Round 28

1. EARTH and SPACE

Writer: Zoe Orlin

Toss Up: Multiple Choice

What was the magnitude of the largest earthquake ever?

W) 9

X) 9.1

Y) 9.5

Z) 9.6

Toss Up Answer: Z

Bonus: Multiple Choice

How much north does the Earth's magnetic north pole move per year?

W) 30 miles

X) 35 miles

Y) 40 miles

Z) 45 miles

Bonus Answer: Y

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2. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Which of the following processes in cellular respiration produce the most ATP

W) Glycolysis

X) Link Reaction

Y) Krebs Cycle

Z) Oxidative Phosphorylation

Toss Up Answer: Z

Bonus: Multiple Choice

Which of the following is not used in cellular respiration

W) Glucose

X) NADH

Y) FADH2

Z) NADPH

Bonus Answer: Z

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3. CHEMISTRY

Writer: Shanjeed Ali

Toss Up: Multiple Choice

Which element has the highest ionization energy?

W) Chlorine

X) Bromine

Y) Selenium

Z) Technetium

Toss Up Answer: W

Bonus: Short Answer

What are the periodic table trends for ionization energy?

Bonus Answer: Increases left to right and decreases from the top to the bottom

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4. EARTH and SPACE

Writer: Shantanu Jha

Toss Up: Multiple Choice

Which of these units is defined as "3.26 light-years"?

W) Astronomical Unit

X) Parsec

Y) Gigasphere

Z) Kilometer

Toss Up Answer: X

Bonus: Multiple Choice

What are the two neighboring galaxies of the Milky Way known as?

W) The Keplers

X) Magellanic Clouds

Y) Twin Cities

Z) Petronas Galaxies

Bonus Answer: X

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5. MATHEMATICS

Writer: Steven Litvack-Winkler

Toss Up: Short Answer

Find x/y + y/x in simplest form if x=7 and y=3

Bonus Answer: 58/21

Bonus: Short Answer

Positive integers a and b satisfy ab | a^2 + 4ab + 4b^2 ["a b divides a squared plus four a b plus four b squared"]. The smallest possible value of a+b is 2, which occurs when a=b=1 ["a equals b equals 1"]. What is the second smallest possible value of a+b?

Bonus Answer: 6: a=4, b=2

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6. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

Who discovered radioactivity in 1896?

W) Wilhelm Rontgen

X) Henri Becquerel

Y) Marie Curie

Z) Albert Einstein

Toss Up Answer: X

Bonus: Multiple Choice

What is made by joining an N-type and P-type semiconductor material?

W) Transistor
X) Diode
Y) Capacitor
Z) Collector

Bonus Answer: X

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7. EARTH and SPACE

Writer: Shanjeed Ali

Toss Up: Multiple Choice

How much of the total mass of the solar system is found in the Sun?
W) between 60.0% and 60.1%
X) between 78.5% and 78.6%
Y) between 98.2% and 98.3%
Z) between 99.8% and 99.9%

Toss Up Answer: Z

Bonus: Multiple Choice

What is the temperature at the Sun's core?
W) 5 million degrees Celsius
X) 10 million degrees Celsius
Y) 15 million degrees Celsius
Z) 20 million degrees Celsius

Bonus Answer: Y

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8. ENERGY

Writer: Aaron Gee

Toss Up: Short Answer

What is the most common sulfur compound that occurs naturally in
natural gas?

Bonus Answer: HYDROGEN SULFIDE

Bonus: Short Answer

Earth's core is kept hot by the radioactive decay of several radioactive substances, including Uranium-235 and 238; name the other two heat-producing isotopes which are also significant contributors to the radioactive heat production of the Earth.

Bonus Answer: POTASSIUM-40 AND THORIUM-232 (Question is very hard?)

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9. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Surfactant helps to prevent the alveoli from collapsing by:
W) humidifying the air before it enters
X) Reducing the surface tension of alveolar fluid
Y) warming the air before it enters
Z) protecting the surface of alveoli from dehydration and other environmental variations

Toss Up Answer: X

Bonus: Multiple Choice

Respiratory control centers are located in the

W) midbrain and medulla

X) pons and midbrain

Y) medulla and pons

Z) upper spinal chord and medulla

Bonus Answer: Y

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10. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What quantity of a magnet determines the torque it will experience in an external magnetic field?

