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Mr. Hill

Science Bowl Assorted Questions (25 Toss-ups, 25 Bonuses)

1. Toss-up: Chemistry: Multiple Choice: Manganese crystallizes in a body-centered cubic unit cell. What is the coordination number of each atom?

W. 4

X. 8

Y. 12

Z. 16

ANSWER: X

Bonus: Chemistry: Short Answer: Given the following clues, name the element. This element forms an amphoteric oxide has the largest liquid range out of any element in the periodic table. This element is produced by the reduction of its oxide by Hydrogen or by electrolysis. Identify this element.

ANSWER: Gallium (Ga)

1. Toss-up: Chemistry: Short Answer: If ΔG for a reaction is equal to the free energy of formation for that reaction, then the reaction quotient must be equal to what?

ANSWER: Equilibrium Constant

Bonus: Chemistry: Multiple Choice: Doubling all the coefficients in the equation for the cell reaction in a galvanic cell:

W. doubles both ε° and ΔG°

X. doubles ε°, but does not change ΔG°

Y. doubles ΔG°, but does not change ε°

Z. does not change ε° or ΔG°

ANSWER: Y

1. Toss-up: Chemistry: Multiple Choice: What is the compound responsible for the green patina seen on bronze monuments?

W. Copper (II) Carbonate

X. Copper (II) Oxide

Y. Copper (I) Oxide

Z. Copper (II) Hydroxide Sulfate

ANSWER: Z

Bonus: Chemistry: Short Answer: Name the complex ion that is formed when 3.0 M Ammonia is slowly added to an aqueous solution of Copper (II) Sulfate using the nomenclature designed by Werner for Transition Metal Coordination Chemistry.

ANSWER: Tetramminecopper(II)

1. Toss-up: Chemistry: Multiple Choice: Which of the following is a mild oxidizing solution commonly present in organic chemistry labs that contains silver ions which precipitate out of solution when in contact with aldehydes, and is a common substance to use to test for the presence of aldehydes?

W. Tollens’ Reagent

X. Benedict’s Reagent

Y. Markonikoxv’s Reagent

Z. Silver Reagent

ANSWER: W

Bonus: Chemistry: Short Answer: What precipitate is formed when Benedict’s Reagent is added to a solution of 3 Molar Formaldehyde?

ANSWER: Copper (I) Oxide

1. Toss-up: Physics: Short Answer: What is the only current dissipating unit in a traditional AC circuit incorporating all AC circuit elements?

ANSWER: Resistor

Bonus: Physics: Multiple Choice: If an AC circuit incorporating a capacitor, a resistor, and an inductor is operated at its resonant frequency, which of the following must be true?

W. The inductance is equal to the capacitance

X. The inductance is equal to the inverse of the capacitance

Y. All three components of the circuit are in phase

Z. All three components of the circuit are out of phase

ANSWER: X

1. Toss-up: Physics: Multiple Choice: What is the name of the equation in optics that relates the focal length of a lens to the radii of curvature of its two surfaces and its index of refraction?

W. Huygen’s Equation

X. Brewster’s Equation

Y. Lens Equation

Z. Lensmaker Equation

ANSWER: Z

Bonus: Physics: Short Answer: If an object is at infinity, then the lens equation states that the focal length of that object will approach what?

ANSWER: Image Distance (Distance from the lens)

1. Toss-up: Physics: Multiple Choice: Which of the following will be true of the velocity of a relativistic ball if thrown from a bike moving at 0.9c and is recorded by a stationary observer as moving at 0.91c, relative to the bike?

W. The velocity of the ball is 0.01c

X. The velocity of the ball is zero

Y. The velocity of the ball is less than 0.01c

Z. The velocity of the ball is greater than 0.01c

ANSWER: Z

Toss-up: Physics: Short Answer: What is the name of the principle that states that classical mechanics will give near-perfect results, close to those of relativity, if the velocities of objects are substantially lower than the speed of light?

ANSWER: Correspondence Principle

1. Toss-up: Physics: Multiple Choice: What type of baryons are made up of exclusively up and down quarks and can reach isospins of up to +3/2?

W. Deltas

X. Sigmas

Y. Xis

Z. Omegas

ANSWER: W

Bonus: Physics: Short Answer: What quantum attribute given to baryons and mesons is the sum of the baryon number and the strangeness of that particle, and is denoted by the letter Y?

