

ROUND 1A

TOSS-UP

1) BIOLOGY *Short Answer* Which class of organic biomolecules is the major component of animal bodies?

ANSWER: PROTEIN

BONUS

1) BIOLOGY *Multiple Choice* In a biology lab, you are asked to pollinate a plant. In order to perform this task, you must move pollen grains from where they are produced to the part of the flower that receives these grains. What two structures must you utilize in this process?

- W) Filament and style
- X) Anther and style
- Y) Filament and stigma
- Z) Anther and stigma

ANSWER Z) ANTHER AND STIGMA

TOSS-UP

2) CHEMISTRY *Multiple Choice* A molecular solid contains what type of bonding?

- W) Metallic
- X) Electrovalent
- Y) Covalent
- Z) Localized

ANSWER: Y) COVALENT

BONUS

2) CHEMISTRY *Short Answer* Identify all of the following four factors that affect the degree of crystallinity in polymers: 1) structure; 2) stereochemistry [*ster-ee-oh-KEM-uh-stree*]; 3) molecular weight; 4) processing conditions.

ANSWER: STRUCTURE, STEREOCHEMISTRY, MOLECULAR WEIGHT, AND PROCESSING CONDITIONS (ACCEPT: 1, 2, 3, AND 4; ALL)

TOSS-UP

3) MATH *Short Answer* If the radius of a right circular cylinder is tripled, by what factor must the height be multiplied in order to keep the volume the same?

ANSWER: 1/9

BONUS

3) MATH *Multiple Choice* If $f(x) = 7x + 19$ [***f of x equals seven x plus nineteen***], for what values of x is $f(x)$ [***f of x***] greater than 33?

- W) x is greater than 2
- X) x is less than 2
- Y) x is between 2 and -2
- Z) All real numbers

ANSWER: W) X IS GREATER THAN 2

TOSS-UP

4) PHYSICS *Short Answer* In the excitation of an atom by light, what specific particle is responsible for the absorption of the photon?

ANSWER: ELECTRON

BONUS

4) PHYSICS *Short Answer* What is the power, in watts, dissipated by a circuit that supplies a potential difference of 1.5 volts and has a current of 0.1 amperes?

ANSWER: 0.15

TOSS-UP

5) EARTH AND SPACE *Multiple Choice* The only continent without conditions favorable for the formation of tornadoes is

- W) South America
- X) Australia
- Y) Asia
- Z) Antarctica

ANSWER: Z) ANTARCTICA

BONUS

5) EARTH AND SPACE *Short Answer* Coral polyps extract what compound out of seawater to form hard external skeletons?

ANSWER: CALCIUM CARBONATE (ACCEPT: LIMESTONE)

TOSS-UP

6) CHEMISTRY *Short Answer* Within the visible spectrum of light, photons with the longest wavelength are associated with what color?

ANSWER: RED

BONUS

6) CHEMISTRY *Short Answer* Identify, by number, the following processes that would result in an increase of potential energy of a system: 1) Energy transfer as work done by a system; 2) Energy transfer as work done on a system; 3) Thermal energy transfer to a system; 4) Thermal energy transfer from a system

ANSWER: 2, 3

TOSS-UP

7) BIOLOGY *Short Answer* What form of transport across membranes is mediated by channel proteins and requires no input of energy?

ANSWER: FACILITATED DIFFUSION (ACCEPT: FACILITATED TRANSPORT or FACILITATED PASSIVE TRANSPORT ; DO NOT ACCEPT: SIMPLE DIFFUSION)

BONUS

7) BIOLOGY *Multiple Choice*. In which of the following female cervids [**SUR-vids**] would you find antlers?

- W) Reindeer
- X) Okapi [**oh-KAH-pee**]
- Y) Mule deer
- Z) Moose

ANSWER: W) REINDEER

TOSS-UP

8) ENERGY *Multiple Choice* Which of the following methods of electricity production typically uses no water?

- W) Solar thermal
- X) Tidal
- Y) Geothermal
- Z) Photovoltaic

ANSWER: Z) PHOTOVOLTAIC

BONUS

8) ENERGY *Short Answer* If 100 joules of energy are added to a 5 kilogram substance and its temperature increases by 4 degrees Celsius, what is its specific heat capacity in joules per kilogram degrees Celsius?

