TOSSUP

1. Biology - *Short Answer* Identify all of the following three features that are characteristic of prokaryotic cells. I. Ribosomes; II. Circular chromosomes; III. Membrane-bound organelles

ANSWER: 1 AND 2 ONLY [AT]

BONUS

1. Biology - *Short Answer* By name or number, arrange the following three organs in the digestive system by the order food travels through them from first to last: I. Stomach, II. Esophagus, III. Jejunum.

ANSWER: II, I, III [SO]

TOSSUP

2. Math - *Short Answer* How many prime factors does 144 have?

Answer: 2

BONUS

2. Math - *Short Answer* Expand the polynomial (x+1)^3 (quantity x plus one end quantity cubed)

Answer: x^3+3x^2+3x+1 (x cubed plus three x squared plus three x plus one [in any order])

TOSSUP

3. Earth and Space - *Short Answer* What is the name given to soil that remains frozen for at least two years?

ANSWER: PERMAFROST [EB; RR ESS-G]

BONUS

3. Earth and Space - *Multiple Choice* Which of the following features is formed by the cutoff of a meander from the main stream?
W) Waterfall
X) Braided stream
Y) Levee
Z) Oxbow lake

ANSWER: Z) OXBOW LAKE [EB; RR ESS-G]

TOSSUP

4. Chemistry - *Short Answer* Alpha particles, which are composed of two protons and two neutrons, are equivalent to the nucleus of what element?

ANSWER: HELIUM [EB; RR Chem-AE]

BONUS

4. Chemistry - *Short Answer* What is the name for hydrogen containing one proton and two neutrons?

ANSWER: TRITIUM [SO]

TOSSUP

5. Physics - *Short Answer* What property of a fluid describes its resistance to flow or changing shape when a stress is applied to it?

Answer: VISCOSITY [RE]

BONUS

5. Physics - *Multiple Choice* Typical light microscopy is limited in the size of objects it can resolve due to the wavelength of light. What particle is now being used in the place of photons to image extremely small objects?

W) Protons
X) Neutrons
Y) Alpha particles
Z) Electrons

ANSWER: Z) ELECTRONS [RE; RR Phys-OS]

TOSSUP

6. Energy - *Multiple Choice* Researchers at Pacific Northwest National Lab are using machine learning to understand the chemistry of uranium, the primary fuel of many nuclear reactors. Nuclear reactors use which of the following processes in order to generate energy?

W) Nuclear fusion
X) Nuclear fission
Y) Combustion
Z) Reduction

ANSWER: X) NUCLEAR FISSION [SO]

BONUS

6. Energy - *Multiple Choice* Researchers at Pacific Northwest National Lab are working to create more accurate models for predicting the intensity of hurricanes. Which of the following scales are used to measure the intensity of a hurricane?

W) Saffir-Simpson scale
X) Enhanced Fujita scale
Y) Richter scale
Z) Modified Mercalli scale

ANSWER: W) SAFFIR-SIMPSON SCALE [RE]

TOSSUP

7. Biology - *Multiple Choice* Yeast can be classified under which of the following taxonomic kingdoms?

W) Protist

X) Fungi

Y) Plant

Z) Animal

ANSWER: X) FUNGI [AT; RR Bio-OS]

BONUS

7. Biology - *Short Answer* How many pairs of autosomal chromosomes are visible in a normal human karyotype?

ANSWER: 22 [AT; RR Bio-G]

TOSSUP

8. Math - *Short Answer* If it takes Alan 5 years to drive from point A to point B at a constant rate, in years, how long will it take him to travel half the distance at double the original rate?