ANSWER: Hypercharge

1. Toss-up: Biology: Multiple Choice: What is the name of a simple carbohydrate ring of five carbon atoms?

W. Pyranose Ring

X. Furanose Ring

Y. Pentose Ring

Z. Anomeric Ring

ANSWER: X

Bonus: Biology: Short Answer: Sort the following sugars into a series of increasing numbers of carbon atoms present: Xylose, Glyceraldehyde, Erythrose, Talose

ANSWER: Glyceraldehyde, Erythrose, Xylose, Talose

1. Toss-up: Biology: Multiple Choice: What is the name of the genetic phenomenon where a gene at one locus in a chromosome alters the phenotypic expression of a gene at second locus?

W. Pleitropy

X. Repressive Dominance

Y. Epistasis

Z. Hypostasis

ANSWER: Y

Bonus: Biology: Short Answer: What is the name given the range of phenotypic possibilities that one person could have due to environmental influences that obscure and prevent any rigidly defined phenotype?

ANSWER: Norm of reaction

1. Toss-up: Biology: Multiple Choice: What is the name a group of microtubules that form between the daughter nuclei of a dividing cell of a charophyte?

W. Sporopollenin

X. Rosette-shaped microtubules

Y. Ratites

Z. Phragmoplast

ANSWER: Z

Bonus: Biology: Short Answer: What is the name of the developing digestive tube that gives rise to the lining of the digestive tract?

ANSWER: Archenteron

1. Toss-up: Biology: Multiple Choice: What is the name of viral DNA that has been integrated into a cell’s DNA?

W. Prophage

X. Provirus

Y. Lysogenic DNA

Z. Exotic DNA

ANSWER: X

Bonus: Biology: Short Answer: What is the name of the process used to study the expression of single genes that uses gel electrophoresis on samples of mRNA from embryos at different stages of development, and then transfers the mRNA to a nitrocellulose membrane allowing them to hybridize with a labeled probe recognizing ß-globin mRNA?

ANSWER: Northern Blotting

1. Toss-up: Math: Short Answer: What is the 2009th derivative of the function ?

ANSWER:

Bonus: Math: Multiple Choice: John and Carol are siblings, but are not twins. John is one year older than Carol. In 5 years, John calculated that his age, multiplied by Carol’s age, will be 210. What is Carol’s age?

W. 5

X. 7

Y. 9

Z. 10

1. Toss-up: Math: Multiple Choice: The following limit: is equivalent to what definite integral?

W.

X.

Y.

Z.

ANSWER: Y

Bonus: Math: Short Answer: Find the above integral: .

ANSWER: Accept or

1. Toss-up: Math: Multiple Choice: Evaluate the integral that gives the volume of the solid formed by revolving the region about the y-axis. The region is on on the x-interval [0,4].

W. 256π/3

X. 64π/3

Y. 64π

Z. 128π/3

ANSWER: Z

Bonus: Math: Short Answer: Use integration by parts to find the antiderivative of .

ANSWER:

1. Toss-up: Math: Multiple Choice: Which of the following trigonometric substitutions for x would be most helpful in solving the integral:

W. x=25 sec(u)

X. x= 5 sec(u)

Y. x= 25 tan (u)

Z. x= 5 tan(u)

ANSWER: Z

Bonus: Math: Short Answer: Find the Maclaurin Polynomial P3 and P5 for f(x)=sin (x).

ANSWER: P3= , P5=

1. Toss-up: ERSC: Multiple Choice: Which of the following is not method that alters the composition of a magma body to create diverse types of rocks?

W. Magmatic Differentiation

X. Magma Mixing

Y. Magma Separation

Z. Assimilation

ANSWER: Y

Bonus: ERSC: Short Answer: During the crystallization of process, the composition of magma constantly changes because it becomes depleted in those elements necessary to make earlier formed minerals. What is the name the most prominent process where earlier-formed minerals sink to the bottom of the chamber due to their higher density than the liquid portion?

ANSWER: Crystal Settling

1. Toss-up: ERSC: Short Answer: This foliated metamorphic rock is produced by the more intense medium-grade metamorphism of slate and breaks along wavey surfaces, has a glossy sheen, and contains fine-grained particle texture.

