***LEGIT LIGHTNING ROUND 4***

**TOSS-UP**

1) CHEMISTRY *Short Answer* By name or number, identify all of the following four statements that are true about reducing agents in organic chemistry.

I. DIBAL-H will reduce esters to aldehydes at -78 degrees Celsius.

II. Lithium aluminum hydride will reduce esters to alcohols.

III. Lithium borohydride is a stronger reducing agent than lithium aluminum hydride.

IV. When DIBAL-H, lithium aluminum hyride, or lithium borohyride is used as a reducing agent, H+ workup must always be added in the second step to get the final product.

ANSWER: I, II AND IV

**TOSS-UP**

2) CHEMISTRY *Short Answer* By name or number, identify all of the following four statements that are true about Raoult’s law.

I. A solution of methanol and ethanol would be expected to create a nearly ideal solution.

II. A solution of hydrofluoric acid and water would be expected to have negative deviation from Raoult’s law.

III. A solution of hexane and water would be expected to have positive deviation from Raoult’s law.

IV. A solution with negative deviation from Raoult’s law is a minimum boiling azeotrope.

ANSWER: I, II AND III

**TOSS-UP**

1. 3) CHEMISTRY *Short Answer* By name or number, identify all of the following four statements that do NOT correctly pair the molecule with its electron pair geometry.

I. Bromine trifluoride – trigonal bipyramidal

II. Boron trifluoride – trigonal planar

III. Ammonia - tetrahedral

IV. Iodine heptafluoride – pentagonal bipyramidal

ANSWER: NONE OF THEM

**TOSS-UP**

4) CHEMISTRY *Short Answer*  In the equation for the freezing point depression, what does the “i” variable signify?

ANSWER: van’t Hoff factor

**TOSS-UP**

5) CHEMISTRY *Short Answer* Hexane and cyclohexane form an essentially ideal solution. The vapor pressure of hexane at 25 degrees Celsius is about 150 Torr, while that of cyclohexane at the same temperature is about 100 Torr. If 1 mole of hexane is mixed with 2 moles of cyclohexane, what would be the expected vapor pressure of the solution rounded off to the nearest whole number?

ANSWER: 117 TORR

**TOSS-UP**

6) BIOLOGY *Short Answer* By name or number, identify all of the following five statements that are true.

I. The hardness of a streak plate lies between orthoclase and apatite on Mohs scale.

II. Most minerals exhibit only one common crystal shape.

III. Feldspar has two cleavage directions that are not perpendicular to each other.

IV. The silicate structure of biotite contains sheets.

V. Calcium sulfate is loosely bonded to four water molecules in gypsum.

ANSWER: II AND IV

**TOSS-UP**

7) BIOLOGY *Short Answer* By name or number, identify all of the following four statements that are true about proton NMR.

I. In the spectrum, each proton is represented by a single peak.

II. In a quadruplet, the ratio of the four peaks is 1 to 3 to 3 to 1.

III. A proton affected by the magnetic fields of two other protons will most commonly have a triplet in the spectrum.

IV. The number of peaks in a spectrum for a compound will always correspond with the number of protons in a compound.

ANSWER: II AND III

**TOSS-UP**

8) BIOLOGY *Short Answer* What was the first metabolic pathway discovered?

ANSWER: GLYCOLYSIS

**TOSS-UP**

9) BIOLOGY *Multiple Choice* Of the following four statements, identify all that are true about the following equilibrium: 3H2 + N2 == 2NH3, for which the forward reaction is exothermic.

I. Increasing the temperature will lead to an increased concentration of NH3.

II. Increasing the pressure by adding an ideal gas will not change the equilibrium position.

III. Reducing the volume of the container in which this equilibrium takes place will increase the concentration of NH3.

IV. Increasing the concentration of H2 in the equilibrium will lead to an overall decrease in concentration of N2.

ANSWER: II, III and IV

**TOSS-UP**

1. 10) BIOLOGY *Short Answer*  Find the point of intersection of the following functions:

x + y = 5

x – y = -1

2x + y + z = 11

ANSWER: (2, 3, 4)

**TOSS-UP**

11) PHYSICS *Short Answer* What is the name of the only natural satellite known to have a dense atmosphere?

