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Science Bowl Questions

Toss-Up

1. BIOLOGY *Short Answer* Epinephrine causes the breakdown of glycogen in a series of steps. The G protein activates which enzyme in the plasma membrane, in turn creating cAMP?

ANSWER: Adenylyl cyclase

Bonus

BIOLOGY *Short Answer* A true-breeding plant with the dominant trait is crossed with another true breeding plant with the recessive trait. The F2 generation has what chance of producing a plant with the dominant trait?

ANSWER: ¾ or 75%

Toss-Up

1. BIOLOGY *Short Answer* Using number or words: which of the following use cyclic electron flow?

1) CAM photosynthesis  
2) C3 Plants  
3) C4 Plants

ANSWER: ‘3’ or ‘C4 Plants’

Bonus

BIOLOGY *Short Answer* Using number or words: which of the following is caused by a lethal dominant allele?

1)Achondroplasmia  
2) Cystic fibrosis  
3) Sickle cell disease  
4) Huntington’s disease

ANSWER: ‘1, 2, 3, 4’ or ‘all of them’

Toss-Up

1. BIOLOGY *Short Answer* In alcohol fermentation, pyruvate is converted into what intermediate before it becomes ethanol?

ANSWER: Acetaldehyde

Bonus

BIOLOGY *Multiple Choice* In which of the following causes the mitotic spindle to penetrate the fully formed nuclear envelope and latch onto the chromosomes?

W) Bacteria  
X) Dinoflagellates   
Y) Yeast  
Z) Humans

ANSWER: X) Dinoflagellates

Toss-Up

1. BIOLOGY *Multiple Choice* Microvilli are comprised of which of the following?

W) Actin   
X) Ribosomes  
Y) Keratin  
Z) Tubulins

ANSWER: W) Actin

Bonus

BIOLOGY *Multiple Choice* Which of the following is false about bacterial DNA replication proteins and their functions?

W) Helicase unwinds parental double helix at replicatin forks  
X) Topoisomerase synthesizes an RNA primer  
Y) DNA ligase joins 3’ end of DNA to the rest of the leading strand  
Z) Single-strand binding protein stabilizes single-stranded DNA

ANSWER: X) Topoisomerase synthesizes an RNA primer

Toss-Up

1. BIOLOGY *Short Answer* Which is the primary steroid, from which others are synthesized, such as estradiol?

ANSWER: Cholesterol

Bonus

BIOLOGY *Short Answer* In which time period did angiosperms appear and diversify, and in which dinosaurs became extinct?

ANSWER: Cretaceous

Toss-Up

1. MATH *Short Answer* Given the equation (y + 3)2 = -4(x-2), which point does the directrix cross directly across from the vertex?

ANSWER: (3, -3)

Bonus

MATH *Multiple Choice* Which of the following is equal to -1?

W) i531  
X) i854  
Y) i165  
Z) i1004

ANSWER: X) i854

Toss-Up

1. MATH *Short Answer* Sixteen marbles are in a bag, 4 red and 12 green. Without replacement, what is the probability that the first draw is red and the second is green?

ANSWER: 3/17

Bonus

MATH *Short Answer* What is the tangent line of the equation 8x5- 4x at the point (1,4)?

ANSWER: 36x- 32

Toss-Up

1. MATH *Short Answer* What is the coefficient of the third term of (x-2)7

ANSWER: 84

Bonus

MATH *Short Answer* If v1= [1,1,1] and v2= [2,1,3], what is the cross product?

ANSWER: [2, -1, -1]

Toss-Up

1. MATH *Short Answer* Find the determinant of the following matrix:

2 4 9  
3 6 7   
4 8 3

ANSWER: 0

Bonus

MATH *Short Answer* If v1= [1,17,3] and v2= [6,1,3], what is the dot product?

ANSWER: 32

Toss-Up

1. MATH *Short Answer* What is the surface area of a sphere with radius of 9, in terms of pi?

ANSWER: 324

Bonus

MATH *Short Answer* What is the integral of sec^3 (x)?

