

BASIS PEORIA SCIENCE BOWL

DOUBLE ELIMINATION ROUND 7

TOSS-UP

1) Biology – *Multiple Choice* Which of the following genuses is not a part of the family enterobacteriaceae?

W) Escherichia
X) Salmonella
Y) Neisseria
Z) Klebsiella

ANSWER: Y) Neisseria

BONUS

1) Biology – *Multiple Choice* Which of the following is not a characteristic of the family enterobacteriaceae?

W) Catalase negative
X) Oxidase negative
Y) Gram - negative
Z) Facultative anaerobes

ANSWER: W) Catalase negative

TOSS-UP

2) Chemistry – *Short Answer* What gaseous electronegative halogen can be found in the mineral cryolite?

ANSWER: Fluorine

BONUS

2) Chemistry – *Short Answer:* What oxygen-chlorine ion readily disproportionates in acidic conditions to form chloride and chlorate?

ANSWER: HYPOCHLORITE

TOSS-UP

3) Physics – *Short Answer* What is the name for the currents produced in a conducting sheet of metal when it is pulled through a magnetic field?

ANSWER: EDDY CURRENTS

BONUS

3) Physics – *Short Answer* The magnitude of the electromotive force induced in a solenoid is equal to the rate of change in what property?

ANSWER: MAGNETIC FLUX

TOSS-UP

4) Math – *Short Answer* Consider the geometric sequence with third term 12 and first term $\frac{4}{3}$. What is the fifth term?

ANSWER: 108

BONUS

4) Math – *Short Answer* Consider a typical, well-shuffled deck of cards. You are given 3 random cards. What is the probability they are all spades, as a fraction reduced to simplest terms?

ANSWER: $\frac{11}{850}$

TOSS-UP

5) ESS– *Short Answer* Upon heating to 1500 C, what mineral does silica form?

ANSWER: CRISTOBALITE

BONUS

5) ESS– *Short Answer* What silver-gray transition metal is often used as a substitute for diamond in jewelry? It forms an orthosilicate mineral and its 89 isotope is used in positron emission tomography cameras.

ANSWER: ZIRCONIUM

TOSS-UP

6) Energy – *Short Answer* Biodiesel is considered cleaner than fossil fuels because it does not emit as much carbon and sulfur-based pollutants like CO2 and SO2. However, biodiesel does emit more of what pollutant that is capable of destroying ozone?

ANSWER: Nitrous Oxide

BONUS

6) Energy – *Short Answer* The state of California has devised a new way to burn biodiesel that will cause less Nitrous Oxide emissions. What is the name of this new method of burning biodiesel

ANSWER: Low Temperature Combustion (LTC)

TOSS-UP

7) Biology – *Short Answer* What is the name for the enlargement of an artery due to the weakening of surrounding arterial walls? This enlargement can cause hemorrhaging if it bursts.

ANSWER: Aneurysm

BONUS

7) Biology – *Short Answer* A hemorrhagic stroke occurs when there is bleeding into the brain as a result of a blood vessel rupturing. Provide the name for the other type of stroke, in which blood supply to the brain is reduced due to the blocking of a blood vessel.

ANSWER: Ischemic stroke

TOSS-UP

8) Chemistry – *Short Answer* *Vesuvian Fire* is the common name for this red inorganic compound that is the combination of two polyatomic ions and is often found in demonstrations of "volcanoes". This compound is used in pyrotechnics and was used in photography. Name this compound.

ANSWER: AMMONIUM DICHROMATE

BONUS

8) Chemistry – *Short Answer* When dichromate is reacted with sulfuric acid, a chromium-oxygen compound is formed. This compound is a carcinogenic substance often used for the oxidation of alcohols. Give the formula for this compound.

ANSWER: CrO_3

TOSS-UP

9) Physics – *Short Answer* Find the torque of a 5N force applied at a 90 degree angle 3 meters from the pivot point.

ANSWER: 15

BONUS

9) Physics – *Short Answer* What is the moment of inertia of a rod of mass M and length L about a perpendicular axis a distance of L/4 from its end towards its center.? Assume the axis is perpendicular to the rod's axis of symmetry.

ANSWER: $\frac{7}{48}ML^2$

TOSS-UP

10) Math – *Multiple Choice* Which of the following terms refers to a function where each element of one set is paired with exactly one element of the other set, and each element of the other set is paired with exactly one element of the first set?

W) Injective
X) Surjective
Y) Bijective
Z) Onto

ANSWER: Y) BIJECTIVE

BONUS

10) Math – *Short Answer* List all of the following functions that are bijective: 1) $f(x) = x^3 + 2x$; 2) $f(x) = x^3 - 2x$; 3) $f(x) = \sqrt{x}$

ANSWER: 1

TOSS-UP

11) ESS– *Short Answer* What class of silicates is a repeating chain based on the metasilicate ion and includes gemstones such as jade?

ANSWER: PYROXENES

BONUS

11) ESS– *Short Answer* What class of minerals, including tremolite, are made of chains of silicate units linked together in ladderlike structures? These are fibrous minerals that can withstand extreme heat.

ANSWER: ASBESTOS

TOSS-UP

12) Energy – *Multiple Choice* Which of the following best describes what an anti-knock is?

