***LEGIT LIGHTNING ROUND 3***

**TOSS-UP**

1) CHEMISTRY *Short Answer* Which two of the following four statements are true about imines?

I. Imines in which the nitrogen atom carries an electronegative group are usually stable.

II. The cyanoborohydride ion is used as a reducing agent for iminium ions because it is a stronger reducing agent than the borohydride ion.

III. Imines are sometimes referred to as Schiff bases.

IV. Reductive amination is one of the most inefficient ways of producing secondary amines from imines.

ANSWER: I and III

**TOSS-UP**

2) BIOLOGY *Short Answer* By name or number, identify all of the following statements that are true about B-vitamins.

I. Vitamin B12 contains cobalt.

II. There are 12 B-vitamins.

III. B vitamins can support and increase the rate of metabolism.

IV. Solutions of riboflavin, vitamin B2, are yellow in color.

ANSWER: I, III and IV

**TOSS-UP**

1. 3) PHYSICS *Short Answer* Of the following four statements, identify all that are true about electric components.

I. Capacitors are used to store energy in an electric field.

II. The equivalent resistance of two resistors in series with resistances of 3 ohms and 6 ohms is 2 ohms.

III. The resistance of an ideal voltmeter is zero.

IV. The equivalent capacitance of two capacitors in series with capacitances of 6 farads and 9 farads is 15 farads.

ANSWER: I ONLY

**TOSS-UP**

4) ENERGY *Short Answer*  What is the oxidizing agent and the reducing agent, respectively, in the alkaline battery?

ANSWER: MnO2 (manganese (IV) oxide); Zn (zinc)

**TOSS-UP**

5) MATH *Short Answer* Calculate the indefinite integral of ln (sin x) dx.

ANSWER: cot x + C

**TOSS-UP**

6) EARTH AND SPACE SCIENCE *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) PHYSICS *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) CHEMISTRY *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) MATH *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) EARTH AND SPACE SCIENCE *Short Answer* What is the name of the only natural satellite known to have a dense atmosphere?

ANSWER: TITAN

**TOSS-UP**

12) ENERGY *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) MATH *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) BIOLOGY *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) CHEMISTRY *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) EARTH AND SPACE SCIENCE *Multiple Choice*  Which of the following relative locations best describes where white dwarfs would be find on the Hertzspring-Russell Diagram?

W) upper left

1. X) lower left

Y) upper right

Z) lower right

ANSWER: X) LOWER LEFT

**TOSS-UP**

17) ENERGY *Short Answer* What law describes the change in the reaction enthalpy of a reaction with temperature?

ANSWER: KIRCHOFF’S LAW

**TOSS-UP**

18) PHYSICS *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) MATH *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) BIOLOGY *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) PHYSICS *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) ENERGY *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