

BASIS PEORIA SCIENCE BOWL

DOUBLE ELIMINATION ROUND 2

TOSS-UP

1) Biology – *Short Answer* This condition is an opacification of the lens of the eye that leads to a hindrance in vision and needs surgical removal. It commonly develops in elderly individuals and slowly over time. What is the name of this condition?

ANSWER: CATARACT

BONUS

1) Biology – *Short Answer* This hormone is produced by the Anterior Pituitary Gland and causes a woman's breasts to enlarge as well as produce milk after a baby is born. What is the name of this hormone?

ANSWER: PROLACTIN

TOSS-UP

2) Chemistry – *Multiple Choice* Which of the following gases will deviate most from the ideal gas law?

W) Hydrogen
X) Helium
Y) Water
Z) Nitrogen

ANSWER: Y

BONUS

2) Chemistry – *Short Answer* Name the effect that causes a real gas to cool when it expands after passing through a throttle. This technique is employed in commercial refrigerators to liquefy gases.

ANSWER: JOULE-THOMSON EFFECT

TOSS-UP

3) Physics – *Multiple Choice* Which of the following is not a "fictitious force"?

W) Centrifugal force
X) Electromagnetic force
Y) Euler force
Z) Coriolis force

ANSWER: X) ELECTROMAGNETIC FORCE

BONUS

3) Physics – *Short Answer* What is the centripetal acceleration, in meters per second squared, of an object with orbital period π and radius of curvature 1?

ANSWER: 4

TOSS-UP

4) Math – *Short Answer* What is the image of the equation y=x+5 when reflected across the x-axis.

ANSWER: y= - x - 5

BONUS

4) Math – *Short Answer* What is the image of the line 3x+2y=5 when reflected across the line y=x. Give your answer in slope intercept form.

ANSWER: $y = -2/3 * x + 5/3$

TOSS-UP

5) Earth and Space – *Short Answer* What is the term for a neutron star with a rotational period of less than 40 milliseconds?

ANSWER: MILLISECOND PULSAR

BONUS

5) Earth and Space – *Short Answer* What is the term for a neutron star with an especially strong magnetic field, the strongest known in the universe?

ANSWER: MAGNETAR

TOSS-UP

6) Energy – *Short Answer* What is the name of the law that provides a theoretical maximum limit for the efficiency of a wind turbine?

ANSWER: Betz's Law

BONUS

6) Energy – *Short Answer* Betz's Law states that the maximum efficiency of a wind turbine cannot exceed the Betz limit. What integer value is closest to the Betz limit?

ANSWER: 59%

TOSS-UP

7) Biology – *Short Answer* Which bone contains the foramen magnum, which is a large opening that allows for the passage of blood vessels and the spinal cord into the skull?

ANSWER: Occipital Bone

BONUS

7) Biology – *Short Answer* The brain case consists of numerous bones fused together. This region is where the frontal, parietal, temporal, and sphenoid bones meet. What is the name of this region, which is the weakest point in the human skull?

ANSWER: Pterion

TOSS-UP

8) Chemistry – *Short Answer* By name or number identify all of the following five elements that are solids at room temperature.

1) Carbon
2) Mercury
3) Fluorine
4) Helium
5) Lead

ANSWER: 1 AND 5

BONUS

8) Chemistry – *Short Answer* What is the term for a property of substances to exhibit variations in physical properties along different molecular axes.

ANSWER: ANISOTROPY

TOSS-UP

9) Physics – *Short Answer* What was the first experiment that disproved the corpuscular theory of light?

ANSWER: DOUBLE-SLIT EXPERIMENT

BONUS

9) Physics – *Short Answer* What is the term for the incident angle at which no light is reflected?

ANSWER: BREWSTER'S ANGLE

TOSS-UP

10) Math – *Short Answer* Solve the following expression: the absolute value of (x-3) is ≥ 7

ANSWER: $x \geq 10 \text{ or } x \leq -4$

BONUS

10) Math – *Short Answer* Find the inflection points of the following equation $y=x^4-x^3$

ANSWER: ½, 0

TOSS-UP

11) Earth and Space – *Short Answer* The Carboniferous period is sometimes classified as 2 separate periods. What are the names of these separate periods?

ANSWER: MISSISSIPPIAN AND PENNSYLVANIAN

BONUS

11) Earth and Space – *Short Answer* The Carboniferous period saw the creation of vast reserves of coal within the earth. At the same time, a great quantity of another substance was also being produced, this time in the atmosphere. What substance is this?

ANSWER: OXYGEN

TOSS-UP

12) Energy – *Multiple Choice* Which of the following biomasses are not a source of energy?

W) Amorphous solids
X) Switchgrass
Y) Algae
Z) Black liquor

ANSWER: W) Amorphous solids

BONUS

12) Energy – *Short Answer* What is the name of the process in which organic materials are heated in the absence of oxygen?

ANSWER: Pyrolysis

TOSS-UP

13) Biology – *Multiple Choice* Which of the following epidermal layers is the most superior?

W) Stratum lucidum
X) Stratum granulosum
Y) Stratum basale
Z) Stratum corneum

ANSWER: Z) Stratum corneum

BONUS

13) Biology – *Short Answer* This disease is the most common skin cancer in the U.S. Primarily caused by extensive exposure to UV light, this cancer affects mitotically active cells in the deepest layer of the epidermis and gradually grows upwards towards the superior layers, forming an uneven bump on the skin surface. Name this disease.

