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Science Bowl Team Round (24 Questions)   
  
Toss-up   
  
1) BIOLOGY Short Answer: What hormone does the kidney secrete when the body tissues do not receive enough oxygen, thereby stimulating erythrocyte production?   
  
ANSWER: erythropoietin   
  
BONUS   
  
BIOLOGY Multiple Choice: Carbon dioxide is carried in blood plasma, in hemoglobin, and as bicarbonate. What percent of carbon dioxide in the body is transported with hemoglobin?

W) 10  
X) 20  
Y) 30   
Z) 40  
  
ANSWER: X  
  
Toss-up  
  
2) Math Short Answer: What is the derivative of sin(2x)cos(2x)?   
  
ANSWER: 2(cos2x)^2 - 2(sin2x)^2

BONUS   
  
Math Short Answer: What is line tangent to parametric equations y= t and x=te^t at t=0?  
  
ANSWER: x-1 = y  
  
Toss-up  
  
3) CHEMISTRY Short Answer: Using name or number, match the 3 colors red, orange, and pink to their respective compounds:

1) potassium chloride  
2) lithium chloride  
3) sodium chloride

ANSWER: 1) pink 2) red 3) orange

BONUS  
  
CHEMISTRY Short Answer: Name the hybridization of the central atom and hybrid orbitals for carbon dioxide and PF5.   
ANSWER: sp and 2; sp3d and 5   
  
Toss-up   
  
4)  PHYSICS Multiple Choice: A stone is thrown upwards at initial velocity 10.0m/s. At what time in seconds does it reach maximum height? Assume gravity to be -10 meters per seconds squared.   
W) 1  
X) 2  
Y) 3  
Z)  4  
  
ANSWER: W  
  
BONUS  
  
PHYSICS Short Answer: The stone is thrown up with initial velocity 10 m/s. Assuming gravity is -10 m/s^2, what is the maximum height in meters?

ANSWER: 5 meters  
  
Toss-up  
  
5) EARTH/ ASTRO Short Answer: Which spectral class of stars is blue in color, is rarest of the main sequence, and comprises the first stars to leave the main sequence?  
  
ANSWER: O  
  
BONUS  
  
EARTH/ ASTRO Multiple Choice: White dwarfs are located in the   
  
W) upper right  
X) upper left  
Y) lower right  
Z) lower left  
  
ANSWER: z

Toss-up   
  
6) ENERGY Multiple Choice: Which geothermal plant requires a rock-catcher?  
  
W) Flash steam  
X) Dry steam  
Y) binary cycle power  
Z) hybrid power  
  
ANSWER: x  
  
BONUS   
  
ENERGY Short Answer: Approximately how much energy in Joules is needed to raise 50 kg of water from 30 to 50 degrees Celsius?   
  
ANSWER: 4000 Joules  
  
Toss-up   
  
7) BIOLOGY Short Answer: What is the name of the thin membrane lining the ventricular system of the brain and spinal cord? It produces cerebrospinal fluid and is one of the four types of neuroglia of the CNS.   
ANSWER: Ependyma   
  
BONUS  
  
BIOLOGY Short Answer: Name the four neuroglia of the CNS.   
  
ANSWER: Ependymal cells, Oligodendrocytes, Microglia, Astrocytes (accept in any order)

TOSS-UP  
  
8) MATH Short Answer: What is the focus of the parabola x=y^2 + 4?

ANSWER: (17/4, 0)

BONUS  
  
Math Short Answer: Find the directrix of the parabola: x2 + 6x +4y + 5 = 0  
  
ANSWER: y = 2  
  
TOSS-UP  
  
9) CHEMISTRY Short Answer:What is the electron configuration of copper?   
ANSWER: [Ar] 3 d10 4s1 or 1s2, 2s2, 2p6, 3s2, 3p6, 3d10, 4s1  
  
BONUS   
  
CHEMISTRY Mult Choice A 25 ml solution of 0.5 M NaOH is titrated until neutralized into a 50 ml sample of HCl. What was the concentration of the HCl?

