Round 22

1. BIOLOGY

Writer: Matthew Lee

Toss Up: Multiple Choice

Which of the following is a bacteriostatic antibiotic that works by disrupting protein synthesis?

W) Erythromycin

X) Penicillin

Y) Trimethoprim

Z) Nalidixic acid

Toss Up Answer: W

Bonus: Multiple Choice

In India, during a cholera epidemic of 1926, European men poured a treatment for cholera into village wells unbeknownst to the villagers. What was the treatment?

W) Alcohol

X) antibiotics

Y) Phages

Z) Iodine

Bonus Answer: Y

==========

2. ENERGY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Which of the following outputs the most energy?

W) Coal

X) Natural Gas

Y) Petroleum

Z) Surface Oil

Toss Up Answer: W

Bonus: Short Answer

What is the powerhouse of the cell?

Bonus Answer: Mitochondria

==========

3. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

An individual suffers brain damage that results in respiratory failure. Which region of the brain was most likely damaged?

W) Substantia nigra

X) Pons

Y) Red nucleus

Z) Reticular formation

Toss Up Answer: X

Bonus: Multiple Choice

A man and a woman get married and soon learn that they both have a rare, genetically inherited recessive disorder

that makes them prone to dizziness. Worried about the fate of their children, they seek the advice of a genetic counselor. She sequences their genomes and assures them that
none of their children will have the disorder. What information would she have to obtain from the sequencing procedure that allows her to make this claim?
W) The dizziness phenotype in the man is due to a mutation in a gene other than the gene responsible for the woman's phenotype.
X) The dizziness disorder is an autosomal recessive trait.
Y) The man and the woman are related genetically causing the same dizziness phenotype.
Z) It is impossible for the man and the woman to have unaffected children - the genetic counselor is wrong.

Bonus Answer: W

==========

4. MATHEMATICS

Writer: Jessica Titensky

Toss Up: Short Answer

Convert CD from hexadecimal to decimal

Bonus Answer: 205

Bonus: Short Answer

Convert CD from hexadecimal to binary

Bonus Answer: 11001101

==========

5. CHEMISTRY

Writer: Jason Mohabir

Toss Up: Multiple Choice

How many electrons occupy the bonding molecular orbitals of a CN triple bond?
W) 2
X) 4
Y) 6
Z) 8

Toss Up Answer: Y

Bonus: Multiple Choice

Which of the following compounds would have the highest boiling point?
W) CH3CH2CH2CH3
X) CH3NH2
Y) CH2F2
Z) CH3OH

Bonus Answer: Z

==========

6. MATHEMATICS

Writer: Elias Milborn

Toss Up: Multiple Choice

What are the solutions for x in the following equation: x^2 - 2x = 8?
W) 0
X) 0 and -2
Y) 4 and -2
Z) -4 and 2

Toss Up Answer: Y

Bonus: Multiple Choice

The sum of the squares of reciprocals of all positive integers equals which of the following?

W) pi^1/2 (read as square root of pi)

X) pi/3

Y) pi^2/6

Z) pi^3/12

Bonus Answer: Y

==========

7. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

Two trucks are 50 kilometers apart and traveling toward each other. One automobile is moving at 60km/h and the other is moving at 40km/h . How long will it take for them meet?

W) 15 minutes

X) 20 minutes

Y) 24 minutes

Z) 30 minutes

Toss Up Answer: Z

Bonus: Short Answer

The position of a particle in meters is given by x(t) = 25t − 3t^3 (READ AS: 16 times t minus 3 times t cubed) , where the time t is in seconds. The particle is momentarily at rest at what time t rounded to the nearest hundredth?

Bonus Answer: 1.67 seconds, accept 1.67

==========

8. MATHEMATICS

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

The sum (1+3+3^2+... 3^n) is equal to which of the following?

W) 2 * 3^n

X) 4 * 3^n

Y) (3^(n+1)+1)/2

Z) (3^(n+1)-1)/2

Toss Up Answer: Z

Bonus: Short Answer

In space, what is the graph of the equation x^2 = y?

Bonus Answer: A parabolic cylinder

==========

9. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What did Ernest Orlando Lawrence develop in 1932?

W) Nuclear Reactor

X) The Microwave

Y) Cyclotron

Z) X-Ray Machine

Toss Up Answer: Y

Bonus: Short Answer

What theory first appeared in a 1905 paper called "On the Electrodynamics of Moving Bodies"?

