Round 3

TOSSUP

1) PHYSICS *Multiple Choice* The Hall Effect is a consequence of what phenomenon?

W) Impedance
X) Eddy currents
Y) Lorentz Force
Z) Skin effect

ANSWER: Y) LORENTZ FORCE

BONUS

1) PHYSICS *Multiple Choice* When a DC voltage source is applied to a capacitor in a circuit for a long time, what does the circuit behave like?

W) A short circuit
X) A VC circuit
Y) An open circuit
Z) An LC circuit

ANSWER: Y) AN OPEN CIRCUIT

TOSSUP

2) CHEMISTRY *Short Answer* A 96 gram mass of pure carbon contains how many moles of carbon?

ANSWER: 8

BONUS

2) CHEMISTRY *Multiple Choice* Which of the following is paired incorrectly with the color observed from the metal in a flame?

W) Lead - Gray
X) Calcium - Orange
Y) Cesium - Red
Z) Potassium - Pink

ANSWER: Y) CESIUM - RED

TOSSUP

3) MATH *Short Answer* How many degrees constitute 3600 arc-seconds?

ANSWER: 1

BONUS

3) MATH *Short Answer* For the function $f(x) = x^2 + 4x + 3$ (F of X equals X squared plus four x plus three), Name all quadrants that the function is in.

ANSWER: 1, 2, 3

TOSSUP

4) ENERGY *Multiple Choice* Find the wattage of an electric circuit if the number of amps is 1.75 and the voltage is 6

W) 9.5
X) 10.5
Y) 11.5
Z) 12.5

ANSWER: X) 10.5

BONUS

4) ENERGY *Short Answer* The Oak Ridge National Laboratory houses Summit, the most powerful of what kind of devices in the world?

ANSWER: SUPERCOMPUTER

TOSSUP

5) BIOLOGY *Multiple Choice* Four elements make up more than 96% of the mass of most living organisms. Which of the following is NOT one of those four elements?

W) sodium
X) carbon
Y) oxygen
Z) nitrogen

ANSWER: W) SODIUM

BONUS

5) BIOLOGY *Multiple Choice* The Monarch butterfly has an undesirable taste and the Viceroy butterfly has a selective advantage because it looks like the Monarch. This is an example of which process?

W) aposematic coloration
X) Batesian mimicry
Y) cryptic coloration
Z) Müllerian mimicry

ANSWER: X) BATESIAN MIMICRY

TOSSUP

6) EARTH AND SPACE *Short Answer* What star, other than the sun, is closest to Earth?

ANSWER: ALPHA CENTAURI

BONUS

6) EARTH AND SPACE *Short Answer* This is the name for the original rock material that soil would be made of. Lichen and moss where the ones that began the process of turning the rock into soil. What is the original rock material that the soil and its minerals comes from?

ANSWER: PARENT MATERIAL

TOSSUP

7) MATH *Short Answer* What is log(243)/log(3) (Log of 243 over Log of 3)?

ANSWER: 5

BONUS

7) MATH *Short Answer* What is value of the fraction with numerator $1 - \cos^2 x$ and denominator $\cos^2 x$, when x equals 45 degrees?

ANSWER: 1

TOSSUP

8) PHYSICS *Short Answer* Which of Newton's laws can be used to measure the mass of an object in free space?

ANSWER: NEWTON'S SECOND LAW (OF MOTION)

BONUS

8) PHYSICS *Short Answer* If an idealized transformer's turn ratio of its Primary Winding to its Secondary Winding is 10, what is the voltage at the secondary side if 1200 V are applied to its Primary Side?

ANSWER: 120 V

TOSSUP

9) ENERGY *Multiple Choice* Which of the following is not a possible negative consequence of fracking?

W) Earthquakes
X) Drinking water contamination
Y) Volcanic Eruptions
Z) Formation of smog

ANSWER: Y

BONUS

9) ENERGY *Multiple Choice* Which of the following is not a renewable energy source?

W) Hydropower
X) Biomass
Y) Natural Gas
Z) Solar and Wind Energy

ANSWER: Y) NATURAL GAS

TOSSUP

10) EARTH AND SPACE *Short Answer* According to NASA, what Jupiter moon is most likely to support life?

ANSWER: EUROPA

BONUS

10) EARTH AND SPACE *Short Answer* Which of the following are types of mining? 1. surface 2. subsurface 3. submerged

ANSWER: 1,2

TOSSUP

11) BIOLOGY *Short Answer* What process allows scientists to separate the parts of a cell based on size and density?

ANSWER: CENTRIFUGATION

BONUS

11) BIOLOGY *Multiple Choice* What does the "mosaic" part of the “fluid mosaic model” of cell membranes refer to?

W) Phospholipids
X) Membrane proteins
Y) Cytoskeleton
Z) ECM

ANSWER: X) MEMBRANE PROTEINS

TOSSUP

12) CHEMISTRY *Multiple Choice* Which element cannot have an expanded octet?

W) Xenon
X) Arsenic
Y) Nitrogen
Z) Krypton

ANSWER: Y) NITROGEN

BONUS

12) CHEMISTRY *Multiple Choice* In a flame test, a sample was tested and the result was a green flame. Which of the following ions is most likely to be present?

