MHS Set 2 Round 1 ERRR

Buzzer test + Ice breaker question: What is your most favorite class you've had?

TOSS-UP

1) Physics – *Short Answer* What quantity is defined to be a rigid body's resistance to rotation?

ANSWER: MOMENT OF INERTIA

BONUS

1) Physics – *Short Answer* A car accelerates at 10 meters per second squared from rest until it travels half a kilometer. What is its final velocity in meters per second?

ANSWER: 100

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TOSS-UP

2) Earth and Space- *Short Answer* At about 1%, what is the third most abundant gas in Earth's atmosphere?

ANSWER: ARGON

BONUS

2) Earth and Space – *Multiple Choice* Which of the following types of gas used in the mid 1900's was a main contributor to ozone depletion until their ban in 1996?

W) Hydrocarbons
X) Greenhouse Gases
Y) Aerosols
Z) Chlorofluorocarbons

ANSWER: Z) CHLOROFLUOROCARBONS
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TOSS-UP

3) Chemistry – *Multiple Choice* Which of the following molecules contains only covalent bonds?

W) NH_3
X) CaCl
Y) $LiAlH_4$
Z) $PbBr_3$

ANSWER: W) NH_3

BONUS

3) Chemistry – *Short Answer* Identify all of the following 3 molecules that have a tetrahedral molecular geometry: 1) NH_4^+; 2) NH_3; 3) H_2O.

ANSWER: 1 ONLY

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TOSS-UP

4) Biology – *Short Answer* What part of a fungi, that consists of the hyphae, is used to extend the area in which the fungi can find food?

ANSWER: MYCELIUM

BONUS

4) Biology – *Multiple Choice* The neck's rotability is attributed to what type of synovial joint?

W) Saddle
X) Pivot
Y) Hinge
Z) Plane

ANSWER: X) PIVOT
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TOSS-UP

5) Math – *Short Answer* How many digits does 2 to the 30th power have?

ANSWER: 10

BONUS

5) Math – *Short Answer* What is the largest positive integer k, where k^2 is a factor of 8! (factorial)?

ANSWER: 24

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TOSS-UP

6) Physics – *Short Answer* Name all of the following 4 options that are vector quantities. 1) Weight; 2) Torque; 3) Electric Field; 4) Magnetic Field

ANSWER: 1,2,3,4 (ACCEPT: ALL)

BONUS

6) Physics – *Short Answer* A skater pushes off a railing to increase her speed on a horizontal frictionless surface. Treating the skater as a system, it is clear that the 3 external forces, gravity, normal, and force due to the railing, do no work to the skater. Yet, she somehow increases her kinetic energy, which seems to be a violation of the conservation of mechanical energy. Which of the following explains this phenomenon?

W) We must account for all external forces in a system
X) The skater is expanding her internal energy to increase her kinetic energy
Y) The normal force and force due to gravity are non-conservative
Z) Although parts of her body move, her center of mass doesn't move.

ANSWER: X) THE SKATER IS EXPANDING HER INTERNAL ENERGY TO INCREASE HER KINETIC ENERGY
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TOSS-UP

7) Earth and Space - *Multiple Choice* The San Andreas Fault, located along the coast of California, is an example of which of the following fault types?

W) Normal Fault
X) Strike-Slip Fault
Y) Reverse Fault
Z) Thrust Fault

ANSWER: X) STRIKE-SLIP FAULT

BONUS

7) Earth and Space - *Short Answer* The Nazca Plate touches which continental plate to its East?

ANSWER: SOUTH AMERICAN PLATE

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TOSS-UP

8) Chemistry – *Short Answer* What principle in equilibrium chemistry states that the equilibrium of a system will shift based on stresses applied to the system?

ANSWER: LE CHATELIER'S PRINCIPLE

BONUS

8) Chemistry – *Multiple Choice* Which of the following statements about water is NOT correct?

W) The products of the water gas shift reaction include carbon dioxide and hydrogen gas.
X) Bond angles are around 109.5 degrees.
Y) Water is only a hydrogen bond acceptor.
Z) The triple point of water is used to determine the Kelvin scale.

ANSWER: Y) WATER IS ONLY A HYDROGEN BOND ACCEPTOR.
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TOSS-UP

9) Biology – *Short Answer* What phylum does the model organism Caenorhabditis Elegans belong to?

ANSWER: NEMATODA

BONUS

9) Biology – *Short Answer* Identify all of the following 3 organelles that are single membrane organelles: 1) Nucleus; 2) Mitochondria; 3) Chloroplast.

ANSWER: NONE

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TOSS-UP

10) *Math* – *Short Answer* Find the area of a rhombus with diagonals of 25 and 20.

ANSWER: 250

BONUS

10) Math – *Short Answer* If $a+b=1$ and $a^2+b^2=2$, find a^4+b^4.

ANSWER: 7/2
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TOSS-UP

11) Physics – *Short Answer* What quantity is defined to be an object's resistance to compression?

