

BASIS PEORIA SCIENCE BOWL

ROUND ROBIN ROUND 4

TOSS-UP

1) Biology – *Short Answer* What type of inhibitor directly competes with an enzyme by binding to the active site?

ANSWER: Competitive inhibitor

BONUS

1) Biology – *Short Answer* What is an enzyme called when it is under high substrate concentrations, and all active sites are occupied?

ANSWER: Saturated

TOSS-UP

2) Chemistry – *Short Answer* Provide the molar mass of water (include units).

ANSWER: 18 g/mol

BONUS

2) Chemistry – *Short Answer* The empirical formula for a compound is CH2. If the molar mass of the compound is 112 g/mol, then what is the molecular formula of the compound?

ANSWER: C8H16

TOSS-UP

3) Physics – *Multiple Choice* What is the second simplest magnetic structure that can exist?

W) Magnetic monopole
X) Magnetic dipole
Y) Magnetic tripole
Z) Magnetic quadrupole

ANSWER: Z) MAGNETIC QUADRUPOLE

BONUS

3) Physics – *Multiple Choice* Which law states that a collection of point charges cannot be maintained in a stable stationary equilibrium configuration solely by the electrostatic interaction of the charges?

W) Braunbeck's Extension
X) Earnshaw's Theorem
Y) Laplace's equation

Z) Lenz's Law

ANSWER: X) EARNSHAW'S THEOREM

TOSS-UP

4) Math – *Short Answer* A triangle ABC has angles A = 60 degrees, B = 100 degrees, and C = 20 degrees. List the three sides in order of increasing length.

ANSWER: AB, BC, AC (ACCEPT: C, A, B)

BONUS

4) Math – *Multiple Choice* A 30-60-90 triangle has one side of $2\sqrt{3}$. Which of the following is not a possible length of another side?
W) $4\sqrt{3}$
X)$\sqrt{6}$
Y) 2
Z) 3

ANSWER: X)$\sqrt{6}$

TOSS-UP

5) Earth and Space – *Short Answer* What is the brightest star in the night sky?

ANSWER: SIRIUS

BONUS

5) Earth and Space – *Short Answer* In which constellation does the star Sirius lie?

ANSWER: CANIS MAJOR

TOSS-UP

6) Energy – *Multiple Choice* Which of the following is not a source of geothermal energy?

W) Volcanoes
X) Geysers
Y) Mud pots
Z) Earthquakes

ANSWER: Z) Earthquakes

BONUS

6) Energy – *Short Answer* The ultimate source of geothermal energy is the radioactive decay of elements within the Earth's interior. Which of the following elements is not thought to be one of the major sources of heat within the Earth's interior?

W) Plutonium
X) Uranium
Y) Thorium
Z) Potassium

ANSWER: W) Plutonium

TOSS-UP

7) Biology – *Multiple Choice* Which of the following cannot function as enzymes?

W) Proteins
X) Lipids
Y) Nucleic Acids
Z) Catalysts

ANSWER: X) Lipids

BONUS

7) Biology – *Short Answer* If a chemical reaction is exergonic and releases energy, what is the sign of its Gibbs free energy?

ANSWER: Negative

TOSS-UP

8) Chemistry – *Multiple Choice* Which of the following is the electron configuration of aluminum?

W) 1s2 2s2 2p1
X) [Ar] 3s2 3p1
Y) 1s2 2s2 2p6 3s2 3p1
Z) 1s2 2s2 2p6 3s2 3p3

ANSWER: Y) 1s2 2s2 2p6 3s2 3p1

BONUS

8) Chemistry – *Multiple Choice* Which of the following is not an electron configuration of one of the elements in the periodic table?

W) [Xe] 5s2 4d5
X) [Ar] 4s2 3d10 4p4
Y) [Ra] 7s1
Z) [He] 2s2 2p5

ANSWER: W) [Xe] 5s2 4d5

TOSS-UP

9) Physics – *Short Answer* Which law of thermodynamics is a restatement of the transitive property of equality?

ANSWER: ZEROTH LAW OF THERMODYNAMICS

BONUS

9) Physics – *Short Answer* A certain amount of heat Q will warm 1 g of material A by 3 degrees Celsius and 1 g of material B by four degrees Celsius. Which material has the greater specific heat?

ANSWER: A

TOSS-UP

10) Math – *Short Answer* Simplify the expression $\frac{\sqrt{x}\sqrt[3]{x}}{x}$ ***[read: the square root of x times the cube root of x all over x]***.

ANSWER: $x^{\frac{-1}{6}}$ ***[read: x to the power of negative one sixth]***

BONUS

10) Math – *Short Answer* Apples cost $0.50 and bananas cost $0.25. 30 apples and bananas were sold for a total of 12 dollars. How many apples were sold?

ANSWER: 18

TOSS-UP

11) Earth and Space – *Multiple Choice* How many constellations are in the night sky?

W) 22
X) 44
Y) 88
Z) 176

ANSWER: Y) 88

BONUS

11) Earth and Space – *Multiple Choice* Which of the following constellations is the largest?

W) Hydra
X) Carina
Y) Puppis
Z) Leo

ANSWER: W) HYDRA

TOSS-UP

12) Energy – *Multiple Choice* Which of the following is NOT made with green algae?

