Standard Division Round Robin 3

TOSS-UP

1) BIOLOGY *Short Answer* What term is given to fluctuations in allele frequencies due to random chance?

ANSWER: GENETIC DRIFT [GKD]

BONUS

1) BIOLOGY *Multiple Choice* During what phase of mitosis does the kinetochore **[*kih-NEE-tuh-core*]** form?

W) Prophase

X) Prometaphase

Y) Metaphase

Z) Anaphase

ANSWER: X) PROMETAPHASE [GKD]

TOSS-UP

2) CHEMISTRY *Multiple Choice* Which of the following best describes the difference between Arrhenius **[*uh-REE-nee-us*]** and Lewis acids?

W) Lewis acids release H+ ions in solution while Arrhenius acids are electron pair donors

X) Arrhenius acids release H+ ions in solution while Lewis acids are electron pair donors

Y) Lewis acids release H+ ions in solution while Arrhenius acids are electron pair acceptors

Z) Arrhenius acids release H+ ions in solution while Lewis acids are electron pair acceptors

ANSWER: Z) ARRHENIUS ACIDS RELEASE H+ IONS IN SOLUTION WHILE LEWIS ACIDS ARE ELECTRON PAIR ACCEPTORS [EB]

BONUS

2) CHEMISTRY *Multiple Choice* Which of the following acids is the strongest?

W) Hypoiodous acid

X) Bromic acid

Y) Nitric acid

Z) Perchloric acid

ANSWER: Z) PERCHLORIC ACID [EB]

TOSS-UP

3) EARTH AND SPACE *Short Answer* By name or number, identify all of the following three planets that have day lengths shorter than that of earth:

1) Jupiter
2) Mars
3) Saturn

ANSWER: 1 AND 3 (ACCEPT: JUPITER, SATURN) [EB]

BONUS

3) EARTH AND SPACE *Multiple Choice* Which of the following depositional features is a narrow ridge of sediment on either side of a stream that is deposited when the stream floods?

W) Point bar
X) Levee
Y) Alluvial fan
Z) Mouth bar

ANSWER: X) LEVEE [EB]

TOSS-UP

4) MATH *Short Answer* What is the sum of the x-intercept and twice the y-intercept of the line 9x plus 4y equals 108?

ANSWER: 66 [MD]

BONUS

4) MATH *Short Answer* Suppose that x and y are complex numbers such that x plus y equals 20 and x times y equals 5. Determine the value of one over x plus one over y.

ANSWER: 4 [SG]

TOSS-UP

5) PHYSICS *Short Answer* Akshansh is skiing down Mt. Rose and hits a circular bump with a radius of 90 meters. If he manages to not get any air time, what is the maximum speed he could have been going at, in meters per second and assuming g is 10 m/s^2?

ANSWER: 30 m/s [AC]

BONUS

5) PHYSICS *Multiple Choice* Which of the following most accurately describes the function of a dielectric in a capacitor?

W) To increase the charge stored in the capacitor for a given voltage

X) To increase the voltage applied by a capacitor for a given amount of stored charge

Y) To decrease the current flowing through the capacitor when in use

Z) To shorten the time until the capacitor is fully charged

ANSWER: W) TO INCREASE THE CHARGE STORED IN THE CAPACITOR FOR A GIVEN VOLTAGE [AC]

TOSS-UP

6) ENERGY *Short Answer* Davidson HS A team members are studying molecular mechanisms of neurophysiology. The influx of which ion directly causes exocytosis of neurotransmitter-containing vesicles?

ANSWER: CALCIUM (ACCEPT: Ca^{2+}) [GKD]

BONUS

6) ENERGY *Multiple Choice* Davidson HS A Team members are currently studying the environmental impacts of lithium mining in Humboldt and Esmeralda counties. In northern Nevada, new technology is being used to extract lithium from clays instead of brines or pegmatites. Which of the following statements about pegmatites is false?

W) They are coarse-grained igneous rocks that can contain atypical igneous minerals, such as tourmaline

X) They are often found near batholiths

Y) They contain large crystals of at least 25 millimeters in size

Z) They form from magma at high temperatures and low pressures

ANSWER: Z) THEY FORM FROM MAGMA AT HIGH TEMPERATURES AND LOW PRESSURES [EB]

TOSS-UP

7) BIOLOGY *Multiple Choice* SnoRNA **[*snow r n a*]** is a special type of RNA that modifies pre-mRNA by adding methyl groups. Where would you expect SnoRNA to be found?

W) Cytoplasm

X) Nucleus

Y) Rough endoplasmic reticulum

Z) Golgi apparatus

ANSWER: X) NUCLEUS [GKD]

BONUS

7) BIOLOGY *Multiple Choice* Griffin constructs an artificial membrane containing aquaporins and no other channels, forming two compartments. He then puts 100 millimolar sodium chloride in the left compartment and 200 millimolar urea in the right compartment. Which of the following would you expect to happen?

