CSBL ROUND 1

TOSS-UP

1) Biology – *Multiple Choice* What is the correct order of phases in mitosis of an animal cell?

W) Prophase, Metaphase, Telophase, Anaphase
X) Telophase, Anaphase, Metaphase, Prophase
Y) Prophase, Metaphase, Anaphase, Telophase
Z) Prophase, Anaphase, Metaphase, Telophase

ANSWER: Y) PROPHASE, METAPHASE, ANAPHASE, TELOPHASE

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BONUS

1) Biology – *Short Answer* In the cell division process called meiosis, what is the name for the regions where crossing over occurs?

ANSWER: CHIASMATA (ALSO ACCEPT: CHIASMA)

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TOSS-UP

2) Chemistry – *Multiple choice* Which of the following is NOT a strong acid?

W) HF
X) HCl
Y) HI
Z) HBr

ANSWER: W) HF

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BONUS

2) Chemistry – *Short Answer* In the chemical reaction between calcium carbonate and nitric acid, which ion is the spectator ion?

ANSWER: NITRATE
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TOSS-UP

3) Physics – *Multiple choice* What is the slope of a position vs. time graph?

W) Displacement
X) Velocity
Y) Acceleration
Z) Force

ANSWER: X) Velocity

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BONUS

3) Physics – *Short Answer* A runner starts at rest and then accelerates to 12 m/s at time t = 3. What is the average acceleration of the runner between times t = 0 and t = 3?

ANSWER: 4 m/s^2

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TOSS-UP

4) Earth and Space – *Multiple Choice* Which of the following is NOT a sedimentary rock?

W) Limestone
X) Chert
Y) Slate
Z) Shale

ANSWER: Y) SLATE

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BONUS

4) Earth and Space – *Short Answer* Rank the following in order from first to last in the Bowen's Reaction Series:

I. Olivine
II. Quartz
III. Pyroxene

ANSWER: I, III, II
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TOSS-UP

5) Math – *Multiple Choice* Which of the following is NOT a factor of 1001?

W) 7
X) 11
Y) 13
Z) 15

ANSWER: Z) 15 (1001 = 7 * 13 * 11)

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BONUS

5) Math – *Short Answer* What is the GCF of 105 and 147?

ANSWER: 21

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TOSS-UP

6) Energy – *Short Answer* Scientists at PNNL are studying how AI can better forecast hurricane tracks and intensity. What effect causes hurricanes in the Northern Hemisphere to spin in a counterclockwise direction?

ANSWER: CORIOLIS EFFECT

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BONUS

6) Energy – *Multiple Choice* Scientists at Brookhaven National Lab are studying how aerosols increase the severity of thunderstorms in Houston and across the US. Houston is prone to thunderstorms because it falls under what Koppen Classification, which is prone to peaks of summer rainfall and hot humid summers?

W) A
X) B
Y) C
Z) D

ANSWER: Y) C

TOSS-UP
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7) Biology – *Multiple Choice* There are three domains of life: Archaea, Bacteria, and Eukarya. While the differences between Eukaryotes and Bacteria are more obvious, which cellular component helped discover that Archaea are separate from Bacteria ?

W) Nucleus
X) Cell Membrane
Y) Organelles
Z) Ribosomes

ANSWER: Z) RIBOSOMES

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BONUS

7) Biology – *Multiple Choice* Ribosomes catalyze the formation of proteins from the information encoded in messenger RNAs. The ribosome is a large macromolecule composed of RNAs and proteins. Which of the following RNAs directly catalyzes the elongation of a polypeptide chain?

W) ribosomal RNA
X) messenger RNA
Y) micro RNA
Z) transfer RNA

ANSWER: Z) TRANSFER RNA

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TOSS-UP

8) Chemistry – *Short Answer* Identify all of the following that are all alkaline earth metals: 1) Rubidium, 2) Strontium, 3) Radium

ANSWER: 2 AND 3

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BONUS

8) Chemistry – *Multiple Choice* What is the oxidation state of sulfur in sulfur hexafluoride?

