Karthik Raju

Science Bowl Questions Full Team Round

#1 Earth and Space Short Answer What is the term given to the displacement of sand from a beach due to diagonal movements of sand that arises from the fact that the swash of a wave is at an angle to the beach while the backwash is perfectly perpendicular to the beach.

Answer: beach drift

#1 Earth and Space Short Answer Identify all of the following 4 options that are zones in the ocean that allows photosynthesis anywhere within its region.

1. Pelagic zone
2. Benthic zone
3. Neritic zone
4. Dysphotic zone

Answer: I and III

#2 Physics Multiple Choice If a rod 5m long and going 0.6c, which of the following phenomena would a stationary observer most likely see?

W) Length expansion

X) Length contraction

Y) A decrease in mass

Z) An increase in mass

Answer: X) Length contraction

#2 Physics Short Answer Identify all of the following 3 options that is or are true of Hawkings radiation.

1. It is emitted through the creation of virtual electrons and positrons
2. The associated black hole gains mass through the emission of Hawkings radiation
3. Hawkings radiation occurs when a virtual positron is caught in the event horizon, leaving its paired electron.

Answer: I and II

#3 Energy Multiple Choice What name is given to power plants that produce energy through the combustion of garbage?

W) Waste to energy plants

X) garbage disposal plants

Y) Biogas digestor plants

Z) Waste conversion plants

Answer : W)

#3 Energy Multiple Choice Which of the following is the safest and most efficient type of mining used when extracting coal from underground?

W) Surface mining

X) deep mining

Y) room – pillar mining

Z) long wall mining

Answer: Z

#4 Chemistry Short Answer Identify all of the 4 following options which is or are true about the heat phase diagram for carbon dioxide?

I) The slope of the bonudary between the liquid and solid phase suggests that as pressure is increased, the freezing point rises

II) It will not appear as a liquid at any point when below 5.1 atm of pressure

III) The gaseous form of Carbon Dioxide dominates the majority of the phase diagram

IV) The phase diagram only has lines that bound three different regions, which are the three states of matter for carbon dioxide

Answer: All of them

#4 Chemistry Short Answer Given that the ln(5) is1.61 and the specific heat capacity of water is 4 J/ g K, What is the change in entropy of the system when 4g of water is heated from 4 deg. C to 100 deg. C to the nearest ones place?

Answer: 52 (accept 51)

#5 Math Short Answer I am jogging home from school. I jog for 15 minutes at 20 mph when I was severely injured b a truck and had to crawl the rest of the way at 3 mph, which took me approximately 2 hours. What was my average speed?

Answer: 4.89

#5 Math Multiple Choice 50 people are in a room and each of them shakes everyone else’s hand exactly once. How many handshakes were given?

Answer: 1225

#6 Biology Short Answer Identify all of the following 4 options that is or are protective sheathes that encovers seeds?

I) coleoptile

II) epicotyl

III) hypocotyl

IV) coleorhiza

Answer: I and IV

#6 Biology Identify all of the following four options that is or are differences between Scyphozoans and Cubozoans?

I) Scyphozoans are predominantly in the medusa stage while cobozoans are in the polyp stage

II) Cubozoans have more complex eyes that is infringed in their medusae

III) Cubozoans are weak swimmers and Schyphozoans are stronger swimmers

IV) Cubozoans are consumed massively by organisms that are immune to the venom they conatin, whereas Schyphozoans are consumed by a greater variety of organisms

Answer: I and IV

#7 Earth and Space Short Answer What is the name of the model that is suggested by synchrotron radiation and hot spots to explain double lobed radio galaxies and states that when the core of the galaxy erupts, clumps of high energy gas is driven in opposite directions, forming the two lobes?

Answer: double exhaust model

#7 Earth and Space Multiple Choice Which of the following features on the sun last for more than 20 days?

I) sunspots

II) spicules

III) granules

IV) Solar prominences

Answer : I only

#8 Physics Multiple Choice 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

#8 Physics Short Answer Identify all of the following 4 options which is or 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  
  
Answer: I and II

#9 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

#9 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

#10 Chemistry Short Answer Identify all of the following four reactions which is or are a buffer solution?

I) CH3COOH + H20 > H3O+ + CH3CO2-

II) HCL + H20 > H3O+ + Cl-

III) NH3 + H20 > OH- + NH4+

IV) NaOH + H20 > OH- + NaOH2+

#10 Chemistry Short Answer Identify all of the following 4 options that is or are 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

#11 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

#11 Math Short Answer Saaket asked his class, “Do you like Chemistry?” At he 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

#12 Biology Short Answer What is the name of the process through which the body of a gasropoda turns 180 degrees, causing the anus and mantle cavity to wind up above the head?

Answer: torsion

#12 Biology Multple Choice Which of the following is a lineage from which most arthropods follow?

W) Chelirae

X) eurypterids

Y) Arachnids

Z) Chelieriforms

Answer: Z

#13 Earth and Space Multiple Choice Which of the following is produced when the environmental lapse rate is less than the adiabatic rate?