W) 0. 25  
X) 2.5  
Y) 25  
Z) 250  
  
ANSWER: w  
  
TOSS-UP  
  
10) PHYSICS  Short Answer: A wheel is rotating at constant angular acceleration of 4 rad/ s^2, with an angular speed of 2 rad/ s at 0 seconds. Find the angular displacement in radians at 2 seconds.

ANSWER: 12 rad  
  
BONUS  
  
PHYSICS Short Answer: A 10 kg object drops at a height of 10 meters. What is the velocity with which it hits the ground? Simplify the answer.   
  
ANSWER: 10 times the square root of 2  
  
TOSS-UP   
  
11) EARTH/ ASTRO Multiple Choice: What is the process by which small “seeds” grow into planets, when microscopic solid particles condensed from the gas of solar nebulae?   
W) accumulation  
X) jovial interaction  
Y) planetesimal growth  
Z) accretion  
  
ANSWER: y  
  
BONUS   
  
EARTH/ ASTRO Short Answer: By name or number, identify all of the following 3 statements which is or are true about how our cores are heated:   
1) Accretion deposites energy brought in from afar by colliding planetesimals.   
2) Differentiations converts thermal energy into gravitational potential energy.   
3) When radioactive nuclei decay, subamotic particles can transfer mass-energy to the planetary interior.  
  
ANSWER: 1 and 3

TOSS-UP

12) ENERGY Short Answer: By name or number, order the following countries from those that consume the least energy to those that consume the most.   
  
1) Australia  
2) Taiwan  
3) Mexico  
4) Germany  
  
ANSWER: 3, 4, 2, 1 (Mexico, Germany, Taiwan, Australia)  
  
BONUS   
  
ENERGY Short Answer: A 50 kg person is at the top of a 200 meter tall rollercoaster. At 40 meters from the ground, assuming energy is conserved as kinetic or potential energy, what is his speed in m/s?   
  
ANSWER: 40 times the square root of 2

13) BIOLOGY Short Answer: Using numbers, identify all of the following three that is or are true about neurons.  
1) afferent neurons have no dendrites   
2) The cell body, dendrite, and small part of an efferent neuron does lie in the CNS  
3) Interneurons make up 99% of all neurons   
  
ANSWER: all   
  
BONUS   
  
BIOLOGY Short Answer: Name the corresponding lobe of the cerebral cortex which is associated with the four following primary sensory and association areas.  
1) motor cortex   
2) somatosensory association area   
3) Hearing  
4) visual association area   
  
ANSWER: frontal, parietal, temporal, occipital (do not accept out of order)  
Toss-up  
  
14) Math Short Answer: The average value of 23, 17, 45, 7 and x is 20. What is the value of x?   
  
ANSWER: 8  
  
BONUS   
  
Math Short Answer: What is the indefinite integral of sin^2 (x)?   
  
ANSWER: 0.5x - 0.25(sin2x)  
  
Toss-up  
  
15) CHEMISTRY Multiple Choice: Which of the statements is false?

W) Electrons are first accommodated into lowest-energy molecular orbitals.  
X) According to the Pauli exclusion principle, each molecular orbital holds up to 2 electrons.  
Y) The bond in a heteronuclear diatomic molecule is nonpolar.  
Z) It takes very little energy to excite an electron from a HOMO to a LUMO.  
  
ANSWER:y   
  
BONUS  
  
CHEMISTRY Multiple Choice: Which experimental procedure is best suited to determine the hydrogen peroxide concentration in an aqueous solution?

W) precipitation with standard MgCl2 solution  
X) reaction with excess Zn to form H2  
Y) titration with standard H2SO4  
Z) Titration with standard KMnO4   
ANSWER: z   
  
Toss-up   
  
16)  PHYSICS Multiple Choice: Which of the following statements is not an assumption of the kinetic theory of gases?   
W) Molecules obey Newton’s laws of motion  
X) Molecules make inelastic collisions with the walls  
Y) The number and average separation of gas molecules is relatively large.  
Z)  all molecules are identical  
  
ANSWER:x  
  
BONUS  
  
PHYSICS Short Answer: Assume the average coefficient of linear expansion for glass is 1 x 10^ -5. What is the change in length of a 10 meter piece of glass that is heated from 20 to thirty degrees Celsius?   
ANSWER: 10^ -3 meters  
  
Toss-up  
  
17) EARTH/ ASTRO Short Answer: What is the name of the dark-colored areas on the moon in which we can see only a few craters on top of generally smooth volcanic plains?  
  
