Round 7

TOSSUP

1) MATH *Short Answer* In what number base does 1 + 2 = 10?

ANSWER: 3

BONUS

1) MATH *Short Answer* What is the octal equivalent of the hexadecimal number AA?

ANSWER: 252

TOSSUP

2) ENERGY *Short Answer* What fundamental particle is theorized to give mass to other particles, which is through an interaction with the namesake field of the particle?

ANSWER: HIGGS BOSON (DO NO ACCEPT: HIGGS FIELD)

BONUS

2) ENERGY *Short Answer* What is the spin of the Higgs boson?

ANSWER: 0

TOSSUP

3) EARTH AND SPACE *Short Answer* From greatest to least, rank the following three elements by their abundance in the Earth's crust. 1) oxygen 2) aluminium 3) silicon.

ANSWER: 1, 3, 2

BONUS

3) EARTH AND SPACE *Short Answer* What is the term for the points in the sky where the Earth's axis intersects the celestial sphere?

ANSWER: CELESTIAL POLES

TOSSUP

4) MATH *Multiple Choice* If a right triangle has a leg of length 7 and hypotenuse of length 25, what is the area of the triangle?

W) 336
X) 168
Y) 84
Z) 42

ANSWER: Y) 84

BONUS

4) MATH *Short answer* What is the average rate of change of the function f(x)=2x^2+3x-2 from x=2 to x=5.

ANSWER: 17

TOSSUP

5) CHEMISTRY *Short Answer* What is the oxidation state of iron in Ferric Oxide?

ANSWER: +3

BONUS

5) CHEMISTRY *Short Answer* Calculate the mass of one mole of Copper Sulfate Pentahydrate in grams. Assume that the mass of one mole of atoms of Copper is 64 grams, Sulfur is 32 grams, Oxygen is 16 grams, and Hydrogen is 1 gram.

ANSWER: 250 GRAMS

TOSSUP

6) BIOLOGY *Multiple Choice* Microbes that are found in hot springs or other extreme environments are most likely to be which of the following

W) Gram-negative
X) Gram-positive
Y) Archaeans
Z) Cyanobacteria

ANSWER: Y) ARCHAEANS

BONUS

6) BIOLOGY *Short Answer* What ions determine the resting potential of a nerve?

ANSWER: SODIUM AND POTASSIUM

TOSSUP

7) PHYSICS *Multiple Choice* What kind of device consists of a platinum wire wrapped around a ceramic core?

W) Probe Thermometer
X) Infrared Thermometer
Y) Analogue Thermometer
Z) Resistance Thermometer

ANSWER: Z) RESISTANCE THERMOMETER

BONUS

7) PHYSICS *Multiple Choice* What kind of pendulum, used for measuring very weak forces, consists of a wheel suspended from its middle by a thin fiber that rotates around its axis rather than swinging?

W) Torsional Pendulum
X) Foucault Pendulum
Y) Galilean Pendulum
Z) Compound Pendulum

ANSWER: X) FOUCAULT PENDULUM

TOSSUP

8) CHEMISTRY *Short Answer* What is the principal quantum number of a valence electron in a Titanium atom?

ANSWER: 4

BONUS

8) CHEMISTRY *Short Answer* This radioactive decay is a type of beta decay, in which a proton is converted into a neutron and an electron neutrino and a namesake particle are released. What is this decay?

ANSWER: POSITRON EMISSION

TOSSUP

9) ENERGY *Short Answer* The First Law of Thermodynamics defines what quantity as the difference between heat added to a system and work done by the system?

ANSWER: INTERNAL ENERGY

BONUS

9) ENERGY *Short answer* Calculate the change in internal energy of a system given that the change in enthalpy is 200 Joules and the change in volume is 5 Liters at a constant pressure of 1 atmosphere.

ANSWER: 195 JOULES

TOSSUP

10) CHEMISTRY *Multiple Choice* Which of the following bonds is the most polar?

W) B-Cl bond
X) C-Cl bond
Y) P-F bond
Z) P-Cl bond

ANSWER: Y) P-F BOND

BONUS

10) CHEMISTRY *Short Answer* How many sigma and pi bonds are present in acetic acid?

ANSWER: 7 SIGMA AND 1 PI

TOSSUP

11) BIOLOGY *Short Answer* Which muscle controls the shape of the human eye?

ANSWER: CILIARY MUSCLE

BONUS

11) BIOLOGY *Short Answer* What is another name for a compact glycocalyx surrounding a prokaryotic cell?

ANSWER: CAPSULE

TOSSUP

12) ENERGY *Short Answer* Scientists at NREL are working on developing solar cells. Upon what principle do solar cells work, which allows them to create an electric current from light?

ANSWER: PHOTOVOLTAIC EFFECT

BONUS

12) ENERGY *Short Answer* Solar cells contain two semiconductors that form a p-n junction. When photons hit the atoms, the electrons jump from the valence band to what higher-energy band?

ANSWER: CONDUCTION BAND

TOSSUP

13) EARTH AND SPACE *Short Answer* In strip mining, what terms refers to the overlying soil and rock that is removed to mine the mineral?

ANSWER: OVERBURDEN

BONUS

13) EARTH AND SPACE *Short Answer* What type of mining involves leaving the ore where it is in the ground, and dissolving the minerals and pumping the solution to the surface where the minerals can be recovered?

