

ROUND 12

TOSS-UP

1) PHYSICAL SCIENCE *Short Answer* What famous scientific apparatus demonstrated the Earth's rotation by integrating the effect of the Coriolis force over a long time period?

ANSWER: FOUCAULT'S PENDULUM (ACCEPT: PENDULUM)

BONUS

1) PHYSICAL SCIENCE *Multiple Choice* Which of the following covalent bonds is most polar?

- W) C-N
- X) N-O
- Y) H-F
- Z) F-F

ANSWER: Y) H-F

TOSS-UP

2) EARTH AND SPACE SCIENCE *Multiple Choice* Which of the following minerals can create metamorphic structures known as snowball structures?

- W) Kyanite (read as: KY-ah-nyt)
- X) Muscovite (read as: MUHS-koh-vyt) mica
- Y) Garnet
- Z) Talc

ANSWER: Y) GARNET

BONUS

2) EARTH AND SPACE SCIENCE *Short Answer* Earth's most severe extinction event, also called the Great Dying, resulted in the extinction of 96% of marine species and 70% of terrestrial vertebrate species. This event marks the boundary between what two geological periods?

ANSWER: PERMIAN AND TRIASSIC

TOSS-UP

3) PHYSICAL SCIENCE *Short Answer* What is the name of the force experienced by a charged particle moving through a magnetic field, such that the force is at right angles to both the direction in which the particle is moving and the direction of the applied field?

ANSWER: LORENTZ

BONUS

3) PHYSICAL SCIENCE *Short Answer* What is the term used for a compound that contains copper in the +2 oxidation state?

ANSWER: CUPRIC

TOSS-UP

4) ENERGY *Multiple Choice* About how many million metric tons of methane do cattle emit into the atmosphere per year in the U.S.?

W) 2.5

X) 3.5

Y) 4.5

Z) 5.5

ANSWER: Z) 5.5

BONUS

4) ENERGY *Multiple Choice* Cow Power farms in Vermont have more than 500 cows on each farm. These farms use the cows' manure to generate approximately how many kilowatt hours of electricity each year?

W) 3.5 thousand

X) 33 thousand

Y) 350 thousand

Z) 3.5 million

ANSWER: Z) 3.5 MILLION

TOSS-UP

5) MATH *Short Answer* What is the number of distinct diagonals in a regular octagon?

ANSWER: 20

BONUS

5) MATH *Short Answer* An isosceles trapezoid has sides of length $9\sqrt{2}$, $9\sqrt{2}$, 30 and y units. Given that the two interior base angles measure 45° , what are all possible values of y in units?

ANSWER: 12 AND 48

TOSS-UP

6) EARTH AND SPACE SCIENCE *Multiple Choice* Which of the following is the coldest and densest water in Earth's oceans?

- W) Antarctic bottom water
- X) North Atlantic deep water
- Y) Atlantic intermediate water
- Z) Arctic water

ANSWER: W) ANTARCTIC BOTTOM WATER

BONUS

6) EARTH AND SPACE SCIENCE *Multiple Choice* An igneous rock has a porphyritic texture. Which of the following does this indicate about the cooling history?

- W) It cooled in stages, at different levels within the crust
- X) It cooled rapidly near the surface
- Y) It cooled on the surface and was quenched
- Z) It cooled slowly, at one time, at depth

ANSWER: W) IT COOLED IN STAGES, AT DIFFERENT LEVELS WITHIN THE CRUST

TOSS-UP

7) PHYSICAL SCIENCE *Multiple Choice* Which of the following elements has the highest first ionization energy?

- W) Sodium
- X) Aluminum
- Y) Phosphorus
- Z) Chlorine

ANSWER: Z) CHLORINE

BONUS

7) PHYSICAL SCIENCE *Short Answer* You lift a book from the floor to a shelf 2 meters above the ground. How much power, in watts, did you use if you exerted an upward force of 20 newtons in 2 seconds?

ANSWER: 20

TOSS-UP

8) EARTH AND SPACE SCIENCE *Short Answer* Bauxite is primarily mined to attain what natural resource?

ANSWER: ALUMINUM

BONUS

8) EARTH AND SPACE SCIENCE *Multiple Choice* Which of the following is NOT true about the Mars Reconnaissance Orbiter?

- W) The transit time from Earth to Mars was about seven months
- X) It has a camera that can spot Martian objects that are as small as a dinner table
- Y) It discovered carbon dioxide snow falling on Mars
- Z) When it is at its closest range to Earth, it can send data to Earth faster than a cable or DSL home internet connection

ANSWER: Y) IT DISCOVERED CARBON DIOXIDE SNOW FALLING ON MARS

TOSS-UP

9) ENERGY *Multiple Choice* When a reptile is cold, it will do which of the following?