W) There would be no net movement of water

X) There would be a net movement of water into the right compartment

Y) There would be a net movement of water into the left compartment

Z) There would be a net movement of sodium chloride into the right compartment

ANSWER: W) THERE WOULD BE NO NET MOVEMENT OF WATER [GKD]

TOSS-UP

8) CHEMISTRY *Short Answer* What is the ideal van't Hoff factor for aluminum nitrate?

ANSWER: 4 [GKD]

BONUS

8) CHEMISTRY *Short Answer* Identify all of the following three polyatomic ions that demonstrate resonance:

1) Nitrate
2) Sulfate
3) Ammonium

ANSWER: 1 AND 2 (ACCEPT: NITRATE, SULFATE) [GKD]

TOSS-UP

9) EARTH AND SPACE *Short Answer* What type of substellar object has a mass of between 13 and 80 times that of Jupiter and is often considered to be a failed star, due to its inability to fuse normal hydrogen?

ANSWER: BROWN DWARF [EB]

BONUS

9) EARTH AND SPACE *Short Answer* The state precious gemstone of Nevada is the black fire opal. Opals are not considered minerals in their own right because they are the hydrated, amorphous form of what compound?

ANSWER: SILICON DIOXIDE [EB]

TOSS-UP

10) MATH *Multiple Choice* How many primes are less than 100?

W) 15

X) 25

Y) 35

Z) 45

ANSWER: X) 25 [MD]

BONUS

10) MATH *Short Answer* A rep-tile **[*pause between the two syllables*]** is a shape that can be tiled by multiple, smaller copies of itself. By name or number, identify all of the following regular polygons that are rep-tiles:

1) Equilateral triangle
2) Square
3) Regular pentagon
4) Regular hexagon

ANSWER: 1 AND 2 [AKa]

TOSS-UP

11) PHYSICS *Short Answer* A lubricated cantaloupe starts at rest and slides across a floor, experiencing an acceleration, in meters per second squared, of 2t at time t. How far, in meters, does the cantaloupe travel between time t equals 0 and t equals 3?

ANSWER: 9 [AC]

BONUS

11) PHYSICS *Multiple Choice* Which of the following best explains how electric field lines and equipotential lines orient themselves?

W) Equipotential lines are always parallel to field lines

X) The dot product is always maximized where two lines cross

Y) Field lines are always perpendicular to equipotential lines

Z) There is no fixed relation between them

ANSWER: Y) FIELD LINES ARE ALWAYS PERPENDICULAR TO EQUIPOTENTIAL LINES [AC]

TOSS-UP

12) ENERGY *Short Answer* Davidson MS B team members are studying the method of stars and bars by rolling dice. How many ways can three distinct six-sided dice have a sum of 8?

ANSWER: 21 [MD]

BONUS

12) ENERGY *Multiple Choice* Davidson HS A Team Members are studying early to mid-20th century developments in nuclear physics. Which of the following scientists shared the 1903 Nobel Prize in Physics with the Curies thanks to his discovery of spontaneous radioactivity through work with Uranium salts?

W) Henri Becquerel **[*beh-cur-REL*]**

X) Wilhelm Röntgen **[*RUNT-gen*]**

Y) Frederic Joliot **[*joe-li-OH*]**

Z) Otto Hahn

ANSWER: W) HENRI BECQUEREL [EB]

TOSS-UP

13) BIOLOGY *Multiple Choice* Which of the following best describes what is occurring at threshold during an action potential?

W) The influx of sodium ions exceeds the efflux of potassium ions

X) The influx of potassium ions exceeds the efflux of sodium ions

Y) The influx of sodium ions is balanced by the efflux of potassium ions

Z) The influx of potassium ions is balanced by the efflux of sodium ions

ANSWER: Y) THE INFLUX OF SODIUM IONS IS BALANCED BY THE EFFLUX OF POTASSIUM IONS [GKD]

BONUS

13) BIOLOGY *Short Answer* Order the following three stages of embryonic development from first to last:

1) Gastrula
2) Morula **[*more-OO-luh*]**
3) Blastula

ANSWER: 2, 3, 1 (ACCEPT: MORULA, BLASTULA, GASTRULA) [GKD]

TOSS-UP

14) CHEMISTRY *Multiple Choice* Which of the following gases experiences the greatest deviation from ideal gas behavior?

W) Chlorine

X) Carbon dioxide

Y) Neon

Z) Sulfur dioxide

ANSWER: Z) SULFUR DIOXIDE [EB]

BONUS

14) CHEMISTRY *Short Answer* Consider the gas-phase combustion of propane at STP. To the nearest whole number, how many liters of gas are formed when one mole of propane is completely combusted in excess oxygen?

ANSWER: 157 [GKD]

TOSS-UP

15) EARTH AND SPACE *Short Answer* What is the name of the type of front that occurs when a fast-moving cold front overtakes a slower-moving warm front?

