

Round 5

1. PHYSICS

Toss Up: Multiple Choice

What is the S.I. unit for luminous intensity?

- W) Lumen
- X) Candela
- Y) Newton
- Z) Watts

Toss Up Answer: X

Bonus: Multiple Choice

For an isotropic source how many candelas equals 3 lumens?

- W) 12π
- X) 10π
- Y) 4π
- Z) 2π

Bonus Answer: W

2. PHYSICS

Toss Up: Short Answer

If the sound intensity is 10,000 times the threshold of hearing then what is the intensity in decibels?

Bonus Answer: 40dB

Bonus: Short Answer

At what standard frequency would 60 decibels have a loudness of 60 phons?

Bonus Answer: 1000Hz

3. PHYSICS

Toss Up: Multiple Choice

What is the relativistic mass of a particle with a rest mass of 8g traveling at a speed of $.6c$?

- W) 4g
- X) 8g
- Y) 10g
- Z) 12g

Toss Up Answer: Y

Bonus: Multiple Choice

What is the length of a 1 meter rod traveling on a spaceship going at $.8c$, as measured by an astronaut on the ship?

- W) .8m
- X) .6m
- Y) 1m
- Z) 1.25m

Bonus Answer: Y

4. PHYSICS

Toss Up: Multiple Choice

Who first suggested that radiant energy could exist only in discrete quanta which were proportional to the frequency in order to explain the frequency distribution of blackbody radiation?

W) Isaac Newton

X) Max Planck

Y) Ernest Rutherford

Z) Paul Dirac

Toss Up Answer: X

Bonus: Short Answer

Later solved by Planck's quantum radiation formula, what asymptotic result of the classical Rayleigh-Jeans Law was the most troubling?

Bonus Answer: Ultraviolet Catastrophe

5. PHYSICS

Toss Up: Short Answer

What law most directly states that the total of the electric flux out of a closed surface is equal to the charge enclosed divided by the permittivity?

Bonus Answer: Gauss's Law

Bonus: Short Answer

When a magnet is moved into a coil of wire, changing the magnetic field and magnetic flux through the coil, a voltage will be generated in the coil according to which law?

Bonus Answer: Faraday's Law

6. MATHEMATICS

Toss Up: Short Answer

Compute: $\sqrt{(3^4 \cdot 5 - 60)^2}$

Bonus Answer: 0

Bonus: Short Answer

Compute $(34/17 - 2 + 5) * (96 + -144) * (1/(46 - 130/5))$

Bonus Answer: -12

7. MATHEMATICS

Toss Up: Multiple Choice

Simplify: $(24 \cdot 63)/(72 \cdot 21)$

W) 1

X) 3

Y) 7

Z) 1/3

Toss Up Answer: W

Bonus: Short Answer

Simplify $(333(x^4 - x^2))/(9(x^2 + 2x + 1)(x^2))$

Bonus Answer: $(x-1)/((37)(x+1))$

8. MATHEMATICS

Toss Up: Multiple Choice

Given $P(x) = x^2 + ax + b$ and $P(1) = 9$, what is $a + b$?

W) 8

X) 10

Y) 9

Z) 1

Toss Up Answer: W

Bonus: Multiple Choice

Factor the following completely: $(4x^4) - (20x^2) + 16$

W) $(x+1)(x-1)(x+2)(x-2)$

X) $(x+1)(x+1)(x-2)(x-2)$

Y) $4(x+1)(x-1)(x+2)(x-2)$

Z) $4(x+1)(x+1)(x-2)(x-2)$

Bonus Answer: Y

9. MATHEMATICS

Toss Up: Multiple Choice

What is the area of an equilateral triangle with side lengths 2?

W) 1

X) $\sqrt{3}$

Y) $\sqrt{6}$

Z) 2

Toss Up Answer: X

Bonus: Multiple Choice

If the roots of $P(x) = 64x^2 - 24x + 2$ are A and B, what is the harmonic mean of A and B in simplest fractional form?

W) $1/3$

X) $1/6$

Y) $1/12$

Z) $1/24$

Bonus Answer: X

10. BIOLOGY

Toss Up: Multiple Choice

Of the following, which is a second messenger used in cell signaling?

W) G protein

X) Protein kinase A

Y) adenylyl cyclase

Z) cAMP

Toss Up Answer: Z

Bonus: Short Answer

Adjacent plant cells most commonly communicate via what intercellular junction?

Bonus Answer: Plasmodesmata (ACCEPT: desmotubule)

11. BIOLOGY

Toss Up: Multiple Choice

Neurotransmitters are received by which kinds of receptors?

- W) G protein coupled receptors
- X) receptor tyrosine kinases
- Y) ion gated channels
- Z) intracellular receptors

Toss Up Answer: Y

Bonus: Multiple Choice

Which of the following is the immediate effect of a signal molecule binding to a receptor tyrosine kinase molecule?

- W) It forms a dimer with another receptor tyrosine kinase.
- X) It initiates a phosphorylation cascade.
- Y) It becomes activated with phosphate groups.
- Z) It attaches to a scaffolding protein.

Bonus Answer: W

12. BIOLOGY

Toss Up: Multiple Choice

Which of the following intermolecular interactions is not exclusive to a single polypeptide's tertiary structure?

- W) hydrophobic interactions
- X) polar interactions
- Y) hydrogen bonding
- Z) disulfide bridges

Toss Up Answer: Y

Bonus: Short Answer

Polypeptide folding is aided by which type of cavity-structured proteins?