- W) Lie perpendicular to the Sun's rays
- X) Lie parallel to the Sun's rays
- Y) Open its mouth wide
- Z) Lighten its color

ANSWER: W) LIE PERPENDICULAR TO THE SUN'S RAYS

BONUS

9) ENERGY *Short Answer* What is the name of the process that involves the injection of more than a million gallons of water, sand, and chemicals at high pressure down and across a horizontally drilled well as far as 10,000 feet below the surface, causing the rock layer to crack?

ANSWER: HYDRAULIC FRACTURING (ACCEPT: FRACKING)

TOSS-UP

10) LIFE SCIENCE *Multiple Choice* Which of the following is a reason why a prion is different from a virus?

- W) Viruses are not alive and do not have genomes
- X) Viruses are much smaller than prions
- Y) Prions do not contain nucleic acids
- Z) Prions are always enveloped, while only some viruses are

ANSWER: Y) PRIONS DO NOT CONTAIN NUCLEIC ACIDS

BONUS

10) LIFE SCIENCE *Short Answer* It is believed that the reduction of what substance helps trigger abscission in plants?

ANSWER: CHLOROPHYLL

TOSS-UP

11) MATH *Short Answer* What is the product of the two complex numbers $4 + i$ and $3 + i$?

ANSWER: $11 + 7i$

BONUS

11) MATH *Short Answer* If the area of a rhombus is 240 square units, and one of the diagonals measures 16 units, what is the length, in units, of a side?

ANSWER: 17

TOSS-UP

12) LIFE SCIENCE *Multiple Choice* Which of the following is NOT a characteristic of the bald eagle?

- W) They have both binocular and peripheral vision
- X) They only eat animals they capture themselves
- Y) They are thought to mate for life
- Z) They tend to construct their nests near water

ANSWER: X) THEY ONLY EAT ANIMALS THEY CAPTURE THEMSELVES

BONUS

12) LIFE SCIENCE *Multiple Choice* Which of the following characteristics suggests that RNA was formed before DNA?

- W) DNA is more stable
- X) DNA can form longer strands
- Y) RNA is less stable
- Z) RNA has catalytic functions

ANSWER: Z) RNA HAS CATALYTIC FUNCTIONS

TOSS-UP

13) ENERGY *Multiple Choice* Which of the following water locations would be the best site for ocean thermal energy conversion?

- W) Off the west coast of South America
- X) Off the west coast of the United States
- Y) Off the east coasts of the Philippines
- Z) Off the east coast of Africa

ANSWER: Y) OFF THE EAST COASTS OF THE PHILIPPINES

BONUS

13) ENERGY *Short Answer* What celestial bodies are the most luminous ever discovered?

ANSWER: QUASARS (ACCEPT: ACTIVE GALAXY NUCLEI)

TOSS-UP

14) PHYSICAL SCIENCE *Multiple Choice* In which of the following processes does the entropy of the system decrease?

- W) Melting ice
- X) Boiling liquid water
- Y) Dissolving sodium chloride in water
- Z) Precipitating silver chloride

ANSWER: Z) PRECIPITATING SILVER CHLORIDE

BONUS

14) PHYSICAL SCIENCE *Short Answer* By name or number, identify all of the following five substances that are non-amorphous carbon allotropes: 1) diamond, 2) vitreous carbon, 3) nanofoam, 4) coal, 5) graphite.

ANSWER: DIAMOND, VITREOUS CARBON, NANOFOAM, GRAPHITE (ACCEPT: 1, 2, 3, AND 5)

TOSS-UP

15) LIFE SCIENCE *Multiple Choice* Respiration is part of the biogeochemical cycle for which of the following elements?

- W) Nitrogen
- X) Phosphorus
- Y) Silicon
- Z) Carbon

ANSWER: Z) CARBON

BONUS

15) LIFE SCIENCE *Multiple Choice* In which of the following locations does the Calvin cycle take place?

- W) Inner thylakoid (read as: THY-lah-koyd) membrane
- X) Mitochondrial (read as: my-toh-KOHN-dree-ahl) membrane
- Y) Stroma
- Z) Interstitial fluid

ANSWER: Y) STROMA

TOSS-UP

16) MATH *Short Answer* The base-six numeral 24 (read as: two-four) is equivalent to what in base 10?

ANSWER: 16

BONUS

16) MATH *Short Answer* If a line segment with endpoints at (0, 0) and (3, 4) in a plane is rotated around the x -axis, then what is the volume of the resulting figure in cubic units in terms of π ?

ANSWER: 16π

TOSS-UP

17) GENERAL SCIENCE *Multiple Choice* A pine tree grows in your backyard. With respect to alternation of generations, the tree itself would be classified as which of the following?

- W) Diploid gametophyte
- X) Haploid gametophyte
- Y) Diploid sporophyte
- Z) Haploid sporophyte

ANSWER: Y) DIPLOID SPOROPHYTE

BONUS

17) GENERAL SCIENCE *Short Answer* What element, when it enters into the carbon crystal structure of a diamond, gives it a blue color?

