Round 11

1. PHYSICS

Toss Up: Short Answer

For the hydrogen atom, which series describes electron transitions to the N=1 orbit, the lowest energy electron orbit?

Bonus Answer: Lyman series

Bonus: Short Answer

Electric current may be expressed in which one of the following units?

Bonus Answer: coulombs/second

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2. PHYSICS

Toss Up: Multiple Choice

Radiocarbon is produced in the atmosphere as a result of?

W) collision between fast neutrons and nitrogen nuclei present in the atmosphere

X) action of ultraviolet light from the sun on atmospheric oxygen

Y) action of solar radiations particularly cosmic rays on carbon dioxide present in the atmosphere

Z) lightning discharge in atmosphere

Toss Up Answer: W

Bonus: Multiple Choice

Nuclear sizes are expressed in a unit named

W) Fermi

X) angstrom

Y) newton

Z) Tesla

Bonus Answer: W

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3. PHYSICS

Toss Up: Multiple Choice

The graphs of the two equations y = a x 2 + b x + c and y = A x 2 + B x + C, such that a and A have different signs and that the quantities b 2 - 4 a c and B 2 - 4 A C are both negative,

W) 1 intersections

X) 2 intersections

Y) None

Z) I do not know

Toss Up Answer: Z

Bonus: Multiple Choice

For x greater than or equal to zero and less than or equal to 2 pi, sin x and cos x are both decreasing on the intervals

W) (0 , pi/2)

X) (pi/2 , pi)

Y) (pi , 3 pi / 2)

Z) (3 pi / 2 , 2 pi)

Bonus Answer: X

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4. PHYSICS

Toss Up: Multiple Choice

How long is a meter stick?

W) 36 inches

X) 100 mm

Y) 10 cm

Z) 1 m

Toss Up Answer: Z

Bonus: Multiple Choice

Which combination of the following statements is wrong? I. A body can have a constant speed but a varying velocity. II. A body can have a constant velocity but a varying speed. III. A body can have a zero velocity and finite acceleration.

W) I

X) II

Y) III

Z) NONE

Bonus Answer: Z

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5. PHYSICS

Toss Up: Multiple Choice

In the absence of air resistance, the magnitude of the vertical component of a projectile's acceleration

W) is constant until the projectile hits the ground.

X) always decreases with time until the projectile hits the ground.

Y) is equal to the magnitude of the horizontal component of the projectile's acceleration.

Z) increases and/or decreases with time, depending on the projectile's velocity.

Toss Up Answer: W

Bonus: Multiple Choice

n the laboratory, the speed of sound is measured to be 344 meters per second, different from the actual value of 343 meters per second. What is the percent error in the measurement?

W) 1%

X) 1%

Y) 10%

Z) 0.30%

Bonus Answer: Z

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6. MATHEMATICS

Toss Up: Multiple Choice

Which of the following shapes is always cyclic?

W) A parallelogram

X) A rhombus

Y) An obtuse triangle

Z) A pentagon

Toss Up Answer: Y

Bonus: Short Answer

In a triangle with side lengths 10, 10 sqrt3, and 20, find the length of the angle bisector which intersects the side of length 10 sqrt3.

Bonus Answer: 20 sqrt3/3

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7. MATHEMATICS

Toss Up: Short Answer

If x^5 - 4x^4 + 3x^2 - 2x + 1 = 0, find the sum of all five of the roots.

Bonus Answer: 4

Bonus: Short Answer

If polynomial P(x) leaves a remainder of 5 when divided by x-1 and a remainder of 7 when divided by x+1, find the remainder when P(x) is divided by x^2-1.

Bonus Answer: -x+6

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8. MATHEMATICS

Toss Up: Short Answer

There are 27 people in a party. If 16 people wanted ice cream and 17 people wanted chocolate, at most how many people wanted only ice cream?

Bonus Answer: 10

Bonus: Short Answer

How many non congruent rectangles are there with an area of 324 and positive integer side lengths?

Bonus Answer: 8

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9. MATHEMATICS

Toss Up: Short Answer

Find the limit of (x^2 - x - 2)/(x + 1) as x approaches -1.

Bonus Answer: -3

Bonus: Short Answer

Find the limit of (x^2 + 6x + 5)/x^3 as x approaches infinite

Bonus Answer: 0

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10. BIOLOGY

Toss Up: Multiple Choice

Hair cells in the ear form synapses on spiral ganglion cells. These spiral ganglion cells join what nerve that projects to the medulla?

W) VI

X) VIII

Y) X

Z) XII

Toss Up Answer: X

Bonus: Short Answer

What are these hair cells, which have a mechanically gated TRPA1 channel, called?

Bonus Answer: Stereocilia

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11. BIOLOGY

Toss Up: Multiple Choice

If I cut your left optic tract, what part of your visual field will you lose?

W) The left temporal section only

X) The left temporal and left nasal sections

Y) The right nasal section only

Z) The right temporal and right nasal sections

Toss Up Answer: Z

Bonus: Short Answer

What is the name of the spot where the left optic tract and the right optic tract intersect?

Bonus Answer: optic chiasm

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12. BIOLOGY

Toss Up: Short Answer

What is the G Protein Coupled Receptor for the G protein transducin?