W) -6
X) 6
Y) 12
Z) -12

ANSWER: X) 6
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TOSS-UP

9) Physics – *Short Answer* How much potential energy does a block of mass 10 kg at rest at height 20m have?

ANSWER: 1960 J (DO NOT ACCEPT: 2000 J)

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BONUS

9) Physics – *Short Answer* According to Hooke's Law, what is the force exerted by a spring with a spring constant of 0.2 on an attached mass at displacement 4 meters?

ANSWER: 0.8 N

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OSS-UP

10) Earth and Space – *Multiple Choice:* Who developed the heliocentric model for the solar system?

W) Plato
X) Aristotle
Y) Nicholas Copernicus
Z) Galileo Galilei
ANSWER: Y) NICHOLAS COPERNICUS

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BONUS

10) Earth and Space – *Multiple Choice* Kepler's Third Law states that the planet's orbital period and semimajor axis are proportional to what powers respectively?
W) 3rd and 2nd
X) 2nd and 3rd
Y) -3rd and -2nd
Z) -2nd and -3rd
ANSWER: X) 2ND AND 3RD

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TOSS-UP

11) Math – *Short Answer* Arin has 5 blue socks, 4 red socks, and 6 purple socks in his sock drawer. How many socks would he have to take out before he is guaranteed to have a pair of the same color?

ANSWER: 4 SOCKS

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BONUS

11) Math – *Short Answer* How many ways are there to form a 3-person committee out of 6 people?

ANSWER: 20 WAYS

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TOSS-UP

12) Energy – *Multiple Choice* Researchers at Oak Ridge Reservation in Tennessee have discovered the importance of a transition metal in helping microbes denitrify soil. Which nitrogen-containing compound do microbes need for denitrification?

W) Ammonium
X) Ammonia
Y) Nitrite
Z) Nitrate

ANSWER: Z) NITRATE

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BONUS

12) Energy – *Multiple Choice* Which of the following transition metals helps microbes denitrify soil as described by the researchers at Oak Ridge Reservation?

W) Molybdenum
X) Gold
Y) Iron
Z) Copper

ANSWER: W) MOLYBDENUM
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TOSS-UP

13) Biology – *Multiple Choice* Which of the following animals do NOT fall into the phylum Cnidaria **(read as ni-Dair-ee-Uh)**?

W) Corals
X) Jellies
Y) Hydras
Z) Flatworms

ANSWER: Z) FLATWORMS

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BONUS

13) Biology – *Short Answer* How many layers of cells do cnidarians have?

ANSWER: 2

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TOSS-UP

14) Chemistry – *Multiple Choice* Which of the following has the smallest atomic radius?

W) Iodine
X) Manganese
Y) Bromine
Z) Sodium

ANSWER: Y) Bromine

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BONUS

14) Chemistry – *Short Answer* Uranium-238 decays into helium atoms and what other isotope?

ANSWER: THORIUM-234

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TOSS-UP

15) Physics – *Multiple Choice* The strong nuclear force between nucleons is mediated by which class of hadrons, composed of a quark-antiquark pair?

W) Gluons
X) Leptons
Y) Mesons
Z) Baryons

ANSWER: Y) MESONS

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BONUS

15) Physics – *Short Answer* When carrier particles such as mesons are emitted, they temporarily violate mass-energy conservation. What fundamental principle of quantum mechanics explains this phenomenon?

ANSWER: HEISENBERG UNCERTAINTY PRINCIPLE

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TOSS-UP

16) Earth and Space – *Short Answer* What is the term for the orbits in the asteroid belt that are free of asteroids?
ANSWER: KIRKWOOD GAPS

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BONUS

16) Earth and Space – *Short Answer* Rank the following Galilean moons from closest to farthest to Jupiter:

I. Ganymede
II. Europa
III. Io
IV. Callisto

ANSWER: III, II, I, IV
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TOSS-UP

17) Math – *Short Answer* In a + bi notation, what is the result of (1 + 3i)(2 - 5i)?