W) absolute stability

X) absolute instability

Y) conditional instability

Z) conditional stability

Answer: W

#13 Earth and Space Short Answer Identify all of the 4 following options that is or are true about algae production.

1. the algae bloom in the fall, although it is not as magnificent as the bloom in spring
2. Algae is limited by the amount of nutrients in summer
3. Algae do not have access to high nutrient waters in the winter
4. The Algae bloom in spring dies out because most of the nutrients are consumed rapidly

Answer: I, II, IV

#14 Physics Short Answer Identify all of the following 4 options that is or 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 electrons that pass through an otherwise surmount barrier
3. The generality of Quantum Tunneling through quantum physics was recognized by George Gamow

Answer: I only

#14 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

#15 Energy Multiple Choice Which state, currently the highest, produces 72.3 % of its energy by nuclear energy?

W) Illinois

X) Vermont

Y) South Carolina

Z) Connecticut

Answer: X

#15 Energy Multiple Choice During what wind speed interval does power production dramatically for wind turbines?

W) 0-5

X) 10 - 20

Y) 20 – 25

Z) 25 – 30

Answer: X

#16 Chemistry Multiple Choice The Carnot Engine contains 4 processes. Consider the first to be an isothermal expansion. During the next process, which of the following variables is kept constant?

W) T

X) Q

Y) U

Z) H

Answer: X

#16 Chemistry Short Answer #16 Chemistry Multiple Choice Provided that the attractive forces are dominant, a real gas cools as it expands. This observation is called what?

Answer: Joule Thompson Effect

#17 Math Short Answer Find all values for the relative maximums of the following function:

x^3 + 4x2 + 5x

Answer: -5/3

#17 Math Short Answer Identify all of the 4 following options which is or are true about the Fibonacci sequence?

1. The twelfth term of the sequence is 144
2. There are no two numbers in the sequence that are equal
3. The Fibonacci sequence follows an arithmetic progression
4. The are the sums of the shallow diagonals in Pascal’s triangle

Answer: I and IV

#18 Biology Multiple Choice Why does a daughter DNA molecule only grow in the 5’ to 3’ direction?

W) Because the new strand is only added by the DNA polymerase to the 3’ section of the DNA

X) Because the new strand is only added by the DNA polymerase to the 5’ section of the DNA

Y) Because the new strand is only added by the DNA ligase to the 3’ section of the DNA

Z) Because the new strand is only added by the DNA ligase to the 5’ section of the DNA

Answer: W

#18 Biology Multiple Choice Which of the following is characteristic of iodine deficiency?

W) Cognitive impairment

X) A large protruding lump at the throat (swelling)

Y) cancer

Z) Skin diseases

Answer: X

#19 Earth and Space Multiple Choice The Tuning fork diagram classifies which of the following?

W) galaxies

X) stars

Y) supernovaes

Z) planets

Answer: W

#19 Earth and Space Short Answer What is the terg given to the mound of sand that is deposited through deposition and connects two or more islands?

Answer: tombolo

#20 Energy Multiple Choice Identify all of the following four options which is or are methods of hydrogen production in industry.

I) Steam refining

II) biomass gasification

III) electrolysis

IV) Hydrogen derivation

Answer: I, II, and III

# 20 Energy Short Answer According to scientists, in what rock structure deep underground is the safest way to store nuclear waste?

Answer: repositories

#21 Physics Short Answer What is the wavelength of the fundamental tone of a standing wave in an organ pipe with length of 4m

Answer: 8m

#21 Physics Short Answer Elementary particles, whose interactions are described by the [gauge theory](http://en.wikipedia.org/wiki/Gauge_theory), usually interact with ieach other by the exchange of virtual particles called what? In particle physics, this particle is stated to be a force carrier, capable of carrying any fundamental interaction of nature.

Answer: guage boson

#22 Chemistry Multiple Choice In order for the change in Gibbs free energy to equal zero, which of the following must be true.?

W) dS = dG

X) Q = K

Y) dH = dS

Z) Q > K

Answer: X

#22 Chemistry Short Answer What line serves the special use of realting the boiling point to the mole fraction in a temperature-composition diagram?

Answer: tie line

#23 Math Short Answer My Math teacher, Mr. Thayer, is trying to establish a group of 7. He has 12 people to choose from. In how many ways can he pick 7 members.

W) 911

X) 865

Y) 792

Z) 677

Answer: Y

#23 Math Short Answer The point (-3, 2) is rotated cross about the origin 90 degrees. Then it is reflected across the line y = x. What is the distance from the original point to the new point?

Answer:

#24 Biology Multiple Choice Which of the following is a difference between allopatric speciation and sympatric speciation?

W) Allopatric has to do with a non-geographic barrier

X) Sympatric can be affected by the factor polypoidy, only

Y) Allopatric speciation must occur in in two geographically separated regions, while sypatric speciation can happen in the same habitat

Z) Polypoidy, a cause of sympatric speciation, refers to cells that have more than two sets of chrmosomes

Answer: Y