TOSS-UP

1) MATH *Multiple Choice* When rolling two fair, six-sided dice, what is the probability of rolling an 11 or a 12?

W) 1/9

X) 1/12

Y) 1/18

Z) 1/36

ANSWER: X) 1/12

# BONUS

1) MATH *Short Answer* If two events are mutually exclusive, and the probability of A is 1/3 and the probability of B is ¼, what is the probability of A union B?

ANSWER: 7/12

# TOSS-UP

2) Energy *Short Answer* What is the sum of an object’s potential and kinetic energy called?

ANSWER: Mechanical energy

# BONUS

2) Energy *Multiple Choice* An object initially has 30 J of kinetic energy. Two forces act on it, one performing 60 J of work and the other performing -20 J of work. What is the final kinetic energy of the object?

W) 20 J

X) 30 J

Y) 60 J

Z) 70 J

ANSWER: Z) 70 J

**TOSS-UP**

3) Earth and Space Science What is the term for when three astronomical bodies are aligned in the same gravitational system along a straight line?

ANSWER: Syzygy

# BONUS

3) Earth and Space Science What type of fog forms when cooling of a surface chills the air layer directly above that surface to the dew-point temperature?

W) Advection fog

X) Upslope Fog

Y) Radiation Fog

Z) Evaporation Fog

ANSWER: Y) Radiation Fog

# TOSS-UP

4) Biology What model describes a plasma membrane with an assortment of various proteins embedded in or attached to a double layer of phospholipids?

ANSWER: Fluid Mosaic Model

# BONUS

4) Biology What term describes a phospholipid as having both a hydrophobic and hydrophilic region?

ANSWER: Amphipathic

**TOSS-UP**

5) Chemistry *Short Answer* Which one of these is the ground state configuration of a paramagnetic element?

W) 1s2 2s2 2p6

X) 1s2 2s2 2p6 3s2

Y) 1s2 2s2 2p6 3s2 3p4

Z) 1s2 2s2 2p6 3s2 3p6 4s2

ANSWER: Y) 1s2 2s2 2p6 3s2 3p4

# BONUS

5) Chemistry In which one of these molecules does oxygen form sp3 hybrid orbitals?

W) H20

X) CO2

Y) SO2

D) NO2

ANSWER: W) H20

# TOSS-UP

6) Physics *Short Answer* If the capacitance of one capacitor is 2 mF and another is 4mF, what is the capacitance when they are connected in parallel?

W) 4/3 mF

X) 2 mF

Y) 3 mF

Z) 6 mF

ANSWER: Z) 6 mF

# BONUS

6) Physics Which force

ANSWER: 4x + 3y – 2z = 24

**TOSS-UP**

7) Math What is the perimeter of a rhombus with one of the sides being 7 cm?

ANSWER:28 cm

# BONUS

7) Math What is the area of an ellipse with major axis 8 units and semi minor axis 3 units?

ANSWER: 12 units ^2

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# TOSS-UP

8) Energy What is the amount of heat that must be transferred to cause a phase change called?

ANSWER: Latent heat (of transformation)

# BONUS

8) Energy The root mean square velocity of a molecule is inversely proportional to which of the following?

W) Mass of one mole of the molecules

X) Temperature

Y) Concentration

Z) Ideal Gas Constant

ANSWER: W) Mass of one mole of the molecules

**TOSS-UP**

9) Earth and Space Science At what date does the circle of illumination exclude the North pole region from sunlight and includes the South Pole region?

W) Summer Solstice

X) Winter Solstice

Y) Vernal Equinox

Z) Autumnal Equinox

ANSWER: X) Winter Solstice

# BONUS

9) Earth and Space Science What is the rate at which moist ascending air cools by expansion?

ANSWER: Moist adiabatic Rate

# TOSS-UP

10) Biology What type of proteins help the passage of water molecules through the membrane in certain cells?

ANSWER: Aquaporins

# BONUS

10) Biology What is the ability of a solution to cause a cell to gain or lose water?

ANSWER: Tonicity

**TOSS-UP**

11) Chemistry What is the pH of a 0.001 molar solution of HNO3?

ANSWER: 3

# BONUS

11) Chemistry Which of the following salts will produce a solution with a pH greater than 7 when placed in distilled water?

W) KCl

X) NaNO3

Y) KI

Z) NaCN

ANSWER: Z) NaCN

# TOSS-UP

12) Physics Which force acts on a charge only if it is moving?

