroph → autotroph (read as: Sun to heterotroph to autotroph)
- X) Chemotroph → autotroph → heterotroph (read as: chemotroph to autotroph to heterotroph)
- Y) Detritovore → autotroph → heterotroph (read as: detritovore to autotroph to heterotroph)
- Z) Sun → autotroph → heterotroph (read as: Sun to autotroph to heterotroph)

ANSWER: Z) SUN → AUTOTROPH → HETEROTROPH

BONUS

7) BIOLOGY *Multiple Choice* Great Lakes coastal wetlands occur along the Great lakes shoreline and portions of the tributary rivers and streams. Which of the following are NOT abiotic factors that influence patterns of species co-occurrence and distributions:

- W) Kinds of aquatic system
- X) Fluctuations in Great Lakes water levels
- Y) Physical and chemical characteristics of the bedrock
- Z) Vegetation zonation

ANSWER: Z) VEGETATION ZONATION

TOSS-UP

8) EARTH AND SPACE *Short Answer* Circling near the edge of the Solar System, the Oort Cloud is a collection of what?

ANSWER: COMETS

BONUS

8) EARTH AND SPACE *Multiple Choice* Which of the following is NOT true about quasars?

- W) They give off enormous amounts of energy
- X) They can be seen with the unaided eye
- Y) They may emit gamma rays
- Z) Some theorists say that there are black holes in the center of the galaxies in which the quasars are located

ANSWER: X) THEY CAN BE SEEN WITH THE UNAIDED EYE

TOSS-UP

9) MATH *Short Answer* What is the greatest common factor of 120 and 165?

ANSWER: 15

BONUS

9) MATH *Short Answer* Simplify the following expression: $(\tan x + \cot x)(\sin x \cos x)$ (read as: open parenthesis tangent x plus cotangent x close parenthesis times open parenthesis sine x cosine x close parenthesis).

ANSWER: 1

TOSS-UP

10) CHEMISTRY *Short Answer* Identify the substance being reduced in the following reaction:
 $3 \text{Zn} + \text{Fe}_2\text{O}_3 \rightarrow$ (read as: yields) $2\text{Fe} + 3 \text{ZnO}$.

ANSWER: THE Fe^{3+} IN THE Fe_2O_3 (ACCEPT: Fe^{3+} OR IRON III. DO NOT ACCEPT: IRON OR IRON METAL)

BONUS

10) CHEMISTRY *Multiple Choice* Which of the following substances could be a precipitate in a double replacement reaction in an aqueous solution?

- W) Silver chloride
- X) Barium hydroxide
- Y) Lead nitrate
- Z) Zinc chloride

ANSWER: W) SILVER CHLORIDE

TOSS-UP

11) PHYSICS *Multiple Choice* Which of the following is NOT a flavor of quark?

- W) Charm
- X) Weird
- Y) Top
- Z) Down

ANSWER: X) WEIRD

BONUS

11) PHYSICS *Multiple Choice* Amy is pulling a heavy cart. It is harder to start pulling the cart than to keep the cart in motion because the kinetic frictional force:

- W) Has decreased
- X) Is zero once the cart starts moving
- Y) Is only present when the cart is first pulled
- Z) Is less than the static frictional force

ANSWER: Z) IS LESS THAN STATIC FRICTIONAL FORCE

TOSS-UP

12) EARTH AND SPACE *Short Answer* Which planet maintains the highest average temperature due to its considerably thicker atmosphere?

ANSWER: VENUS

BONUS

12) EARTH AND SPACE *Short Answer* If the input of methane in the Martian atmosphere is 2×10^6 moles per day, and 6×10^8 moles are estimated to reside in the Martian atmosphere, what is the residence time of methane in days?

ANSWER: 300

TOSS-UP

13) BIOLOGY *Multiple Choice* A mutation that produces a dominant allele (read as: ah-LEEL) would:

- W) Give the bearer a selective advantage
- X) Result in the death of the bearer
- Y) Be expressed as an observable phenotype in a heterozygous organism
- Z) Never produce an observable phenotype

ANSWER: Y) BE EXPRESSED AS AN OBSERVABLE PHENOTYPE IN A HETEROZYGOUS ORGANISM

BONUS

13) BIOLOGY *Short Answer* If two parents are both heterozygous for a given trait, about what percent of the time would they produce a homozygous offspring?

ANSWER: 50%

TOSS-UP

14) CHEMISTRY *Multiple Choice* What happens when metal freezes and forms a solid?

- W) The metal gets high electrical conductivity
- X) The atoms form crystals
- Y) The atoms have higher density
- Z) The atoms form liquids

ANSWER: X) THE ATOMS FORM CRYSTALS

BONUS

14) CHEMISTRY *Multiple Choice* Which of the following do NOT have liquid crystals as a possible component?

- W) Mood rings
- X) Digital thermometers
- Y) Stalactites
- Z) Laptop computers

ANSWER: Y) STALACTITES

TOSS-UP

15) BIOLOGY *Multiple Choice* How do vaccines work to prevent illness? They:

- W) Stimulate production of disease-specific antibodies
- X) Calm the body's inflammatory response
- Y) Stop antihistamines from triggering an immune response
- Z) Alter cell surface proteins, blocking pathogens' ability to enter the cell

ANSWER: W) STIMULATE PRODUCTION OF DISEASE-SPECIFIC ANTIBODIES

BONUS

15) BIOLOGY *Multiple Choice* Which of the following is true about vitamins?