ANSWER:

\int \sec^3 x \, dx = \frac{1}{2}\sec x \tan x + \frac{1}{2}\ln|\sec x + \tan x| + C

Toss-Up

1. EARTH/ SPACE *Short Answer* Which of the following are true about meteorite classifications?

1) Differentiated meteorites have had fewer changing influences than undifferentiated.  
2) Stony-irons, mixtures of metallic irons and stones, are the most common.  
3) Irons are made of nearly pure metallic nickel-iron, one of the earliest sources of usable iron.  
4) Differential meteorites include irons and stony-irons.

ANSWER: 3 and 4

Bonus

EARTH/ SPACE *Multiple Choice* Which is false about Neptune?

W) Its irregular moons include Triton, Naiad, and Halimede.  
X) The mass is approximately 17.2 times Earth’s.  
Y) The surface gravity is only surpassed by Jupiter.  
Z) It experiences dynamic storm systems.

ANSWER: W) Its irregular moons include Triton, Naiad, and Halimede.

Toss-Up

1. EARTH/ SPACE *Short Answer* The world’s largest telescope, located on Mauna Kea, is named what?

ANSWER: Keck

Bonus

EARTH/ SPACE *Short Answer* Formed some 4.6 billion years ago, which types of asteroid are most abundant in the solar system?

ANSWER: C-type or carbonaceous asteroid

1. EARTH/ SPACE *Multiple Choice* If the light curves of a supernova have sharp peaks at maxima and die away gradually, and have strong helium lines at 615 nm, which of the following is the best classification?

W) 1a  
X) 1b  
Y) 1c  
Z) 2

ANSWER: X) 1b

Bonus

EARTH/ SPACE *Multiple Choice* In the rock cycle, sediments undergoing compaction and cementation (or lithification), move on to which state?

W) Igneous Rocks   
X) Metamorphic Rocks  
Y) Magma  
Z) Sedimentary rocks

ANSWER: Z) Sedimentary rocks

Toss-Up

1. EARTH/ SPACE *Short Answer* The Marianas Trench marks the convergent boundary of which two plates?

ANSWER: Pacific and Philippine

Bonus

EARTH/ SPACE *Multiple Choice* Which of the following fossils were found in these three continents: Africa, India, and Antarctica?

1) Lystrosaurus   
2) Mesosaurus  
3) Glossopteris

ANSWER: 1 and 3

Toss-Up

1. ) EARTH/ SPACE *Short Answer* Which law states that for any closed loop path, the sum of the length elements times the magnetic field in this direction equals the permeability times electron current in the loop?

ANSWER: Ampere

Bonus

EARTH/ SPACE *Multiple Choice* Mafic lava could have which percentage of silica?  
W) 12  
X) 47   
Y) 55  
Z) 83

ANSWER: X) 47

Toss-Up

1. CHEMISTRY *Multiple Choice* The human eye can see which wavelengths on the electromagnetic spectrum?  
   W) 1 nm- 140 nm  
   X) 140 nm- 280 nm  
   Y) 280 nm- 390 nm  
   Z) 390 nm- 470 nm

ANSWER: Z) 390 nm- 470 nm

Bonus

CHEMISTRY *Short Answer* Which of the following include bosons: Graviton, photon, meson, electron, quark.

ANSWER: Graviton

Toss-Up

1. CHEMISTRY *Short Answer* The splitting of atomic spectral lines from an externally applied electric field is called what, relating to its founder?

ANSWER: Stark effect

Bonus

CHEMISTRY *Multiple Choice* Which of the following is ordered correctly, from most acidic to most basic?

W) Great Salt Lake, acid rain, milk  
X) soda, vinegar, tomato juice  
Y) banana, eggs, baking soda  
Z) milk of magnesia, bleach, ammonia solution

ANSWER: Y) banana, eggs, baking soda

Toss-Up

1. CHEMISTRY *Short Answer* Give the electron configuration for the pure element copper.

ANSWER: 1s2 2s2 2p6 3s2 3p6 4s1 3d10 or [Ar] 4s1 3d10

Bonus

CHEMISTRY *Short Answer* Convert 2 inches into angstroms to two significant digits and correct scientific notation.

