Replacements:

TOSS-UP

1) Physics – *Short Answer* [1] A block with mass 10 kilograms is sliding down a ramp with an incline of 60 degrees to the horizontal. In newtons, what is the normal force acting on the block as it slides down the ramp?

ANSWER: 49

BONUS

1) Physics – *Multiple Choice* [1] Which of the following quarks is negatively charged?

W) Up
X) Top
Y) Strange
Z) Charm

ANSWER: Y) STRANGE

TOSS-UP

1) Physics – *Short Answer* A satellite is orbiting a planet with an orbit speed of 10 kilometers per second, at a distance of 100 kilometers from the planet's center. If the planet's mass were suddenly doubled, and the satellite orbited at the same distance from the center, then to the nearest integer and in kilometers per second, what is the new orbiting velocity of the satellite?

ANSWER: 14

BONUS

1) Physics – *Multiple Choice* Which of the following leptons has the greatest mass?

W) Electron
X) Electron neutrino
Y) Muon
Z) Muon neutrino

ANSWER: Y) MUON

TOSS-UP

2) Biology – *Short Answer* [1] What common disease that causes fevers is carried by plasmodium, a genus of algae transmitted by mosquitoes?

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ANSWER: MALARIA

BONUS

2) Biology – *Short Answer* [1] Identify all of the following 3 compounds that are considered electron carriers in the Krebs cycle: 1) NAD+; 2) O_2; 3) FAD

ANSWER: 1 AND 3

TOSS-UP

2) Biology -- *Short Answer* What is the name given to the bonds that form which form between phosphate groups and hydroxyl groups that connect different nucleotides in a DNA strand?

ANSWER: PHOSPHODIESTER BONDS

BONUS

2) Biology – *Short Answer* [1] Identify all of the following 3 chromosomes that are inactivated in the formation of a Barr body: 1) 21; 2) X; 3) Y.

ANSWER: 2 ONLY [DJ]

TOSS-UP

3) Earth and Space – *Short Answer* [1] Which two global-scale atmospheric circulation cells bound the subpolar jet stream?

ANSWER: FERREL AND POLAR (any order)

BONUS

3) Earth and Space – *Short Answer* [1] Identify all of the following three rocks that formed through slow cooling: 1) Basalt; 2) Gabbro; 3) Rhyolite

ANSWER: 2 ONLY

TOSS-UP

4) Math – *Multiple Choice* [3] Which of the following geometric sequences has a common ratio greater than 3?

W) 1, 3, 9
X) 2, 8, 32
Y) 3, 9, 27

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Z) 4, 10, 25

ANSWER: X) 2, 8, 32

BONUS

4) Math – *Multiple Choice* [4] Over the years, there has been no correlation between the monthly precipitation in Seattle and the average SAT score in Detroit. Therefore, these two variables are best described as which of the following?

W) Deterministic
X) Confounded
Y) Dependent
Z) Independent

ANSWER: Z) INDEPENDENT

TOSS-UP

5) Chemistry – *Short Answer* [1] Identify all of the following 3 elements, that when used to dope a semiconductor, produces a p-type semiconductor: 1) Nitrogen; 2) Phosphorus; 3) Germanium.

ANSWER: NONE

TOSS-UP

5) Chemistry -- *Multiple Choice* Which of the following gases does not obey the octet rule?

W) HF
X) Ne
Y) NO_2
Z) CH_4

ANSWER: Y) NO_2

BONUS

5) Chemistry – *Multiple Choice* [7] A photon is emitted from an electron falling from one energy level to another. Which of the following pairs of energy levels would emit a photon with the highest frequency?

W) n = 5 to n = 3
X) n = 5 to n = 2
Y) n = 4 to n = 2
Z) n = 4 to n = 1

ANSWER: Z) N = 4 TO N = 1

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TOSS-UP

6) Energy – Short Answer [1] Researchers at UW Madison are studying metal organic frameworks in an attempt to study new methods of energy storage. Which of the following diatomic gases would a metal organic framework most likely aid in storing?

W) Hydrogen
X) Nitrogen
Y) Oxygen
Z) Fluorine

ANSWER: W) HYDROGEN [DJ]

BONUS

6) Energy – Short Answer [1] Researchers at the UW Madison are studying the negative symptoms of bad insulin management in diabetes patients. What deadly symptom presents itself in patients who have an excess of ketone bodies in their bloodstream.

