1. BIOLOGY *Short Answer*- Denote all of the following four statements that was NOT a disadvantage that land plants had that sea plants did not when land plants first evolved?

1: Scarcity of water

2: Many herbivores and pathogens

3: Lack of structural support

4: Lack of nutrients in the soil

ANSWER: 2 AND 4

1. MATH *Short Answer*- A ball is dropped straight down off the top of a 160-meter tall building. The ball bounces back to a height of 120 meters, then 90, and so on until it comes to a stop. What is the total distance that the ball travelled?

ANSWER: 640 meters

1. PHYSICS *Multiple Choice*­- Which of the following is correct?

W) A region of reduced density in a longitudinal wave is called a common faction

X) The speed of sound is affected by the frequency of the wave

Y) The wavelength of super high C, which is three octaves above middle C, is 1/8 the wavelength of middle C

Z) The equation y(x,t) = A cos [w(t – x / v)] is moving in the positive x-direction

ANSWER: Y

1. EARTH AND SPACE SCIENCE *Multiple Choice*- Which of the following is the most luminous?

W) A star with a radius four times the radius of our sun, and three times the temperature

X) A star with a radius six times the radius of our sun, and two times the temperature

Y) A star with a radius two times the radius of our sun, and four times the temperature

Z) A star with a radius one half that of our sun, and five times the temperature

ANSWER: W

1. CHEMISTRY *Short Answer*- A container has a temperature of 30 degrees Celsius, a pressure of 1200 psi, and a volume of x liters. The pressure stays constant and then the temperature is raised by 10 degrees. 4/3 x. Then, the temperature stays constant and the pressure is raised by 300 psi. What is the new volume in terms of x?

ANSWER: 16/15

1. BIOLOGY *Short Answer-* Denote which two of the following four statements that is TRUE about tracheophytes.

1: The first known vascular land plant was *Cooksonia*

2: All seed plants are homosporous

3: Flowering plants and conifers have motile sperm

4: Only one living species remains in the phylum Ginkgophyta

ANSWER: 1 AND 4

1. MATH *Short Answer-* Take the triangle ABC. If angle A is 30 degrees, side BC is 10, side AC is 15, and the altitude of point A to side BC is 12, what is the sin of angle B?

ANSWER: ¾

1. PHYSICS *Multiple Choice*­- Which of the following is correct?

W) A region of reduced density in a longitudinal wave is called a common faction

X) The speed of sound is affected by the frequency of the wave

Y) The wavelength of super high C, which is three octaves above middle C, is 1/8 the wavelength of middle C

Z) The equation y(x,t) = A cos [w(t – x / v)] is moving in the positive x-direction

ANSWER: Y

1. EARTH AND SPACE SCIENCE *Short Answer*- What is the center of mass between a star with a mass of 12 space mass and a moon with a mass of 3 solar mass and a distance of 5 astronomical unit?

ANSWER: 1 AU OFF THE MOON

1. CHEMISTRY *Multiple Choice*- Which of the following incorrectly pairs the chemist with reason why he or she received the Nobel Prize?

W) Elie Metchnikoff- discovered that CFC gases and other gases reduced ozone levels

X) Kary Mullis- invention of a polymerase chain reaction technique

Y) Michael Smith- technique of splicing foreign gene segments

Z) Paul Ehrlich- discovered that aniline dyes could kill disease-causing microorganisms without harming patient

ANSWER: W

1. BIOLOGY *Short Answer*- What type of plant originated about 350 million years ago and have over 11,000 living species. It is homosporous and produce sori, clusters of sporangia. Its leaves begin as tightly curled fiddleheads, which unroll into leaves called fronds.

ANSWER: FERNS

1. MATH *Multiple Choice*- Two circles of radius six and three are externally tangent to each other. Point P lies on circle one and point Q lies on circle two. If line PQ is tangent to both circle one and two, then which of the following is the length of line PQ?

