2024 SMH Invitational Cup - ROUND ROBIN 1

TOSSUP

1) Biology – *Short Answer* What connective tissues connect muscle to bone?

ANSWER: TENDONS [SO]

BONUS

1) Biology – *Short Answer* Identify all of the following three barriers that are considered to be prezygotic.

I. Behavioral isolation

II. Gametic isolation

III. Hybrid breakdown

ANSWER: 1 and 2 [SO]

TOSSUP

2) Chemistry – *Multiple Choice* Which of the following hybrid orbitals has the greatest bond angle?

W) sp

X) sp2

Y) sp3

Z) sp4

ANSWER: W) sp [CZ]

BONUS

2) Chemistry – *Short Answer* What is the systematic name of the chemical compound with formula Fe2(SO3)3?

ANSWER: Iron (III) Sulfite, ACCEPT: Ferric Sulfite [CZ]

TOSSUP

3) Physics – *Short Answer* What is the name for the speed at which the gravitational force on an object is exactly balanced out by drag?

ANSWER: terminal velocity [SO]

BONUS

3) Physics – *Short Answer* Two charged particles, both with charge +Q, are held a distance d apart on the x-axis and exert a force F on each other. If one of the particles is replaced by a charged particle with charge -3Q, and the distance between the two charges is increased to 2d, what is the new force exerted by the particles on each other in terms of F?

ANSWER: -3F/4 [SO]

TOSSUP

4) Earth and Space – *Multiple Choice* Which of the following best explains why point bars form on the insides of meanders?
W) Vegetation growth traps sediment
X) Water is slower on the inside edge
Y) The river protects the inside of a meander from wind
Z) The inside of a curve has less room for point bar growth than the outside

ANSWER: X) Water is slower on the inside edge [SO]

BONUS

4) Earth and Space – *Short Answer* When mapped, the asteroid belt appears to be separated into different bands with few asteroids between them. These gaps between bands form due to resonance with what solar system body?

ANSWER: Jupiter [PB]

TOSSUP

5) Math – *Short Answer* What is the degree measure of one exterior angle in a regular dodecagon?

ANSWER: 30 [DL]

BONUS

5) Math – *Short Answer* In the new game Science Quiz, you can choose to answer Level 1 or Level 2 questions. If you answer a Level 1 question correctly, you get 4 points, and if you answer a Level 2 question correctly, you get 10 points. There are no penalties for incorrect answers. If a player answered 10 questions correctly and earned 52 points, how many Level 2 questions did they answer correctly?

ANSWER: 2 [RG]

TOSSUP

6) Biology – *Multiple Choice* During bacterial replication, which of the following proteins can be found on both the leading and lagging strands?

W) DNA polymerase
X) DNA ligase
Y) RNA primase
Z) helicase

ANSWER: W) DNA polymerase [SO]

BONUS

6) Biology – *Short Answer* Order the following three types of glucose catabolism from least to most efficient: 1) aerobic respiration, 2) lactic acid fermentation, 3) anaerobic respiration.

ANSWER: 231 [SO]

TOSSUP

7) Chemistry – *Short Answer* In a chemical reaction, what is the name for the difference between the energy of the transition state and the energy of the reactants?

ANSWER: activation energy [CZ]

BONUS

7) Chemistry – *Short Answer* Anurag accidentally put his HF in a glass bottle and now it is being eaten! What is the formal charge of silicon in the main product of this reaction, the fluorosilicate ion with formula SiF_6^{2-}?

ANSWER: -2 [CZ]

TOSSUP

8) Physics – *Short Answer* An incompressible fluid flows through a pipe with radius 4 meters at a velocity of 12 meters per second. In another section of the same pipe, the fluid flows at a velocity of 3 meters per second. In meters, what is the radius of the pipe in the second section?

ANSWER: 8 meters [SO]

BONUS

8) Physics – *Short Answer* Identify all of the following three adjectives which correctly describe the image formed by a planar mirror: 1) real, 2) upright, 3) magnified.

ANSWER: 2 ONLY [SO]

TOSSUP

9) Earth and Space – *Multiple Choice* Which of the following astronomical bodies typically would not be plotted on an HR diagram?

W) Red dwarf
X) Yellow dwarf
Y) Brown dwarf
Z) White dwarf

ANSWER: Y) Brown dwarf [PB]

BONUS

9) Earth and Space – *Short Answer* Identify all of the following three silicate minerals that are located on the discontinuous branch of Bowen's reaction series: 1) Biotite; 2) Olivine; 3) Pyroxene.

ANSWER: All [PB]

TOSSUP

10) Math – *Short Answer* Order the following 3 geometric shapes by increasing eccentricity.

1) Hyperbola

2) Ellipse

3) Parabola

ANSWER: 2, 3, 1 [RG]

BONUS

10) Math – *Short Answer* Euna is playing a game. After paying $5 to start playing, she pays $3 per turn in order to roll a fair 6-sided dice with faces labeled 1 through 6. The number that is rolled is the amount of money she gets back. What is the minimum number of turns she must play in order to expect to make a profit?