ANSWER: IN-SITU MINING (ACCEPT: IN-SITU LEACHING, ISL, SOLUTION MINING, IN-SITU RECOVERY, ISR)

TOSSUP

14) BIOLOGY *Multiple Choice* What organ weighs an average of 1.6 kilograms, sits on the right side of the belly and is responsible for secreting bile?

W) Gallbladder
X) Pancreas
Y) Liver
Z) Duodenum

ANSWER: Y) LIVER

BONUS

14) BIOLOGY *Multiple Choice* Which of the following factors does not promote linkage disequilibrium?

W) asexual reproduction
X) random mating
Y) epistasis
Z) population subdivision

ANSWER: X) RANDOM MATING

TOSSUP

15) PHYSICS *Multiple Choice* When a woman pushes on her grocery cart, which force causes the woman to move in the same direction as the cart?

W) the force the woman exerts on the grocery cart.
X) the force the grocery cart exerts on the woman.
Y) the force the woman exerts on the ground.
Z) the force the ground exerts on the woman.

ANSWER: Z) THE FORCE THE GROUND EXERTS ON THE WOMAN.

BONUS

15) PHYSICS *Multiple Choice* What is a false statement regarding the Carnot Cycle and Engine?

W) The Carnot Cycle consists of two reversible isothermal and two reversible adiabatic processes
X) No engine can be more efficient than a Carnot engine operating between the same two temperatures
Y) The Carnot Cycle is derived from the First Law of Thermodynamics
Z) All Carnot engines operating between the same two temperatures have the same efficiency

ANSWER: Y) THE CARNOT CYCLE IS DERIVED FROM THE FIRST LAW OF THERMODYNAMICS

TOSSUP

16) CHEMISTRY *Multiple Choice* Which of the following statements is false?

W) a 1 mol sample of pure water contains 18 grams of water
X) Oxygen is a reactant in a combustion reaction
Y) 1 mol of Oxygen in its natural state contains 8 grams of oxygen
Z) Oxygen has a smaller atomic radius than Nitrogen

ANSWER: Y) 1 MOL OF OXYGEN IN ITS NATURAL STATE CONTAINS 8 GRAMS OF OXYGEN

BONUS

16) CHEMISTRY *Short Answer* What is the crystal structure of NaCl?

ANSWER: FACE-CENTERED CUBIC (ACCEPT: FCC)

TOSSUP

17) MATH *Short Answer* What is 999 times 1001?

ANSWER: 999999

BONUS

17) MATH *Short Answer* If two numbers add up to 46 and their difference is 12, find their product.

ANSWER: 493

TOSSUP

18) EARTH AND SPACE *Multiple Choice* What is the oldest planet of the solar system

W) Mercury
X) Earth
Y) Neptune
Z) Jupiter

ANSWER: Z) JUPITER

BONUS

18) EARTH AND SPACE *Short Answer* What are the unwanted materials after strip mining known as?

ANSWER: MINING SPOILS (ACCEPT: TAILINGS)

TOSSUP

19) BIOLOGY *Multiple Choice* What type of endocytosis occurs when a cell engulfs a fluid and encloses it in a vesicle?

W) Phagocytosis
X) Epicytosis
Y) Receptor-mediated endocytosis
Z) Pinocytosis

ANSWER: Z) PINOCYTOSIS

BONUS

19) BIOLOGY *Short Answer* What vitamin complex includes thiamine, niacin, and riboflavin?

ANSWER: VITAMIN B

TOSSUP

20) PHYSICS *Multiple Choice* If the distance between the centers of mass of two bodies is doubled, the gravitational force between the bodies will become what portion of the original force:

W) double
X) one half
Y) remain the same
Z) one quarter

ANSWER: Z) ONE QUARTER

BONUS

20) PHYSICS *Short Answer* Two rockets A and B are traveling towards each other. Rocket A's speed is 80% of the speed of light, and Rocket B's speed is 60% of the speed of light. With what velocity do the observers in Rocket A see Rocket B?

ANSWER: SPEED OF LIGHT (C)

TOSSUP

21) MATH *Multiple Choice* A sector of a circle with radius 5 has an area of 10 pi. Which of the following is the degree measure of the angle created by the sector?

W) 72
X) 144
Y) 216
Z) 288

ANSWER: X) 144

BONUS

21) MATH *Short Answer* Given that the tangent from a point to a circle measures 5 and the length of a secant from the same point to the circle measures 10, what is the measure of the length of the chord created by the secant?

ANSWER: 7.5 OR 15/2

TOSSUP

22) EARTH AND SPACE *Short Answer* What type of glacier, also known as valley glacier or mountain glacier, forms on the mountainside and moves downward through valleys?

ANSWER: ALPINE (GLACIER)

BONUS

22) EARTH AND SPACE *Short Answer* Identify which of the following three geologic features is an alpine glacier. 1) Gorner, 2) Furtwangler, 3) Greenland.

ANSWER: 1 AND 2 (GORNER AND FURTWANGLER)

TOSSUP

23) PHYSICS *Short Answer* What physical quantity is defined as the change in momentum?

ANSWER: IMPULSE

BONUS

23) PHYSICS *Short Answer* Calculate the impulse in kg.m/s between time t = 0 seconds and t = 2 seconds given that the position of a 2 kg particle is 2t^2 + 4t + 8.

ANSWER: 16 (KG.M/S)