TOSS-UP

1. BIOLOGY *Short Answer*- What is the name of the process when plants respond to mechanical stress as they grow through the soil by growing horizontal in order to avoid any obstacles?

ANSWER: TRIPLE RESPONSE

BONUS

BIOLOGY *Short Answer*- What is the name of the most common natural cytokinin, named because it was first discovered in maize?

ANSWER: ZEATIN

TOSS-UP

1. MATH *Multiple Choice*- A cone is circumscribed in a cube with side lengths of 6. Which of the following is the area of the cone?

W) 15π

X) 18π

Y) 21π

Z) 24π

ANSWER: X

BONUS

MATH *Short Answer*- There is a 4 x 4 grid with sixteen dots. An ant starts on the very bottom-left dot and can only move up or right along the grid. How many different paths can the ant take to the very top-right dot?

ANSWER: 20

TOSS-UP

1. EARTH AND SPACE SCIENCE *Short Answer*- Denote all of the following four statements that are true.

1: A-type stars have strong lines of hydrogen and helium as their most conspicuous features

2: The sun is an example of a G-type star, which has hydrogen lines weaker than F-typed stars

3: O-type stars are the hottest stars and thus have strong lines of neutral metals

4: Lines of neutral metals predominate K-typed stars

ANSWER: 2 AND 4

BONUS

EARTH AND SPACE SCIENCE *Multiple Choice*- Which of the following statements is not true?

W) Galaxies have luminosity classes of I to VI, with I as the most luminous

X) About one-fifth of the galaxies observed by ground-based telescopes are elliptical

Y) Spiral galaxies were the most common type of galaxy billions of years ago

Z) Irregular galaxies are dominated by H II regions and OB stars

ANSWER: W

TOSS-UP

1. CHEMISTRY *Short* Answer- A 2.5-L sample of gaseous sulfur dioxide has a pressure of 4.5 X 104 Pascals. If the pressure is changed to 1.5 X 105 Pa, then what will be the new volume of the gas?

ANSWER: .75 L

BONUS

CHEMISTRY *Short* Answer- A 15-L sample of gas has a temperature of 27ᵒC and a pressure of 3.6 X 103 Pa. The temperature drops to -73ᵒC and the pressure does not change. Then the pressure changes and temperature is held constant. What is the new value of pressure needed to bring the volume back to 15 liters, in proper significant figures?

ANSWER: 2.4 X 103 Pa

TOSS-UP

1. PHYSICS *Short Answer*- A wheel rotates with a constant angular acceleration of 4.2 radians per seconds squared. If the angular speed at t=0 is 4.00 rad/s, through what angle does the wheel rotate between t=0 and t=3? Give your answer to the nearest tenth.

ANSWER: 18.3 RADIANS

BONUS

PHYSICS *Multiple Choice*- A car is moving at 50 kilometers per hour and is moving along the edge of a circular ring. If the diameter of the ring is 6 meters and the acceleration due to gravity is 10 meters per second squared, then what is the smallest coefficient of static friction needed to keep the car on the track.

W) .2

X) .3

Y) .4

Z) .5

ANSWER: Z

TOSS-UP

1. ENERGY *Short Answer*- Denote all of the following three statements that are true about hydropower?

1: Hydropower at its height provided 1/3 of the country’s electricity

2: The top three hydropower producing states, in no particular order, are California, Oregon, and Washington

3: About 15% of the energy generated in the US is from hydropower

ANSWER: 1 AND 2

BONUS

ENERGY *Short Answer*- What is the name of the large tubes through which water from reservoirs move through on their way to the turbines?

ANSWER: PENSTOCKS

TOSS-UP

1. BIOLOGY *Short Answer*- Denote all of the following four statements that is a role carried out by actinomycetes.

1: They are used to manufacture antibiotics

2: They fix nitrogen in nodules on plants

3: They are grown as a source of protein

4: They are used to kill certain types of plants

ANSWER: 1 AND 2

BONUS

BIOLOGY *Multiple Choice*- Which of the following is the correct name for the multicellular fragments which occur when chains of bacteria break apart?

W) Glycocalyx X) Hormogonia Y) Akinetes Z) Saprobes

ANSWER: X

TOSS-UP

1. MATH *Short Answer*- What is the combined amount of the two angles that the hour and minute hand travels across in 40 minutes?

ANSWER: 140 DEGREES

BONUS

MATH *Multiple Choice*- A clock is at the time 12:00 PM. 2 hours and a half later, the clock is now at 2:30. What is the absolute value of the difference between the area that the 12-centimeter long hour hand covered and the area that the 6-meter long centimeter hand covered?

ANSWER: 352.5

TOSS-UP

1. EARTH AND SPACE SCIENCE *Short Answer*- Label the four following four events as either physical weathering or chemical weathering.

1: Smudged letters on gravestones and monuments

2: Karsts

3: Smooth rocks on the bottom of a stream bed

4: Oolites

ANSWER: CHEMICAL, CHEMICAL, PHYSICAL, CHEMICAL

BONUSfollow

EARTH AND SPACE SCIENCE *Short Answer*- List the following three parts of the stream from closest to the source of the river to furthest.

RHITHRON, CRENON, POTAMON

ANSWER: CRENON, RHITHRON, POTAMON (ACCEPT: 2, 1, 3)

TOSS-UP

1. CHEMISTRY *Short Answer*- Denote all of the following three statements that are true.

1: Polyprotic acids disassociate one proton at a time

2: Ascorbic acid is a triprotic acid

3: Creating a p-type semiconductor would involve replacing some silicon atoms with arsenic atoms

ANSWER: 1

BONUS

CHEMISTRY *Short Answer*- What is the name of a device that produces a pulsating direct current instead of an alternating current? A p-n junction is an example of this.

ANSWER: RECTIFIER

TOSS-UP

1. PHYSICS *Short Answer*- A ball has a mass of 7 kilograms. A man kicks the ball and it goes rolling on the frictionless floor at a speed of 15 meters per second. If the amount of time that his foot was in contact with the ball was .21 seconds, then what was the force he exerted?

ANSWER: 500 N

BONUS

PHYSICS *Short Answer*- A ball rolls down a frictionless ramp angled at 30 degrees with the horizontal with a length of 40. When the ball leaves the bottom of the ramp, friction causes a constant deceleration of 5 meters per second squared and the ball stops in 4 seconds. How far did the ball travel?

ANSWER: 40 METERS

TOSS-UP

1. ENERGY *Short Answer*- Denote all of the following four statements that are not true about geothermal power.

1: If hot water from production wells flash into steam, then the steam is typically condensed and returned to the reservoir to maintain water and pressure

2: Dry steam plants do not need rock-catchers, because they produce mostly steam and thus has no great uplift

3: If space is not limited, then vertical geothermal exchange pipes are the cheapest and most efficient to use

4: Although it is impossible for binary cycle power plants to not emit sulfur compounds, they only emit about one to three percent of those that coal and oil power plants do.

ANSWER: 2, 3, AND 4 (ACCEPT: ALL BUT 1)

BONUS

ENERGY *Multiple Choice*- Which of the following is true about geothermal energy?

W) Geothermal energy comprises of about four percent of the total US domestic energy reserves

X) In 2008, there were geothermal power plants in over 38 countries, generating about 13,870 megawatts of electricity

Y) The first distric heating system in the US was built in the 1950s

Z) Despite having copious amounts of water loss, binary cycle power plants can work at lower temperatures than flash or dry steam power plants

ANSWER: W