Science Bowl Team Round by Karthik Raju

#1Chemistry Short Answer What is the name of the phenomena that occurs when the forces of adhesion and cohesion aid a liquid to travel up a tubular structure?

Answer: Capillary action

#1 Chemistry Short Answer Which of the following is true about the Maxwell distribution of speeds?

1. Because the exponential factor increases as v increases, a lot of molecules have very high speeds
2. As the velocity approaches zero, the functional value approached zero
3. Very few molecules have low speeds

Answer: II and III

#2 Earth And Space Multiple Choice Which of the following types of mass wasting phenomena would one most likely expect after a period of heavy precipitation or snow in a humid area filled with rolling plains?

W) Solifluction

X) Rockslide

Y) Earth Flow

Z) Lahar

Answer: Y) Earth Flow

#2 Earth And Space Short Answer During what two periods of the geologic time scale did Earth accumulate of its coal and carbon rich deposits mostly due to plant decay?

Answer: Mississippian and Pennsylvanian

#7 Chemistry Short Answer Which of the following instruments can be used to measure the magnetic character of a substance?

I) Gouy Balance

II) SQUID magnemometer

III) manometer

IV) glass microreactor

Answer: I and II

#3 Math Short Answer What is the name of the series that gives an infinitely accurate approximation for a curve?

Answer: Taylor Series

#3 Math Short Answer For how many values of a is it true that the line y = x + a passes through the parabola y = x^2 + a^2 through the vertex?

Answer: 2

#4 Biology Short Answer What technique, developed by Hans Christain Gram, allows scientists to classify bacteria into two groups, one group with cell walls containing peptidoglycan and the other with cell walls containing complex structures with an outer membrane consisting of lipopolysaccharides?

Answer: Gram Stain

#4 Biology Short Answer What is the name of the large outer proteins that protrude from the doublets of flagella and motile cilia and are also responsible for the bending action of organelles?

Answer: Dyneins

#5 Physics What term describes the process of producing an electric current across a conductor that is moving through an electromagnetic field?

W) conduction

X) Induction

Y) convection

Z) Insulation

Answer: X) Induction

#5 Physics Short Answer Which of the following 4 options are true concerning superconductors?

I) They produce a magnetic field in the transition to the superconducting state called the Meissner effect

II) In a weak field, the depth at which not all the magnetic field is cancelled out within the superconductor is called the London penetration depth

III) The occurrence of the Meissner effect implies that superconductivity can be fully understood with the idealization of perfect conductivity in classical physics

IV) superconductors can be [Type I](http://en.wikipedia.org/wiki/Type_I_superconductor), meaning they have two critical fields, between which they allow partial penetration of the magnetic field; or they can be [Type II](http://en.wikipedia.org/wiki/Type_II_superconductor), meaning they have one critical fields, above which all superconductivity is lost

Answer: I and II

#6 Energy Multiple Choice Which of the following statements are true about ethanol being used as a fuel in petrol engines?

W) It can be used as a direct substitute for gasoline in petrol engines

X) It can only be used in petrol engine as a mixture of 15% ethanol and 75% gasoline

Y) It is the preferred type of fuel in because it has a much larger energy density than petroleum

Z) It has a lower octane rating than ethanol-free gasoline

Answer: W) It can be used as a direct substitute for gasoline in petrol engines

#6 Energy Short Answer Identify all of the following 4 statements that are true of biogas.

1. It is produced by the anaerobic digestion of organic materials by anaerobes
2. Landfill gas is a form of biogas formed in landfills
3. It is produced by the partial combustion of organic material with small amounts of oxygen
4. It can be recovered by mechanical biological treatment waste processing systems

Answer: I, II, and IV

#7 Chemistry Short Answer Identify all of the following five options that match each element/compound with the color it emits during a flame test correctly.

I) Lithium emits red

II) Sodium emits yellow

III) Copper chloride emits green

IV) Boron emits a bright green

V) Strontium emits a strong blue

Answer: I, II, IV

#8 Earth and Space Multiple Choice What type of Supernova is classified as having weak or no amounts of helium spectral lines?

W) Type Ib

X) Type Ic

Y) Type II – P

Z) Type IIb

Answer X) Type Ic

#8 Earth and Space Short Answer Identify all of the following 4 options that describe Saturn.

1. It has the highest oblateness out of all the planets in our solar system
2. It displays faint belt-zone circulation at the surface and produce winds that are three time faster than those found on Jupiter
3. The Enckes division and Cassini’s division within its rings are kept clear of particles due to the difference of gravitational pull on parts of the rings
4. The distinct color of Saturn is attributable to the layer of hydrogen gas found at the top of its atmosphere

Answer: I and II

#9 Math Multiple Choice if r was the distance from the center of a shape to the farthest most point from the center, and the area of that shape was a function of r, then what is the name of the shape that produces the maximum area for when r = 4?

W) Circle

X) Square

Y) Trapezoid

Z) Triangle

Answer: W) Circle

#9 Math Short Answer Saaket asked his class, “Do you like Chemistry?” At the beginning of the school year, 50% of all students in Saaket's Chemistry class answered "Yes" and 50% answered "No." At the end of the school year, 70% answered "Yes" and 30% answered "No." Altogether, x% of the students gave a different answer at the beginning and end of the school year. What is the difference between the maximum and the minimum possible values of x?

Answer: 60

#10 Biology Multiple Choice What sex-linked disorder is caused by a lack of muscle protein called dystrophin and causes a progressive weakness in the muscles and a loss of coordination?

W) Color blindness

X) Duchenne muscular dystrophy

Y) Hemophilia

Z) Barr body

Answer: X) Duchenne muscular dystrophy

#10 Biology Short Answer What mode of ATP Synthesis in the third stage of respiration in which electrons are passed from one molecule to another through a chain uch that at the end of the chain, the electrons react with oxygen and hydrogen, producing water. The energy released by this mode of ATP Synthesis is stored within the mitochondrion.

Answer: Oxidative Phosphorylation

#11 Physics Short Answer What is the name of the resonant transformer that was designed in 1891 to produce an AC electricity that is low in current, high in voltage, and high in frequency?

Answer: Tesla Coil

#11 Physics Short Answer Which of the following 3 statements are true about quantum tunneling?

1. It can be explained using the Heisenberg Uncertainty Principle and the wave-particle duality of matter
2. It can only occur for electron that pass through an otherwise surmount barrier
3. The generality of Quantum Tunneling through quantum physics was recognized by George Gamow

Answer: I only

#12 Energy Multiple Choice What type of biofuel is made from an alcohol through fermentation of carbohydrates in sugar and starch crops?

W) Biodiesel

X) Bioether

Y) Bioethanol

Z) Syngas

Answer: Y) Bioethanol

#12 Energy Short Answer Identify all of the 4 following fuels that hydrogenation and hydrocracking, which are methods of refining vegetable oils into fuels, can also produce?

1. Gasoline
2. Diesel
3. Propane
4. Petroleum

Answer: I, II, III