2022 MIT Science Bowl High School Invitational Tiebreak Round 7

TOSSUP

1) CHEMISTRY *Short Answer* Kevin creates two equimolar 100-milliliter solutions of hypochlorous and hypobromous acid for his AP Chemistry lab. Rank the following three chemical species by increasing concentration at equilibrium:

1) Hypochlorite
2) Hypobromite
3) Proton

ANSWER: 3, 2, 1

TOSS UP

2) EARTH AND SPACE *Short Answer* By name or number, order the following three spectral types by increasing strength of their hydrogen Balmer lines:

1) O
2) A
3) F

ANSWER: 1, 3, 2

TOSS UP

3) PHYSICS *Short Answer* Leon has discovered three new particle decay processes, S, W, and E, which occur through the strong, weak, and electromagnetic forces respectively. Unfortunately, after he prints out his data, he accidentally mixes up his papers, and can only see that the half-lives of the three processes are 10^{-23} seconds, 10^{-17} seconds, and 10^{-8} seconds. Identify which half-life corresponds to which decay process.

ANSWER: S: 10^{-23} seconds, W: 10^{-8} seconds, E: 10^{-17} seconds

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TOSS UP

4) BIOLOGY *Short Answer* By name or number, rank of the following three types of DNA sequences in the human genome by increasing prevalence:

1) Transposable elements
2) Intron sequences
3) Exon sequences

ANSWER: 3, 2, 1

TOSS UP

5) MATH *Multiple Choice* How many digits are in the base-10 representation of 40 raised to the 100th power?

W) 160
X) 161
Y) 162
Z) 163

ANSWER: X) 161