W. Schist

X. Phyllite

Y. Gneiss

Z. Marble

ANSWER: X

Bonus: ERSC: Short Answer: What is the name of schists composed mainly of muscovite and biotite?

ANSWER: Mica Schists

1. Toss-up: ERSC: Multiple Choice: What is the name of the material deposited by a stream? This term is the general term for any stream-deposited sediment.

W. Silt

X. Load

Y. Alluvium

Z. Lamina

ANSWER: Y

Bonus: ERSC: Short Answer: What is the name of the process that moves sediment in the bed load of a river or stress by making them appear to jump or skip along the river bed?

ANSWER: Saltation

1. Toss-up: Astro: Multiple Choice: What are the names of specialized telescopes that are meant to observe Gamma rays? These telescopes don’t actually detect the gamma rays directly but instead detect the flashes of visible light produced when gamma rays are absorbed by the Earth's atmosphere.

W. Compton Gamma Ray Atmospheric Telescopes

X. Chandrasekhar Atmospheric Telescopes

Y. Atmospheric Cherenkov Telescopes

Z. MAGIC Telescopes

ANSWER: Y

Bonus: Astro: Short Answer: After World War II, two models emerged about how the Universe came about. One was the Big Bang Theory; what was the other one, which said that the Universe was roughly the same at any point in time?

ANSWER: Steady State Model

1. Toss-up: Astro: Short Answer: What is the name of the star cycle that occurs in our sun 96.6% of the time to produce heavy elements such as Nitrogen and Oxygen?

W. Heavy elements cycle

X. Nitrogen-Oxygen Cycle

Y. CNO Cycle

Z. Intermediate Star Carbon Cycle

ANSWER: Y

Bonus: Astro: Short Answer: Name the cycle of heavier elements in Red Giant and more massive stars that also includes Fluorine and is analogous to the CNO cycle.

ANSWER: OF cycle

1. Toss-up: Astro: Multiple Choice: This galaxy was the first to be discovered and characterized as a spiral galaxy in 1845. This galaxy has the astronomical name M51a and is one of the most famous galaxies in the sky. Name this galaxy.

W. Pinwheel Galaxy

X. Andromeda Galaxy

Y. Whirlpool Galaxy

Z. Sombrero Galaxy

ANSWER: Y

Bonus: Astro: Short Answer: Name the astronomical name of the Pinwheel galaxy and the constellation that it is located in.

ANSWER: M101, Ursa Major

1. Toss-up: GENSCI: Multiple Choice: What is the name of a black hole that has electric charge Q not equal to zero but has an angular momentum of zero and a finite mass?

W. Schwarzchild Black Hole

X. Hawking Black Hole

Y. Kerr-Newman Black Hole

Z. Reissner-Nordström black hole

ANSWER: Z

Bonus: GENSCI: Short Answer: Theoretical physicist Stephen Hawking predicted that Black Holes radiate energy in discrete quantum units in a process called Hawking Radiation. What classical/quantum-mechanics law did Hawking adapt to find the energy radiated from a black hole?

ANSWER: Stefan-Boltzmann Law

1. Toss-up: GENSCI: Multiple Choice: Françoise Barré-Sinoussi and Luc Montagnier won the Nobel Prize for medicine in 2008 for their discovery of what?

W. Of human papilloma viruses causing cervical cancer

X. Of human immunodeficiency virus

Y. Of principles for introducing gene modifications in mice by the use of embryonic stem cells

Z. Of RNA interference - gene silencing by double-stranded RNA

ANSWER: X

Bonus: GENSCI: Short Answer: Name one of the Nobel Prize winners for medicine in 2006 for their discovery of RNA interference - gene silencing by double-stranded RNA.

ANSWER: Andrew Z. Fire, Craig C. Mello

1. Toss-up: GENSCI: Multiple Choice: What is an SI derived base unit used for measuring the rate of an absorbed dose of radiation per second?

W. Gray/second

X. Watt/Steradian

Y. Coloumb/Kilogram

Z. Katal/ Cubic Meter

ANSWER: W

Bonus: GENSCI: Multiple Choice: The Siemens, an SI unit used for electrical conductance, is the combination of which of the following SI base units?

W. m2 kg s-3

X. cd s2

Y. kg s-2 A-1

Z. m-2 kg-1 s3 A2

ANSWER: Z