ANSWER: Basal cell carcinoma

TOSS-UP

14) Chemistry – *Short Answer* The 1972 Nobel Prize in Physics was awarded to Bardeen, Cooper, and Schrieffer for their BCS theory which explains what physical phenomenon using Cooper pairs.

ANSWER: SUPERCONDUCTIVITY

BONUS

14) Chemistry – *Short Answer* Superconductivity was first observed by Dutch physicist Heike Kamerlingh Onnes in 1911 when he cooled this metal to a temperature of 4 K. Name this metal that is also famous for its poisoning.

ANSWER: MERCURY

TOSS-UP

15) Physics – *Multiple Choice* What was the first calibrated temperature scale?

W) Fahrenheit
X) Celsius
Y) Rankine
Z) Rømer

ANSWER: Z) RØMER

BONUS

15) Physics – *Short Answer* At what temperature does the average of the temperature in degrees Celsius and degrees Kelvin equal the temperature in degrees Fahrenheit? Give your answer in degrees Celsius.

ANSWER: 131

TOSS-UP

16) Math – *Multiple Choice* Assuming the Fibonacci sequence starts with 1, 1, 2, What is the sum of the squares of its first five terms?

W) 26
X) 32
Y) 36
Z) 40

ANSWER: Z) 40

BONUS

16) Math – *Short Answer* What is the sum of the reciprocals of all the prime numbers?

ANSWER: INFINITY

TOSS-UP

17) Earth and Space – *Short Answer* 3C 273 is an object that is very faint in the night sky, having an apparent magnitude of only 12.9. It looks exactly like a star through amateur telescopes as well as through larger telescopes. However, 3C 273 emits a very large quantity of radio waves, which is not expected for a star. What object is 3C 273?

ANSWER: QUASAR (ACCEPT: ACTIVE GALAXY)

BONUS

17) Earth and Space – *Short Answer* Quasars are extremely bright galaxies that emit radiation in all directions. Sometimes, however, they also display focused jets that expel matter and radiation out of the galaxy at relativistic speeds. If these jets point directly at Earth, they look significantly brighter, and are classified under a new name. What is the name for these extreme quasars?

ANSWER: BLAZARS

TOSS-UP

18) Energy – *Short Answer* Rank the following elements from lowest RMS velocity to highest RMS velocity, if they are all at a constant temperature of 30 degrees Celsius: 1) Nitrogen, 2) Carbon, 3) Oxygen, 4) Argon

ANSWER: 4), 3), 1), 2) (ACCEPT: Argon, Oxygen, Nitrogen, Carbon)

BONUS

18) Energy – *Short Answer* A container is filled with 3L of Neon at 30 degrees Celsius at 1.5 atmospheres. Another container is filled with 3L of Xenon at 30 degrees Celsius at 2.5 atmospheres. Knowing these conditions, which element's atoms will have a lower RMS velocity?

ANSWER: Xenon

TOSS-UP

19) Biology – *Short Answer* This term is used to explain the fundamental contraction of muscle fibers. What is the name of this model, which describes how thin filaments slide past thick filaments after the release of calcium into the sarcoplasm.

ANSWER: Sliding Filament Model / Theory

BONUS

19) Biology – *Short Answer* Order the following events in the order that they occur during the muscle contraction process. (1) Calcium ions bind to troponin. (2) Acetylcholine is released into the sarcolemma and binds to receptors. (3) Action potential travels down T - tubules to the sarcoplasmic reticulum, triggering the release of calcium ions. (4) Myosin heads attach to actin and perform a power stroke. (5) Sodium ion channels open, creating an action potential in the sarcolemma.

ANSWER: 2, 5, 3, 1, 4

TOSS-UP

20) Chemistry – *Multiple Choice* Which of the following is true of the relationship between temperature and conductivity for a semiconductor?

W) Semiconductors can only conduct electricity at one temperature.
X) As temperature rises, conductivity rises.

Y) As temperature rises, conductivity falls.
Z) Temperature doesn't affect conductivity.

ANSWER: X

BONUS

20) Chemistry – *Short Answer* Which type of semiconductor is germanium doped with arsenic?

ANSWER: N-TYPE

TOSS-UP

21) Physics – *Short Answer* What law states that the electromotive force is equal to the negative of the derivative with respect to time of the magnetic flux?

ANSWER: FARADAY'S LAW

BONUS

21) Physics – *Short Answer* By number, list all of the following that are true about Maxwell's equations. 1) Ampere's original law was given an addition by Faraday; 2) Gauss's law for magnetism is not one of the original four equations; 3) Magnetic monopoles are forbidden by Gauss's law of magnetism; 4) Two of Maxwell's equations are named after Gauss.

ANSWER: 3 AND 4

TOSS-UP

22) Math – *Short Answer* Water flows out of a pump. The amount of water flowing out of the pump at time t is given by $t^2 + 1$. What is the rate at which the amount of water flowing out of the pump is changing at t = 2?

ANSWER: 4

BONUS

22) Math – *Short Answer* Water flows out of a pump. The amount of water flowing out of the pump at time t is given by $t^2 + 1$. How much total water flows out of the pump from t = 0 to t = 3?

ANSWER: 12

TOSS-UP

23) Earth and Space – *Short Answer* The Mendocino Triple Junction is the border between the San Andreas Fault and what subduction zone?

ANSWER: CASCADIA

BONUS

23) Earth and Space – *Multiple Choice* The Cascadia subduction zone is the boundary between the North American Plate and what other plate?

W) Scotia
X) Nazca
Y) Pacific
Z) Juan de Fuca

ANSWER: Z) JUAN DE FUCA