ANSWER: 5

TOSS-UP

9) EARTH AND SPACE *Multiple Choice* Which of the following is the most important feature characterizing the stratosphere?

- W) Clouds
- X) Ozone
- Y) Ions
- Z) Dust

ANSWER: X) OZONE

BONUS

9) EARTH AND SPACE *Short Answer* The deepest known point of the oceans is found in what ocean?

ANSWER: PACIFIC OCEAN

TOSS-UP

10) MATH *Multiple Choice* If a number eight times as large as x is increased by two, then one fourth of the result equals

- W) $2x + 1/2$ [**2x plus half**]
- X) $x + 1/2$ [**x plus half**]
- Y) $2x + 2$ [**2x plus 2**]
- Z) $2x + 4$ [**2x plus 4**]

ANSWER: W) $2x + 1/2$

BONUS

10) MATH *Short Answer* Subtracting a certain positive number from its square gives 110. Find the number.

ANSWER: 11

TOSS-UP

11) BIOLOGY *Multiple Choice* In which of the following habitats would you expect to find the highest productivity AND lowest diversity of species?

- W) Salt marsh
- X) Desert
- Y) Deciduous forest [*di-SIJ-oo-uhs*]
- Z) Grassland

ANSWER: W) SALT MARSH

BONUS

11) BIOLOGY *Multiple Choice* All of the following pairs of structures are homologous [*huh-MOL-uh-guhs*], EXCEPT:

- W) The wing of a bat and the wing of a bird
- X) The leg of a human and the leg of a centipede
- Y) The scales on a bird's legs and the scales on a lizard
- Z) The shell of a clam and the shell of a snail

ANSWER: X) THE LEG OF A HUMAN AND THE LEG OF A CENTIPEDE

TOSS-UP

12) CHEMISTRY *Multiple Choice* Which of the following acids is diprotic?

- W) Oxalic acid
- X) Phosphoric acid
- Y) Nitric acid
- Z) Hydrochloric acid

ANSWER: W) OXALIC ACID

BONUS

12) CHEMISTRY *Short Answer* To the nearest power of ten and in meters, what is the diameter of the hydrogen atom?

ANSWER: 10^{-10}

TOSS-UP

13) PHYSICS *Multiple Choice* What elementary particle is the carrier of the electromagnetic force?

- W) Electron
- X) Gluon
- Y) Photon
- Z) Neutrino

ANSWER: Y) PHOTON

BONUS

13) PHYSICS *Short Answer* What particle, recently confirmed to exist at the Large Hadron Collider, is postulated by electroweak theory to explain the origin of mass?

ANSWER: HIGGS BOSON

TOSS-UP

14) EARTH AND SPACE *Multiple Choice* What is the primary reason that volcanic rocks are porous?

- W) Erosion
- X) Marine organisms
- Y) Rapid cooling
- Z) Gases trapped inside lava

ANSWER: Z) GASES TRAPPED INSIDE LAVA

BONUS

14) EARTH AND SPACE *Short Answer* Over 200 million years ago, the continents as we know them existed as one landmass called Pangaea [*pan-JEE-uh*]. About 200 million years ago, this landmass divided into two landmasses. What are the names of these two landmasses?

ANSWER: LAURASIA AND GONDWANA (ACCEPT: GONDWANA LAND)

TOSS-UP

15) BIOLOGY *Short Answer* What specialized plant cells are responsible for the opening and closing of stomatal airways in response to water stress?

ANSWER: GUARD CELLS

BONUS

15) BIOLOGY *Multiple Choice* Certain plants cannot convert nitrate to ammonia because they lack the enzyme nitrate reductase. What would you expect for the pH of the environments where these plants are found?

- W) Basic
- X) Acidic
- Y) Neutral
- Z) Highly basic

ANSWER: X) ACIDIC

TOSS-UP

16) MATH *Short Answer* If the radius of a sphere is doubled, by what percent does the volume increase?

ANSWER: 700 % (DO NOT ACCEPT: 800%)

BONUS

16) MATH *Multiple Choice* Four students and two moderators sit at a circular table. How many distinct arrangements are there of these 6 people if the two moderators must sit opposite each other?

- W) 4
- X) 6
- Y) 24
- Z) 48

ANSWER: Y) 24

TOSS-UP

17) ENERGY *Short Answer* What unit of energy is defined as the amount of heat needed to raise the temperature of one pound of water by one degree Fahrenheit?

