

## WISC Round 1

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### TOSS-UP

1) Physics – *Short Answer* Object A is dropped off a cliff. Object B is thrown horizontally from the same height with an initial velocity of 4.6 m/s. After 3 seconds, how far apart are the two objects? [AT]

ANSWER: 13.8 METERS

### BONUS

1) Physics – *Short Answer* A cannonball is launched at an angle of 15 degrees to hit an object 10 meters away. If the cannonball exactly hits its target, what was its initial velocity to the nearest meter per second? [AT]

ANSWER: 14 METERS PER SECOND

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### TOSS-UP

2) Biology – *Short Answer* In what form of mimicry is the mimic just as harmful or unpalatable as the original species? [CJ]

ANSWER: MULLERIAN MIMICRY

### BONUS

2) Biology – *Multiple Choice* Which of the following groups of protists is most closely related to plants? [CJ]

- W) Euglenozoans
- X) Golden Algae
- Y) Green Algae
- Z) Brown Algae

ANSWER: Y) GREEN ALGAE

### TOSS-UP

3) Earth and Space – *Multiple Choice* What is the most common gas in the atmosphere of Jupiter? [JI]

- W) Hydrogen
- X) Nitrogen
- Y) Methane
- Z) Ammonia

ANSWER: W) HYDROGEN

### BONUS

3) Earth and Space – *Short Answer* Choose all of the following four moons which are larger than Pluto? [AT]

- 1) Ganymede
- 2) Triton
- 3) Earth's Moon
- 4) Io

ANSWER: ALL (1, 2, 3, 4 OR GANYMEDE, TRITON, EARTH'S MOON, IO)



### TOSS-UP

4) Math – *Multiple Choice* What point inside a triangle refers to the intersection of the angle bisectors? [SA]

- W) Centroid
- X) Orthocenter
- Y) Circumcenter
- Z) Incenter

ANSWER: Z) INCENTER

### BONUS

4) Math – *Short Answer* What is the area of a triangle with side lengths of 5, 6, and 7? [SA]

ANSWER:  $6\sqrt{6}$  (6 ROOT 6)

### TOSS-UP

5) Chemistry – *Multiple Choice* Which of the following salts will NOT produce a colored solution when dissolved in water? [JI]

- W) Sodium chromate
- X) Copper chloride
- Y) Cobalt chloride
- Z) Barium hydroxide

ANSWER: Z) BARIUM HYDROXIDE

### BONUS

5) Chemistry – *Short Answer* Identify all of the following three conditions that would shift the equilibrium to the products in the synthesis of ammonia from hydrogen and nitrogen: 1) Increasing the pressure of the container 2) Addition of ammonia 3) Addition of nitrogen. [JI]

ANSWER: 1 AND 3



### TOSS-UP

6) Energy – *Short Answer* Scientists at the Jet Propulsion Biotechnology and Planetary Protection group have been studying microorganisms on earth that may be able to withstand the high salt concentrations on mars. Most such extreme halophiles are members of what domain? [CJ]

ANSWER: ARCHAEA

### BONUS

6) Energy – *Multiple Choice* Researchers at Pacific Northwest National Lab are trying to identify which areas on the West coast would be the best spots for harnessing wave energy. Which of the following is not a factor that affects the energy in a wave formed in the open ocean? [JI]

- W) Wind speed
- X) Distance wind blows
- Y) Ocean depth
- Z) Duration of wind

ANSWER: Y) OCEAN DEPTH

### TOSS-UP

7) Physics – *Multiple Choice* Which of the following is true about uniform circular motion?  
[AT]

- W) Centripetal acceleration is directly proportional to the radius
- X) Velocity remains constant
- Y) Centripetal acceleration is directly proportional to velocity
- Z) Kinetic energy remains constant

ANSWER: Z) KINETIC ENERGY REMAINS CONSTANT

### BONUS

7) Physics – *Short Answer* Sephiroth has a mass of about 6 kg. If this were the case, how much average power would you need to be exerting over 3 seconds to send him flying at a speed of 3 m/s? [AT]

ANSWER: 9 WATTS

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### TOSS-UP

8) Biology – *Multiple Choice* Huntington's disease, a condition which causes the progressive degeneration of the nervous system, follows which of the following inheritance patterns?

- W) X Linked Recessive
- X) Mitochondrial
- Y) Autosomal Dominant
- Z) Autosomal Recessive

ANSWER: Y) AUTOSOMAL DOMINANT

### BONUS

8) Biology – *Multiple Choice* Which of the following DNA elements are not found in eukaryotic DNA?

