

## **WISC Round 2**

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### **TOSS-UP**

- 1) Physics – *Short Answer* What law, derived in the 17th century by a Dutch scientist, states the relationship between the indices of refraction of two mediums in terms of the angles of refraction? [AT]

ANSWER: SNELL'S LAW

### **BONUS**

- 1) Physics – *Short Answer* If a ray of light enters air at an angle of  $45^\circ$  to the normal, what is the minimum index of refraction needed for the original medium to reflect the light? [AT]

ANSWER:  $\sqrt{2}$  (ROOT 2)

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### **TOSS-UP**

- 2) Biology – *Short Answer* What disease is characterized by the autoimmune disruption of the myelin sheaths of axons?

ANSWER: MULTIPLE SCLEROSIS (ACCEPT: MS)

### **BONUS**

- 2) Biology – *Short Answer* The summation of graded potentials that may lead to an action potential occurs in what specific part of the neuronal cell body?

ANSWER: AXON HILLOCK (DO NOT ACCEPT: AXON)

### **TOSS-UP**

3) Earth and Space – *Short Answer* How many times more light will a 60 centimeter telescope collect compared to a 5 centimeter telescope? [JI]

ANSWER: 144

### **BONUS**

3) Earth and Space – *Short Answer* Order the following three moon phases from first to last in a lunar month: 1) Full moon; 2) Third quarter; 3) Waxing gibbous. [JI]

ANSWER: 3, 1, 2 (WAXING GIBBOUS, FULL MOON, THIRD QUARTER)

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### **TOSS-UP**

4) Math – *Short Answer* A byte consists of 8 bits, which can each take a value of 0 or 1 in binary. In decimal, what is the maximum value that can be represented by a byte? [SA]

ANSWER: 255

### **BONUS**

4) Math – *Short Answer* Given that a polygon has 152 diagonals, find the number of sides in the polygon. [SA]

ANSWER: 19

## **TOSS-UP**

5) Chemistry – *Multiple Choice* How many milliliters of a 2 molar sodium chloride solution are needed to make 500 milliliters of a 0.25 molar sodium chloride solution? [JI]

- W) 50
- X) 62.5
- Y) 75
- Z) 87.5

ANSWER: X) 62.5

## **BONUS**

5) Chemistry – *Multiple Choice* Which of the following salts is the least soluble in water? [JI]

- W) Barium hydroxide
- X) Sodium dichromate
- Y) Silver fluoride
- Z) Mercury (I) bromide

ANSWER: Z) MERCURY (I) BROMIDE

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## **TOSS-UP**

6) Energy – *Multiple Choice* Researchers at Pacific Northwest National Lab are analyzing how offshore wind energy in Oregon could increasingly support the electrical grid of nearby cities. Which of the following best describes why there are prevalent winds in coastal areas such as in this example? [JI]

- W) Differing elevations between the coast and ocean cause pycnic circulation
- X) Differential heating between the coast and ocean cause thermal circulation
- Y) Prevailing winds are often amplified in coastal areas
- Z) Winds accelerate as they move downhill along coastal areas to the ocean

ANSWER: X) DIFFERENTIAL HEATING BETWEEN THE COAST AND OCEAN CAUSE THERMAL CIRCULATION

## **BONUS**

6) Energy – *Short Answer* Scientists at Pacific Northwest National Lab are studying soil respiration and how it could relate to climate change and the biogeochemical cycles. One important characteristic of soils is the layering of the horizons. Order the following three soil horizons from nearest to farthest from the surface 1) A 2) E 3) O. [JI]

## **TOSS-UP**

ANSWER: 3, 1, 2 (ACCEPT: O, A, E)

7) Physics – *Multiple Choice* When an elevator goes from the top floor to the bottom floor, at what point does the cable have the least tension? [AT]

- W) When it is still
- X) When it begins to go down
- Y) While it is going down
- Z) When it slows down

ANSWER: X) WHEN IT BEGINS TO GO DOWN

## **BONUS**

7) Physics – *Short Answer* Mr. Phat stands on a scale inside of an elevator. When the elevator begins to go up, the scale reads 9600 N. When the elevator begins to stop, the scale reads 6900 N. If the elevator accelerates and decelerates at equal rates, how much does Mr. Phat weigh, in newtons? [AT]

ANSWER: 8250 N

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## **TOSS-UP**

8) Biology – *Short Answer* Josh has gotten into a car accident and desperately needs blood. The only blood available nearby is unlabeled and you have no way of knowing its type. However, you are still certain that the transfusion will not cause an immune response. What must be Josh's blood type?