ANSWER: 17 + i (ACCEPT: 17 + 1i)

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BONUS

17) Math – *Short Answer* What is the result of $\left(\frac{\sqrt{2}}{2}+\frac{\sqrt{2}}{2}i\right)^4$?

ANSWER: -1 (ACCEPT: -1 + 0i)

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TOSS-UP

18) Energy – *Multiple Choice* Scientists at Brookhaven National Labs are building an Electron-Ion Collider to examine the force that holds quarks together. What is this force?

W) Gravity
X) Weak Nuclear Force
Y) Strong Nuclear Force
Z) Electromagnetic Force

ANSWER: Y) Strong Nuclear Force

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BONUS

18) Energy – *Multiple Choice* Scientists at Brookhaven National Lab are studying the combination of quarks and gluons. Which of the following best describes the result of this combination?

W) Meson
X) Baryon
Y) Lepton
Z) Hadron

ANSWER: Z) HADRON
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TOSS-UP

19) Biology – *Multiple Choice* Hardy and Weinberg, the famous mathematicians developed a mathematical model to understand population genetics. Their famous equations are described in the Hardy-Weinberg Principle. Which of the following is NOT a condition required for the Hardy-Weinberg Principle to apply?

W) Population Size is Infinitely Large
X) Organisms reproduce sexually
Y) Mutations occasionally occur
Z) There is no gene flow

ANSWER: Y) MUTATIONS OCCASIONALLY OCCUR

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BONUS

19) Biology – *Short Answer* A population of emus is in Hardy-Weinberg equilibrium. 36% of the emus have floppy tails. What percent of emus in the population are heterozygous for their tail trait if a stiff tail is dominant to a floppy tail?

ANSWER: 48%

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TOSS-UP

20) Chemistry – *Multiple Choice* What did scientist Rutherford discover from his gold foil experiment?

W) The plum-pudding model
X) That most of the mass of an atom is concentrated in its center
Y) Gold atoms naturally arrange themselves in foils
Z) Gold atoms have 79 protons

ANSWER: X) THAT MOST OF THE MASS OF AN ATOM IS CONCENTRATED IN ITS CENTER

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BONUS

20) Chemistry – *Short Answer* Identify ALL of the following values that the Ideal Gas Law includes: 1) Pressure, 2) Force, 3) Temperature

ANSWER: 1 AND 3
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TOSS-UP

21) Physics – *Multiple Choice* A box of mass 20 kg is being pulled on the ground with coefficient of kinetic friction $\mu_k = 0.5$. Assuming the angle of the applied force is 0^o and g = 10 m/s^2, what is the force of friction acting on the box?

W) 50 N
X) 100 N
Y) 200 N
Z) 400 N

ANSWER: X) 100 N

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BONUS

21) Physics – *Short Answer* A box has mass 10 kg and has an acceleration equation of a(t) = 4t. What is the equation of net force on the box in terms of time?

ANSWER: F(t) = 40t

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TOSS-UP

22) Earth and Space – *Short Answer* Rank the following 3 components of a continental margin, from closest to farthest to the shoreline:

I. Continental Slope
II. Continental Rise
III. Continental Shelf

ANSWER: III, I, II

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BONUS

22) Earth and Space – *Multiple Choice:* Which of the following DOES NOT determine the height, length, and period of a wave?

W) Fetch
X) Wind Speed
Y) Time of Day
Z) Time Wind has Blown

ANSWER: Y) TIME OF DAY
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TOSS-UP

23) Math – *Multiple choice* Which of the following sets of 3 side lengths makes a valid triangle?

W) 1, 2, 4
X) 10, 5, 16
Y) 4, 5, 6
Z) 2, 2, 4

ANSWER: Y) 4, 5, 6

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BONUS

23) Math – *Short Answer* The area of a circle with radius 10 is equal to the circumference of a circle with radius r. What is r?

ANSWER: 50

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