- W) Promoter
- X) Operator
- Y) Enhancer
- Z) Poly A Signal

ANSWER: X) OPERATOR

### TOSS-UP

9) Earth and Space – *Short Answer* What property of the atmosphere is measured by a barometer? [JI]

ANSWER: ATMOSPHERIC PRESSURE (ACCEPT: AIR PRESSURE, PRESSURE)

### BONUS

9) Earth and Space – *Multiple Choice* Which of the following metamorphic rocks is paired with the INCORRECT protolith? [JI]

- W) Slate - shale
- X) Marble - calcite
- Y) Quartzite - granite
- Z) Schist - shale

ANSWER: Y) QUARTZITE - GRANITE



### TOSS-UP

10) Math – *Short Answer* The 1961 Ferrari Spider costs about 18 million dollars. If Josh currently has 7.5 million dollars in savings and earns about 700,000 dollars a year, how many years will it take for Josh to have enough money to buy the Ferrari? [AT]

ANSWER: 15 YEARS

### BONUS

10) Math – *Short Answer* What is the smallest three-digit factor of the number 1,000,001? [SA]

ANSWER: 101

### TOSS-UP

11) Chemistry – *Short Answer* What is the maximum number of stereoisomers that can exist for a compound with 3 chiral centers? [JI]

ANSWER: 8

### BONUS

11) Chemistry – *Multiple Choice* The mineral Moissanite has the formula SiC. Which of the following best describes this mineral? [JI]

- W) Ionic solid
- X) Amorphous solid
- Y) Network solid
- Z) Crystalline solid

ANSWER: Y) NETWORK SOLID

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### TOSS-UP

12) Energy – *Short Answer* Researchers at the University of Bonn have synthesized a silicon-containing compound that has an unusual structure. In the compound, each silicon atom is bonded to four ligands in a planar trapezoid arrangement. This structure is unusual because silicon along with four ligands generally forms molecules with what molecular geometry? [SA]

ANSWER: TETRAHEDRAL (ACCEPT: TETRAHEDRON)

### BONUS

12) Energy – *Short Answer* The researchers at the University of Bonn are interested in studying compounds containing silicon because silicon is an essential component of electronics, especially semiconductors. By name or number, identify which of the following three elements form an n-type semiconductor when doped on silicon. 1) Phosphorus; 2) Antimony; 3) Gallium. [SA]

ANSWER: 1 AND 2 (PHOSPHORUS AND ANTIMONY)

### TOSS-UP

13) Physics – *Multiple Choice* Which of the following is an elementary particle? [JI]

- W) Pion
- X) Kaon
- Y) Meson
- Z) Muon

ANSWER: Z) MUON

### BONUS

13) Physics – *Multiple Choice* Which of the following statements about particle physics is incorrect? [SA]

- W) Fermions have half-integral spin.
- X) Interaction with Higgs field is responsible for mass of gauge bosons.
- Y) Gluons mediate the strong force.
- Z) Photons have a spin of 0.

ANSWER: Z) PHOTONS HAVE A SPIN OF 0.



### TOSS-UP

14) Biology – *Multiple Choice* Molecules of which of the following classes of macronutrients first enter the lymphatic system after their absorption by the intestinal epithelium? [CJ]

- W) Proteins
- X) Carbohydrates
- Y) Lipids
- Z) Nucleic acids

ANSWER: Y) LIPIDS

### BONUS

14) Biology – *Short Answer* What term describes the collection of all microorganisms living on and within the human body? [CJ]

ANSWER: MICROBIOME (DO NOT ACCEPT: BIOME)

### TOSS-UP

15) Earth and Space – *Short Answer* The Chandrasekhar limit is the upper mass limit for what type of stellar remnant? [JI]

ANSWER: WHITE DWARF (ACCEPT: DEGENERATE DWARF; DO NOT ACCEPT: DWARF)

### BONUS

15) Earth and Space – *Short Answer* Order the following four planets by INCREASING density: 1) Venus; 2) Mars; 3) Jupiter; 4) Saturn. [JI]

ANSWER: 4, 3, 2, 1 (ACCEPT: SATURN, JUPITER, MARS, VENUS)



### TOSS-UP

16) Math – *Multiple Choice* Which of the following shapes can not tessellate the plane? [JI]