W) Cu^{2+}
X) Sr^{2+}
Y) Pb^{+}
Z) Li^{+}

ANSWER: W) Cu^{2+}

TOSSUP

13) BIOLOGY *Short Answer* In what organelle does the citric acid cycle take place?

ANSWER: MITOCHONDRIA

BONUS

13) BIOLOGY *Multiple Choice* What is the purpose of myelin sheaths?

W) To insulate the axon and speed up impulses
X) To insulate the dendrites and speed up the impulse
Y) To conduct the axon and slow down the impulse
Z) To insulate the cell body and and increase neurotransmitter speed

ANSWER: W) TO INSULATE THE AXON AND SPEED UP IMPULSES

TOSSUP

14) EARTH AND SPACE *Short Answer* What is the brightest star in the night sky?

ANSWER: SIRIUS

BONUS

14) EARTH AND SPACE *Multiple Choice* Which of the following, if any, is NOT a Galilean moon of Jupiter? 1) Ganymede 2) Europa 3) Io 4) Callisto

ANSWER: NONE

TOSSUP

15) CHEMISTRY *Multiple Choice* What is the name of element 113, named after the Japanese word for Japan?

W) Japanium
X) Nipponium
Y) Nihonium
Z) Jipangium

ANSWER: Y) NIHONIUM

BONUS

15) CHEMISTRY *Multiple Choice* What is the formal charge of oxygen in H2O?

W) 1
X) -1
Y) -2
Z) 0

ANSWER: Z) 0

TOSSUP

16) MATH *Multiple Choice* What is the name of a matrix that has all zeroes except for a diagonal of 1s from the upper left corner to the bottom right corner?

W) Ideal Matrix
X) Identity Matrix
Y) Singular Matrix
Z) Complete Matrix

ANSWER: X) IDENTITY MATRIX

BONUS

16) MATH *Short Answer* Donald has a drawer full of socks each with 5 different colors of socks: Blue, Red, Green, Brown, and Pale Goldenrod. How many socks does Donald need to randomly pull out of his drawer so that he is guaranteed to get a pair of matching socks?

ANSWER: 6

TOSSUP

17) CHEMISTRY *Multiple Choice* Which of the following is necessarily true of a nonionic substance with a high boiling point?

W) It has a large vapor pressure.
X) It has strong intermolecular attractive forces.
Y) It has a low freezing point.
Z) It has a low heat of vaporization.

ANSWER: X) IT HAS STRONG INTERMOLECULAR ATTRACTIVE FORCES.

BONUS

17) CHEMISTRY *Short answer* What is the general name for an organic compound that contains an -SH group?

ANSWER: THIOL

TOSSUP

18) PHYSICS *Short Answer* Which failed experiment showed evidence that the speed of light is a constant to all observers?

ANSWER: MICHELSON-MORLEY EXPERIMENT

BONUS

18) PHYSICS *Short Answer* Which of the following are fictitious forces? 1) Centrifugal force 2) Gravity 3) Coriolis force 4) Centripetal force

ANSWER: 1, 3 (CENTRIFUGAL FORCE AND CORIOLIS FORCE)

TOSSUP

19) ENERGY *Short Answer* What circuit component allows electrons to flow in one direction only?

ANSWER: DIODE

BONUS

19) ENERGY *Short Answer* What term refers to the boundary between two semiconductors in a diode?

ANSWER: P-N JUNCTION

TOSSUP

20) BIOLOGY *Multiple Choice* The most abundant organic molecule on Earth is:

W) cellulose
X) chitin
Y) DNA
Z) hemoglobin

ANSWER: W) CELLULOSE

BONUS

20) BIOLOGY *Multiple Choice* In which phase of meiosis does crossover occur?

W) Anaphase II
X) Metaphase I
Y) Metaphase II
Z) Prophase I

ANSWER: Z) PROPHASE I

TOSSUP

21) PHYSICS *Short Answer* A person is standing on a scale inside an elevator. When the elevator accelerates upwards, the scale reads 690 N, and when the elevator decelerates to a stop, the scale reads 420 N. In Newtons, what is the net force exerted on the person when the elevator is ascending?

ANSWER: 135

BONUS

21) PHYSICS *Short Answer* In the situation above, how many forces are exerted on the elevator?

ANSWER: 3

TOSSUP

22) MATH *Short Answer* For a function with first coefficient a > 0 and with x-intercepts at -3, -1, 0, 5, and 7, which of the following domains contain points at which the second derivative of the function is positive?

1) from -3 to -1 2) from -1 to 0 3) from 0 to 5 4) from 5 to 7

ANSWER: 2 AND 4

BONUS

22) MATH *Short Answer* Jack is playing a game where he controls a character that moves from one square to another in cardinal directions. If he is playing on a 4x4 square grid, how many different paths can Jack take from one corner to the opposite corner, assuming he cannot go backwards?

ANSWER: 20

TOSSUP

23) EARTH AND SPACE *Short Answer* Used to calculate the distance between an observer on earth and an astronomical object, what is the difference between that object's apparent and absolute magnitudes?

ANSWER: DISTANCE MODULUS

BONUS

23) EARTH AND SPACE *Multiple Choice* Galena is a major ore of which of the following elements?

W) Lead
X) Iron
Y) Copper
Z) Zinc

ANSWER: W) LEAD