W) Multipole Expansion

X) Dipole Inversion

Y) Magnetic Moment

Z) Hysteresis Loop

Toss Up Answer: Y

Bonus: Multiple Choice

What Dutch physicist, living from 1626-1695, pioneered the use of the pendulum in clocks?

W) Willems Gravesande

X) Hans Christian Oersted

Y) Nicolas Hartsoeker

Z) Christiaan Huygens

Bonus Answer: Z

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11. EARTH and SPACE

Writer: Mohammed Jamil

Toss Up: Multiple Choice

The seasons we experience on the Earth are caused by

W) the change in the Earth's distance from the sun during the year

X) the precession of the Earth's pole

Y) the tilt of the Earth's axis with respect to the ecliptic pole

Z) the change in the Moon's distance from the Earth during the year

Toss Up Answer: Y

Bonus: Multiple Choice

If we compare two stars of different temperature, the hotter star

W) will appear redder

X) emits more energy from each unit area of surface

Y) will have a brighter apparent magnitude

Z) will have a brighter absolute magnitude

Bonus Answer: X

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12. PHYSICS

Writer: Shantanu Jha

Toss Up: Short Answer

Which of the 6 quarks is the lightest?

Bonus Answer: Up

Bonus: Multiple Choice

What is the "formal" SI unit of elementary particle spin?

W) joule-second

X) spin-h (planck constant)

Y) joule-plancktime

Z) spinor-second

Bonus Answer: W

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13. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

In plant cells grown in the presence of a metabolic poison that specifically inhibits mitochondrial F1 ATP synthase, one would expect:

W) the pH difference across the cristae to be greater than normal.

X) the pH difference across the cristae to be less than normal.

Y) the electron transport chain to become inoperative.

Z) oxygen consumption to cease.

Toss Up Answer: W

Bonus: Short Answer

With proofreading, what is approximately the error rate of DNA polymerase?

Bonus Answer: One error in every 10^9 bases.

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14. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What is studied in ballistics?

W) explosive impact of chemicals

X) speeds of atomic particles

Y) travel of sound

Z) motion of projectiles

Toss Up Answer: Z

Bonus: Multiple Choice

What is it called when all possible states of a system are represented, with each possible state corresponding to 1 unique point?

W) Boltzmann Set

X) Phase Space

Y) Poincare Space

Z) Configuration Space

Bonus Answer: X

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15. CHEMISTRY

Writer: Shanjeed Ali

Toss Up: Short Answer

What is the energy level and orbital of the outermost electrons in a ground state sulfur atom?

Bonus Answer: 3p

Bonus: Short Answer

What is the maximum number of covalent bonds sulfur can form?

Bonus Answer: 6

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16. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

Whose law defines the relationship between angle of incidence and of refraction?

W) Snell's

X) DeBroglie's

Y) Kepler's

Z) Carnot's

Toss Up Answer: W

Bonus: Short Answer

What are the names of Hydrogen's three isotopes?

Bonus Answer: Protium, Deuterium, Tritium (accept: Hydrogen, Deuterium, Tritium)

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17. BIOLOGY

Writer: Josh Tish

Toss Up: Short Answer

During the late Carboniferous period, terrestrial arthropods such as
Hexapoda, Myriapoda, and Arachnida showed great diversity in form
and size. Why are modern day arthropods are much smaller than their Carboniferous ancestors?

Bonus Answer: decreased volume of oxygen in the atmosphere in modern times versus comparatively higher volume of oxygen present during Carboniferous Era

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Bonus: Short Answer

Arrange the following five events in the order that explains the bulk
flow of substances in the phloem.

1. Sugar moves down the stem.
2. Leaf cells produce sugar by photosynthesis.
3. Sugar is transported from cell to cell via the apoplast and/or symplast.
4. Solutes are actively transported into sieve elements.
5. Water diffuses into the sieve tube elements.

