Sriram Pendyala

Science Bowl

Assorted Lightning Round: 25 Toss-ups

1. Chemistry: Multiple Choice: Iodine (I2) is a solid at room temperature. What is the major attractive force that exists among different I2 molecules in its solid form?

W. dispersion

X. dipole

Y. ionic

Z. covalent

ANSWER: W

1. Biology: Multiple Choice: A nonfunctional CD4 protein on a helper T cell would result in the helper T cell being unable to do which of the following?

W. respond to T-independent antigens

X. stimulate a cytotoxic T cell

Y. interact with a class I MHC-antigen complex

Z. interact with a class II MHC-antigen complex

ANSWER: Z

1. Earth Science: Short Answer: What is the name of a barrier built at a right angle to a beach to trap sand that is moving parallel to the shore, usually constructed of large rocks or wood? This barrier may end up sand-starving the longshore current beyond its edge.

ANSWER: Groin

1. Astronomy: Multiple Choice: Which of the following types of supernovas occurs when a slow-rotating white dwarf star begins to accrete mass from a binary companion and surpasses the mass limit of 1.38 to 1.44 solar masses, generating a giant thermonuclear explosion?

W. Type Ia

X. Type Ib

Y. Type Ic

Z. Type IIa

ANSWER: X

1. General Science: Short Answer: Name one of the scientists, who in 1925, found that electrons have spin-up and spin-down quantum states, discovering the 4th quantum number and the Zeeman effect for quantum spin?

ANSWER: Goudsmit OR Uhlenbeck

1. Physics: Multiple Choice: Which of the following is the correct value for the equivalent resistance when one 10 ohm, one 25 ohm, and one 50 ohm light bulb are connected in series to a DC 17 V battery, assuming no internal battery resistance?

W. 0.2 ohms

X. 25/4 ohms

Y. 85 ohms

Z. 12,500 ohms

ANSWER: Y

1. Math: Short Answer: Factor the following polynomial expression: x3 - 5x2 + 2x - 10.

ANSWER: (x-5)(x2+2)

1. General Science: Multiple Choice: Which of the following was a use of the compound diethyl ether in the 19th century?

W. antifreeze

X. anesthetic

Y. solvent

Z. antiseptic

ANSWER: X

1. Earth Science: Multiple Choice: What type of low clouds, which exist below 2,000 meters, are soft, gray clouds in globular patches or rolls, which may join together to make a continuous cloud form?

W. Nimbostratus

X. Stratus

Y. Stratocumulus

Z. Cumulus

ANSWER: Y

1. Biology: Short Answer: Which hormone inhibits the release of Gonadotropin Releasing Hormone from the hypothalamus?

Answer: Testosterone

1. Biology: Multiple Choice: Which of the following describes the function of an enzyme known as Dicer?

W. It degrades single-stranded DNA

X. It degrades single-stranded mRNA

Y. It degrades mRNA with no poly(A) tail

Z. It trims small double-stranded RNAs into molecules that can block translation

ANSWER: Z

1. Chemistry: Multiple Choice: Which of the following molecules below should have the highest gas-phase absolute entropy at 1 atm and 298 K?

W. H2

X. C2H6

Y. CH4

Z. C2H2

ANSWER: X

1. Physics: Short Answer: Give the name of the vector whose direction gives the direction of an electromagnetic wave's travel and energy transport at a certain point, and whose magnitude is the instantaneous energy flow rate at a certain point.

ANSWER: Poynting Vector

1. Math: Multiple Choice: Given that f(x) is continuous at point (c, f(c)), and that the second derivative of f(x) at point c is zero, which of the following MUST be true?

W. f(x) has a relative extrema at c

X. f'(x) has a relative extrema at c

Y. f(x) has a critical point at c

Z. f'(x) has a critical point at c

ANSWER: Z

1. Astronomy: Short Answer: Name this galactic object in a binary system, which was first identified as an X-ray source in 1964, and then later surmised to be one of the first pieces of evidence for the existence of the strange cosmic phenomena of black holes. It was the subject of a friendly scientific wager between physicists Stephen Hawking and Kip Thorne in 1974, with Hawking betting that it was not a black hole. He conceded the bet in 1990 after observational data had strengthened the case for a gravitational singularity in the system. It was mentioned by famed lecturer Walter Lewin in one of his lectures as one of the first identified black holes.

ANSWER: Cygnus X-1

1. Chemistry: Multiple Choice: Which of the following salt solutions would be acidic when dissolved in water?

W. Na3PO4

X. Na2S

Y. CuSO4

Z. Na[Al(OH)4]

ANSWER: Y

1. Physics: Short Answer: Given that the moment of inertia of a solid disk is 0.5MR^2, find the rotational kinetic energy for a disc of mass 10 kilograms, radius 1 meter, with an angular velocity/speed of 2 m/s.

ANSWER: 10 Joules

1. Biology: Multiple Choice: Which structure or compartment is NOT part of the plantʹs apoplast?

W. the lumen of a xylem vessel

X. the lumen of a sieve tube

Y. the cell wall of a mesophyll cell

Z. the cell wall of a transfer cell

ANSWER: X

1. Earth Science: Multiple Choice: What are the names of secondary vents, many of which have built cones, that emit only gases?

W. Parasitic cones

X. Gas Columns

Y. Gas Tubes

Z. Fumaroles

ANSWER: Z

1. Chemistry: Short Answer: What is the molecular geometry, as predicted by VSEPR, of bromine pentafluoride, BrF5?

ANSWER: Square pyramidal

1. Astronomy: Short Answer: What is the name of the beginning of carbon fusion into silicon, present in Type 1a and Type II supernovas?

ANSWER: Carbon detonation/deflagration

1. Physics: Multiple Choice: In fluid mechanics, what instability is formed at a non-accelerating interface between two fluids of different densities when one fluid, on the top, pushes against another? This instability commonly forms in interstellar cloud systems, as well as cloud systems here on Earth.

W. Kelvin-Helmholtz Instability

X. Rayleigh-Taylor Instability

Y.  Richtmyer–Meshkov Instability

Z. Poisson-Boltzmann Instability

ANSWER: X

1. General Science: Multiple Choice: Which of the following men was an influential French, mathematician, geometer, and scientist, who is known for his well-known correction of Laplace's second order partial differential equation for potential, as well as for his probability mass function, a limiting approximation of the binomial probability distribution.

W. Lagrange

X. Bernoulli

Y. Dirac

Z. Poisson

ANSWER: Z

1. Earth Science: Multiple Choice: What is the name for a relatively flat, bench life surface left behind by a receding cliff near a beach, which broadens as wave attack continues?

W. Wave-cut platform

X. Wave-cut cliff

Y. Marine Terrace

Z. Sea Arch

ANSWER: W

1. Math: Multiple Choice: Which of the following functions could be an antiderivative of the function f(x) = x + 1/x?

W. 4 - 1/x^2

X. -3 + 1/x^2

Y. x + x^2/2 + ln(x)

Z. 1 + x^2/2 + ln(x)

ANSWER: Z