Round 1

TOSSUP

1) PHYSICS *Short Answer* What law states that the current in a conductor is directly proportional to voltage and inversely proportional to resistance?

ANSWER: OHM'S LAW

BONUS

1) PHYSICS *Multiple Choice* A bicycle wheel spins on its axis at a constant rate but has not yet made a complete rotation. Which of the following statements is correct?

W) The angular displacement is zero.
X) The moment of inertia is zero.
Y) The angular acceleration is zero.
Z) The angular velocity is zero.

ANSWER: Y) THE ANGULAR ACCELERATION IS ZERO.

TOSSUP

2) BIOLOGY *Multiple Choice* What membrane protein facilitates the diffusion of water across the cell membrane?

W) aquaporin
X) rhodopsin
Y) nuclear pore complex
Z) ion pump

ANSWER: W) AQUAPORIN

BONUS

2) BIOLOGY *Short Answer* Order the following four structures from beginning to end in which air passes through during inhalation.

1) Nasal Cavities
2) Bronchioles
3) Trachea
4) Alveoli

ANSWER: 1, 3, 2, 4

TOSSUP

3) ENERGY *Multiple Choice* Livermore National Lab has helped to discover many very heavy, transuranic elements. Which of the following elements is NOT transuranic?

W) Protactinium
X) Americium
Y) Meitnerium
Z) Flerovium

ANSWER: W) PROTACTINIUM

BONUS

3) ENERGY *Short answer* Oak Ridge National Lab has used neutron scattering to image SARS-CoV-2 virus and how it reproduces. What is the color charge of a neutron?

ANSWER: 0

TOSSUP

4) CHEMISTRY *Short Answer* What chemical is commonly used as nail polish remover and is the simplest ketone?

ANSWER: ACETONE

BONUS

4) CHEMISTRY *Short Answer* What two monosaccharides together form lactose?

ANSWER: GLUCOSE AND GALACTOSE

TOSSUP

5) EARTH AND SPACE *Short Answer* What outer layer of the sun is usually only visible during a solar eclipse?

ANSWER: CORONA

BONUS

5) EARTH AND SPACE *Short Answer* By name of number, identify all of the following three factors that do NOT contribute to acid precipitation?

1) Fossil fuel combustion
2) Sulfur dioxide emissions

3) Nitrogen oxide emissions

ANSWER: NONE

TOSSUP

6) MATH *Short Answer* What is the sum of the first 6 positive integers?

ANSWER: 21

BONUS

6) MATH *Short Answer* What is the natural logarithm of -1? Give an exact answer in terms of i.

ANSWER: PI*I (PI TIMES I)

TOSSUP

7) BIOLOGY *Multiple Choice* How do cyanobacteria differ from green unicellular algae?

W) cyanobacteria reduce sulfur compounds.
X) cyanobacteria have no nuclei
Y) green algae contain lipids.
Z) green algae produce cell membranes

ANSWER: X) CYANOBACTERIA HAVE NO NUCLEI

BONUS

7) BIOLOGY *Short Answer* Give the phenotypic ratio that is most commonly associated with the Mendelian dihybrid cross, assuming independent assortment.

ANSWER: 9:3:3:1

TOSSUP

8) PHYSICS *Short Answer* What is the only series in the hydrogen emission spectrum with visible wavelengths called?

ANSWER: BALMER SERIES

BONUS

8) PHYSICS *Short Answer* A disk is rotating thirty (30) revolution per minute, what is its angular velocity in radians per second?

ANSWER: ONE PI (RAD/S)

TOSSUP

9) CHEMISTRY *Multiple Choice* For each mole of glucose oxidized by cellular respiration, how many moles of carbon dioxide are released in the citric acid cycle?

W) 2
X) 4
Y) 6
Z) 32

ANSWER: X) 4

BONUS

9) CHEMISTRY *Multiple Choice* An unknown solution having a pH of 3.5 was titrated with 0.1 M NaOH. Analysis of the resulting titration curve showed a single equivalence point at pH 7. Therefore, which of the following could be the unknown solute in the initial solution?

W) HF
X) NH3
Y) LiOH
Z) HCl

ANSWER: Z) HCL

TOSSUP

10) EARTH AND SPACE *Multiple Choice* What is the most abundant element in the universe?

W) Oxygen
X) Aluminum
Y) Helium
Z) Hydrogen

ANSWER: Z) HYDROGEN

BONUS

10) EARTH AND SPACE *Short answer* In what part of the water cycle is water vapor converted into liquid water?

ANSWER: CONDENSATION

TOSSUP

11) MATH *Short Answer* What are the roots of the polynomial x^2-6x+9?

ANSWER: 3

BONUS

11) MATH *Short answer* If 1/x +1/x^2=1+1/x^3, what is the smallest possible real value of x?

ANSWER: -1

TOSSUP

12) CHEMISTRY *Short Answer* This type of bond is usually formed when two atoms which are bonding have an electronegativity difference that is below 0.5.

ANSWER: NON-POLAR COVALENT BOND

BONUS

12) CHEMISTRY *Short Answer* Rounded to the nearest tenth, what is the bond angle in methane in degrees?

