

2019 Discord Summer Packet 3

TOSS-UP

1) Physics – *Multiple Choice* Which of the following describes a region within a magnetic material that has uniform magnetization?

- W) Magnetic pole
- X) Magnetosphere
- Y) Magnetic domain
- Z) Magnetic line

ANSWER: Y) MAGNETIC DOMAIN

BONUS

1) Physics – *Short Answer* An object is launched at 15 degrees from the ground at an initial velocity of 10m/s. Assuming gravity is 10 m/s² how far away will it land in meters?

ANSWER: 5m

TOSS-UP

2) Biology – *Short Answer* What macromolecule is simultaneously produced with insulin during its post translational modification

ANSWER: C-PEPTIDE

BONUS

2) Biology – *Multiple Choice* If Bob were to take a cross section from the stem of a monocot, how are the vascular bundles arranged?

- W) The xylem and phloem form concentric rings
- X) The vascular bundles form concentric rings
- Y) The xylem and phloem are scattered throughout the stem
- Z) The vascular bundles are scattered throughout the stem

ANSWER: Z) THE VASCULAR BUNDLES ARE SCATTERED THROUGHOUT THE STEM

TOSS-UP

3) Chemistry – *Short Answer* Which covalent compound can be formed from ammonium cyanate through the Wohler synthesis?

ANSWER: UREA (ACCEPT EQUIVALENTS)

BONUS

3) Chemistry – *Short Answer* Select all of the following primary alcohols which are not miscible with water. 1) Methanol 2) Ethanol 3) Propanol 4) n-butanol

ANSWER: 4 ONLY (ACCEPT: BUTANOL)

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## **TOSS-UP**

4) Earth and Space – *Multiple Choice* In the past 800,000 years, Earth's period of glacial maximums has followed a period of about 100,000 years. Which of the following periodic changes can be attributed as the main forcing factor to cause these glacial maximums?

- W) Axial obliquity
- X) Axial precession
- Y) Brightness of the sun
- Z) Eccentricity

ANSWER: Z) ECCENTRICITY

## **BONUS**

4) Earth and Space – *Multiple Choice* In order for a surface low to gain in intensity, which of the following needs to occur at high altitudes?

- W) Convergence
- X) Divergence
- Y) Absolute geostrophic flow
- Z) Conditional geostrophic flow

ANSWER: X) DIVERGENCE

## **TOSS-UP**

5) Math – *Short Answer* You flip a coin 7 times. What is the probability of flipping more heads than tails?

ANSWER:  $\frac{1}{2}$

## **BONUS**

5) Math – *Short Answer* What is the smallest n such that  $n!$  contains at least 6 trailing zeroes?

ANSWER: 25

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## **TOSS-UP**

6) Physics – *Short Answer* Identify all of the following 3 choices that are considered inertial reference frames where astronomical motions are negligible. 1) In a merry go round 2) An airplane taking off in its runway 3) High Speed train on cruise mode.

ANSWER: 3 ONLY

## **BONUS**

6) Physics – *Short Answer* What observatory works with ICECUBE to detect cosmic rays between 100GeV and 100TeV in Puebla Mexico?

ANSWER: HAWC OBSERVATORY

## **TOSS-UP**

7) Biology – *Short Answer* If two parents of a child are carriers for an autosomal dominant disease, what is the probability that their child is a carrier as well? Express your answer as a reduced fraction.

ANSWER: 1/2

## **BONUS**

7) Biology – *Multiple Choice* Geoff is brought to the emergency room after being hit with a baseball bat on the side of his leg immediately below the knee. He is unable to dorsiflex his foot. Which of the following nerves is most likely injured?

- W) Peroneal
- X) Tibial
- Y) Femoral
- Z) Obturator

ANSWER: W) PERONEAL

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## **TOSS-UP**

8) Chemistry – *Multiple Choice* Which of the following does not represent an increase in entropy?