- W) Vitamins give you energy
- X) Vitamins are inorganic compounds low in calories that can provide energy when dieting
- Y) Vitamins are organic compounds and serve as a great way to maintain energy levels when you don't have time to eat
- Z) Vitamins do not provide energy for the body

ANSWER: Z) VITAMINS DO NOT PROVIDE ENERGY FOR THE BODY

TOSS-UP

16) PHYSICS *Short Answer* The NASA "Vomit Comet" allows passengers to feel the effects of weightlessness by ascending to 30,000 feet and then dropping downward at what acceleration?

ANSWER: g (ACCEPT: 9.8 m/s^2 , THE ACCELERATION DUE TO GRAVITY)

BONUS

16) PHYSICS *Multiple Choice* Imagine that you tie a ball on the end of a long string and swing it around your head in a horizontal circle. If you let go of the string, where will the ball go initially?

- W) It will hit you in the head
- X) It will fall at your feet
- Y) It will fly up in the air
- Z) It will continue in the direction in which it was traveling when you let go

ANSWER: Z) IT WILL CONTINUE IN THE DIRECTION IN WHICH IT WAS TRAVELING WHEN YOU LET GO

TOSS-UP

17) EARTH AND SPACE *Multiple Choice* The Moon's composition is most similar to which layer of Earth?

- W) Crust
- X) Mantle
- Y) Core
- Z) Asthenosphere (read as: ahs-THEH-noh-sfir)

ANSWER: W) CRUST

BONUS

17) EARTH AND SPACE *Multiple Choice* Approximately how long, in days, does it take the Moon to rotate about its axis?

- W) It does not rotate about its axis
- X) 7
- Y) 28
- Z) 365

ANSWER: Y) 28

TOSS-UP

18) MATH *Short Answer* Using one exterior angle per vertex, what is the sum in degrees of the measures of the exterior angles of a convex dodecagon?

ANSWER: 360

BONUS

18) MATH *Multiple Choice* Given that a is not a multiple of π , the expression $(\cos a / \tan a) \times (1 - \cos^2 a)$ (read as: cosine of a over tangent of a times the quantity 1 minus cosine squared of a) is equivalent to which of the following expressions?

- W) $\cos a$
- X) $\cos^2 a \times \sin a$
- Y) $\sin^2 a \times \cos^2 a$
- Z) $\cos^2 a$

ANSWER: X) $\cos^2 a \times \sin a$

TOSS-UP

19) BIOLOGY *Multiple Choice* In beats per minute, what is the normal range of resting heart rates in adults?

- W) 20 to 50
- X) 60 to 100
- Y) 80 to 120
- Z) 100 to 150

ANSWER: X) 60 TO 100

BONUS

19) BIOLOGY *Short Answer* Name the blood type referred to as the "universal donor" because people of any blood type can accept it.

ANSWER: O NEGATIVE

TOSS-UP

20) CHEMISTRY *Multiple Choice* Which of the following is used to measure the decay time for an unstable isotope?

- W) Radioactive-life
- X) Half-time
- Y) Isotope-time
- Z) Half-life

ANSWER: Z) HALF-LIFE

BONUS

20) CHEMISTRY *Short Answer* An isotope has a half-life of 26 years. If a sample of this isotope has a mass of 300.0 grams, how long will it take in years until 37.5 grams remain?

ANSWER: 78

TOSS-UP

21) PHYSICS *Multiple Choice* Pure water would conduct electricity if we added to it which of the following?

- W) Sugar
- X) Alcohol
- Y) Salt
- Z) Pepper

ANSWER: Y) SALT

BONUS

21) PHYSICS *Short Answer* A positive and negative charge are initially 1 centimeter apart. What happens to the force between them as they are moved closer and closer together?

ANSWER: IT INCREASES

TOSS-UP

22) CHEMISTRY *Short Answer* What do we call electrons in the outer shell of an atom that can participate in forming chemical bonds with other atoms?

ANSWER: VALENCE ELECTRONS

BONUS

22) CHEMISTRY *Short Answer* What is the maximum number of electrons that a shell of $n = 3$ can accommodate?

ANSWER: 18

TOSS-UP

23) MATH *Multiple Choice* Which of the following is not equal to $(5^2)^3$ (read as: 5 squared to the power of 3)?

W) $(5^3)^2$ (read as: 5 cubed to the power of 2)

X) 5^5

Y) 5^6

Z) $(5^3)(5^3)$ (read as: 5 cubed times 5 cubed)

ANSWER: X) 5^5

BONUS

23) MATH *Short Answer* Where does the graph of $y = 2x^2 - 5x - 1$ cross the x-axis?

ANSWER: $\frac{5+\sqrt{33}}{4}$ AND $\frac{5-\sqrt{33}}{4}$ (ACCEPT: $\frac{5 \pm \sqrt{33}}{4}$)

TOSS-UP

24) ENERGY *Multiple Choice* What region of the country has the greatest percentage of homes heated with heating oil?

W) Northwest

X) Northeast

Y) Southwest

Z) Southeast

ANSWER: X) NORTHEAST

BONUS

24) ENERGY *Multiple Choice* Which of the following is NOT a possible reason for potentially dramatic changes in home oil heating prices?

W) Crude oil price changes

X) Outdoor temperature

Y) Insufficient supplies

Z) The burning of wood

ANSWER: Z) THE BURNING OF WOOD

TOSS-UP

25) EARTH AND SPACE *Multiple Choice* Greenhouse gases in the Earth's atmosphere are trapping excess heat, resulting in radiative imbalance. Which of the following is responsible for absorbing the greatest fraction of this excess heat?

- W) Ice
- X) Atmosphere
- Y) Ocean
- Z) Land

ANSWER: Y) OCEAN

BONUS

25) EARTH AND SPACE *Multiple Choice* What is the largest size of sediment you would expect to find near the headwaters of a stream?

- W) Boulder
- X) Pebble
- Y) Gravel
- Z) Sand

ANSWER: W) BOULDER