BASH



Round Robin 1

TOSS-UP

1. Energy *Short Answer* Students at Montgomery Blair are cramming for their AP Statistics test. In hypothesis testing, what is the term for the assumption that there is no effect or no difference, and that any observed differences are due to random chance?

ANSWER: NULL HYPOTHESIS

BONUS

1. Energy *Short Answer* Students at Amador Valley are studying rectifiers. Rectifying alternating current to direct current can be done using what general type of device, which allows current to flow easily in one direction but blocks it in the opposite direction?

ANSWER: DIODE

TOSS-UP

2. Earth and Space *Short Answer* Order the following three mountain ranges from oldest to youngest:

1) Himalayas
2) Rocky Mountains
3) Appalachian Mountains

ANSWER: 3, 2, 1

BONUS

2. Earth and Space *Multiple Choice* Tornado Alley experiences so much severe weather because it is the meeting place between which two types of air masses, one from central Canada and one from the Gulf of Mexico?

W) cP and cT
X) cP and mT
Y) mP and cT
Z) mP and mT

ANSWER: X) CP AND MT

TOSS-UP

3. Chemistry *Multiple Choice* Which of the following elements has the highest first ionization energy?

W) Fluorine

X) Chlorine

Y) Bromine

Z) Iodine

ANSWER: W) FLUORINE

BONUS

3. Chemistry *Short Answer* If the pH of a solution at room temperature is 4.5, then what is the pOH of the solution?

ANSWER: 9.5

TOSS-UP

4. Physics *Short Answer* A rock is stationary on the ground. There is a gravitational force acting on the rock, but the rock does not accelerate into the ground. What force balances the action of gravity?

ANSWER: NORMAL FORCE

BONUS

4. Physics *Short Answer* What is the power dissipated, in watts, in a DC circuit with voltage 200 volts and a resistance of 100 ohms?

ANSWER: 400

TOSS-UP

5. Math *Multiple Choice* Two side lengths of a triangle are doubled, while the third is kept constant. Which of the following describes how the area of the triangle changes, assuming it is still non-degenerate?

W) Increases

X) Decreases

Y) Stays the same

Z) Varies

ANSWER: Z) VARIES

BONUS

5. Math *Short Answer* If the repeating decimal 0.0454545…, where the 45 is repeating, is written as a over b, where a and b are positive integers, what is the smallest possible sum of a and b?

ANSWER: 23

TOSS-UP

6. Biology *Short Answer* In humans, the toxic byproduct ammonia is produced when proteins and nucleic acids are degraded. To safely transport nitrogenous waste at high volumes, ammonia must be converted into what other compound before excretion?

ANSWER: UREA

BONUS

6. Biology *Short Answer* Unlike cellular respiration, where electrons in the electron transport chain originate from glucose, the electrons in the photosystems originate from what other compound?

ANSWER: WATER

TOSS-UP

7. Earth and Space *Multiple Choice* Which of the following best describes the origins of short period and long period comets, respectively?

W) Kuiper belt **[KY-per]**, Asteroid belt

X) Kuiper belt, Oort cloud

Y) Oort cloud, Kuiper belt

Z) Oort cloud, Asteroid belt

ANSWER: X) KUIPER BELT, OORT CLOUD

BONUS

7. Earth and Space *Short Answer* What is the term for when planets appear to move backwards in their orbits relative to the stars?

ANSWER: RETROGRADE MOTION

TOSS-UP

8. Chemistry *Multiple Choice* Which of the following elements is a semimetal?

W) Aluminum

X) Sodium

Y) Nitrogen

Z) Boron

ANSWER: Z) BORON

BONUS

8. Chemistry *Short Answer* What is the VSEPR **[VES-per]** geometry of xenon tetrafluoride, or XeF4?

ANSWER: SQUARE PLANAR

TOSS-UP

9. Physics *Multiple Choice* A student walks a circular lap around the classroom, starting and ending in the same place. Which of the following quantities is nonzero?

W) Total displacement

X) Average acceleration

Y) Average velocity

Z) Average speed

ANSWER: Z) AVERAGE SPEED

BONUS

9. Physics *Multiple Choice* A rock is thrown downwards with an initial velocity of 5 meters per second. Its speed right before it hits the ground is v. A second rock is thrown horizontally with an initial velocity of 10 meters per second. Which of the following describes the speed of the second rock right before it hits the ground?

W) Greater than v

X) Less than v

Y) Equal to v

Z) Depends on the height

ANSWER: W) GREATER THAN V

TOSS-UP

10. Math *Multiple Choice* x and y are parametrically defined as $x = 3\sin(t)$ and $y = 4\cos(t)$. Which of the following describes the figure traced when (x,y) is plotted at all t?

W) Circle

X) Ellipse

Y) Parabola

Z) Hyperbola

ANSWER: X) ELLIPSE

BONUS

10. Math *Short Answer* Rohan has a 30% in his math class after the first 3 tests and needs to bring it up to a 50% after the next 2 tests. Given that all the tests are weighted equally, what is the minimum percentage he can get on the 4th test to have a chance at reaching his goal?

ANSWER: 60%

TOSS-UP

11. Biology *Multiple Choice* Kian is studying mitosis through his handy microscope. He notices that during a certain stage of mitosis, sister chromatid cohesin **[co-HEE-sin]** is cleaved. Which of the following phases could he be observing?

W) Prophase
X) Metaphase
Y) Anaphase
Z) Telophase

ANSWER: Y) ANAPHASE

BONUS

11. Biology *Short Answer* Order the following three groups of organisms from least to most closely related to humans:

1) Thermophiles
2) Staphylococcus **[STAF-uhl-oh-COK-is]**
3) Yeasts

ANSWER: 2, 1, 3

TOSS-UP

12. Energy *Short Answer* Students at Amador Valley are observing the enzyme-substrate complex. They notice that only a tiny portion of the amino acids that make up an enzyme actually binds to the substrate. What is the name of this location on the enzyme?

