THUMB: ROUND ROBIN 5

1) Physics – *Multiple Choice* A charged particle fired into a uniform magnetic field traces a clockwise semicircle before exiting. If the same particle is fired again at twice the speed into a reversed magnetic field, which of the following best describes the particle's travel direction and the radius of its path?

W) Clockwise, larger
X) Clockwise, smaller
Y) Counterclockwise, larger
Z) Counterclockwise, smaller

ANSWER: Y) Counterclockwise, larger [FJ]

2) Chemistry – *Multiple Choice* Which of the following cations forms the least soluble hydroxide salt?

W) Sodium
X) Potassium
Y) Magnesium
Z) Calcium

ANSWER: Y) Magnesium [DS] [AlX]

3) Biology – *Short Answer* Sean wakes up in an unknown location. He observes a deciduous forest to the east and a wetland to the west. What zone is he most likely standing in, where two different ecosystems transition and intermingle?

ANSWER: Ecotone [FJ]

4) Math – *Multiple Choice* The hit game Hollow Knight was released in 2017 with a price of $15. Its sequel, Silksong, was released in 2025 with a price of $20. Given that 1 2017 USD is equivalent to 1.28 2025 USD, in terms of 2025 USD and to one significant figure, which of the following is closest to how much more expensive Silksong was upon release than Hollow Knight?

W) 0.2
X) 0.44
Y) 0.6
Z) 0.8

ANSWER: Z) 0.8 [OM]

5) Earth and Space – *Short Answer* Identify all of the following three stages in the life of a one solar mass star where core hydrogen fusion is the primary source of energy: 1) Main sequence 2) Red giant branch 3) White dwarf

ANSWER: 1 only [FJ]

6) Physics – *Short Answer* Owen heats a pan on the stove and adds a droplet of water to test if it's hot enough. The droplet skitters across the surface instead of immediately boiling away as a result of what phenomenon?

ANSWER: Leidenfrost effect [AX]

7) Chemistry – *Short Answer* Rank the following three metals based on increasing reactivity: 1) Zinc 2) Platinum 3) Sodium

ANSWER: 2, 1, 3 [DS]

8) Biology - *Short Answer* In prokaryotic cells, mRNA transcription is frequently terminated by what specific ATP-dependent helicase, which initially binds to a namesake Cytosine-rich "rut" sequence on the mRNA transcript before unraveling the RNA-DNA hybrid at the termination site?

ANSWER: Rho factor [SY]

9) Math - *Short Answer* In Colonist, one resource is produced on a tile when the number assigned to that tile is equal to the sum of two random six sided dice rolls. If three tiles are numbered 3, 6, and 8, what is the expected amount of ore produced on a given roll?

ANSWER: 1/3 [OM]

10) Earth and Space – *Multiple Choice* In which of the following environments do the most fine-grained sediments accumulate?

W) Shallow marine
X) Deep marine
Y) River delta
Z) Glacial outwash

ANSWER: X) Deep marine [FJ]

11) Physics – *Multiple Choice* Which of the following is NOT a difference between mechanical and electromagnetic waves?

W) Mechanical waves can be polarized, electromagnetic waves cannot
X) Mechanical waves require a medium to travel, electromagnetic waves do not
Y) The speed of mechanical waves in a medium depends on the medium's properties, while the speed of electromagnetic waves in a vacuum is constant
Z) Mechanical waves can be transverse or longitudinal, while electromagnetic waves are only transverse

ANSWER: W) Mechanical waves can be polarized, electromagnetic waves cannot [AX]

12) Chemistry – *Short Answer* In molecular biology, tests such as the Bradford protein assay and BCA assay are used to quantify proteins in a cuvette spectrophotometer. These quantification assays rely on what principle, which relates the absorption of photons in a solution of fixed medium to the concentration of solute?

ANSWER: Beer-lambert law [SY]

13) Biology – *Multiple Choice* In Eukaryotes, microtubules can bundle together to form higher structures with distinct functions. Consisting of microtubule triplets, what is the microtubule arrangement of a centriole?

W) 7 plus 0
X) 7 plus 2
Y) 9 plus 0
Z) 9 plus 2

ANSWER: Y) 9 plus 0 [SY]

14) Math – *Short Answer* Team PINKY is playing regular science bowl and wants a negative score. Unfortunately, they have already correctly answered 8 toss-up questions with a bonus conversion of 37.5%. Assuming they get no more questions correct, and that a neg subtracts 4 points, how many negs would they need to have a negative score for the round?

ANSWER: 16 [OM, AX]

15) Earth and Space – *Short Answer* Identify all of the following three clouds types that are expected to form halos: 1) Cirrostratus 2) Nimbostratus 3) Stratocumulus

ANSWER: 1 only [FJ]

16) Physics – *Short Answer* To the nearest ten degrees Fahrenheit and assuming atmospheric pressure, at what temperature is water the densest?

ANSWER: 40 [AX]

17) Chemistry – *Short Answer* By name or number, identify all of the following four acids that are a component of aqua regia: 1) Hydrochloric acid 2) Sulfuric acid 3) Nitric Acid 4) Chromic acid

ANSWER: 1 and 3 [DS, AlX]

18) Biology – *Short Answer* Owen the endosome has big dreams to become a functioning lysosome, but for some reason his lysosomal enzymes were lost in post-translation. Though the enzymes are being synthesized properly, he peers into the Golgi and notices that the enzymes are being exported out of the cell! This is because his enzymes are not being tagged with which sugar, which is the targeting signal for the shipment of proteins to lysosomes?

ANSWER: Mannose (6-phosphate) [SY]

19) Math – *Multiple Choice* What is 7^13 mod 9?

W) 1
X) 3
Y) 5
Z) 7

ANSWER: Z) 7 [AX]

20) Earth and Space – *Multiple Choice* The Ithaca Chasma on Saturn's moon Tethys was formed as a result of expansion due to cooling after the moon's formation. This suggests that Tethys is primarily composed of which of the following compounds?

W) Methane
X) Silicon dioxide
Y) Water
Z) Carbon dioxide

ANSWER: Y) Water [FJ]