W)

X)

Y)

Z)

ANSWER: X

1. PHYSICS *Short Answer*- What is the phase speed of a wave with an angular velocity of 112 π and a wavelength of 4? Ignore units.

ANSWER: 224

1. EARTH AND SPACE SCIENCE *Multiple Choice*- Which of the following is the correct term for a river that has channels that are self-formed in weakly consolidated sediments and have multiple sinuous channels that carry large volumes of sediment?

W) Braided bedrock

X) Wandering alluvial

Y) Meandering bedrock

Z) Anastomose alluvial

ANSWER: Z

1. CHEMISTRY *Multiple Choice*- Which of the following is correct about amino acid degradation?

W) Aspartate aminotransferase catalyzes the following reaction: aspartate and alpha-ketoglutarate yields pyruvate and glutamate

X) Guanosine triphosphate and adenosine monophosphate are allosteric activators

Y) Raising the energy charge accelerates the oxidation of amino acids

Z) Glutamate dehydrogenase is unusual because it can use either NAD+ or NADP+

ANSWER: Z

1. BIOLOGY *Multiple Choice*- A farmer is planting trees of various kinds. His centerpiece is a black walnut tree. He attempts to beautify the tree by planting flowers under its shade. However, nothing grows. Which of the following is the best reason?

W) Not enough nutrients

X) Allelopathy

Y) Overcrowding

Z) Auxopathy

ANSWER: X

1. MATH *Short Answer*- A square’s side length increases by three feet per second. How fast is the area increasing when the perimeter is 48 feet, in square feet per second?

ANSWER: 72 FEET SQUARED PER SECOND

1. PHYSICS *Multiple Choice*- If the velocity of a ball on a string is 8 and the period of the revolution is 8, then what is the radial acceleration?

W) 2 π

X) 4 π

Y) 6 π

Z) 8 π

ANSWER: W

1. EARTH AND SPACE SCIENCE *Short Answer*- Denote all of the following three statements that are true about the different types of volcanoes?

1: Cinder-cone volcanoes have magma that contain more water and silica than those of shield volcanoes

2: Shield volcanoes have larger volumes of gas in their magma than cinder-cone and composite volcanoes

3: Lapilli is a type of tephra that is larger than dust but less than 2 mm wide

ANSWER: 1 AND 3

1. CHEMISTRY *Short Answer*- What law is used to compute the resultant magnetic field at a certain position that is generated by a steady current?

ANSWER: BIOT-SAVART LAW

1. BIOLOGY *Multiple Choice*- Which of the following occurs if auxin levels are high and cytokinin levels are low during organ regeneration?

W) High stem growth; high root growth

X) Low stem growth; low root growth

Y) High stem growth; low root growth

Z) Low stem growth; high root growth

ANSWER: Z

1. MATH *Short Answer*- Roger is composing a song using a eight note keyboard, that runs consecutively through keys 1-8. If he has to start at key 1 and end on key 5 and he’s not allowed to repeat notes, how many different ways can he play a seven note song?

ANSWER: 720

1. PHYSICS *Short Answer*- If a person has a mass of 50 kg and the value of the constant D is 980, assuming that gravity is 10 ms-2, then what is his terminal velocity?

ANSWER: 5/7

1. EARTH AND SPACE SCIENCE *Short Answer*- Denote which two of the following four choices are properties of degenerate matter that affect the star.

1: Compressing degenerate gas causes temperatures to rise sharply

2: The pressure of degenerate gas depends on the speed of electrons

3: Compressing degenerate gas causes circulation within the star

4: In order to compress degenerate gas, electrons need to be boosted to the top of the energy ladder

ANSWER: 2 AND 4

1. CHEMISTRY *Short Answer*- What is the pressure of .5 moles of gas with volume of 15 liters, temperature of 27 degrees Celsius, and a gas constant of 8.2?

ANSWER: 82 ATMS