ANSWER: AB POSITIVE OR AB (DO NOT ACCEPT: AB NEGATIVE)

## **BONUS**

8) Biology – *Short Answer* Foolish seedling disease, a condition observed in rice seedlings where seedlings grow so tall they often topple before maturity, is caused by an excess of what plant hormone?

ANSWER: GIBBERELLIN

### **TOSS-UP**

9) Earth and Space – *Multiple Choice* What type of lake is formed when a meander in a river becomes so wide that the river cuts off the meander, creating a separate body of water? [JI]

- W) Oxbow lake
- X) Paternoster lake
- Y) Tarn
- Z) Plunge pool lake

ANSWER: W) OXBOW LAKE

### **BONUS**

9) Earth and Space – *Short Answer* Order the following three gases in terms of increasing concentration in Earth's atmosphere: 1) Carbon dioxide; 2) Argon; 3) Methane. [JI]

ANSWER: 3, 1, 2 (METHANE, CARBON DIOXIDE, ARGON)



### **TOSS-UP**

10) Math – *Short Answer* The greatest common divisor of two numbers is 6. If their least common multiple is four times their gcd, what is the product of the two numbers? [SA]

ANSWER: 144

### **BONUS**

10) Math – *Short Answer* What is the smallest number greater than 3 that leaves a remainder of 3 when divided by 6, 10, and 14? [SA]

ANSWER: 213

### **TOSS-UP**

11) Chemistry – *Multiple Choice* Which of the following is nearest to the bond angles, in degrees, present in an ammonia molecule? [JI]

- W) 90
- X) 107
- Y) 109.5
- Z) 120

ANSWER: X) 107

### **BONUS**

11) Chemistry – *Multiple Choice* Given that the molar heat capacity of water at STP is 75 joules per mol kelvin and that the enthalpy of vaporization of water is 40 kilojoules per mol kelvin, find which of the following is nearest to the amount of heat, in kilojoules, required to transform two moles of water at 60 degrees celsius to water vapor at 100 degrees celsius. [JI]

- W) 43
- X) 80
- Y) 86
- Z) 150

ANSWER: Y) 86

## **TOSS-UP**

12) Energy – *Multiple Choice* Scientists at Ames National Lab have turned to the heavens to search for new possible high-performance magnets by analyzing alloys naturally found in meteorites. These materials exhibit ferromagnetism. Which of the following elements is not ferromagnetic? [JI]

- W) Manganese
- X) Iron
- Y) Cobalt
- Z) Nickel

ANSWER: W) MANGANESE

## **BONUS**

12) Energy – *Multiple Choice* The meteorites which the researchers are studying contain a nickel-iron alloy in which all of the magnetic moments are highly aligned. Which of the following best describes what type of meteorites these are? [JI]

- W) Chondrites
- X) Achondrites
- Y) Siderites
- Z) Pallasites

ANSWER: Y) SIDERITE



**TOSS-UP**

13) Physics – *Multiple Choice* What is the magnification of a mirror that produces a real image that is 50 centimeters tall for an object with a height of 100 centimeters? [SA]

- W) -1/2
- X) 1/2
- Y) -2
- Z) 2

ANSWER: W) -1/2

**BONUS**

13) Physics – *Short Answer* An object 12 centimeters tall is placed 4 centimeters in front of a diverging lens with a focal length of 6 centimeters. If the virtual image is 3 centimeters from the lens, then how tall is the image? [AT]

ANSWER: 9 CENTIMETERS

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**TOSS-UP**

14) Biology – *Short Answer* What cycle of bacteriophage reproduction involves the integration of phage DNA molecules into a bacterial genome to form a prophage?

ANSWER: LYSOGENIC

**BONUS**

14) Biology – *Short Answer* Temperate lakes usually undergo seasonal turnover during what two seasons?