W) Magnetic Force

X) Electric Force

Y) Gravity

Z) Weak Nuclear Force

Answer: W) Magnetic Force

# BONUS

12) Physics A nonconducting sphere is given a nonzero net electric charge, +Q, and then brought close to a neutral conducting sphere of the same radius. Which of the following is true?

W) An electric field will be induced within the sphere.

X) The other sphere will develop a net electric charge of –Q.

Y) The spheres will experience no electrostatic attraction.

Z) The spheres will experience an electrostatic attraction.

ANSWER: X) 5

**TOSS-UP**

13) Math Which of these numbers is less than its reciprocal?

W) -2

X) -1

Y) 1

Z) 2

ANSWER: W) -2

# BONUS

13) Math How many whole numbers lie in the interval between 5/3 and 2 pi?

ANSWER: 4

# 

# TOSS-UP

14) Energy A book with mass 5kg is lifted at constant velocity a distance of 3m. How much work was done on the book?

ANSWER: 150 J

# BONUS

14) Energy If an object with weight 350 N is at a height of 10 m, what is its gravitational potential energy?

ANSWER: 3500 J

**TOSS-UP**

15) Earth and Space Science What phenomenon causes dry regions leeward of mountains and occurs when air rises upslope as it pushes against a mountain?

ANSWER: Orographic lifting

# BONUS

15) Earth and Space Science What is a small mountain lake, especially one that collects in a cirque basin behind risers of rock material?

ANSWER: Tarn

# TOSS-UP

16) Biology What is a transport protein that generates voltage across a membrane called?

ANSWER: Electrogenic pump

# BONUS

16) Biology What is the term when a single ATP powered pump that transports a specific solute indirectly transports several other solutes?

ANSWER: Cotransport

**TOSS-UP**

17) Chemistry What is the conjugate acid of NH3?

ANSWER: NH4+

# BONUS

17) Chemistry What is the temperature at which the molecules of a substance have too much kinetic energy to stick together and form a liquid?

ANSWER: Critical point

# TOSS-UP

18) Physics What would happen to the electrostatic force between a pair of charged particles if both charges were doubled and the distance between them were also doubled?

W) It would decrease by a factor of 2.

X) It would stay the same.

Y) It would increase by a factor of 2.

Z) It would increase by a factor of 4.

Answer: X) It would stay the same.

# BONUS

18) Physics Which of the following would decrease the capacitance of a parallel-plate capacitor? Using smaller plates, decreasing the voltage between the plates, and replacing the dielectric material between the plates with one that has a smaller dielectric constant?

ANSWER: The first and the third

**TOSS-UP**

19) Math What is the sum of the two smallest prime factors of 250?

ANSWER: 7

# BONUS

19) Math A spinner is initially pointing west. It is then moved 2 ¼ revolutions clockwise then 3 ¾ revolutions counterclockwise. What direction does it now point?

ANSWER: east

# TOSS-UP

20) Energy What unit is used for power?

ANSWER: Watt

# BONUS

20) Energy In an inelastic collision, what is conserved?

ANSWER: momentum

**TOSS-UP**

21) Earth and Space Science What is the level below which a stream cannot erode its valley?

Answer: Base level

# BONUS

21) Earth and Space Science What is the hypothetical ultimate base level?

Answer: Sea level

# TOSS-UP

22) Biology What is the term when a protein’s function at one site is affected by the binding of a regulatory molecule to a separate site?

ANSWER: Allosteric regulation

# BONUS

22) Biology What type of cell division do single-celled eukaryotes go through?

ANSWER: Binary Fission

**TOSS-UP**

23) Chemistry What is the phase change from gas to solid called?

ANSWER: Deposition

# BONUS

23) Chemistry What is the van’t Hoff factor of CaCl2?

ANSWER: 3

# TOSS-UP

24) Physics What quantity is equal to force times delta T?

ANSWER: Impulse

# BONUS

24) Physics What is the change in wave speed when a wave strikes the boundary to another medium?

ANSWER: Refraction

**TOSS-UP**

25) Math There are six doors in a house. How many ways can someone enter a house by one door and leave by a different door?

ANSWER: 30

# BONUS

25) Math The average of 5 people in a room is 30 years. An 18-year-old person leaves the room. What is the average age of the remaining people?

Answer: 33