

### **Things to mention**

- Four questions for all categories except for energy
- Difficulty is, regs, regs, nats RR, nats DE
- There's superpower, which is 4 points, power which is 3 points in all questions. If you get it after power then you get 2 points.
- In order to prevent blind guessing for multiple choice, there is a 1 point penalty for incorrect responses for multiple choice.
- There is no penalty for incorrect responses on short answers.
- You do not have to buzz on a question if you do not want to, particularly you don't need to buzz on multiple choice.
- You have 7 seconds to answer.
- Buzz in dms

### TOSS-UP

Biology [3] – *Multiple Choice* Intermediate filaments are cytoskeletal structural components\*\* composed of which of the following proteins?

- W) Actin\*
- X) Myosin
- Y) Tubulin
- Z) Keratin

ANSWER: Z) KERATIN [SS]

### TOSS-UP

Biology [4] – *Short Answer* Many hormones directly stimulate target cells to induce effects. However,\*\* some hormones have other endocrine glands as their targets.\* What is the name given to these hormones?

ANSWER: TROPIC HORMONES [SS]

### TOSS-UP

Biology [5] – *Multiple Choice* Which of the following best describes brassinosteroids' effect on root growth at low and high concentrations respectively?

- W) Low concentrations inhibit root growth, High concentrations\*\* promote root growth
- X) Low concentrations promote root growth, High concentrations inhibit root growth\*
- Y) Both low and high concentrations inhibit root growth
- Z) Both low and high concentrations promote root growth

ANSWER: X) LOW CONCENTRATIONS PROMOTE ROOT GROWTH, HIGH CONCENTRATIONS INHIBIT ROOT GROWTH [SS]

### TOSS-UP

Biology [8] – *Short Answer* Hemoglobin can transition from its T-state to its R-state by the shifting of the position of what amino acid residue\*\*, to which the F-helix is\* attached?

ANSWER: HISTIDINE (ACCEPT: HISTIDINE F8) []

### TOSS-UP

Chemistry [1] – *Short Answer* Rank the following four hydrohalic acids in increasing acidity\*\*: 1) HF\*; 2) HCl; 3) HBr; 4) HI.

ANSWER: 1, 2, 3, 4 [SS]

### TOSS-UP

Chemistry [3] – *Multiple Choice* How many sigma and pi bonds, respectively, are found in one molecule of acetone?

- W) 5 sigma, 1 pi\*\*
- X) 7 sigma, 2 pi
- Y) 9 sigma, 1 pi\*
- Z) 10 sigma, 1 pi

ANSWER: Y) 9 SIGMA, 1 PI [SS]

### TOSS-UP

Chemistry [6] – *Multiple Choice* What is the absolute difference in the number of nodes in the HOMO of 1,3,5-Hexatriene and the number of nodes in the LUMO of 1,3-Butadiene?

- W) 0 \*\*
- X) 1
- Y) 2
- Z)\* 3

ANSWER: W) 0 [SS]

### TOSS-UP

Chemistry [9] – *Multiple Choice* The reaction of sodium borohydride with an alpha-beta unsaturated ketone, generally reduces both the carbonyl and the carbon-carbon double bond. The addition of which of the following compounds to the reaction vessel would force NaBH<sub>4</sub> to attack only the carbonyl group?

- W) KHSO<sub>3</sub>\*\*
- X) CeCl<sub>3</sub>\*
- Y) BeCl<sub>2</sub>
- Z) SnCl<sub>2</sub>

ANSWER: X) CeCl<sub>3</sub> [SS]

### TOSS-UP

Earth and Space [1] – *Multiple Choice* Which of the following jovian planets has a retrograde\*\* rotation?

- W) Jupiter
- X) Saturn
- Y) Uranus\*
- Z) Neptune

ANSWER: Y) URANUS [SS]

### TOSS-UP

Earth and Space [2] – *Short Answer* Order the following three types of magma in increasing viscosity.\*\* 1) Basaltic; 2) Rhyolitic;\* 3) Andesitic.

ANSWER: 1, 3, 2 [SS]

### TOSS-UP

Earth and Space [6] – *Short Answer* The removal of the lithospheric mantle from the base of a plate causes the isostatic rebound of the remaining surface\*\* of the plate. What term is given to\* this process by which the upper crust separates from the lower crust and lithospheric mantle?

ANSWER: DELAMINATION [SS]

### TOSS-UP

Earth and Space [8] – *Multiple Choice* Spectra containing strong titanium oxide absorption bands are most prevalent among which of the following spectral classes?\*\*

- W) A
- X) G
- Y) M\*
- Z) T

ANSWER: Y) M [SS]

### TOSS-UP

Math [1] – *Short Answer* Alice, Bob, Chris, and David are sitting around a circular table. How many\*\* different seating arrangements are possible for the 4 of them\* to sit around the table?

ANSWER: 6 []

### TOSS-UP

Math[3] – *Short Answer* What is the sum of the roots of the polynomial  $4x^3 - 6x^2 + ** 9x + * 17$ ?

ANSWER: 3/2 (ACCEPT: 1.5) []

### TOSS-UP

Math [6] – *Multiple Choice* A circle is inscribed in a regular hexagon, and another circle is circumscribed about the same regular hexagon. What is the ratio of the area of the larger circle to\*\* the smaller circle?

W)  $2/\sqrt{3}$

X)  $4/3$

Y)  $3/2$ \*

Z) 2

ANSWER: X)  $4/3$  []

### TOSS-UP

Math [8] – *Multiple Choice* Which of the following numbers can NOT be written as the sum of 3 perfect squares?

W) 2021\*\*

X) 2022

Y) 2023\*

Z) 2024

ANSWER: Y) 2023 []

### TOSS-UP

Physics [3] – *Multiple Choice* Which of the following subatomic particles is the most penetrating?

- W) Neutrino \*\*
- X) Electron
- Y) Proton \*
- Z) Neutron

ANSWER: W) Neutrino []

### TOSS-UP

Physics [2] – *Multiple Choice* At which of the following launch angles, in degrees, should a projectile be launched from ground level to maximize its \*\* range?

- W) 15
- X) 30 \*
- Y) 45
- Z) 60

ANSWER: Y) 45 []

### TOSS-UP

Physics [6] – *Short Answer* If the charge of a non-relativistic point charge triples and its acceleration doubles, then\*\* by what factor does its emitted\* power increase?

ANSWER: 36 []

### TOSS-UP

Physics [8] – *Multiple Choice* In CGS-EMU units, the vacuum permeability is defined to be unitless. In this system, what are the units of inductance? \*\*

- W) unitless
- X) cm
- Y)  $\text{cm}^2$  \*
- Z)  $\text{cm}^3$

ANSWER: X) cm []