- W) Condensation of water
- X) Dissolution of NaCl in water
- Y) Sublimation of CO<sub>2</sub>
- Z) Gas Evolution

ANSWER: W) CONDENSATION OF WATER

## **BONUS**

8) Chemistry - *Multiple Choice* Consider the mass spectrometry graphs for n-butanol, sec butanol, and tert butanol. Order the relative areas of the m/z=57 peaks for the three butanol isomers by increasing area. The mass of butanol is 74

ANSWER: N BUTANOL, SEC BUTANOL, TERT BUTANOL

## **TOSS-UP**

9) Earth and Space – *Multiple Choice* Which ion is the most common ion in seawater?

- W) Sodium
- X) Sulfate
- Y) Magnesium
- Z) Chloride

ANSWER: Z) CHLORIDE

## **BONUS**

9) Earth and Space – *Short Answer* The internal structural damage of many zircon crystals is caused by self-irradiation from the radioactive decay of uranium and thorium in the crystal structure. This process of continuous structural disintegration is known as what?

ANSWER: METAMICTIZATION (ACCEPT: METAMICHTION)

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## **TOSS-UP**

10) Math – *Short Answer* If  $2 = x^x^x$  to the infinitely many xs, what is x?

ANSWER:  $\sqrt{2}$

## **BONUS**

10) Math – *Short Answer* Find the indefinite integral of  $\cos(x)*\cos(\sin(x))dx$ ?

ANSWER:  $\sin(\sin(x))+C$

## **TOSS-UP**

11) Physics – *Short Answer* What is the maximum number of 4W light bulbs that could be connected with a 12V source with the circuit allowing a maximum current of 5A?

ANSWER: 15

## **BONUS**

11) Physics – *Short Answer* What is the electric flux through a Gaussian surface of area A enclosing an electric dipole where each charge has an equal magnitude of q?

ANSWER: 0

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## **TOSS-UP**

12) Biology – *Short Answer* The photoreceptor phytochrome is responsible for what response an organism has to seasonal changes in daylength.

ANSWER: PHOTOPERIODISM

## **BONUS**

12) Biology – *Multiple Choice* Which of the following happens to hemoglobin when one of its subunits takes up an oxygen molecule?

- W) The hemoglobin's affinity for oxygen decreases
- X) The hemoglobin's affinity for oxygen is unaffected
- Y) The hemoglobin's affinity for oxygen increases
- Z) The change in the hemoglobin is dependant on which subunit the oxygen molecule bonded with

ANSWER: Y) The hemoglobin's affinity for oxygen increases

## **TOSS-UP**

13) Chemistry – *Multiple Choice* What equation is responsible for relating the equilibrium constants for a reaction with varying measurements of temperature?

- W) Van't Hoff Equation
- X) Arrhenius Equation
- Y) Clausius Clapeyron Equation
- Z) Boltzmann Equation

ANSWER: W) VAN'T HOFF EQUATION

## **BONUS**

13) Chemistry – *Multiple Choice* Which of the following is not a way to commonly use zeolites?

- W) Zeolites are used as ion exchange beds for commercial water purification
- X) Zeolites assist silver in naturally emitting light
- Y) Zeolites are used to remove nitrogen in compressed air to supply oxygen in flights.
- Z) Zeolites are used in conjunction with beta blockers to reduce blood pressure

ANSWER: Z) ZEOLITES ARE USED IN CONJUNCTION WITH BETA BLOCKERS TO REDUCE BLOOD PRESSURE

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## **TOSS-UP**

14) Earth and Space – *Multiple Choice* Which of the following best describes the main formation mechanism of tropospheric ozone?