ANSWER: 109.5 DEGREES

TOSSUP

13) ENERGY *Multiple Choice* Researchers at Brookhaven National Lab are studying how greenhouse gases are exchanged in the carbon cycle and terrestrial ecosystems. Which of the following is NOT a greenhouse gas?

W) Methane
X) Water Vapor
Y) Sulfur Dioxide
Z) Carbon Dioxide

ANSWER: Y) SULFUR DIOXIDE

BONUS

13) ENERGY *Short Answer* Researchers at the Max Planck Institute for Plasma Physics have recently created the Wendelstein 7-X. What energy source was the Wendelstein 7-X designed to harness?

ANSWER: FUSION

TOSSUP

14) PHYSICS *Short Answer* What is the amplitude of a wave, in meters, if the wave is represented by the equation y = 5sin(2pi(2x - 3)), where x and y are in meters

ANSWER: 5

BONUS

14) PHYSICS *Short Answer* A car is driving on a straight highway at 30 m/s. The driver hits the brakes until the car stops with a constant acceleration of -7 m/s^2. To the nearest meter, how far does the car travel after hitting the brakes?

ANSWER: 129

TOSSUP

15) EARTH AND SPACE *Short Answer* Which of the following volcanoes are composed of mafic igneous rocks?

1) Composite
2) Shield
3) Cone

ANSWER: 1,2,3 (ALL)

BONUS

15) EARTH AND SPACE *Multiple Choice* If our sun one day collapses into a black hole, what would happen to earth's orbit?

W) Start moving toward the black hole in a straight line
X) Start moving toward black hole in a spiral path
Y) Maintain the same orbit as now
Z) Be expelled from the solar system

ANSWER: Y) MAINTAIN THE SAME ORBIT AS NOW

TOSSUP

16) CHEMISTRY *Multiple Choice* Which of the following is an alkaline earth metal?

W) Vanadium
X) Actinium
Y) Strontium
Z) Antimony

ANSWER: Y) STRONTIUM

BONUS

16) CHEMISTRY *Short Answer* A molecule has 50 single bonds, 15 double bonds, and 13 triple bonds. How many sigma and pi bonds does it have, respectively?

ANSWER: 78 SIGMA BONDS AND 41 PI BONDS

TOSSUP

17) BIOLOGY *Short Answer* What is the name given to the mechanism by which information encoded in DNA is made into a complementary RNA copy?

ANSWER: TRANSCRIPTION

BONUS

17) BIOLOGY *Short Answer* What are the non-protein-coding sequences in the pre-mRNA called?

ANSWER: INTRONS

TOSSUP

18) ENERGY *Multiple Choice* Researchers at Berkeley National Lab are studying how the Higgs boson may decay into two muons. Muons fall into which of the following categories on the standard model?

W) Quarks
X) Leptons
Y) Bosons
Z) Mesons

ANSWER: X) LEPTONS

BONUS

18) ENERGY *Short answer* Researchers at Berkeley National Lab are using a combination of optical microscopy and synchrotron infrared beams to study symbiosis in aquatic ecosystems. What organism lives symbiotically with coral polyps and provides them with energy as well as giving them their color?

ANSWER: (PHOTOSYNTHETIC) ALGAE

TOSSUP

19) MATH *Short Answer* You have 4 cm of rope and you want to make a rectangle. What is the length and width of this rectangle when its area is maximized?

ANSWER: 1 CM X 1 CM

BONUS

19) MATH *Short Answer* What is the units digit of 3^2020

ANSWER: 1

TOSSUP

20) BIOLOGY *Multiple Choice* In fungi, cell walls are reinforced by which polymer?

W) chitin
X) silica
Y) lignin
Z) collagen fibers

ANSWER: W) CHITIN

BONUS

20) BIOLOGY *Multiple Choice* In what part of the cell does glycolysis take place?

W) Golgi apparatus
X) Endoplasmic Reticulum
Y) Mitochondria
Z) Cytosol

ANSWER: Z) CYTOSOL

TOSSUP

21) PHYSICS *Short Answer* What term describes an angle of incidence beyond which total internal reflection occurs?

ANSWER: CRITICAL ANGLE

BONUS

21) PHYSICS *Short Answer* What is the critical angle for light traveling from a substance with a refractive index of 2 a substance with a refractive index of 1?

ANSWER: 30°

TOSSUP

22) EARTH AND SPACE *Short Answer* Astronomers often use an object's apparent magnitude to characterize its brightness when observed from earth. What term is defined as an object's apparent magnitude when viewed from a distance of 10 parsecs?

ANSWER: ABSOLUTE MAGNITUDE

BONUS

22) EARTH AND SPACE *Short Answer* What is the name of the large, basaltic plains on the moon, the largest of which is the Oceanus Procellarum?

ANSWER: LUNAR MARIA (OR LUNAR MARE)

TOSSUP

23) MATH *Short Answer* What is the difference between the largest prime number under 40 and the smallest prime number under 40?

ANSWER: 35

BONUS

23) MATH *Short Answer* Calculate the area of a triangle with adjacent side lengths 8,9, and an angle of 30 degrees between them.

ANSWER: 36