1. Math toss up multiple choice: How many factors does the number 210 have?

W) 8

X) 12

Y) 16

Z) 20

Answer: 16

2. Math bonus short answer: A number has x factors. The number times 2 has 3x factors, the number times 3 has 4x factors, the number times 5 has 5x factors, and the number times any other prime has 2x factors. Find x.

Answer: 24

3. Physics toss up short answer: In a series motor, the rotor is connected in series with the electromagnetic that produces the magnetic field. If the electromotive force is 70 volts, there is a current of 5 Amperes, and a internal resistance of 10 ohms, what is the potential difference between the two terminals?

Answer: 120 Volts

4. Physics bonus short answer: Which of the following four statements is or are true:

I. The equivalent resistance of a 4 ohm resistor and a 2 ohm resistor connected in series in 6 ohms.

II. The equivalent resistance of a 2 ohm, a 3 ohm, and a 4 ohm resistor connected in parallel is 15/7 ohms

III. The equivalent capacitance of a 3 farad, a 5 farad, and a 7 farad capacitor connected in series is 15 farads

IV. The equivalent capacitance of 10 capacitors all connected in parallel with capacitances of 20 Farads each is 2 Farads.  
Answer: I only

5. Biology toss up short answer: What is the name for the physical processes that give an organism its shape? The word means “creation of form”.

Answer: Morphogenesis

6. Biology bonus multiple choice: Which of the following ideas is common to both darwin’s and Lamarck’s theories of evolution?

W) Adaptation results from differential reproductive success

X) Evolution drives organisms to greater and greater complexity

Y) Evolutionary adaptation results from interactions between organisms and their environments

Z) Adaptation results from the use and disuse of anatomical structures

Answer: Y

7. Chemistry toss up short answer: A child at ground level, 20 degrees Celsius and 1 ATM, lets go of a 4 liter balloon. The balloon rises to where the new temperature is 10 degrees Celsius and the pressure is .94 ATM. What is the new volume of the balloon to 2 significant figures?

Answer: 4.1 Liters

8. Chemistry bonus multiple choice: A polyethylene bag from a store weighs 14.0 g. How many moles of ethylene must be polymerized to make such a bag?

W) 8.43 \* 1024

X) 1.20 \*1024

Y) 6.02 \* 1023

Z) 3.01 \* 1023

Answer: Z

9. Earth and space toss up multiple choice: What is the difference between porosity and permeability?  
W) Porosity is percent pore space while permeability is total pore space

X) Porosity is total pore space while permeability is percent pore space

Y ) Porosity is percent pore space while permeability is rate of motion of the water

Z) Porosity is the rate of motion of the water while permeability is percent pore space  
Answer: Y

10. Put the following three items in order of increasing hydraulic conductivity

I. Gravel

II. Sand

III. Clay

IV. Till

Answer: Clay, till, sand, gravel

11. Math toss up short answer: The first term in an arithmetic sequence is 2. The sum of the first 10 terms of the sequence is 5. The sum of the next 10 terms is -5. What is the sum of the next 10 terms of the sequence?

Answer: -15

12. 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

13 Physics toss up short answer: An object is thrown at an angle of 15 degrees from the horizontal with a speed of 30 meters per second. Calculate the speed of the object when it his the ground?

Answer: 30 meters per second

14. Physics bonus multiple choice: A particle in a box with length L is in the nth energy level. What is the average value of its x-component of momentum px?

W) nh/2L

X) (sqrt2/2)nh/L

Y) 1/(2sqrt2)nh/L

Z) 0

Answer: Z

15. Biology toss up multiple choice: Which of the following four structures or components is or ore part of the plant’s apoplast?

I. The lumen of a xylem vessel

II. The lumen of a sieve tube

III. The cell wall of a posophyll cell

IV. The cell wall of a transfer cell

Answer: I,III,and IV (All but II)

16. Biology bonus multiple choice: A plant cell with a solute potential of -.65 MPa maintains a constant volume when it is bathed in a solution with a solute potential of -.3 MPA and is in an open container. Which of the following is true about the cell.

W) The cell has a pressure potential of +.65 MPa

X) The cell has a water potential of -.65 MPa

Y) The cell has a pressure potential of +.35 MPa

Z) The cell has a pressure potential of -.35 MPa

Answer: Y

17. Chemistry toss up multiple choice: What is the pH of a 5.0\*10^-14 M NaOH solution?

W) 9.7

X) 10.7

Y) 11.7

Z) 12.7

Answer: W

18. Chemistry bonus short answer: The pH of a .20 molar acetic acid solution is found to be 2.88. Calculate the ionization constant for acetic acid to two significant figures. Express your answer in scientific notation.

Answer: 1.7\*10^-5

19. Earth and Space toss up multiple choice: What pH is rain water?

W) 4-5

X) 6-7

Y) 7-8

Z) 9-10

Answer: W

20. Earth and Space bonus short answer: What are two types of units that are used to measure turbidity:

Answer: Nephelometric turbidity units, Jackson turbidity units (NTUs, JTUs)

21. Math toss up multiple choice: How many times less likely is a string of 50 heads while flipping a coin than a head followed by an alternating sequence of heads and tails?

Answer: 1

22. In a town, 30% of the people are short. 20% of the people who are short do Science Bowl. 40% of the people who are tall do Science Bowl. Two people are selected at random from the Science bowl Team. What is the probability that one is short and one is tall (Assume that there are enough science bowlers and enough people in the town that the chances of each of these two people being short or tall are independent)

Answer: 84/289

23. Physics toss up multiple choice: If you leave your refrigerator door open, which of the following will happen?

W) The room will get colder

X) The room will get warmer

Y) The temperature of the room will stay the same

Z) The temperature of the room will go up and then down

Answer: X

24. Physics bonus short answer: What form of the second law of thermodynamics states that it is impossible for a system to undergo a process in which it absorbs heat from a reservoir at a single temperature and converts the heat completely into mechanical work, with the system ending in the same state in which it began?

Answer: Kelvin-Planck