- W) Splitting of H<sub>2</sub>O into H<sub>2</sub> and O by ionosphere-to-ground electrolysis, recombination of O and O<sub>2</sub> into ozone
- X) Splitting of NO<sub>2</sub> into NO and O by high energy radiation, then recombination of O and O<sub>2</sub> into ozone
- Y) Combination of two O<sub>2</sub> molecules, releasing O<sub>3</sub> and O
- Z) Splitting of O<sub>2</sub> into two O radicals, recombination of O radical with O<sub>2</sub> into ozone

ANSWER: X) SPLITTING OF NO<sub>2</sub> INTO NO AND O BY HIGH ENERGY RADIATION, THEN RECOMBINATION OF O AND O<sub>2</sub> INTO OZONE(Reverse)

## **BONUS**

14) Earth and Space – *Multiple Choice* Which of the following is indicative of a Type 1a supernova?

- W) Strong silicon line at 615 nm, no hydrogen lines
- X) Strong helium lines, no hydrogen lines
- Y) Strong iron line at 810 nm, no hydrogen lines
- Z) Strong helium and hydrogen lines

ANSWER: W) STRONG SILICON LINE AT 615 NM, NO HYDROGEN LINES (Reverse)

## **TOSS-UP**

15) Math – *Short Answer* Toph flips a quarter four times. Find the probability that the quarter lands heads exactly twice.

ANSWER: 3/8

## **BONUS**

15) Math – *Short Answer* *Short Answer* Find the sum of all positive rational numbers that are less than 1 and that have denominator of 20 when written in lowest terms.

ANSWER: 4



## **TOSS-UP**

16) Physics – *Short Answer* What hydrogen series lies in the infrared section of the spectrum and overlaps with the Brackett series?

ANSWER: PASCHEN SERIES (ACCEPT: BOHR SERIES)

## **BONUS**

16) Physics – *Multiple Choice* What kind of flow is considered drag-induced flow either between parallel flat plates or between concentric rotating cylinders

- W) Poiseuille flow
- X) Couette flow
- Y) Viscous flow
- Z) Navier flow

ANSWER: X) COUETTE FLOW

## **TOSS-UP**

17) Biology – *Short Answer* What term describes a plant cell whose membrane has separated from its cell wall due to dehydration?

ANSWER: PLASMOLYSIS

## **BONUS**

17) Biology – *Multiple Choice* In prokaryotes, which polymerase is used to carry out most of DNA replication?

- W) DNA Polymerase 1
- X) DNA Polymerase 2
- Y) DNA Polymerase 3
- Z) RNA Polymerase 3

ANSWER: Y) DNA POLYMERASE 3



## **TOSS-UP**

18) Chemistry – *Short Answer* Rank the following 3 weak acids in order of increasing pKa values. 1) HClO 2) HBrO 3) HIO

ANSWER: 1, 2, 3

## **BONUS**

18) Chemistry – *Short Answer* What isomer differs by the exchange of a ligand with an anion or a neutral molecule that is outside the coordination sphere?

ANSWER: IONIZATION

## **TOSS-UP**

19) Earth Science – *Short Answer* Which of the following minerals has a sheet-like silicate structure?  
1) Biotite 2) Muscovite 3) Microcline 4) Talc

ANSWER: 1,2,4 (Reverse)

## **BONUS**

19) Earth Science – *Multiple Choice* Large, euhedral crystals of muscovite embedded in an igneous rock are indicative of which of the following environments?

- W) Quick cooling time at high temperatures
- X) Quick cooling time at low temperatures
- Y) Slow cooling time at high temperatures
- Z) Slow cooling time at low temperatures

ANSWER: Z) SLOW COOLING TIME AT LOW TEMPERATURES (Reverse)

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## **TOSS-UP**

20) Math – *Short Answer*

## **TOSS-UP**

20) Math – *Short Answer* Find the volume of the region of points (x,y,z) such that  $(x^2 +y^2 +z^2 +8)^2 \leq 36(x^2 +y^2)$ .

ANSWER:  $6\pi^2$

## **BONUS**

20) Math – *Short Answer* Evaluate,  $2*(6^2)$

ANSWER: 72

20'B) Math - Short Answer The Trivial Theorem states that the square of any real number is not less than what number?

ANSWER: 0

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