MHS Set 2 Round 4 LRRR

Buzzer test + Ice breaker question: What do you plan on majoring in in college?

TOSS-UP

1) Physics – *Multiple Choice* Identify all of the following quantities that are dimensionless. 1) Reynold's number; 2) Viscosity; 3) Friction coefficient

ANSWER: 1, 3

BONUS

1) Physics – *Multiple Choice* When waves encounter an obstacle, they tend to bend and curve around corners. What is the name of this phenomenon?

W) Diffraction
X) Diffusion
Y) Dispersion
Z) Refraction

ANSWER: W) DIFFRACTION

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TOSS-UP

2) Earth and Space - *Short Answer* The KT Boundary, marked by its high iridium concentration, stratigraphically marks the end of which period?

ANSWER: CRETACEOUS PERIOD

BONUS

2) Earth and Space - *Short Answer* Order the following four events from most recent to least recent: 1) Extinction of the Dinosaurs; 2) End of the last Ice Age; 3) Krakatoa's last major eruption; 4) Breakup of Pangea

ANSWER: 3, 2, 1, 4
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TOSS-UP

3) Chemistry – *Short Answer* Identify all of the following 4 compounds that are considered weak Bronsted Lowry acids: 1) Acetic Acid; 2) Ammonia; 3) Nitrous acid; 4) Hydrofluoric acid

ANSWER: 1, 3, AND 4

BONUS

3) Chemistry – *Short Answer* For a hypothetical reaction that has a rate constant of 24 Moles per liter seconds, what is the reaction order?

ANSWER: 0

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TOSS-UP

4) Biology – *Short Answer* Identify all of the following 3 compounds that are considered electron carriers in cellular respiration: 1) NAD+; 2) FAD; 3) O_2

ANSWER: 1 AND 2

BONUS

4) Biology – *Multiple Choice* Which of the following statements about muscle tissue is NOT true?

W) Acetylcholinesterase is an enzyme used to excite neuromuscular junctions.
X) Tropomyosin wraps around actin and prevents myosin from grabbing it, and causes skeletal muscle contraction.
Y) Muscle tissue is formed from embryonic development through a process called myogenesis.
Z) Cardiac and skeletal muscles are striated because they contain sarcomeres.

ANSWER: W) ACETYLCHOLINESTERASE IS AN ENZYME USED TO EXCITE NEUROMUSCULAR JUNCTIONS.
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TOSS-UP

5) Math – *Short Answer* When the second derivative of a function at a certain point is zero, which of the following best describes the point?

W) Critical Point
X) Maximum
Y) Minimum
Z) Point of Inflection

ANSWER: Z) POINT OF INFLECTION

BONUS

5) Math–*Short Answer* An ant is walking on the edges of an equilateral triangle. If its average speed was 1 mile per hour for the first edge, 2 miles per hour for the second edge, and 3 miles per hour for the 3rd edge, what is its total average speed? Express your answer as a common fraction.

ANSWER: 18/11

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TOSS-UP

6) Physics – *Short Answer* A block with mass 2 kilograms is attached to a spring with spring constant 200 Newtons per meter. If the block is stretched a distance of 7 meters, what will its instantaneous acceleration be when it is released?

ANSWER: 700

BONUS

6) Physics – *Short Answer* How many degrees of freedom does neon gas have?

ANSWER: 3
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TOSS-UP

7) Earth and Space - *Multiple Choice* - Which of the following terrestrial planets will have the largest temperature difference between their day and night cycles?

W) Mercury
X) Venus
Y) Earth
Z) Mars

ANSWER: W) MERCURY

BONUS

7) Earth and Space - *Short Answer* Which of the terrestrial planets has the most natural satellites?

ANSWER: MARS

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TOSS-UP

8) Energy – *Multiple Choice* Researchers at Lawrence Livermore national lab are studying the growth of neutron stars. Which of the following types of supernovae cannot lead to the birth of a neutron star?

W) Type Ia
X) Type Ib
Y) Type Ic
Z) Type II

ANSWER: W) TYPE IA

BONUS

8) Energy – *Short Answer* Researchers at Ames national lab are studying the catalytic uses of ferric oxide. What is the name of the most common mineral that is composed of ferric oxide?

ANSWER: HEMATITE
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TOSS-UP

9) Biology – *Short Answer* Companion cells and sieve cells originate from what other plant structure that consists of undifferentiated cells?

ANSWER: MERISTEMS

BONUS

9) Biology – *Short Answer* The electron carrier protein Ferredoxin aids most heavily in which of the following processes?

W) Photosynthesis
X) Citric acid cycle
Y) Fermentation
Z) Glyoxylate cycle

ANSWER: W) PHOTOSYNTHESIS

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TOSS-UP

10) Math – *Short Answer* What is the value of the second derivative of $y = 4x^3 - 6x + 9$ at $x = 3$?

W) 24
X) 36
Y) 48
Z) 72

ANSWER: Z) 72

BONUS

10) Math – *Short Answer* What is the area of a trapezoid with parallel bases of length 16, and 19, and a height of length 12?

ANSWER: 210
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TOSS-UP

11) Physics – *Short Answer* What quantity can be described as the time derivative of angular momentum?

ANSWER: TORQUE

BONUS

11) Physics – *Short Answer* A block is on an incline with an angle 30 degrees to the horizontal. Given that the block has a length of 25 meters, how long, to the nearest second, will the block take to slide to the bottom, assuming friction to be negligible?

ANSWER: 3

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TOSS-UP

12) Earth and Space - *Multiple Choice* - Red granite, the state rock of Wisconsin, earns its reddish pink hue from which of the following minerals?