ANSWER: BORON

TOSS-UP

18) EARTH AND SPACE SCIENCE *Multiple Choice* Both 30° north and 30° south latitude are characterized by zones of which of the following?

- W) Surface convergence
- X) High pressure
- Y) Low pressure
- Z) Jet streams

ANSWER: X) HIGH PRESSURE

BONUS

18) EARTH AND SPACE SCIENCE *Multiple Choice* As ancient seas evaporate, thick layers of which of the following minerals can be formed and later mined for economic use?

- W) Galena (read as: gah-LEE-nah)
- X) Halite
- Y) Quartz
- Z) Diamonds

ANSWER: X) HALITE

TOSS-UP

19) GENERAL SCIENCE *Multiple Choice* Which of the following is NOT one of the distinct properties of water that permits life on Earth?

- W) There is hydrogen bonding among water molecules
- X) Most nonpolar substances easily dissolve in it
- Y) Water has a lower density in the solid phase than the liquid phase
- Z) Water exists in all three states of matter at normal temperatures on Earth

ANSWER: X) MOST NONPOLAR SUBSTANCES EASILY DISSOLVE IN IT

BONUS

19) GENERAL SCIENCE *Short Answer* What is the term for the very long time scales of change for Earth's tilt and orbit?

ANSWER: MILANKOVITCH CYCLES

TOSS-UP

20) LIFE SCIENCE *Short Answer* What is the name of a mat of absorptive filaments in fungus?

ANSWER: MYCELIUM

BONUS

20) LIFE SCIENCE *Short Answer* Name the two types of secondary structures found in proteins.

ANSWER: ALPHA HELIX AND BETA STRAND (ACCEPT: SHEET)

TOSS-UP

21) GENERAL SCIENCE *Multiple Choice* Which of the following is NOT characteristic of a typical enzyme?

- W) Enzymes are composed of polypeptides
- X) Enzymes catalyze reactions best at very high temperatures
- Y) Enzymes lower the activation energy of a reaction
- Z) Enzymes can exhibit saturation at high substrate levels

ANSWER: X) ENZYMES CATALYZE REACTIONS BEST AT VERY HIGH TEMPERATURES

BONUS

21) GENERAL SCIENCE *Short Answer* What is the name of the process in which sediments compact under pressure and gradually become solid rock?

ANSWER: LITHIFICATION

TOSS-UP

22) MATH *Multiple Choice* The equation $x^2 - 3y^2 + 2x - 4y - 8 = 0$ graphs as which of the following conic sections?

- W) Hyperbola
- X) Ellipse
- Y) Parabola
- Z) Circle

ANSWER: W) HYPERBOLA

BONUS

22) MATH *Short Answer* How many vertical asymptotes does the function

$f(x) = \frac{x^2 - 2x - 3}{x^4 - 13x^2 + 36}$ (read as: f of x equals open parenthesis x squared minus $2x$ minus 3 close parenthesis over open parenthesis x to the fourth minus $13x$ squared plus 36 close parenthesis) have?

ANSWER: 3

TOSS-UP

23) PHYSICAL SCIENCE *Short Answer* Molecules such as molecular nitrogen and hydrocarbons are able to be liquefied due to what kind of intermolecular forces?

ANSWER: VAN DER WAALS (ACCEPT: LONDON DISPERSION)

BONUS

23) PHYSICAL SCIENCE *Short Answer* Calculate the impulse, in newton seconds, when an average force of 15 newtons is exerted on a 700 kilogram car for 2 seconds.

ANSWER: 30

TOSS-UP

24) LIFE SCIENCE *Multiple Choice* Which of the following types of organisms caused the potato famine in Ireland in the 1800s?

- W) Fungus
- X) Bacteria
- Y) Virus
- Z) Protist

ANSWER: Z) PROTIST

BONUS

24) LIFE SCIENCE *Short Answer* Which group of fungi has never been observed reproducing sexually?

ANSWER: IMPERFECT

TOSS-UP

25) GENERAL SCIENCE *Multiple Choice* Which of the following statements is TRUE about dew, fog, and frost?

- W) It is possible to have dew without fog
- X) It is possible to have fog without dew
- Y) Frost is formed from condensed dew
- Z) Frost is formed from condensed fog

ANSWER: W) IT IS POSSIBLE TO HAVE DEW WITHOUT FOG

BONUS

25) GENERAL SCIENCE *Multiple Choice* A weight is pulled by a force over a horizontal surface and friction results. Which of the following scenarios would decrease the frictional force?

- W) Increase the force pulling the object
- X) Have the force pull at an angle of 0° upward
- Y) Have the force pull at an angle of 20° downward
- Z) Have the force pull at an angle of 20° upward

ANSWER: Z) HAVE THE FORCE PULL AT AN ANGLE OF 20° UPWARD