1. Math toss up short answer: Bob goes to work in his new car. On the way there, he drives at 45 mph. On the way back, he drives at 20 mph. What was his average speed for the entire trip?

Answer: 30 mph

2. Math bonus multiple choice: how many pairs of positive integers are there whose harmonic mean is equal to 6.

W) 2

X) 3

Y) 4

Z) 6

Answer: 3

3. Physics toss up short answer: What is the point called for a substance where it can exist in gas, liquid and solid form all at once?

Answer: Triple point

4. Physics bonus short answer: You start with a block of ice which is at 0 degrees Celsius and add heat to it at a steady rate. At time t the block is converted to steam at 100 degrees Celsius. What is there at time t/2?

W) A mixture of ice and water at 0 degrees Celsius

X) Water at a temperature between 0 and 100 degrees Celsius

Y) Water at 100 degrees Celsius

Z) A mixture of steam and water at 100 degrees Celsius

Answer: Z

5. Biology toss up multiple choiceTransposition differs from other mechanisms of genetic recombination because it

W) occurs only in bacteria

X) Moves genes between homologous regions of the DNA

Y) scatters genes to new loci in the genome

Z) Occurs only in Eukaryotes

Answer: Y

6. Biology Bonus short answer: Which of the following four processes contributes to genetic variation within a bacterial population

I. Transduction

II. Transformation

III Conjugation

IV Translation

Answer: I,II,III

7. Earth and Space toss up short answer: What is the name of a small lake inside of cirque formed by glaciations?

Answer: A tarn

8. Earth and Space bonus short answer: What is the name of a vertical or nearly vertical shaft in a glacier, formed by surface water percolating through a crack in the ice.

Answer: Moulin

9. Chemistry short answer toss up:How many liters of .4 molar H+ solution are needed to neutralize 3 liters of .2 Molar OH- solution

Answer: 1.5 L

10. Chemistry Bonus multiple choice: Arrange the following from slowest to fastest effusion rate

I. CO2

II N2

III F2

IV: O2

Answer: I,III,IV,II

11. Which of the following is closest to the number of 0’s in n!

W) n/10

X) n/5

Y) n/4

Z) n

Answer: Y

12. A coin is tossed which always lands on the opposite of the side it landed on the previous time it was thrown. If this coin is toss an infinite number of times and on each toss k you bet 3-k dollars, what is your expected earnings given that the first time the coin is tossed it lands on heads.

Answer: ¼

13. Biology short answer toss up: What enzyme joins the sugar-phosphate backbones of the Okazaki fragments together?

Answer: (DNA) ligase

14. Biology bonus short answer: What is the color of the bands on the legs and thorax of an asian tiger mosquito?

Answer: Silver(y white)

15. Chemistry toss up short answer A typical example of what type of solution is made up of acetic acid, which dissociates into a small amount of H+ and C2H3O2- ions?

Answer: buffer solution

16. Chemistry bonus short answer Calculate the pH of a .002 molar aqueous solution of HCl to the nearest tenth:

Answer: 2.7

17. Math toss up short answer: Given that 2011 is prime, find the remainder when 2013^2012 is divided by 2011.

Answer: 4

18. Math bonus short answer: A sequence a is defined as follows. a1=1, a2=11, and an=2an-1-3an-2­. Find a general non recursive formula for an in terms of n.

Answer: 2(-1)^n+3^n

19. Earth and Space toss up multiple choice: What is the name of a lake with an excess of nutrients

W) Eutrophic

X) Oligotrophic

Y) Dystophic

Z) Hypertrophic

20. Earth and Space bonus short answer: What formula relates the coefficient of permeability, hydraulic gradient, and velocity in an aquifer?

Answer: Darcy’s law

21. Math toss up short answer: Find the sum of all squares less than 150.

Answer: 650

22. Math bonus short answer: There are positive integers a, b, c, and d such that a^5=b^4, c^3=d^2, and a-c=19 Find b-d.

Answer: 757

23. Physics toss up multiple choice: The amplitude of an object in simple harmonic motion is doubled. Which of the following four things must also be changed?

I. The frequency

II. The period

III. The maximum speed of the object

IV. The minimum speed of the object

Answer: III (only)

24. Find the period of a simple pendulum 40 meters long to the nearest second. Assume g is 10 m/s^2

Answer: 13 s