W) A substance added to gasoline that prevents pre ignition
X) A substance that lowers the temperature required to combust gasoline
Y) A substance that allows the for the homogenization of gasoline and ethanol
Z) A substance that mixes with gasoline, allowing it to be frozen

ANSWER: W) A substance added to gasoline that prevents pre ignition

BONUS

12) Energy – *Short Answer* What compound, which was banned in the United States in 1996, was traditionally added to gasoline as an anti-knocking agent?

ANSWER: Tetraethyl Lead (ACCEPT: TEL)

TOSS-UP

13) Biology – *Short Answer* What word is used to describe stem cells that have the ability to divide into any of the cells needed to enable the growth and development of an organism?

ANSWER: Totipotent

BONUS

13) Biology – *Short Answer* What are the only totipotent cells in the human body?

ANSWER: Zygote

TOSS-UP

14) Chemistry – *Short Answer* Below 2K, liquid He-4 flows without viscosity. What is the name of this phenomenon?

ANSWER: SUPERFLUIDITY

BONUS

14) Chemistry – *Short Answer* Cooling a mass of bosons to extremely low temperatures until a large fraction of bosons reach the lowest quantum state causes a substance to enter this state of matter. Name this state of matter first produced in a mass of Rb atoms in 1995.

ANSWER: BOSE EINSTEIN CONDENSATE

TOSS-UP

15) Physics – *Short Answer* Find the coordinates of the center of mass of a system with a particle of mass 5kg at (1,0), mass 3kg at (-1,0), mass 2kg at (0,1) and mass 2kg at (0,-1).

ANSWER: (0.25,0)

BONUS

15) Physics – *Short Answer* Find the rotational kinetic energy of a rod with uniform mass density with mass 12 kg and radius 2 m spinning with an angular velocity of 5 Hz.

ANSWER: 50

TOSS-UP

16) Math – *Short Answer* What is the definite integral of sin x with respect to x from 0 to pi?

ANSWER: 2

BONUS

16) Math – *Short Answer* What is the integral of $x^7 + 3x^2$ from 0 to 2 with respect to x?

ANSWER: 40

TOSS-UP

17) ESS– *Short Answer* Mica and talc differ in their chemical composition because of the presence of the +3 ion of what common group 3A element.

ANSWER: Aluminum

BONUS

17) ESS– *Short Answer* KAlSi3O8 is the typical formula for what group of aluminosilicate minerals that is a major component of granite?

ANSWER: FELDSPARS

TOSS-UP

18) Energy – *Multiple Choice* Which of the following countries has led the world in carbon neutrality and was able to run 100% on renewable energy sources for almost a year?

W) Denmark

X) Siberia
Y) Ethiopia
Z) Costa Rica

ANSWER: Z) Costa Rica

BONUS

18) Energy – *Short Answer* Carbon neutrality is when the carbon emitted is equal to the carbon removed from the atmosphere, thus cancelling out the negative effects. What is the name of the process in which atmospheric Carbon is captured and stored to better achieve carbon neutrality?

ANSWER: Carbon sequestration

TOSS-UP

19) Biology – *Short Answer* What is the most abundant antibody in the human body?

ANSWER: Immunoglobulin G (IgG)

BONUS

19) Biology – *Short Answer* Provide the names for the 5 primary classes of immunoglobulins in the human body.

ANSWER: Immunoglobulin A (IgA), Immunoglobulin D (IgD), Immunoglobulin E (IgE), Immunoglobulin G (IgG), Immunoglobulin M (IgM)

TOSS-UP

20) Chemistry – *Short Answer* What is the geometric shape of dimethylmercury(0)?

ANSWER: LINEAR

BONUS

20) Chemistry – *Short Answer* What are the two possible geometric shapes of coordination complexes with 4 monodentate ligands bound to a metal center?

ANSWER: TETRAHEDRAL AND SQUARE PLANAR

TOSS-UP

21) Physics – *Multiple Choice* Which of the following is the best explanation of rolling friction? Assume we are discussing rolling without slipping.

W) The object rubs against the atoms of the surface it rolls upon.
X) The point on the bottom of a rolling object is instantaneously at rest.
Y) Heat is generated from rolling against a surface.
Z) Rolling friction is not experienced in objects that roll without slipping.

ANSWER: X

BONUS

21) Physics – *Multiple Choice* When the following objects are released from rest at the top of a ramp, which of the following will reach the bottom of the ramp first? Assume they all have the same mass.

W) Circular Hoop
X) Solid Sphere
Y) Solid Rod
Z) Solid Cylinder

ANSWER: Y) SOLID ROD

TOSS-UP

22) Math – *Short Answer* What 3dimensional geometric polyhedron has four corners and six edges?

ANSWER: TETRAHEDRON

BONUS

22) Math – *Short Answer* What is the height of a regular tetrahedron with sides of length 9. Give your answer in simplest radical form.

ANSWER: $3\sqrt{6}$

TOSS-UP

23) ESS– *Short Answer* The weathering of feldspar with CO2 and H2O produced what water soluble carbonate?

ANSWER: POTASSIUM CARBONATE

BONUS

23) ESS–*Multiple Choice* Which of the following is a mineral in the mica family of phyllosilicates? It is known as magnesium mica.

W) Lizardite
X) Phlogopite
Y) Talc
Z) Chlorite

ANSWER: X