ANSWER: BRITISH THERMAL UNIT (ACCEPT: BTU)

BONUS

17) ENERGY *Multiple Choice* How would you classify a bacterium that derives its energy from inorganic sources such as hydrogen sulphide?

W) Chemoheterotroph [*kee-moh-HET-er-uh-trof*]

X) Chemoautotroph [*kee-moh-AW-tuh-trof*]

Y) Photoautotroph [*foh-toh-AW-tuh-trof*]

Z) Photoheterotroph [*foh-toh-het-ER-uh-trof*]

ANSWER: X) CHEMOAUTOTROPH

TOSS-UP

18) CHEMISTRY *Short Answer* Carbon dioxide, iron(III) [*read as iron three*] ions, and the hydrogen sulfate ion are all acids in what named theory of acids and bases, which states that bases donate electron pairs, and acids accept them?

ANSWER: LEWIS THEORY (ACCEPT: LEWIS ACIDS AND BASES)

BONUS

18) CHEMISTRY *Multiple Choice* Which of the following matches the molecular formula of a cyclic alkane [*AL-kayn*]?

W) C₅H₁₂ [*C five H twelve*]

X) C₅H₁₀ [*C five H ten*]

Y) C₅H₈ [*C five H eight*]

Z) C₅H₅ [*C five H five*]

ANSWER: X) C₅H₁₀

TOSS-UP

19) BIOLOGY *Short Answer* Which neurotransmitter is most commonly responsible for action potentials at the animal neuromuscular **[noo-roh-MUHS-kyuh-ler]** junction?

ANSWER: ACETYLCHOLINE

BONUS

19) BIOLOGY *Multiple Choice* Assume that genes A and B are not linked. If an organism is heterozygous **[het-er-uh-ZY-guhs]** for both genes, what is the probability that the organism will produce a gamete **[GAM-eet]** with both the dominant A and B alleles **[uh-LEELS]**?

W) $\frac{1}{4}$

X) $\frac{1}{2}$

Y) 1

Z) 0

ANSWER: W) $\frac{1}{4}$

TOSS-UP

20) PHYSICS *Short Answer* Interference patterns in light-based experiments arise due to what reaction of waves to the confinement of their pathways?

ANSWER: DIFFRACTION

BONUS

20) PHYSICS *Short Answer* Two particles have initial velocities of 10 meters per second and -10 meters per second, respectively. If both particles undergo a constant acceleration of 2 meters per second squared for 2 seconds, what will be the difference in their velocities, in meters per second?

ANSWER: 20

TOSS-UP

21) ENERGY *Multiple Choice* What hazardous material enables compact fluorescent light bulbs to be more efficient while also requiring special disposal methods?

- W) Tungsten
- X) Lead
- Y) Hafnium [**HAF-nee-uhm**]
- Z) Mercury

ANSWER: Z) MERCURY

BONUS

21) ENERGY *Short Answer* What device in a modern car allows the turning engine to recharge the car's battery while driving?

ANSWER: ALTERNATOR (DO NOT ACCEPT: GENERATOR)

TOSS-UP

22) MATH *Short Answer* Determine all of the prime factors of 111.

ANSWER: 3 AND 37

BONUS

22) MATH *Multiple Choice* How many faces does a cuboctahedron [**kyoo-bok-tuh-HEE-druhn**] have?

- W) 8
- X) 14
- Y) 24
- Z) 48

ANSWER: X) 14

TOSS-UP

23) CHEMISTRY *Short Answer* What is the name in organic chemistry that is given to hydrocarbons with general formula C_nH_{2n-2} [**C- n -H -two -n -minus- two**] that possess a triple bond, the simplest of which is acetylene [**uh-SET-l-eeen**]?

ANSWER: ALKYNES

BONUS

23) CHEMISTRY *Multiple Choice* Which of the following nucleotides [**NOO-klee-uh-tyds**] is not derived from pyrimidine [**py-RIM-i-deen**]?

- W) Uracil [**YOOR-uh-sil**]
- X) Thymine [**THY-meen**]
- Y) Guanine [**GWAH-neen**]
- Z) Cytosine [**SY-tuh-seen**]

ANSWER: Y) GUANINE