ANSWER: BULK MODULUS

BONUS

11) Physics – *Short Answer* A 500 gram baseball is thrown at a speed of 30 m/s at a hitter. The bat and ball remain in contact for 0.2 seconds and the baseball is hit at 30 m/s. In Newtons, what is the average force that the bat exerts on the ball?

ANSWER: 150 N

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TOSS-UP

12) Earth and Space- *Short Answer* What relatively common type of star is usually used to easily gauge stellar distances due to regular cycles of brightness with a frequency related to its luminosity,

ANSWER: CEPHEID VARIABLE

BONUS

12) Earth and Space – *Multiple Choice* A star's unique interstellar absorption spectrum is used to determine its:

W) Mass
X) Absolute Luminosity
Y) Chemical Composition
Z) Angular Momentum

ANSWER: Y) CHEMICAL COMPOSITION
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TOSS-UP

13) Biology – *Short Answer* Identify all of the following 3 amino acids that do not contain sulfur: 1) Cysteine; 2) Methionine; 3) Arginine.

ANSWER: 1 AND 2

BONUS

13) Biology – *Short Answer* Oxygen is bound to what protein in order to be stored in muscles?

ANSWER: MYOGLOBIN

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TOSS-UP

14) Chemistry – *Multiple Choice* Which of the following functional groups does not contain an oxygen atom?

W) Ester
X) Carbonyl
Y) Amide
Z) Phenyl

ANSWER: Z) PHENYL

BONUS

14) Chemistry – *Short Answer* A container of 4L at 1.5 atmospheres of pressure is expanded to 25L, to the nearest hundredth, what is the new pressure in atmospheres?

ANSWER: .24 ATMOSPHERE
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TOSS-UP

15) Math – *Short Answer* Pipe 1 can fill a pool in 2 hours, and Pipe 2 can fill the pool in 3 hours. How many minutes does it take for the two to fill the pool if they are operating at the same time?

ANSWER: 72

BONUS

15) Math – *Short Answer* Find the determinant of the matrix with first row 0, 1, 2; second row 1, 2, 3; and third row 2, 3, 4.

ANSWER: 0

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TOSS-UP

16) Physics – *Multiple Choice* Which of the following are the correct dimensions for Planck's constant?

W) Joules
X) Joule-seconds
Y) Newtons
Z) Newton-seconds

ANSWER: X) JOULE-SECONDS

BONUS

16) Physics – *Short Answer* What phenomenon, seen with a spinning bicycle wheel, is the change in orientation of the rotational axis of a rotating body?

ANSWER: PRECESSION
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TOSS-UP

17) Chemistry – *Short Answer* What order reaction characterizes an alpha decay?

ANSWER: FIRST (ACCEPT: 1)

BONUS

17) Chemistry – *Short Answer* What is the hybridization of the central atom in the following 3 molecules: 1) SF_4; 2) IF_5; 3) CH_4

ANSWER: 1) SP^3D 2) SP^3D^2; 3) SP^3

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TOSS-UP

18) Biology – *Multiple Choice* What type of selection is depicted by human babies, where babies who have lower weight more likely die, and babies of larger weight have a troubled time getting through the birth canal and also die.

W) Directional
X) Stabilizing
Y) Disruptive
Z) Sexual

ANSWER: X) STABILIZING

BONUS

18) Biology – *Short Answer* What two amino acids are constitutional isomers of each other?

ANSWER: LEUCINE AND ISOLEUCINE
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TOSS-UP

19) Earth and Space- *Short Answer* Similar to the thermocline, the halocline represents a stratification of what in seawater?

ANSWER: SALINITY (ACCEPT SALT)

BONUS

19) Earth and Space- *Short Answer* A partially collapsed, submerged, and flat-topped seamount is known as what?

ANSWER: GUYOT

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TOSS-UP

20) Math – *Short Answer* What is the distance between the points, (1,2) and (6, -10)?

ANSWER: 13

BONUS

20) Math – *Short Answer* What is the indefinite integral of sec(x) dx?

ANSWER: ln|sec x + tan x|
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TOSS-UP

21) Physics – *Short Answer* Order the following 3 elements in increasing mean-free path assuming constant number densities: 1) Carbon; 2) Nitrogen; 3) Oxygen

ANSWER: 123

BONUS

21) Physics – *Short Answer* What is the energy stored in an inductor with an inductance of 2 Henrys, attached in series to a 9 volt battery with an internal resistance of 1 ohm?

ANSWER: 81 JOULES

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TOSS-UP

22) Chemistry – *Short Answer* What gas law states that pressure and volume are inversely related for an ideal gas?

ANSWER: BOYLE'S LAW

BONUS

22) Chemistry – *Multiple Choice* Which of the following reactions has the largest increase in entropy?

W) Melting of water
X) Sublimation of water
Y) Freezing of water
Z) Condensation of water

ANSWER: X) SUBLIMATION OF WATER
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TOSS-UP

23) Math – *Short Answer* How many positive divisors does one million have?

ANSWER: 49

BONUS

23) Math – *Short Answer* What is the sum of the first ten perfect cubes?

ANSWER: 3025