Answer: 1.25 YEARS

BONUS

8. Math - *Short Answer* What is the area, in square units, of a triangle with sides 20, 21, and 29 units?

Answer: 210 SQUARE UNITS

TOSSUP

9. Earth and Space - *Multiple Choice* Which of the following ocean zones is the shallowest?

W) Hadal

X) Abyssal

Y) Photic

Z) Benthic

ANSWER: Y) PHOTIC [EB; RR ESS-AO]

BONUS

9. Earth and Space - *Multiple Choice* Which of the following is not a moon of Saturn?

W) Enceladus

X) Titan

Y) Hyperion

Z) Io

ANSWER: Z) IO [EB; RR ESS-SS]

TOSSUP

10. Chemistry - *Multiple Choice* Salt is added to roads in winter to cause what change to the chemical properties of water?

W) Decreasing boiling point

X) Increasing boiling point

Y) Decreasing freezing point

Z) Increasing freezing point

ANSWER: Y) DECREASING FREEZING POINT [SO]

BONUS

10. Chemistry - *Short Answer* Graphite and fullerene are different structural arrangements of what atom?

ANSWER: CARBON [RE]

TOSSUP

11. Physics - *Multiple Choice* What color does a red shirt primarily reflect?

W) Red

X) Magenta

Y) Yellow

Z) Cyan

Answer: W) RED [RE]

BONUS

11. Physics - *Multiple Choice* Which of the following best explains why a metal spoon at 100 degrees fahrenheit feels much warmer than a styrofoam cup at 100 degrees fahrenheit?

W) The specific heat of metal is higher than styrofoam

X) The specific heat of styrofoam is higher than metal

Y) The thermal conductivity of metal is higher than styrofoam

Z) The thermal conductivity of styrofoam is higher than metal

Answer: Y) THE THERMAL CONDUCTIVITY OF METAL IS HIGHER THAN STYROFOAM [RE]

TOSSUP

12. Energy - *Short Answer* Scientists at Lawrence Berkeley National Lab are worried about the chemical interactions between ozone and nicotine creating thirdhand smoke. What is the chemical formula for ozone?

ANSWER: O3 [EB; RR Energy-PS]

BONUS

12. Energy - *Short Answer* Researchers at the Princeton Plasma Physics Lab are studying alternative energy sources. Identify all of the following three types of energy generation which rely on spinning a turbine. I. Nuclear; II. Solar; III. Geothermal

ANSWER: 1 AND 3 [SO]

TOSSUP

13. Biology - *Multiple Choice* Which of the following structures would NOT be present in an animal cell?
W) Nucleus
X) Centrosomes
Y) Ribosomes
Z) Cell wall

Answer: Z) CELL WALL [AT]

BONUS

13. Biology - *Multiple Choice* Which of the following terms describes the tissue connecting bones to other bones in the human body?
W) Muscles
X) Tendons
Y) Ligaments
Z) Cartilage

Answer: Y) LIGAMENTS [AT]

TOSSUP

14. Math - *Short Answer* There are 15 heads and 40 legs in a barn. Assuming that there are only chickens and cows, how many total animals are there?

Answer [HK]: 15 ANIMALS

BONUS

14. Math - *Short Answer* If the radius of a circle is 4 units, to the nearest integer, what is the circumference of the circle?

Answer: 25 UNITS

TOSSUP

15. Earth and Space - *Short Answer* What geologic era are we currently living in?

ANSWER: CENOZOIC [EB; RR ESS-G]

BONUS

15. EARTH AND SPACE *Short Answer* The average rate of plate motion is 2.5 centimeters per year. How many years would it take an ocean basin to become 20 kilometers wider than it is now?

ANSWER: 800,000 [EB; RR ESS-G]

TOSSUP

16. Chemistry - *Multiple Choice* Which of the following pieces of glassware is used for measuring precise amounts of a liquid?
W) Earlenmeyer flask
X) Beaker
Y) Test tube
Z) Graduated cylinder

ANSWER: Z) GRADUATED CYLINDER [EB; RR Chem-NS]

BONUS

16. Chemistry - Short Answer Daniel mixes 10 milliliters of a substance, which has a density of 200 grams per liter, with 20 milliliters of another substance, which has a density of 250 grams per liter. In kilograms, what is the total mass of his mixture?

