1. Math multiple choice toss up: If three dice are rolled, what is the probability that the numbers shown will be one 2, one 4, and one 6?

W) 1/216

X)1/108

Y)1/54

Z)1/36

Answer: Z

2. Math short answer bonus: How many dice must be rolled so that there is a greater than 50% chance that there will be at least one 6?

Answer: 4

3. Physics short answer toss up: What is the name of the series of transitions in a hydrogen atom to the n=1 level?

Answer: Lyman Series

4. Physics short answer bonus: An object is thrown from the surface of the earth with a speed of 30 m/s at an angle of 45 degrees to the horizontal. 1. How long does it take for the object to hit the ground? 2. What is the speed of the ball when it hits the ground?

Answer: 1. 3sqrt2 seconds 2. 30 m/s

5. Earth and Space toss up multiple choice: Which of the following fossils was not found in the Rancho La Bre tar pits in Los Angeles?

W) saber-toothed cat

X) dire wolf

Y) wooly mammoth

Z) giant ground sloth

Answer: wooly mammoth

5. Earth and Space short answerbonus: What is the name of a slow-moving extensive cyclone which forms in subtropical latitudes during the winter season?

Answer: kona cyclone (kona storm)

7. Biology multiple choice toss up: Cells do not catabolize carbon because

W) Its double bonds are too stable to be broken

X) CO2 has fewe bonding electrons than other organic compounds

Y) The carbon atom is already completely reduced

Z) Most of the available electron energy was released by the time the CO2 was formed

Answer: Z

8. Biology short answer bonus What chemical characteristic of oxygen accounts for its function in cellular respiration?

Answer: (High) Electronegativity

9. Chemistry short answer toss up: What is the oxidation number for carbon in carbon dioxide?

Answer: +4

10. Chemistry short answer bonus: Which of the following is or are true about solubility?

I. As temperature increases, solubility of a solid in a liquid tends to increase

II. As pressure increases, solubility of a solid in a liquid tends to decrease

III. As temperature increases, solubility of a gas in a liquid tends to increase

IV. A pressure increases, solubility of a gas in a liquid tends to remain constant

Answer: 1 only

11. Math multiple choice toss up: Which of the following is not a Pythagorean triple which includes 12?

W) 5,12,13

X) 9,12,15

Y) 12,16,20

Z) 6,9,12

Answer: Z

12. Math short answer bonus: Little red riding hood wants to bring water to her grandmother. To deliver the water, Red must start at her house, walk to a nearby river to get the water, and then walk from the river to her grandmother’s house. If Red lives 3 miles away from the river, her grandmother lives 9 miles away from the river on the same side, and the two houses are 5 miles apart along the river, what is the length of the shortest path Red can take to deliver the water?

Answer: 13 (miles)

13. Physics multiple choice toss up: What is the name for the phenomenon where a particle, when encountering a potential barrier, emerges on the other side without any loss of kinetic energy?

Answer: Tunneling

14. Physics multiple choice bonus: The temperature of a surface is doubled. By what factor does its heat current increase?

W) 2

X) 4

Y) 8

Z) 16

15. Math multiple choice toss up: What is the name of the number with a continued fraction of all ones?

Answer: phi (Accept (1+sqrt5)/2)

16. Math short answer bonus: Which of the following three statements are benefits of continued fractions to represent numbers over a standard base system?

I. All irrational but not transcendental numbers have a repeating continued fraction, but in a standard base system there is no way to distinguish between algebraic irrationals and transcendentals.

II. There is only one way to represent any real number as a continued fraction, but some numbers have multiple representations in standard base systems

III. All rationals have a finite continued fraction, but some rationals have infinite representations in a standard base system

Answer: 3

17. Biology toss up multiple choice: Despite the difference ins tructure of plants and animals, they share some basic similarities in development such as

W) The importance of cell and tissue movements

X) The importance of selective cell enlargement

Y) The retention of meristematic tissues in the adult

Z) Master regulatory genes that encode DNA-binding proteins

Answer: Z

18 Biology multiple choice bonus: Absence of bicoid mRNA from a Drosophila egg leads to the absence of anterior larval body parts and mirror-image duplication of posterior parts. This is evidence that the bicoid gene

W) Is an inducer

X) contains a homeobox

Y) is a morphogen

Z) is a transcription factor

Answer: Y

19. Chemistry toss up short answer: Classify the following three molecules as polar or nonpolar

I. F2

II. CO2

III NH3

Answer: nonpolar, nonpolar, polar

20. Chemistry bonus short answer: To the nearest liter, what volume of oxygen at STP can be formed from .5 moles of potassium chlorate. Use the conversion of 22.4 liters per mole.

Answer: 17 liters

21. Math short answer toss up: What is the sum of the coefficients in (x+1)^10?

Answer: 1024

22. Math short answer bonus: What is (3+sqrt7)^4 to the nearest integer?

1016

23. Physics short answer toss up: What is the name for the splitting of atomic energy levels and the associated spectral lines when the atoms are placed in a magnetic field?  
Answer: Zeeman effect

24. Physics multiple choice bonus: Approximately what is the ratio between the gyromagnetic ratio for electron spin than for orbital angular momentum?

W) They are about the same

X) The orbital angular momentum is about twice as high as the electron spin angular momentum

Y) The electron spin angular momentum is about twice as high as the orbital angular momentum

Z) The electron spin angular momentum is about four times as high as the orbital angular momentum

Answer: Y