ANSWER: lunar maria  
  
BONUS  
  
EARTH/ ASTRO Multiple Choice: Which of the following was likely the most responsible for erasing Mars’ ancient craters?   
  
W) tectonics  
X) erosion  
Y) planetary contraction  
Z) volcanism  
  
ANSWER: y

Toss-up

A heat engine takes in 700 J of heat from a high temperature reservoir and rejects 500 J of heat to a lower temperature reservoir. How much work does the engine do in each cycle?   
  
18) ENERGY Short Answer: A heat engine takes in 700 J of energy from a high temperature reservoir and rejects 500 J of heat to a lower temperature reservoir. How much work is done in each cycle?   
  
ANSWER: 200 J  
  
BONUS   
  
ENERGY Short Answer: If a heat engine does 100 kJ of work per cycle and releases 400 kJ as heat, what is the efficiency in percent?  
  
ANSWER: 20  
  
Toss-up   
  
19) BIOLOGY Short Answer: Name the phylum of organisms that produce hirudin.   
ANSWER: annelida  
  
BONUS  
  
BIOLOGY Short Answer: Using number, put the following four renin-angiotensin- aldosterone system (RAAS) steps in order first to last.

1) the adrenal glands are stimulated to release aldosterone  
2) ACE cleaves angiotensin I  
3) the JGA produces renin  
4) blood pressure drops  
  
ANSWER: 4, 3, 2, 1

TOSS-UP  
  
20) MATH Short Answer: How many distinct diagonals are in a decagon?

ANSWER: 35

BONUS  
  
Math Short Answer: Vector a is <3,4> and vector b is <4,5>. What is the scalar projection of b onto a? Give your answer as a fraction.   
  
ANSWER: 32/5  
  
TOSS-UP  
  
21) CHEMISTRY Mult Choice: In the chemical reaction A + B equilibrium arrow C + D, A, B, C and D are gases. Increasing the pressure causes which of the following in this reaction?  
W) equilibrium shifts to the left  
X) equilibrium shifts to the right  
Y) No change  
Z) the reaction stops occurring  
  
ANSWER: Y   
  
BONUS   
  
CHEMISTRY Mult Choice Which of the following has the longest bond?

W) H-F  
X) H-I  
Y) H-Cl  
Z) H-Br  
  
ANSWER: x  
  
TOSS-UP  
  
22) PHYSICS  Short Answer: What is the name of the transfer of energy by the movement of a substance?

ANSWER: convection  
  
BONUS  
  
PHYSICS Short Answer: List of the following four from highest dielectric constant to lowest.

Air, benzene, vacuum, pure water  
  
ANSWER: pure water, benzene, air, vacuum  
  
TOSS-UP   
  
23) EARTH/ ASTRO Multiple Choice: Which lava forms from basaltic lava?   
  
W) a’a  
X) pahoehoe  
Y) block lava  
Z) lava dome  
  
ANSWER: x  
  
BONUS   
  
EARTH/ ASTRO Short Answer: Identify by name or number which of the following four planets contains 1% nitrogen or greater.  
1) mercury   
2) venus  
3) earth  
4) Mars  
  
ANSWER: 2, 3, 4

TOSS-UP

24) ENERGY Multiple Choice: Which of the following is true?   
  
W) Biogas is cheaper to collect than methane.  
X) Industry uses the largest percentage of U.S. biomass.  
Y) Ethanol has one of the lowest octane ratings.  
Z) Using the land we grow food on for corn ethanol is not a problem in the U.S.  
  
ANSWER: x  
  
BONUS   
  
ENERGY Short Answer: Rank the following types of coal by carbon content: bituminous, anthracite, lignite, subbituminous   
  
ANSWER: 3, 4, 1, 2