W) Quartz
X) Mica
Y) Feldspar
Z) Amphibole

ANSWER: Y) FELDSPAR

BONUS

12) Earth and Space - *Multiple Choice* - Exclusively coarse grained igneous rocks are known as what?

W) Aphanitic
X) Phaneritic
Y) Porphyritic
Z) Phenocrysts

ANSWER: X) PHANERITIC
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TOSS-UP

13) Energy – *Short Answer* Researchers at Argonne national lab are studying the strength of network solids in various conditions. Identify all of the following three materials that are network solids: 1) Silicon carbide; 2) Diamond; 3) Sodium Chloride.

ANSWER: 1 AND 2

BONUS

13) Energy – *Multiple Choice* Researchers at Los Alamos national lab are studying metal-ligand bonding in actinides. Which of the following elements is not an actinide?

W) Gadolinium
X) Thorium
Y) Plutonium
Z) Nobelium

ANSWER: W) GADOLINIUM

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TOSS-UP

14) Chemistry – *Multiple Choice* At which of the following conditions would a real gas behave most ideal?

W) 0.5 atmospheres, 546 Kelvin
X) 1 atmosphere, 273 Kelvin
Y) 10 Atmospheres, 273 Kelvin
Z) 10 atmospheres, 546 Kelvin

ANSWER: W) 0.5 ATMOSPHERES, 546 KELVIN

BONUS

14) Chemistry – *Short Answer* Identify all of the following 3 molecules that have an even amount of sigma bonds and an odd amount of pi bonds: 1) Acetylene; 2) Ethylene; 3) Acetone.

ANSWER: 3 ONLY
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TOSS-UP

15) Math – *Short Answer* What is the *y*-intercept of the line that passes through the points (2,8) and (3, 17)?

ANSWER: -10 (ACCEPT: (0,-10))

BONUS

15) Math – *Short Answer* What is the remainder when $4x^4 - 3x^3 + 17x - 16$ is divided by $x - 2$?

ANSWER: 58

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TOSS-UP

16) Physics – *Multiple Choice* Which of the following quarks is the most massive?

W) Up
X) Bottom
Y) Charm
Z) Down

ANSWER: X) BOTTOM

BONUS

16) Physics – *Short Answer* A circuit containing a 9 volt battery is connected to a resistor with a resistance of 6 ohms. Given that the battery has an internal resistance of 3 ohms, what is the power, in watts, dissipated by the resistor?

ANSWER: 6
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TOSS-UP

17) Chemistry – *Short Answer* Order the following 3 atoms from shortest to longest half-life:
1)Tritium; 2) Carbon-14; 3) Uranium-238

ANSWER: 1, 2, 3

BONUS

17) Chemistry – *Short Answer* What is the maximum number of emission lines that you would observe of a hypothetical electron in the n=100 energy level in a hydrogen atom.

ANSWER: 4950

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TOSS-UP

18) Biology – *Short Answer* What cellular organelle is responsible for the catabolism of long-chain fatty acids through beta-oxidation?

ANSWER: PEROXISOME

BONUS

18) Biology – *Multiple Choice* Which of the following diseases is NOT correctly linked with the organ primarily affected?

W) Cardiomyopathy; Heart
X) Diabetes Insipidus; Pancreas
Y) Adenocarcinoma; Lungs
Z) Glomerulonephritis; Kidneys

ANSWER: X) DIABETES INSIPIDUS; PANCREAS
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TOSS-UP

19) Earth and Space - *Short Answer* The three major atmospheric circulation cells are the Hadley, polar, and what other cell?

ANSWER: FERRELL CELL

BONUS

19) Earth and Space - *Multiple Choice* - If the dry and wet bulbs of a psychrometer show very similar temperatures, that means that the air is:

W) Completely Unsaturated
X) Somewhat Saturated
Y) Mostly Saturated
Z) Completely Saturated

ANSWER: Z) COMPLETELY SATURATED

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TOSS-UP

20) Math – *Short Answer* Triangle ABC is inscribed within a circle. Given that angle ABC measures 20 degrees, what is the degree measure of arc AC?

ANSWER: 40

BONUS

20) Math – *Short Answer* What is the product of all the factors of 12?

ANSWER: 1728
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TOSS-UP

21) Chemistry – *Short Answer* How much 0.5 molar sulfuric acid, in milliliters, is required to fully neutralize 60mL of 0.2 molar potassium hydroxide.

ANSWER: 12

BONUS

21) Chemistry – *Short Answer* What is the equivalence factor for sulfuric acid if only 0.5 mols of sulfuric acid are required to fully neutralize a sample of hydroxide ions.

ANSWER: 0.5

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TOSS-UP

22) Biology – *Short Answer* Mannose-6-phosphate is a compound that marks proteins headed for what other cellular organelle?

ANSWER: LYSOSOME

BONUS

22) Biology – *Short Answer* Identify all of the following 3 things that are present in prokaryotes but not eukaryotes: 1) Nucleolus; 2) Pili; 3) Cecum.

ANSWER: 2 ONLY
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TOSS-UP

23) Energy – *Short Answer* Researchers at Princeton Plasma Physics laboratory are modelling the magnetic field of Mercury. The magnetic field of large bodies such as the Earth and the Sun are created as a result of what effect?

ANSWER: DYNAMO EFFECT

BONUS

23) Energy – *Short Answer* Researchers at Fermilab are studying the interactions and behaviors of neutrinos. What process that neutrinos undergo leads to only a fraction of them being detected?

ANSWER: OSCILLATION