Bonus Answer: Chaperonins

13. BIOLOGY

Toss Up: Multiple Choice

Cellulose and glycogen differ in

- W) their alpha/beta glucose configurations
- X) branching
- Y) their ability to be metabolized
- Z) all of the above

Toss Up Answer: Z

Bonus: Short Answer

N-Acetylglucosamine is the monomer of which common polysaccharide?

Bonus Answer: Chitin

14. BIOLOGY

Toss Up: Short Answer

Name all of the following that are amphipathic: integral proteins, cholesterol, phospholipids, triacylglycerol, mannose

Bonus Answer: integral proteins and phospholipids

Bonus: Multiple Choice

Which of the following is not true about a part of the phospholipid?

- W) They contain two fatty acid chains.

- X) Their heads contain a net charge.
- Y) They have a phosphate group in their heads.
- Z) They have a choline group in their heads.

Bonus Answer: X

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15. BIOLOGY

Toss Up: Multiple Choice

Exocytotic vesicles are most frequently exported via the

- W) endoplasmic reticulum
- X) the nuclear envelope
- Y) the trans Golgi
- Z) the cis Golgi

Toss Up Answer: Y

Bonus: Multiple Choice

Endosomes formed as a result of receptor-mediated endocytosis are most frequently coated with which type of proteins?

- W) G proteins
- X) clathrins
- Y) pseudopodium
- Z) microtubules

Bonus Answer: X

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16. BIOLOGY

Toss Up: Multiple Choice

What transmissible agent causes Mad Cow Disease (BSE)?

- W) Viron
- X) Virus
- Y) Bacteria
- Z) Prion

Toss Up Answer: Z

Bonus: Multiple Choice

Which of the following are prions made up of?

- W) Proteins, only
- X) Nucleic Acids, only
- Y) Proteins and Nucleic Acids, only
- Z) Proteins and Carbohydrates, only

Bonus Answer: W

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17. CHEMISTRY

Toss Up: Multiple Choice

Which of the following elements has the largest number of possible oxidation states?

- W) Fe
- X) Cl

- Y) Ca
- Z) Mn

Toss Up Answer: X

Bonus: Multiple Choice

What is the minimum number of electrons needed to balance the following half-reaction with whole number coefficients?

$\text{IO}_3^- \rightarrow \text{I}_2$

- W) 1 e-
- X) 2 e-
- Y) 5 e-
- Z) 10 e-

Bonus Answer: Z

18. CHEMISTRY

Toss Up: Multiple Choice

Which of the following is closest in mass to a proton?

- W) Alpha Particle
- X) Positron
- Y) Neutron
- Z) Hydrogen Molecule

Toss Up Answer: Y

Bonus: Short Answer

What is the amount of calories of heat transferred to the water is when the temperature of a 20-gram sample of water is increased from 10°C to 30°C?

Bonus Answer: 400

19. CHEMISTRY

Toss Up: Multiple Choice

The term(s) most useful in determining the solubility of a substance is (are)

- W) K_a and Q
- X) K_{sp}
- Y) Q and Le Chatelier's Principle
- Z) K_c

Toss Up Answer: X

Bonus: Multiple Choice

The effect of temperature on a chemical system is best described using

- W) K_a and Q
- X) K_{sp}
- Y) Le Chatelier's Principle
- Z) K_c

Bonus Answer: Y

20. CHEMISTRY

Toss Up: Multiple Choice

What is the correct term(s) used to determine if a system has come to equilibrium?

- W) K_a and Q
- X) K_{sp}
- Y) Q
- Z) K_c

Toss Up Answer: Y

Bonus: Multiple Choice

Chemical equilibrium may be used to describe

- W) gas phase chemical reactions
- X) acid and based ionization
- Y) Solubility
- Z) All of the Above

Bonus Answer: Z

21. CHEMISTRY

Toss Up: Multiple Choice

Which of the following species is amphoteric?

- W) Na_3PO_4
- X) HSO_4^-
- Y) KOH
- Z) HNO_3

Toss Up Answer: X

Bonus: Short Answer

A 600-milliliter container holds 2 moles of $\text{O}_2(\text{g})$, 3 moles of $\text{H}_2(\text{g})$, and 1 mole of $\text{He}(\text{g})$. Total pressure within the container is 760 torr. What is the partial pressure of O_2 ?

Bonus Answer: 253 torr

22. CHEMISTRY

Toss Up: Short Answer

Is HCL a strong acid?

Bonus Answer: Yes

Bonus: Short Answer

Is NaOH a strong base?

Bonus Answer: Yes

23. EARTH and SPACE

Toss Up: Multiple Choice

In the Northern Hemisphere, the Coriolis force deflects in which direction?

- W) Up
- X) Down
- Y) Right
- Z) Left

Toss Up Answer: Y

Bonus: Short Answer

The altitude of Polaris is equal to...

Bonus Answer: Your latitude

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24. EARTH and SPACE

Toss Up: Short Answer

What determines a mineral's properties?

Bonus Answer: The internal arrangement of its atoms.

Bonus: Short Answer

What type of currents cause plates to move in the mantle?

Bonus Answer: Convection currents

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25. EARTH and SPACE

Toss Up: Short Answer

What is the driving force behind all erosion?

Bonus Answer: Gravity

Bonus: Short Answer

What type of body of water does the most erosion?

Bonus Answer: Streams

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