ANSWER: SPRING AND AUTUMN (ACCEPT: SPRING AND FALL)

**TOSS-UP**

15) Earth and Space – *Short Answer* What term describes the infinitely dense point at the center of a black hole? [JI]

ANSWER: SINGULARITY

**BONUS**

15) Earth and Space – *Multiple Choice* The Scooter and the Great Dark Spot are both storms on what planet? [JI]

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

ANSWER: Z) NEPTUNE

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**TOSS-UP**

16) Math – *Multiple Choice* Which of the following numbers is perfect? [SA]

- W) 25
- X) 26
- Y) 27
- Z) 28

ANSWER: Z) 28

**BONUS**

16) Math – *Short Answer* How many factors does the number 1008 have? [SA]

ANSWER: 30

## **TOSS-UP**

17) Chemistry – *Multiple Choice* What is the order of a reaction if its rate constant has units of liters over moles seconds? [JI]

- W) Zeroth
- X) First
- Y) Second
- Z) Third

ANSWER: Y) SECOND

## **BONUS**

17) Chemistry – *Short Answer* Order the following three compounds by increasing carbon-carbon bond order: 1) Acetylene 2) Pentane 3) Benzene. [JI]

ANSWER: 2, 3, 1 (PENTANE, BENZENE, ACETYLENE)



## **TOSS-UP**

18) Energy – *Short Answer* Scientists at Pacific Northwest National Lab have found a way to quickly isolate pathogens from complicated samples. What characteristic of the pathogen is unchanged by this method, which is the physical expression of the genotype? [JI]

ANSWER: PHENOTYPE

## **BONUS**

18) Energy – *Multiple Choice* Researchers at Pacific Northwest National Lab are searching for more sustainable fuels for airplanes that have lower carbon emissions. Regardless of other considerations, which of the following fuels would be best for this use because its combustion produces the lowest ratio of carbon dioxide to water? [JI]

- W) Methane
- X) Octane
- Y) Kerosene
- Z) Naphtha

ANSWER: W) METHANE

### **TOSS-UP**

19) Physics – *Short Answer* What is the fifth harmonic of a musical instrument given that its fundamental frequency is 120 Hertz? [SA]

ANSWER: 600 HERTZ

### **BONUS**

19) Physics – *Multiple Choice* A thick rope and a thin nylon string have their ends attached, with the nylon tied to a wall on the other side. An upright wave is sent through starting on the rope side. When the wave reaches the nylon, which of the following will occur? [AT]

- W) The reflected wave is upright, and the incident wave is inverted
- X) The reflected wave is inverted, and the incident wave is upright
- Y) Both the reflected wave and the incident wave are upright
- Z) Both the reflected wave and incident wave are inverted

ANSWER: Y) BOTH THE REFLECTED WAVE AND INCIDENT WAVE ARE UPRIGHT

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### **TOSS-UP**

20) Biology – *Short Answer* What enzyme prevents DNA damage as a result of the shortening of chromosomes after replication by adding new nucleotides to the ends of chromosomes? [CJ]

ANSWER: TELOMERASE

### **BONUS**

20) Biology – *Short Answer* After three cycles of PCR, how many newly synthesized molecules match the original double-stranded target sequence? [CJ]

ANSWER: 2

### **TOSS-UP**

21) Earth and Space – *Short Answer* What igneous formations are created when lava is erupted underwater and cools quickly to form rounded masses? [JI]

ANSWER: PILLOW BASALT (ACCEPT: PILLOW LAVA)

### **BONUS**

21) Earth and Space – *Short Answer* Choose all of the following which may occur as a native element: 1) Gold 2) Potassium 3) Copper? [JI]

ANSWER: 1 AND 3 (ACCEPT: GOLD AND COPPER)



### **TOSS-UP**

22) Math – *Multiple Choice* Which of the following lines is perpendicular to the line  $3x + 4y = 5$ ? [SA]

- W)  $6x - 4y = 5$
- X)  $8x - 6y = 5$
- Y)  $6x + 4y = 5$
- Z)  $8x + 6y = 5$

ANSWER: X)  $8x - 6y = 5$

### **BONUS**

22) Math – *Short Answer* A tangent line intersects the parabola  $y = 2x^2 - 5x$  at  $x = 4$ . What is the equation of the line in slope-intercept form? [SA]

ANSWER:  $y = 11x - 32$

### **TOSS-UP**

23) Chemistry – *Multiple Choice* The first law of thermodynamics states that the change in the internal energy of a system is equal to the sum of what two quantities? [JI]

- W) Work and pressure
- X) Work and entropy
- Y) Heat and enthalpy
- Z) Heat and work

ANSWER: Z) HEAT AND WORK

### **BONUS**

23) Chemistry – *Short Answer* Order the following three ions by INCREASING atomic radius

- 1)  $\text{Na}^+$  2)  $\text{Mg}^{2+}$  3)  $\text{Cl}^-$  [JI]

ANSWER: 2, 1, 3 (ACCEPT:  $\text{Mg}^{2+}$ ,  $\text{Na}^+$ ,  $\text{Cl}^-$ )