Bonus Answer: Special Theory of Relativity

==========

10. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

Certain amino acids are considered essential in an animal's diet because they cannot be produced within the organism. Which of the following cellular processes would be most DIRECTLY affected by a dietary deficiency in essential amino acids?

W) Translation of mRNA
X) Cellular respiration
Y) Cell division
Z) Oxygen transport

Toss Up Answer: W

Bonus: Multiple Choice

Integral transmembrane proteins are proteins embedded in the cell membrane. Which of the following amino acids would you MOST expect to find in the transmembrane region of such proteins?

W) Tryptophan
X) Lysine
Y) Arginine
Z) Serine

Bonus Answer: W

==========

11. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

When 236U fissions, the products might be which of the following?

W) Ba-146 (READ AS: barium 146), Kr-89 (READ AS: krypton 89), and a proton
X) Ba-146 (READ AS: barium 146), Kr-89 (READ AS: krypton 89), and a neutron
Y) Cs-148 (READ AS: cesium 148) and Br-85 (READ AS: barium 85)
Z) two uranium nuclei

Toss Up Answer: X

Bonus: Short Answer

In the proton-proton cycle, two hydrogen atoms initially react to form what 3 particles?

Bonus Answer: Deuterium, a positron, and an electron neutrino (ACCEPT neutrino)

==========

12. ENERGY

Writer: Aaron Gee

Toss Up: Short Answer

Used normally, a 150-watt, 120 volt light bulb requires how many amps of current?

Bonus Answer: 1.25 Amps

Bonus: Short Answer

If 10 joules of energy are required to move 5 coulombs of charge between two points, the potential difference between the two points is equal to how many volts?

Bonus Answer: 2 volts

==========

13. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

The coefficient of linear expansion of a certain steel is 0.000034 per C◦ (READ AS: celsius degree). What is the exact coefficient of volume expansion, in (C◦) ^ (−1) (READ AS: celsius degree to the negative 1)?

Bonus Answer: 0.000102 (DO NOT ACCEPT APPROXIMATIONS)

Bonus: Multiple Choice

The energy given off as heat by 300 g of an alloy as it cools through 50C◦(READ AS: 50 celsius degree) raises the temperature of 300 g of water from 30◦C (READ AS: 30 degrees celsius) to 40◦ C. The specific heat of the alloy (in cal/g · C◦) is:

W) 0.0015

X) 0.1

Y) 0.2

Z) 1

Bonus Answer: Y

==========

14. BIOLOGY

Writer: Matthew Lee

Toss Up: Short Answer

Which of the following are classified as Type III hypersensitivity? (Note more than one answer may apply.)

I. Systemic Lupus Erythematosus

II. Farmer's lung

III. Erythroblastosis fetalis

IV. Glomerulonephritis

Bonus Answer: I, II, and IV

Accept: Systemic Lupus Erythematosus, Erythroblastosis fetalis, Glomerulonephritis

---

Bonus: Multiple Choice

Erythroblastosis fetalis can kill the baby in any pregnancy of the mother but the first. This fatal condition occurs when

W) The mother is Rh(-) and the fetus from her first pregnancy is Rh(-)

X) The mother is Rh(-) and the fetus from her first pregnancy is Rh(+)

Y) The mother is Rh(+) and the fetus from her first pregnancy is Rh(-)

Z) The mother is Rh(+) and the fetus from her first pregnancy is Rh(+)

Bonus Answer: X

==========

15. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

If a wheel is turning at 3.0/PI rad/s, what is it's period?

W) 3.14

X) 6.58

Y) 8.73
Z) 9.67

Toss Up Answer: X

Bonus: Multiple Choice

What is the total energy of a block attached to a spring with spring constant of 5 N/m if the block's velocity corresponds to the equation, v(t) = 10sin(2t) (READ AS: v of t equals 10 times sin of quantity 2*t)?
W) 100 J
X) 125 J
Y) 250 J
Z) 500 J

Bonus Answer: Y

==========

16. CHEMISTRY

Writer: Mohammed Jamil

Toss Up: Short Answer

What is the chemical equation(s) for the reversible reaction(s) in the contact process

Bonus Answer: 2SO2(g) + O2(g) ⇌ 2SO3(g)

Bonus: Multiple Choice

Which set of conditions would promote the fastest rate for the converter reaction in the contact process?
W) No catalyst, high pressure, low temperature. Catalyst, high pressure, high temperature. Catalyst, low pressure, low temperature. Catalyst, low pressure, high temperature.
X) Catalyst, high pressure, high temperature.
Y) Catalyst, low pressure, low temperature
Z) No catalyst, high pressure, low temperature. Catalyst, high pressure, high temperature. Catalyst, low pressure, low temperature. Catalyst, low pressure, high temperature.