Bonus Answer: 2,3,4,1,5

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18. PHYSICS

Writer: Shantanu Jha

Toss Up: Short Answer

By name or number, which of these is a non-newtonian fluid?

1. Ketchup

2. Water
3. Custard
4. Toothpaste

Bonus Answer: 1,3,4

Bonus: Multiple Choice

What two parts comprise a semiconductor crystal?
W) Lattice and Symmetry
X) Motif and Basis
Y) Motif and Symmetry
Z) Basis and Lattice

Bonus Answer: Z

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19. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

If active transport is inhibited, the passive sodium and potassium ion fluxes across the plasma membrane are still coupled. What makes these two passive ion fluxes dependent on each other?
W) The membrane potential.
X) The potassium channels.
Y) The ratio of cholesterol to phospholipids in the membrane.
Z) The pumping ratio of the Na+/K+ ATPase.

Toss Up Answer: W

Bonus: Multiple Choice

If a carboxylic acid has a pKa of 3.9, what percentage of the functional group will carry a negative charge at pH 4.9?
W) 10%
X) 90.90%
Y) 9.09%
Z) 50%

Bonus Answer: X

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20. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Short Answer

Given 2,3-dichloropentane, what is the resulting molecule if potassium hydroxide is reacted with it at 200 degrees celsius?

Bonus Answer: 2 pentyne

Bonus: Short Answer

Which single atom is the difference between an organic acid functional group and an aldehyde functional group?

Bonus Answer: O, Oxygen

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21. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

The majority of proteins exist as homo-oligomers rather than hetero-oligomers. Which of the following is not a reason that quaternary structures are homo-oligomers?

W) Aggregation of identical subunits gives rise to symmetry and possible allosteric interactions.

X) A slow post-translational process favors a quaternary structure with the homo-oligomers held together by covalent bonds.

Y) Homodimers may increase binding specificity and stability.

Z) Homo-oligomerization results in a genetic savings with lower energy demand.

Toss Up Answer: X

Bonus: Multiple Choice

Which of the following is not an action of epinephrine or norepinephrine?

W) Glycogen broken down to glucose.

X) Increased gastric motility and secretion.

Y) Increased blood pressure.

Z) Increased salivation.

Bonus Answer: X

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22. CHEMISTRY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

Boyle's Law relates:

W) pressure to volume

X) pressure to mols

Y) volume to mols

Z) temperature to volume

Toss Up Answer: W

Bonus: Short Answer

A container holds 500. mL of CO_2 at 20.° C and 742 torr. What will be the volume of the CO_2 if the pressure is increased to 795 torr?

Bonus Answer: 467 ml

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23. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

Select the description that most correctly describes the term recessive:

W) A weak phenotype.

X) An allele that confers a weak phenotype.

Y) A phenotype conferred when only one copy of an allele is present.

Z) A phenotype conferred when two copies of an allele are present.

Toss Up Answer: Z

Bonus: Multiple Choice

Which of the following interactions is most responsible for the structural stability of soluble globular proteins?
W) Dipole-dipole interactions.
X) Electrostatic interactions.
Y) Hydrogen bonds.
Z) The Hydrophobic Effect.

Bonus Answer: Z

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24. CHEMISTRY

Writer: Ahmad Alnasser

Toss Up: Short Answer

Write the formula name for the strongest acid?

Bonus Answer: H2SO4

Bonus: Short Answer

List in order of strength the following strong acid: (1) H3PO4 (2) HBr (3) HCl (4) H2SO4

Bonus Answer: 1 3 2 4

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25. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

Using accelerator mass spectrometry, the 14C atoms in a 2 mg bone fragment were directly counted and found to be 1/8 of those that would be present in a 2 mg bone fragment in 1950. What is the approximate age of this specimen?
W) 1,540 years
X) B. 5,730 years
Y) C. 17,190 years
Z) D. 22,920 years

Toss Up Answer: Y

Bonus: Multiple Choice

Positive cooperativity is an emergent property of what type of enzymatic regulatory mechanism?
W) Allosteric interactions.
X) Cellular compartmentalization.
Y) Genetic regulatory mechanisms.
Z) Second messenger systems.

Bonus Answer: W

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