ANSWER: TITAN

**TOSS-UP**

12) PHYSICS *Short Answer* According to physicists from the European Organization of Nuclear Research, by March 2012, there should be sufficient data to prove or disprove the existence of what particle?

ANSWER: HIGGS BOSON

**TOSS-UP**

13) PHYSICS *Short Answer* What is the first term in the arithmetic sequence for which the 99th, 100th and 101st terms are 60, 54, 48?

ANSWER: 648

**TOSS-UP**

14) PHYSICS *Multiple Choice* Which of the following terms best describes a plant cell when it is hypertonic relative to the surrounding solution?

W) plasmolyzed

X) turgid

Y) flaccid

Z) lysed

ANSWER: X) TURGID

**TOSS-UP**

15) PHYSICS *Multiple Choice* The combustion of octane is…

W) thermodynamically favored and kinetically favored

X) thermodynamically not favored and kinetically favored

Y) thermodynamically favored and kinetically not favored

Z) thermodynamically not favored and kinetically not favored

ANSWER: Y) THERMODYNAMICALLY FAVORED AND KINETICALLY NOT FAVORED

**TOSS-UP**

16) CHEMISTRY *Multiple Choice*  Which of the following solvents would not be used to promote an Sn2 reaction?

W) THF

1. X) Et2O

Y) water

Z) BHT

ANSWER: Y) WATER

**TOSS-UP**

17) CHEMISTRY *Short Answer* What law describes the vapor pressure of a solution resulting from separate solutions?

ANSWER: RAOULT’S LAW

**TOSS-UP**

18) CHEMISTRY *Short Answer* If displacement x of a massless object on a spring that exhibits simple harmonic motion can be represented by x = x(not) sin ((omega)(t) + alpha), given that x(not) times omega = v(not), what equation can be used to represent the velocity of this object?

ANSWER: v = v(not) cos ((omega)(t) + alpha)

**TOSS-UP**

19) CHEMISTRY *Multiple Choice* 8 fair coins are tossed. What is the probability that there will be three consecutive coins with the same face?

W) 3/64

X) 1/256

Y) 1/128

Z) 3/128

ANSWER: W) 3/64

**TOSS-UP**

20) CHEMISTRY *Multiple Choice* Which of the following is the strongest ligand?

W) H2O

X) I-

Y) CN-

Z) NH3

ANSWER: Y) CN-

**TOSS-UP**

21) EARTH AND SPACE SCIENCE *Short Answer* What is the term given to homologous genes that are found in different species because of speciation?

ANSWER: ORTHOLOGOUS GENES

**TOSS-UP**

22) EARTH AND SPACE SCIENCE *Multiple Choice* What principle states that if an external pressure is applied to a confined fluid, the pressure at every point within the fluid increases by that amount?

W) Bernoulli’s Principle

X) Pascal’s Principle

Y) Archimedes’ Principle

Z) Torricelli’s Principle

ANSWER: X) PASCAL’S PRINCIPLE

**TOSS-UP**

23) EARTH AND SPACE SCIENCE *Short Answer* What are streams that carry water only in response to specific episodes of rainfall, such as those found in deserts, known as?

ANSWER: EPHERMERAL STREAMS

**TOSS-UP**

24) EARTH AND SPACE SCIENCE *Multiple Choice* According the stats by the US Energy Information Administration, electricity tends to flow in which direction in the United States?

W) north

X) south

Y) east

Z) west

ANSWER: X) SOUTH

**TOSS-UP**

25) EARTH AND SPACE SCIENCE *Short Answer* What is the term that can be applied to any situation in which groundwater rises in a well above the level where it was initially encountered?

ANSWER: ARTESIAN