Bonus Answer: X

==========

17. MATHEMATICS

Writer: Calvin Vuong

Toss Up: Short Answer

What is the 451st derived function of y = e^x?

Bonus Answer: y = e^x (DO NOT ACCEPT: e^x)

Bonus: Short Answer

What is the 451st derived function of y = -sin(e^x)?

Bonus Answer: y = cos(e^x) * (e^x)^451 (ACCEPT: y = cos(e^x) * (e^451x)) (DO NOT ACCEPT: any expression w/o y =)

==========

18. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

Assume that Earth is in circular orbit around the Sun with kinetic energy K and potential energy U, taken to be zero for infinite separation. What is the relationship between K and U?

Bonus Answer: K = -U/2 (accept equivalent forms)

Bonus: Multiple Choice

A planet is in circular orbit around the Sun. Its distance from the Sun is four times the average distance of Earth from the Sun. The period of this planet, in Earth years, is:

W) 4

X) 8

Y) 16

Z) 64

Bonus Answer: X

==========

19. MATHEMATICS

Writer: George Papastefanou

Toss Up: Short Answer

What is the tangent of (27(pi)/4)

Bonus Answer: -1

Bonus: Short Answer

With a 5 percent compound interest rate, how long, to the nearest year, will it take a sum of money to double?

Bonus Answer: 14 years

==========

20. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What is studied in ballistics?

W) explosive impact of chemicals

X) speeds of atomic particles

Y) travel of sound

Z) motion of projectiles

Toss Up Answer: Z

Bonus: Multiple Choice

What is it called when all possible states of a system are represented, with each possible state corresponding to 1 unique point?

W) Boltzmann Set

X) Phase Space

Y) Poincare Space

Z) Configuration Space

Bonus Answer: X

==========

21. CHEMISTRY

Writer: Andrew Chen (Senior)

Toss Up: Multiple Choice

In the following redox reaction: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ which compound is the oxidizing agent?

W) $2O_2$

X) CH_4

Y) CO_2

Z) H_2O

Toss Up Answer: W

Bonus: Short Answer

Given the organic molecule C6H14 how many different structural isomers can be formed?

Bonus Answer: Five

==========

22. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

If an object attached to one end of a spring makes 20 complete oscillations in 2*PI s, what is its angular frequency?

Bonus Answer: 20 rad/s

Bonus: Multiple Choice

A 1-kg object attached to a spring whose spring constant is 400N/m executes simple harmonic motion. If its maximum speed is 5.0m/s, find the amplitude of its oscillation.

W) 0.1

X) 0.25 m

Y) 0.45

Z) 0.75

Bonus Answer: X

==========

23. CHEMISTRY

Writer: Mohammed Jamil

Toss Up: Short Answer

Copper sulfate can be made by warming copper oxide with sulfuric acid. The equation for the reaction is:

$CuO+H_2SO_4 \rightarrow CuSO_4+H_2O$

Calculate the maximum mass of copper oxide which can react with 9.8 g of sulfuric acid in this reaction.

(Relative atomic masses: H=1, O=16, Cu=64)

Bonus Answer: 8g

Bonus: Short Answer

It takes 83ml of a 0.45M NaOH solution to neutralize 235mL of an HCl solution.What is the concentration of the HCl solution ?

Bonus Answer: 0.16 M

==========

24. BIOLOGY

Writer: Josh Tish

Toss Up: Short Answer

After 12 weeks of gestation, what is the principal source of estrogen and progesterone to a human fetus?

Bonus Answer: corpus luteum

Bonus: Multiple Choice

Fat enters the venous system from the digestive system via the:

W) hepatic artery

X) hepatic vein

Y) thoracic duct

Z) hepatic portal system

Bonus Answer: Y

==========

25. CHEMISTRY

Writer: Elias Milborn

Toss Up: Multiple Choice

Which of the following elements, in gaseous state, has the highest electron affinity?

W) Fluorine

X) bromine

Y) sulfur

Z) chlorine

Toss Up Answer: W

Bonus: Multiple Choice

In order to calculate the heat of fusion for a piece of ice placed in warm water, you must know:

W) The energy released by the warm water and the mass of the water

X) The energy released by the warm water and the mass of the ice

Y) the energy released by the ice and the mass of the warm water

Z) the energy released by the ice and the mass of the ice

Bonus Answer: X

==========