ANSWER: KETOACIDOSIS [DJ]

TOSS-UP

6) Energy – *Short Answer* [1] Researchers at UW Madison are using laboratory methods to image the intermediates of the glyoxylate cycle. What spectroscopic technique uses a magnetic field to analyze the interactions of nuclear spins to image molecules?

ANSWER: NMR (ACCEPT: SPECIFIC TYPES OF NMR)

BONUS

6) Energy – *Short Answer* [1] Researchers at the enzyme institute at UW Madison are studying the evolution of enzymes during the early development of the earth. What enzyme is theorized to be one of the first enzymes to exist that is made from RNA?

ANSWER: RIBOZYMES

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Tiebreaks:

1. Physics -- *Short Answer* The electric flux of a spherical surface about a point charge is equivalent to F. If the radius of the spherical surface is tripled, what is the new electric flux about the surface in terms of F?

ANSWER: F

2. Biology -- *Short Answer* In what phase of meiosis does crossing over take place?
ANSWER: PROPHASE 1

3. Earth and Space -- *Multiple Choice* Which of the following is not a feature formed by glaciers?
W) U-shaped valley
X) Moraine
Y) Drumlins
Z) Atoll

ANSWER: Z) ATOLL

4. Chemistry -- *Short Answer* Rank the following three substances in order of increasing boiling point: 1) Water; 2) Diethyl ether; 3) Ethane

ANSWER: 3, 2, 1 (ACCEPT: ETHANE, DIETHYL ETHER, WATER)

5. Math -- *Short Answer* There are 30 vehicles in a garage, and each one is either a car with 4 wheels or a bike with 2 wheels. If there are 72 wheels in total, how many cars are there?
ANSWER: 6

6. Physics -- *Multiple Choice* A beam of light with intensity I passes through two polarizing filters at an angle of 60 degrees to each other. Which of the following is equivalent to the new intensity of the light?

W) I/16
X) I/8
Y) 3I/16
Z) I/4

ANSWER: X) I/8

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7. Biology -- *Short Answer* In comparison to the blood of vertebrates, what fluid in invertebrates occupies similar roles as blood?
ANSWER: HEMOLYMPH

8. Earth and Space -- *Short Answer* Rank the following three layers of the sun in order of increasing temperature: 1) Chromosphere; 2) Photosphere; 3) Corona

ANSWER: 2, 1, 3 (ACCEPT: PHOTOSPHERE, CHROMOSPHERE, CORONA)

9. Chemistry -- *Multiple Choice* How many lone pairs are there in the Lewis diagram of hydrogen peroxide?
W) 1
X) 2
Y) 3
Z) 4

ANSWER: Z) 4

10. Math -- *Short Answer* Yuchen rolls a 20-sided die. What is the probability that he rolls a multiple of 6?
ANSWER: 3/20

11. Physics -- *Short Answer* A transformer has a secondary winding of 50 turns. It is connected to a 90 volt battery, and 30 volts are passed through the secondary winding. How many turns does the primary winding have?
ANSWER: 150

12. Biology -- *Multiple Choice* Which of the following immunoglobulins is produced for the response against allergens?

W) IgA
X) IgB
Y) IgE
Z) IgG

ANSWER: Y) IgE

13. Earth and Space -- *Multiple Choice* Which of the following is not true about western boundary currents in Northern Hemisphere subtropical gyres?

W) They have greater volume transport than eastern boundary currents
X) They travel north
Y) The Gulf Stream is an example of a western boundary current
Z) They are generally cooler and shallower than eastern boundary currents

ANSWER: Z) THEY ARE GENERALLY COOLER AND SHALLOWER THAN EASTERN BOUNDARY CURRENTS

14. Chemistry -- *Short Answer*

15. Math -- *Short Answer* How many vertices does a pentagonal pyramid have?
ANSWER: 6

TOSS-UP

16) Earth and Space – *Short Answer* [finals] Pyroxenes are inosilicates that contain chains of silica tetrahedra. What is the charge of the silicate ion in pyroxenes?

ANSWER: 2-

BONUS

16) Earth and Space – *Short Answer* [okeh] What moon of Saturn has the highest albedo?

ANSWER: ENCELADUS

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