

TOSS-UP

1) BIOLOGY *Short Answer* What are integral proteins which facilitate transport of water across biological membranes called?

ANSWER: Aquaporin

BONUS

1) BIOLOGY *Short Answer* Name the form of asexual reproduction through which an embryo develops without fertilization.

ANSWER: Parthenogenesis

TOSS-UP

2) CHEMISTRY *Short Answer* A compound that can behave as both an acid and a base is called what?

ANSWER: Amphoteric (DO NOT ACCEPT: amphiprotic)

BONUS

2) CHEMISTRY *Multiple Choice* Which of the following combinations compounds in aqueous solutions cannot form a buffer?

W) H_2CO_3 , NaHCO_3

X) NH_3 , NH_4Cl

Y) HCl , NaCl

Z) HNO_2 , KNO_2

ANSWER: Y) HCl , NaCl

TOSS-UP

3) EARTH & SPACE *Short Answer* What is the name of the area of high tectonic and volcanic activity that surrounds the Pacific ocean? (James)

ANSWER: Ring of Fire

BONUS

3) EARTH & SPACE *Multiple Choice* The ocean comprises approximately what percentage of the Earth's surface?

W. 60%

X. 70%

Y. 80%

Z. 90%

ANSWER: X

TOSS-UP

4) PHYSICS *Short Answer* What elementary particles makes up protons and neutrons?

ANSWER: Quarks

BONUS

4) PHYSICS *Short Answer* Name any 4 of the 6 quarks.

ANSWER: Accept any 4 from: up, down, strange, charm, top, bottom.

TOSS-UP

5) MATH *Short Answer* A number, when multiplied by 10 and added to 7, yields the number 67. What was the original number?

ANSWER: 6

BONUS

5) MATH *Short Answer* Three erasers and one pencil cost \$1.32. One eraser and three pencils cost \$1.56. What is the cost of one eraser and one pencil?

ANSWER: 72 cents

TOSS-UP

6) BIOLOGY *Short Answer* What was the name of the first sheep cloned from an adult sheep's somatic cell?

ANSWER: Dolly

BONUS

6) BIOLOGY *Multiple Choice* Which of the following is NOT a plant hormone?

W) Methylene

X) Auxin

Y) Cytokinin

Z) Absciscic acid

ANSWER: W) Methylene

TOSS-UP

7) CHEMISTRY *Short Answer* In an oxygen-18 atom, how many protons, neutrons, and electrons are there?

ANSWER: 8 protons, 10 neutrons, 8 electrons

BONUS

7) CHEMISTRY *Short Answer* By name or number, rank the following three parts of the atom by increasing magnitude of charge to mass ratio: proton, neutron, electron

ANSWER: Neutron, proton, electron

TOSS-UP

8) EARTH & SPACE *Short Answer* What is the primary erosive agent in deserts?

ANSWER: Water

BONUS

8) EARTH & SPACE *Multiple Choice* Regions are classified as deserts based on what property?

W. Temperature

X. Precipitation

Y. Amount of Sunlight received

Z. Latitude

ANSWER: X

TOSS-UP

9) PHYSICS *Multiple Choice* What law states that the pressure of a container increases as the volume decreases?

W) Boyle's law

X) Charles's law

Y) Gay-Lussac's law

Z) Boltzmann's law

ANSWER: W) Boyle's law

BONUS

9) PHYSICS *Short Answer* What elementary particle is responsible for carrying the strong nuclear force?

ANSWER: Gluon

TOSS-UP

10) MATH *Short Answer* The complement of angle A is 70 degrees. What is the degree measure of the supplement of A?

ANSWER: 160

BONUS

10) MATH *Multiple Choice* Which of the following is a famous unsolved conjecture relating to the complexity hierarchy of algorithms?

W) P vs NP

X) Poincaré Conjecture [**read it like you would in Spanish**]

Y) Four Color Theorem

Z) Navier Stokes Equations

ANSWER: W) P vs NP

TOSS-UP

11) BIOLOGY *Short Answer* Name the scientist best known for his contributions to understanding of evolution and natural selection.

ANSWER: Charles Darwin (ACCEPT: Darwin)

BONUS

11) BIOLOGY *Short Answer* What is the scientific term for difference between two sexes' secondary sexual characteristics?

ANSWER: Sexual Dimorphism

TOSS-UP

12) CHEMISTRY *Multiple Choice* Which of the following class of compounds only contains single bonds?

W) alkanes

X) alkenes

Y) alkynes

Z) cyclo-alkenes

ANSWER: W) alkanes

BONUS

12) CHEMISTRY *Short Answer* How many sigma and pi bonds respectively are in one molecule of propene?

ANSWER: 8 sigma, 1 pi

TOSS-UP

13) EARTH & SPACE *Multiple Choice* What type of drainage pattern is associated with mountains?

W. Radial

X. Rectangular

Y. Trellis

Z. Dendritic

ANSWER: W.

BONUS

13) EARTH & SPACE *Multiple Choice* The presence of many meanders in a section of a stream or river indicates that it is

W. Relatively old

X. Relatively young

Y. Located at a high elevation

Z. Located at a low elevation

ANSWER: W

TOSS-UP

14) PHYSICS *Short Answer* What is the unit of magnetic field?