Bonus Answer: Rhodopsin

Bonus: Short Answer

The phototransduction pathway controlled by light striking rhodopsin ultimately affects a sodium channel. What is the second messenger that controls the channel? Be sure to give your answer as “cyclic _ _ _(Read as: “the word cyclic followed by a three letter acronym”)”.

Bonus Answer: cGMP (accept: cyclic guanosine monophosphate)

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13. BIOLOGY

Toss Up: Short Answer

What is the phenomenon that describes the pupil continuously adjusting to different ambient light levels?

Bonus Answer: Pupillary Light Reflex

Bonus: Short Answer

How large, in degrees, is the visual field for the right eye?

Bonus Answer: 150

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14. BIOLOGY

Toss Up: Multiple Choice

Which of the following most closely approximates the number of
protein-coding genes in the human genome?

W) 10,000

X) 20,000

Y) 50,000

Z) 100,000

Toss Up Answer: X

Bonus: Short Answer

Arrange the following to depict the conduction pathway in the
vertebrate heart: 1) atrioventricular node, 2) right and left bundle branches, 3) sinoatrial node, 4) Bundle of His, 5) Purkinje fibers.

Bonus Answer: 3) SINOATRIAL NODE

1) ATRIOVENTRICULAR NODE

4) BUNDLE OF HIS
2)RIGHT AND LEFT BUNDLE BRANCHES
5) PURKINJE FIBERS

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15. BIOLOGY

Toss Up: Short Answer

What is the most abundant element in the human body?

Bonus Answer: Oxygen

Bonus: Short Answer

What is the function of the alveoli?

Bonus Answer: to allow oxygen and carbon dioxide to move between the lungs and bloodstream

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16. BIOLOGY

Toss Up: Short Answer

What family are fruit flies apart of?

Bonus Answer: Drosophilidae

Bonus: Short Answer

Which species of animals are the most abundant on Earth?

Bonus Answer: nematodes

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17. CHEMISTRY

Toss Up: Short Answer

What element has the largest atomic radius?

Bonus Answer: Francium

Bonus: Multiple Choice

What is the most electronegative element?

W) Francium
X) Beryllium
Y) Fluorine
Z) Lithium

Bonus Answer: Y

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18. CHEMISTRY

Toss Up: Multiple Choice

Which of the following radioactive isotopes is used in the treatment of thyroid cancer?

W) Carbon-12
X) Iodine-131
Y) Uranium-238
Z) Technetium-99

Toss Up Answer: X

Bonus: Short Answer

If a radioactive isotope has a half life of 2 years, how long would it take for 1/8 of the original material to remain?

Bonus Answer: 6 years

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19. CHEMISTRY

Toss Up: Short Answer

What is the largest ion with an equal amount of protons and neutrons?

Bonus Answer: Ca20+

Bonus: Short Answer

Who is regarded as the father of the modern periodic table? (1st and last name)

Bonus Answer: Dmitri Mendeleev

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20. CHEMISTRY

Toss Up: Multiple Choice

What does Pauli's Exclusion Principle state?

W) Electrons of an atom must have the same spin

X) No two electrons of an atom travel in the same orbital

Y) no two electrons in an atom can be at the same time in the same state or configuration

Z) Electrons can switch spin automatically

Toss Up Answer: Y

Bonus: Short Answer

What law states that electrons in the same orbitals reorganize themselves to maximize spin?

Bonus Answer: Hund's law

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21. CHEMISTRY

Toss Up: Multiple Choice

Which of the following has the highest electronegativity?

W) Francium

X) Carbon

Y) Fluorine

Z) Oxygen

Toss Up Answer: Y

Bonus: Short Answer

How many times faster does hydrogen diffuse through a hole than oxygen?

Bonus Answer: 4

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22. CHEMISTRY

Toss Up: Multiple Choice

The H–C–O bond angle in $H_2C{=}O$ (formaldehyde) is approximately:

W) 90

X) 109

Y) 120

Z) 180

Toss Up Answer: Y

Bonus: Short Answer

In which compound does carbon have the highest oxidation state?

1. CH_4
2. HCN
3. H_2CO
4. CH_2Cl_2

Bonus Answer: 2. HCN

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23. EARTH and SPACE

Toss Up: Short Answer

What is the name of the tectonic plate that is currently undergoing subduction under the South American plate, responsible for the Andes mountains?

Bonus Answer: Nazca

Bonus: Multiple Choice

Which of the following has the highest number of cleavage planes?

W) Muscovite

X) Halite

Y) Fluorite

Z) Mica

Bonus Answer: Y

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24. EARTH and SPACE

Toss Up: Short Answer

What is the general name for blood disorders?

Bonus Answer: Thalassemia

Bonus: Multiple Choice

Which of the following is a housekeeping gene?

W) Ubiquitin

X) Haemoglobin

Y) Ovalbumin

Z) Pyronisin

Bonus Answer: W

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25. EARTH and SPACE

Toss Up: Short Answer

In which hemisphere are constellations named after scientific instruments?

Bonus Answer: Southern

Bonus: Short Answer

What is the latin name for the constellation that the big dipper is a part of?

Bonus Answer: Ursa Major

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