ANSWER: OCCLUDED FRONT (ACCEPT: OCCLUDED) [EB]

BONUS

15) EARTH AND SPACE *Short Answer* What adjective is used to describe a stream that flows all year and not just during the wet season?

ANSWER: PERENNIAL [EB]

TOSS-UP

16) MATH *Short Answer* $3x + 8y + 9z = 93$, $3x + 6y + 9z = 87$, and $x + 8y + 9z = 77$. What is $x + 2y + 3z$?

ANSWER: 29 [MD]

BONUS

16) MATH *Multiple Choice* Which of the following numbers has the most distinct prime factors:

W) 7700

X) 1170

Y) 2310

Z) 5040

ANSWER: Y) 2310 [SG]

TOSS-UP

17) PHYSICS *Multiple Choice* In terms of tensile/compressive stress and axial strain, what is Young's modulus defined as?

W) Stress times strain

X) Stress plus strain

Y) Strain over stress

Z) Stress over strain

ANSWER: Z) STRESS OVER STRAIN [AC]

BONUS

17) PHYSICS *Short Answer* Paolo has built a machine that accelerates moss spores at 20,000 m/s^2 for 1 second. What is the impulse, in Newton seconds, given to a one milligram spore launched by Paolo's machine?

ANSWER: 0.02 [AC]

TOSS-UP

18) ENERGY *Short Answer* Davidson MS A team members are studying ideal gases. By name or number, identify all of the following three pairs of quantities that are inversely proportional according to the ideal gas law, assuming all other variables are held constant:

1) Moles of a gas and pressure
2) Moles of a gas and temperature
3) Pressure and volume

ANSWER: 2 AND 3 (ACCEPT: MOLES OF A GAS AND TEMPERATURE, PRESSURE AND VOLUME) [EB]

BONUS

18) ENERGY *Multiple Choice* Davidson HS B Team members are studying the object ESO 577-24 **[*E-S-O five seventy seven twenty-four*]**. In the center of this object lies a white dwarf, the only remnant after a red giant ejects its outer layers. ESO 577-24 is an example of what type of object?

W) Planetary nebula
X) Herbig Haro **[*HER-big HAIR-oh*]** Object
Y) Supernova remnant
Z) Absorption nebula

ANSWER: W) PLANETARY NEBULA [EB]

TOSS-UP

19) BIOLOGY *Short Answer* What term is given to a flower with both male and female reproductive structures?

ANSWER: PERFECT (ACCEPT: HERMAPHRODITIC; DO NOT ACCEPT: COMPLETE) [GKD]

BONUS

19) BIOLOGY *Multiple Choice* Sage plants secrete toxins that kill off plants in the surrounding area. This would most likely result in what type of species distribution?

W) Uniform

X) Clumped

Y) Random

Z) Dispersive

ANSWER: W) UNIFORM [GKD]

TOSS-UP

20) CHEMISTRY *Short Answer* Rank the following four substances in order of increasing standard molar entropy:

1) Gaseous water
2) Solid potassium
3) Solid sodium
4) Gaseous benzene

ANSWER: 3, 2, 1, 4 (ACCEPT: SOLID SODIUM, SOLID POTASSIUM, GASEOUS WATER, GASEOUS BENZENE) [GKD]

BONUS

20) CHEMISTRY *Multiple Choice* The suffix -al **[*A L*]** in organic chemistry indicates the presence of which functional group?

W) Alcohol
X) Aldehyde
Y) Ketone
Z) Ester

ANSWER: X) ALDEHYDE [DC]

TOSS-UP

21) EARTH AND SPACE *Short Answer* What type of aberration is caused due to light of different wavelengths having different focal lengths?

ANSWER: CHROMATIC [EB]

BONUS

21) EARTH AND SPACE *Short Answer* Arrange the following three features in order of decreasing distance from the coast:

1) Continental shelf
2) Mid-ocean ridge
3) Continental rise

ANSWER: 2, 3, 1 (ACCEPT: MID-OCEAN RIDGE, CONTINENTAL RISE, CONTINENTAL SHELF) [EB]

TOSS-UP

22) MATH *Short Answer* Twenty people race towards a line of three indistinguishable ice cream machines. How many ways can we choose the first 3 to get ice cream, assuming order doesn't matter?

ANSWER: 1140 [MD]

BONUS

22) MATH *Short Answer* If x plus 2y equals 11 and 2x minus y equals 12, find x squared plus y squared.

ANSWER: 53 [SG]

TOSS-UP

23) PHYSICS *Short Answer* In general relativity, what term is given to the path that a freely moving particle will follow?

ANSWER: GEODESIC [AC]

BONUS

23) PHYSICS *Multiple Choice* Which of the following types of mirrors only produces virtual images?

W) Concave

X) Convex

Y) Both concave and convex

Z) Every mirror can produce a real image

ANSWER: X) CONVEX [AC]