ANSWER: ACTIVE SITE

BONUS

12. Energy *Short Answer* Students at Montgomery Blair are dancing at prom and their continuous jumping has caused a small-scale earthquake. This most resembles what smaller earthquakes that occur in the same area following a larger earthquake?

ANSWER: AFTERSHOCK

TOSS-UP

13. Earth and Space *Short Answer* Order the following 3 cloud types by increasing altitude:

1) Stratus

2) Altocumulus

3) Cirrus

ANSWER: 1, 2, 3

BONUS

13. Earth and Space *Multiple Choice* Which of the following levels of porosity and permeability would an aquifer have?

W) High, high

X) High, low

Y) Low, high

Z) Low, low

ANSWER: W) HIGH, HIGH

TOSS-UP

14. Chemistry *Multiple Choice* Which of the following indicators would be most suitable for the titration of a weak acid with a strong base?

W) Methyl red

X) Phenolphthalein

Y) Bromothymol blue

Z) Thymolphthalein

ANSWER: X) PHENOLPHTHALEIN

BONUS

14. Chemistry *Short Answer* What equation in electrochemistry can be used to calculate the cell potential at non-standard temperatures and concentrations?

ANSWER: NERNST EQUATION

TOSS-UP

15. Physics *Short Answer* When Evan punches a wall after negging 26 times in a match, the wall punches him back with a force of equal magnitude in the opposite direction. This is a consequence of what fundamental law of physics?

ANSWER: NEWTON'S THIRD LAW

BONUS

15. Physics *Short Answer* A triangular plate of uniform mass density is located in the xy plane such that the vertices lie at the points (0, 0), (5, 13), and (19, 23). What are the coordinates of the center of mass of the plate?

ANSWER: (8, 12)

TOSS-UP

16. Math *Short Answer* If x% of y is 70, then what is 2y% of x?

ANSWER: 140

BONUS

16. Math *Short Answer* Edwin adds a linear function f(x) and a quadratic function g(x), both with leading coefficient 1, to get a new function h(x). If h(0) is 3 and h(1) is 4, what is h(2)?

ANSWER: 7

TOSS-UP

17. Biology *Short Answer* Due to DNA polymerase III only being able to synthesize new DNA from the 5 prime to 3 prime direction, DNA synthesis on the lagging strand occurs in short discontinuous segments. What is the name of these segments of DNA?

ANSWER: OKAZAKI FRAGMENTS

BONUS

17. Biology *Multiple Choice* Which of the following types of junctions would be most common in the stomach epithelium?

W) Desmosomes
X) Tight junctions
Y) Gap junctions
Z) Adherens junctions

ANSWER: X) TIGHT JUNCTIONS

TOSS-UP

18. Earth and Space *Short Answer* What is the name for the maximum mass a white dwarf can have before it undergoes a type Ia supernova?

ANSWER: CHANDRASEKHAR LIMIT

BONUS

18. Earth and Space *Short Answer* The apparent brightness of an astronomical object is proportional to its distance raised to what power?

ANSWER: -2

TOSS-UP

19. Chemistry *Short Answer* Identify all of the following three states of matter that are considered fluids:

1) Solid

2) Liquid

3) Gas

ANSWER: 2 AND 3

BONUS

19. Chemistry *Short Answer* Plutonium-239 is unstable in nature and decays to uranium-235. This is an example of what kind of radioactive decay?

ANSWER: ALPHA DECAY

TOSS-UP

20. Physics *Short Answer* A car accelerates from rest to a final speed of 64 meters per second in 4 seconds. In meters per second squared, what is the car's average acceleration?

ANSWER: 16

BONUS

20. Physics *Multiple Choice* Chris is running at 0.9 times the speed of light towards Sam, who is at rest in the lab frame. Chris shines a flashlight at Sam. In Sam's frame of reference, and in terms of c, what is the speed of the light from the flashlight?

W) 0.1c

X) 0.9c

Y) c

Z) 1.9c

Answer: Y) C

TOSS-UP

21. Math *Multiple Choice* Taking the logarithm base 2 of a certain number gives A. What would the logarithm base 2 of double the number give?

W) A+1

X) A+2

Y) 2A

Z) 2A+1

ANSWER: W) A+1

BONUS

21. Math *Short Answer* What is the minimum possible area of a regular convex polygon with perimeter 6?

ANSWER: SQRT 3

TOSS-UP

22. Biology *Multiple Choice* Which of the following would best characterize a species following a type III survivorship curve?

W) High parental care, low offspring production

X) High parental care, high offspring production

Y) Low parental care, low offspring production

Z) Low parental care, high offspring production

ANSWER: Z) LOW PARENTAL CARE, HIGH OFFSPRING PRODUCTION

BONUS

22. Biology *Short Answer* Order the following three bonds found in the double helix of DNA by increasing strength:

1) Bond between nitrogenous bases of differing strands

2) Bond between nitrogenous bases of the same strand

3) Bond between deoxyribose and phosphate

ANSWER: 2, 1, 3

TOSS-UP

23. Energy *Short Answer* Students at Amador Valley don't go outside, so they study computer science. What special type of connected graph has the least number edges possible for a specific number of nodes and contains no cycles?

ANSWER: TREE

BONUS

23. Synergy *Short Answer* Gaurav arranges the 4 stages of mitosis in alphabetic order. He wants to arrange the 4 stages in chronological order and he is allowed to swap the location of any two consecutive stages in the ordering. What is the minimum number of switches they would need to make to reach their goal?

ANSWER: 3