ANSWER: Tesla (Accept: Gauss)

BONUS

14) PHYSICS *Short Answer* Often called the “point of no return”, what boundary in black holes marks the point where even light cannot escape?

ANSWER: Event Horizon

TOSS-UP

15) MATH *Short Answer* A quadratic function with integer coefficients has the quantity $1-4i$ as a root. What is the other root?

ANSWER: $1+4i$

BONUS

15) MATH *Short Answer* A circle with radius two is cut by two rays that start at the center of the circle and form an angle of 60 degrees. What is the length of the smaller arc defined on the boundary of the circle by these rays?

ANSWER: $2\pi/3$

TOSS-UP

16) BIOLOGY *Short Answer* How many different nitrogenous bases exist in a DNA strand?

ANSWER: 4

BONUS

16) BIOLOGY *Multiple Choice* Which of the following nitrogenous bases cannot be found in a DNA strand?

W) Adenine

X) Cytosine

Y) Guanine

Z) Uracil

ANSWER: Z) Uracil

TOSS-UP

17) CHEMISTRY *Multiple Choice* Which of the following compounds is not soluble in water?

W) KNO_3

X) CuS

Y) Ba(OH)_2

Z) HI

ANSWER: X) CuS

BONUS

17) CHEMISTRY *Short Answer* In slightly soluble salts, a K_{sp} value is given. What does the sp in K_{sp} stand for?

ANSWER: solubility product

TOSS-UP

18) EARTH & SPACE *Multiple Choice* The sun is part of what group of stars that form a downward sloping line in the middle of the H-R diagram?

W. Red Giants

X. Main-sequence stars

Y. Blue Supergiants

Z. White dwarfs

ANSWER: X

BONUS

18) EARTH & SPACE *Multiple Choice* Which of the following best describes the age of our solar system?

W. 450,000 years

X. 45 million years

Y. 450 million years

Z. 4.5 billion years

ANSWER: Z

TOSS-UP

19) PHYSICS *Multiple Choice* A car at rest accelerates at a rate of 10 meters per second squared. After 5 seconds, the car would have traveled: (Jinwoo)

W) 110 meters

X) 115 meters

Y) 120 meters

Z) 125 meters

ANSWER: Z) 125 meters

BONUS

19) PHYSICS *Multiple Choice* Which of the following scientists suggested that all matter was both a particle and a wave?

W) Einstein

X) Planck

Y) de Broglie

Z) Heisenberg

ANSWER: Y) de Broglie

TOSS-UP

20) MATH *Short Answer* What is the volume of a sphere with radius 3?

ANSWER: 36 pi

BONUS

20) MATH *Multiple Choice* The analogue of the tetrahedron in higher dimensions is known by what name?

W) Simplex

X) Orthoplex

Y) Icosahedron

Z) Dualplex

ANSWER: W) Simplex

TOSS-UP

21) BIOLOGY *Short Answer* What is the permanent alteration of the nucleotide sequence of a genome called?

ANSWER: Mutation

BONUS

21) BIOLOGY *Short Answer* What is the full name of the MMR vaccine?

ANSWER: Measles, Mumps, Rubella

TOSS-UP

22) CHEMISTRY *Short Answer* What is the pH of 1M NaOH?

ANSWER: 14

BONUS

22) CHEMISTRY *Multiple Choice* Which of the following is the closest to the pH of 0.5 M CH₃COOH?

W) 0

X) 2

Y) 4

Z) 6

ANSWER: X) 2

TOSS-UP

23) EARTH & SPACE *Multiple Choice* Steep slopes and explosive eruptions as a result of andesitic or rhyolitic magma are characteristics of what type of volcano?

W. Cinder cone

X. Stratovolcano

Y. Shield volcano

Z. Fissure volcano

ANSWER: X.

BONUS

23) EARTH & SPACE *Short Answer* Order the following three types of magma from lowest to highest in terms of silica content: 1. Andesitic 2. Basaltic 3. Rhyolitic.

ANSWER: 2, 1, 3

TOSS-UP

24) PHYSICS *Multiple Choice* Which of the following is not a type of transverse wave?

W) Radio

X) Sound

Y) Gravitational

Z) Ultraviolet

ANSWER: X) Sound

BONUS

24) PHYSICS *Short Answer* By name or number, list the following four choices in order of increasing frequency: 1. Visible, 2. Ultraviolet, 3. Infrared, 4. Radio

ANSWER: 4, 3, 1, 2

TOSS-UP

25) MATH *Short Answer* Every day from Monday until Friday, there is a $\frac{3}{5}$ chance that it will rain that day. What is the probability that it first rains on Tuesday?

ANSWER: $\frac{6}{25}$

BONUS

25) MATH *Multiple Choice* The side lengths a, b, c of a triangle satisfy the inequality $a^2 + b^2$ is greater than c^2 . Which of the following is true about the angle opposite side c ?

W) It is acute

X) It is a right angle

Y) It is obtuse

Z) There is insufficient information to determine anything

ANSWER: W) It is acute