ANSWER: 0.007 (DO NOT ACCEPT: 7) [SO]

TOSSUP

17. Physics - *Multiple Choice* Which of the following laws states that forces come in equal-yet-opposite pairs?
W) Gauss's law
X) Hooke's law
Y) Second law of thermodynamics
Z) Newton's third law

ANSWER: Z) NEWTON'S THIRD LAW [EB; RR Phys-ME]

BONUS

17. Physics - *Short Answer* What is the SI unit for pressure?

ANSWER: PASCAL [EB; RR Phys-ME]

TOSSUP

18. Energy - *Short Answer* Researchers at Pacific Northwest National Lab are studying the role of clouds in atmospheric models. What type of cloud is made primarily of ice crystals due to its typically high altitudes?

ANSWER: CIRRUS [RE]

BONUS

18. Energy - *Short Answer* Researchers in the Office of Public Health are studying the musculoskeletal system. What bone in the human body extends from the elbow to the little finger?

ANSWER: ULNA [SO]

TOSSUP

19. Biology - *Short Answer* What term describes the process by which water evaporates from plant leaves, effectively pulling water up from the roots?

ANSWER: TRANSPIRATION [AT]

BONUS

19. Biology - *Short Answer* Identify all of the following statements that are true about cells. I. All living organisms are composed of cells; II. All cells are produced from other cells; III. All microorganisms contain a cell wall.

ANSWER: 1 AND 2 ONLY [AT]

TOSSUP

20. Math - *Short Answer* If f(x) = 2x+1 (f of x is 2x plus 1), what is f(f(2)) (f of f of 2)?

Answer: 11

BONUS

20. Math - *Short Answer* Find $a + b + c$ such that $49a + 7b + c = 64$ and a, b, and c are nonnegative integers less than 7.

Answer: 4

TOSSUP

21. Earth and Space - *Short Answer* What is the name of the closest major galaxy to the Milky Way?

ANSWER: ANDROMEDA [EB; RR ESS-OA]

BONUS

21. Earth and Space - *Multiple Choice* Which of the following orbital configurations would produce a solar eclipse?

W) The moon is behind the Earth with respect to the sun

X) The moon is in front of the Earth with respect to the sun

Y) The moon is to the right of the Earth with respect to the sun

Z) The moon is to the left of the Earth with respect to the sun

ANSWER: X) THE MOON IS IN FRONT OF THE EARTH WITH RESPECT TO THE SUN [EB; RR ESS-OA]

TOSSUP

22. Chemistry - *Multiple Choice* Which of the following explains why pure sodium metal is so reactive?

W) It is an alkali metal that needs to accept one valence electron

X) It is an alkali metal that needs to donate one valence electron

Y) It is a halogen that needs to accept one valence electron

Z) It is a halogen that needs to donate one valence electron

ANSWER: X) IT IS AN ALKALI METAL THAT NEEDS TO DONATE ONE VALENCE ELECTRON [OB; RR Chem-AE]

BONUS

22. Chemistry - *Short Answer* Glucose has a large amount of energy stored within its chemical bonds, but under standard conditions it is considered to be stable. This is because of what energetic barrier that must be overcome before glucose can undergo a decomposition reaction?

ANSWER: ACTIVATION ENERGY [SO]

TOSSUP

23. Physics - *Short Answer* What name is given to the optical phenomenon where light traveling from one medium to another appears to bend?

ANSWER: REFRACTION [EB; RR Phys-OS]

BONUS

23. Physics - *Multiple Choice* Which of the following pairs of particles would experience an attractive electromagnetic force?

W) Two electrons

X) A proton and a neutron

Y) A proton and an alpha particle

Z) An electron and an alpha particle

ANSWER: Z) AN ELECTRON AND AN ALPHA PARTICLE [EB; RR Phys-EM]