ANSWER: 5.1 x 10 ^ 7

Toss-Up

1. CHEMISTRY *Multiple Choice* Which of the following is false?  
   W) Unsaturated hydrocarbons include alkenes, alkynes, and aromatic compounds.  
   X) The general formula for alkynes is C n H 2n+1.  
   Y) Benzene and those resembling it are aromatic compounds.  
   Z) Coal tar is a by-product of making coke from coal.

ANSWER: Z X) The general formula for alkynes is C n H 2n+1.

Bonus

CHEMISTRY *Short Answer* Given 20.0 L of ammonia at 1 atm and 27 degrees Celsius, find the temperature of 100 L at 0.5 atm. Give the final answer in Kelvin and with two significant digits.

ANSWER: 750 Kelvin

1. PHYSICS *Multiple Choice* Kepler’s 3rd Law states which of the following?  
   W) Planets have elliptical orbit with the sun at one focal point.  
   X) A line drawn from the sun to any planet sweeps out equal areas in equal time.  
   Y) The period cubed equals the radius squared.
2. The period of the planet is directly proportional to the radius

ANSWER: Z) The period of the planet is directly proportional to the radius

Bonus

PHYSICS *Short Answer* What is the gravitational force acting on a 5 kg object with a tangential velocity of 4 m/s at a radius of 3 m from another object, in 2 significant digits and Newtons?

ANSWER: 27 N

Toss-Up

1. PHYSICS *Short Answer* The kinetic theory of ideal gases states which of the following?  
   1) As a whole molecules move randomly.  
   2) Molecules interact only through short-range forces during inelastic collisions.  
   3) The molecules make elastic collisions with the walls.  
   4) All molecules in the gas are identical.

ANSWER: 1, 3, 4

Bonus

PHYSICS *Short Answer* Which law states that the rate which an object radiates energy is proportional to the fourth power of its absolute temperature?

ANSWER: Stefan’s Law

Toss-Up

1. PHYSICS *Short Answer* In which type of process does the pressure remain constant while the gas expands or is compressed?

ANSWER: Isobaric

Bonus

*Short Answer* The work done on gas at constant pressure is 4,000,000 J. If the pressure is 1.00 x 10^5 Pascals, and the starting pressure was 4 m^3, then what is the final volume in meters cubed?

ANSWER: 44

Toss-Up

1. PHYSICS *Short Answer* Which of the following is true?  
   W) Rarefaction refers to a region of reduced density.

X) In transverse waves, the vibrations of the elements of the medium are parallel to travel.  
Y) The piezoelectric effect transforms electrical to mechanical energy and is irreversible.  
Z) Audible waves are longitudinal waves that lie within 10 to 40, 000 Hz.

ANSWER: W) Rarefaction refers to a region of reduced density.

Bonus

PHYSICS *Short Answer* Which law states that the EMF generated is proportional to the time rate change of the magnetic flux throughout the experiment?

ANSWER: Faraday’s Law

Toss-Up

1. ENERGY *Short Answer* Which of the following are true?

1) Kinetic energy is conserved in elastic collisions.  
2) The Lagrangian is a function that summarizes the heat quantity of a system.  
3) Internal energy is the sum of all microscopic forms of energy of a system.

ANSWER: 1 and 3

Bonus

ENERGY *Short Answer* What is the power in kilowatts in a hydroelectric dam, when the water has started at a height of 40 m, has a flow rate of 30 m3/s, and has an efficiency of 25%? Give the answer with 2 significant digits.

ANSWER: 2900

Toss-up

1. ENERGY *Short Answer* Electron-positron annihilation produces two or more what?

ANSWER: Gamma ray photons

Bonus

ENERGY *Short Answer* Though most fissions are of binary fissions, 2-4 times in 1000 events produces three positively charged fragments. What type of fission is this?

ANSWER: ternary