ANSWER: 11 [RG]

TOSSUP

11) Biology – *Short Answer* Statins inhibit the production of what membrane lipid, which is the precursor to steroid hormones and is often implicated in coronary heart disease?

ANSWER: cholesterol [SO]

BONUS

11) Biology – *Short Answer* Neighboring plant cells remain attached to each other because of the presence of pectin in what area between primary cell walls?

ANSWER: MIDDLE LAMELLA [SO]

TOSSUP

12) Chemistry – *Multiple Choice* Which of the following alkanes has the highest boiling point?

W) Methane

X) Ethane

Y) Propane

Z) Butane

ANSWER: Z) Butane [CZ]

BONUS

12) Chemistry – *Short Answer* How many lone pairs are present in one molecule of ozone?

ANSWER: 6 [CZ]

TOSSUP

13) Physics – *Multiple Choice* Hugo is traveling faster and faster, approaching the speed of light. Which of the following would he NOT observe as his speed increases?

W) length contraction

X) increased relativistic mass of surrounding objects

Y) time dilation

Z) decreased speed of causality

ANSWER: Z) decreased speed of causality [SO]

BONUS

13) Physics – *Short Answer* Penelope is measuring various electrical properties of a conducting sphere with radius 6 meters. If she measures the electric potential to be 10 volts at one point on the surface of the sphere, what is the electric potential, in volts, at the center of the sphere?

ANSWER: 10 [SO]

TOSSUP

14) Earth and Space – *Multiple Choice* In which of the following regions of Earth do seismic waves travel fastest?

W) Upper mantle
X) Lower mantle
Y) Outer core
Z) Inner core

ANSWER: X) Lower mantle [PB]

BONUS

14) Earth and Space – *Short Answer* What quantity describes the smallest radius at which a mass can be compacted before it collapses to form a black hole?

ANSWER: Schwarzschild radius [PB]

TOSSUP

15) Math – *Multiple Choice* Which of the following are the slopes of the asymptotes of the hyperbola y squared over 4 - x squared over 9 = 1?
W) Plus or minus 3/2
X) Plus or minus 2/3
Y) Plus or minus 2
Z) Plus or minus 3

ANSWER: X) Plus or minus 2/3 [RG]

BONUS

15) Math – *Short Answer* The faces of a rectangular prism have areas 40, 60, and 96. What is the volume of the rectangular prism?

ANSWER: 480 [RG]

TOSSUP

16) Biology – *Multiple Choice* Simple columnar epithelium, which can be found in the small intestine, is specialized for which of the following functions?
W) diffusion of gases
X) hormone secretion
Y) protection against abrasion
Z) absorption of nutrients

ANSWER: Z) absorption of nutrients [SO]

BONUS

16) Biology – *Multiple Choice* Which of the following immune system components is considered part of the innate immune system?
W) interferons

X) T cells
Y) B cells
Z) antibodies

ANSWER: W) interferons [SO]

TOSSUP

17) Chemistry – *Short Answer* Rank the following 3 liquids by increasing surface tension:
1) Ethanol
2) Acetone
3) Water

ANSWER: 2,1,3 [CZ]

BONUS

17) Chemistry – *Short Answer* Connor places 0.2 molar Cu2+ and 4 molar Cu2+ in the two compartments of a galvanic cell. What equation could be used to calculate this cell's voltage?

ANSWER: Nernst equation [CZ]

TOSSUP

18) Physics – *Multiple Choice* The voltage drop across an inductor is directly proportional to the time derivative of what quantity?
W) resistance
X) current
Y) electromotive force
Z) capacitance

ANSWER: X) CURRENT [SO]

BONUS

18) Physics – *Short Answer* A car traveling at 24 meters per second decelerates to a stop in 6 seconds. In meters, how far does the car travel before it comes to a stop?

ANSWER: 72 [SO]

TOSSUP

19) Earth and Space – *Multiple Choice* Which of the following astronomical features is NOT an example of an active galactic nucleus?

W) Blazar
X) Pulsar
Y) Quasar
Z) Seyfert galaxy

ANSWER: X) Pulsar [PB]

BONUS

19) Earth and Space – *Short Answer* When crystals are allowed to grow unrestricted, they form well-defined faces. What is the term for such crystals?

ANSWER: Euhedral [SO]

TOSSUP

20) Math – *Multiple Choice* Which of the following pairs of dimensions for two matrices allows the first matrix to be multiplied by the second?

W) 1 by 2 and 1 by 2

X) 2 by 2 and 2 by 2

Y) 3 by 2 and 3 by 2

Z) 4 by 2 and 4 by 2

ANSWER: X) 2 by 2 and 2 by 2 [RG]

BONUS

20) Math – *Short Answer* In triangle ABC, angles A, B, and C form an arithmetic progression, in that order. Expressing your answer in degrees, what is the measure of the exterior angle at angle B?

ANSWER: 120 [RG]