- W) Square
- X) Parallelogram
- Y) Regular octagon
- Z) Regular hexagon

ANSWER: Y) REGULAR OCTAGON

### BONUS

16) Math – *Short Answer* A cyclic quadrilateral ABCD is inscribed in a circle with center O. If angle AOD measures 40 degrees and angle COD measures 50 degrees, what is the measure of angle D? [SA]

ANSWER: 135 DEGREES



### TOSS-UP

17) Chemistry – *Multiple Choice* Which of the following compounds is nonpolar? [SA]

- W) Ammonia
- X) Boron trifluoride
- Y) Sulfur tetrafluoride
- Z) Oxalic acid

ANSWER: X) BORON TRIFLUORIDE

### BONUS

17) Chemistry – *Short Answer* By name or number, order the following three compounds by increasing boiling points: 1) Hydrogen sulfide, 2) Hydrogen chloride, 3) Hydrogen bromide. [SA]

ANSWER: 2, 3, 1 (HYDROGEN CHLORIDE, HYDROGEN BROMIDE, HYDROGEN SULFIDE)

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### TOSS-UP

18) Energy – *Short Answer* Researchers at Argonne National Lab are researching a new way to treat dengue virus, a prevalent mosquito-borne illness. To do this they are using what class of proteins, which are large y-shaped compounds used to combat infections [JI]

ANSWER: ANTIBODIES (ACCEPT: IMMUNOGLOBULIN, AB, IG)

### BONUS

18) Energy – *Short Answer* Scientists at SLAC National Accelerator Lab have found an unexpected rearrangement of atoms in a substrate while trying to boost the efficiency of turning water into hydrogen fuel. This rearrangement occurred on what type of substance which accelerates the reaction rate by lowering the activation energy of a chemical reaction. [JI]

ANSWER: CATALYST

### TOSS-UP

19) Physics – *Short Answer* A circuit contains a 3 ohm resistor in series with a 6 volt battery. In watts, how much power is dissipated by the resistor? [SA]

ANSWER: 12 WATTS

### BONUS

19) Physics – *Multiple Choice* Which of the following statements about circuit components is INCORRECT? [SA]

- W) An inverter can be used to convert DC to AC.
- X) There are voltage drops across resistors.
- Y) Diodes are made up of two p-n junctions.
- Z) A rectifier converts AC to DC.

ANSWER: Y) DIODES ARE MADE UP OF TWO P-N JUNCTIONS.



### TOSS-UP

20) Biology – *Multiple Choice* Which of the following is NOT an example of a countercurrent system? [CJ]

- W) The loop of Henle and surrounding capillaries
- X) The gills of a fish
- Y) The tracheal system of an insect
- Z) The flippers of a dolphin

ANSWER: Y) THE TRACHEAL SYSTEM OF AN INSECT

### BONUS

20) Biology – *Short Answer* Name all of the fat soluble vitamins.

ANSWER: VITAMINS A, D, E, K (ACCEPT: EQUIVALENTS)

### TOSS-UP

21) Earth and Space – *Multiple Choice* Which of the following is NOT an iron ore? [JI]

- W) Goethite (say: gurr-tite)
- X) Hematite
- Y) Magnetite
- Z) Sphalerite

ANSWER: Z) SPHALERITE

### BONUS

21) Earth and Space – *Multiple Choice* What term describes underwater volcanic peaks that look similar to those on land? [JI]

- W) Guyot (say: gee-oh with a hard “g”)
- X) Tablemount
- Y) Seamount
- Z) Atoll

ANSWER: Y) SEAMOUNT



### TOSS-UP

22) Math – *Multiple Choice* Which of the following numbers is not equal to the binary number 1 000 000 (say each digit)? [SA]

- W) 1000 in octal
- X) 64 in decimal
- Y) 40 in hexadecimal
- Z) 54 in base 12

ANSWER: W) 1000 IN OCTAL

### BONUS

22) Math – *Short Answer* A circle is inscribed in a square with a diagonal of 10. Another square is inscribed in the circle. What is the area of the inscribed square? [SA]

ANSWER: 25

### TOSS-UP

23) Chemistry – *Short Answer* What class of compounds are characterized by a carbonyl group attached to nitrogen? [JI]

ANSWER: AMIDE (DO NOT ACCEPT: AMINE)

### BONUS

23) Chemistry – *Multiple Choice* Which of the following is nearest to how much work is done by the expansion of 5 moles of nitrogen gas from 5 to 35 liters against a constant external atmosphere of 2 atmospheres. [JI]

- W) 2,000 joules
- X) 6,000 joules
- Y) 10,000 joules
- Z) 15,000 joules

ANSWER: X) 6,000 JOULES