W) Gasoline
X) Methane
Y) Ethanol
Z) Biogas

ANSWER: W) Gasoline

BONUS

12) Energy – *Multiple Choice* Which of the following is a disadvantage of using green algae as an alternative fuel source?

W) Algae is not a renewable resource
X) Algae can not grow in many climates
Y) Algae requires a large amount of water to grow
Z) The CO2 produced from burning algal fuel is more than the CO2 that algae consumes

ANSWER: Y) Algae requires a large amount of water to grow

TOSS-UP

13) Biology – *Multiple Choice* What type of bone is the sternum?

W) Flat bone

X) Long bone
Y) Short bone
Z) Irregular bone

ANSWER: W) Flat bone

BONUS

13) Biology – *Short Answer* The patella is an example of this type of bone, which is embedded within a tendon or muscle in response to pressure and strain.

ANSWER: Sesamoid bone

TOSS-UP

14) Chemistry – *Short Answer* What is the molarity of 3 moles of NaCl in a 500 mL solution (Provide answer in molars)?

ANSWER: 6 M

BONUS

14) Chemistry – *Short Answer* Given that the molar mass of CO2 is 44 g / mol, what is the molarity of 1056 g of CO2 in a 2000 cL solution (Provide answer in molars)?

ANSWER: 1.2 M

TOSS-UP

15) Physics – *Short Answer* Find the instantaneous acceleration of a rocket with thrust 28 Newtons and mass 4 kg.

ANSWER: 7

BONUS

15) Physics – *Short Answer* Find the center of mass of a cone with a circular base of radius 3, centered at the origin, and an apex at (0, 12, 0). Give your answer in the form (x, y, z).

ANSWER: (0, 3, 0)

TOSS-UP

16) Math – *Multiple Choice* Which of the following is the slope of a line perpendicular to the line $-7x = 3y + 4$?

W) 7/3
X) 3/7

Y) -7/3
Z) -3/7

ANSWER: X) 3/7

BONUS

16) Math – *Multiple Choice* What is the equation of tan(x) reflected around the axis y=x?
W) -tan(-x)
X) cot(x)
Y) -cot(x)
Z) arctan(x)

ANSWER: Z) ARCTAN(X)

TOSS-UP

17) Earth and Space – *Short Answer* What was the first period in the Paleozoic Era?

ANSWER: CAMBRIAN

BONUS

17) Earth and Space – *Multiple Choice* Which of the following periods occurred during the Mesozoic Era?

W) Ordovician
X) Jurassic
Y) Neogene
Z) Paleogene

ANSWER: X) JURASSIC

TOSS-UP

18) Energy – *Multiple Choice* Which US state has the highest methane emissions?

W) Wyoming
X) Alaska
Y) Wisconsin
Z) Texas

ANSWER: Z) Texas

BONUS

18) Energy – *Short Answer* Rank the following states from most greenhouse gas emissions to least greenhouse gas emissions: 1) Michigan, 2) Ohio, 3) Texas, 4) Indiana, 5) California

ANSWER: 3), 5), 2), 4), 1) (ACCEPT: Texas, California, Ohio, Indiana, Michigan)

TOSS-UP

19) Biology – *Multiple Choice* What is the orientation of fibers in dense irregular connective tissue?

W) Fibers are oriented in one direction.
X) Fibers are oriented in two directions.
Y) Fibers are oriented in four directions.
Z) Fibers are oriented in random directions.

ANSWER: Z) Fibers are oriented in random directions.

BONUS

19) Biology – *Multiple Choice* Which of the following is classified as dense irregular connective tissue?

W) Dermis
X) Tendon
Y) Ligament
Z) Muscle fascicle

ANSWER: W) Dermis

TOSS-UP

20) Chemistry – *Short Answer* If 12 moles of Na react with 7 moles of chlorine gas, how many moles of NaCl will be produced?

ANSWER: 12 moles NaCl

BONUS

20) Chemistry – *Short Answer* Provide the simplified whole number coefficients of both the reactants and products in the following reaction after balancing: $C4H8 + O2$ yields $CO2 + H2O$

ANSWER: C4H8: 1, O2: 6, CO2: 4, H2O: 4

TOSS-UP

21) Physics – *Short Answer* What is the force on a 20 kilogram box in Newtons, if it is accelerating at 10 m/s^2?

ANSWER: 200

BONUS

21) Physics – *Short Answer* A 10 kg box is moving to the right on a rough surface with no applied forces acting on it. If the box is slowing down at $1m/s^2$, what is the coefficient of kinetic friction of the surface? Assume the acceleration of gravity is $10m/s^2$.

ANSWER: 0.1

TOSS-UP

22) Math – *Multiple Choice* What is the most common sum of the top numbers on four fair dice?

W) 10
X) 11
Y) 14
Z) 21

ANSWER: Y) 14

BONUS

22) Math – *Multiple Choice* Consider a dartboard made of 20 equally sized sectors, labeled with the numbers 1 through 20. A dart is thrown randomly at the board. What is the chance that it hits a sector numbered with a prime number, as a fraction reduced to lowest terms?
W) 1/2
X) 2/5
Y) 3/10
Z) 1/4

ANSWER: X) 2/5

TOSS-UP

23) Earth and Space – *Short Answer* What is the term for a mountain that is formed by the glacial weathering of the rocks around it?

ANSWER: HORN

BONUS

23) Earth and Space – *Short Answer* What type of moraine was deposited at the terminus of a glacier?

ANSWER: END MORAINE