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/s^2 how far away will it land in meters?

ANSWER: 5m

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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
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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
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TOSS-UP

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

ANSWER: ½

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
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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 CO2
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
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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: METAMICTION)

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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
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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
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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 H2O into H2 and O by ionosphere-to-ground electrolysis, recombination of O and O2 into ozone
X) Splitting of NO2 into NO and O by high energy radiation, then recombination of O and O2 into ozone
Y) Combination of two O2 molecules, releasing O3 and O
Z) Splitting of O2 into two O radicals, recombination of O radical with O2 into ozone

ANSWER: X) SPLITTING OF NO2 INTO NO AND O BY HIGH ENERGY RADIATION, THEN RECOMBINATION OF O AND O2 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)
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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

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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
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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

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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
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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*
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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 ≤ 36(x^2 +y^2).

ANSWER: 6pi^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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