

Round 9

1. PHYSICS

Writer: Shantanu Jha

Toss Up: Short Answer

What is the S.I. unit for Inductance?

Bonus Answer: Henry

Bonus: Multiple Choice

Which law states that for any closed loop path, the sum of the length elements times the magnetic field in the direction of the length element is equal to the permeability times the electric current enclosed in the loop?

W) Faraday's Law of Induction

X) Kirchhoff's Law

Y) Coulomb's Law

Z) Ampere's Law

Bonus Answer: Z

2. PHYSICS

Writer: Amrit Hingorani

Toss Up: Short Answer

What is the metric unit for mass?

Bonus Answer: Kilogram (kg)

Bonus: Short Answer

What is the SI unit of force?

Bonus Answer: Newton

3. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

Any change in the magnetic environment of a coil of wire will cause a voltage (emf) to be "induced" in the coil. Which law summarizes the ways in which voltage can be generated using this method?

W) Ohm's Law

X) Faraday's Law

Y) Pascal's Law

Z) Coulomb's Law

Toss Up Answer: X

Bonus: Short Answer

A magnet is brought close to a flat square coil of 50 loops. The coil is .2 meters on each side, and the magnetic field passing through the coil increased uniformly from 3 Tesla to 8 Tesla in 4 seconds. While that change in magnetic field takes place, using correct signs, what is the induced emf in the coil?

Bonus Answer: -2.5 Volts

4. PHYSICS

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

The binding energy of a nucleus is the energy that must be supplied to:

W) Remove a nucleon

X) Remove an alpha particle

- Y) Remove a beta particle
- Z) Separate the nucleus into its constituent nucleons

Toss Up Answer: Z

Bonus: Multiple Choice

A radium atom, ^{226}Ra emits an alpha particle. The number of protons in the resulting atom is

- W) 84
- X) 85
- Y) 86
- Z) 88

Bonus Answer: W

5. PHYSICS

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

An acceptor replacement atom in silicon might have how many electrons in its outer shell?

- W) 3
- X) 4
- Y) 5
- Z) 6

Toss Up Answer: W

Bonus: Multiple Choice

When a forward bias is applied to a p-n junction the concentration of electrons on the p side:

- W) increases slightly
- X) decreases slightly
- Y) increases dramatically
- Z) decreases dramatically

Bonus Answer: Y

6. MATHEMATICS

Writer: Seiji Yawata

Toss Up: Short Answer

What is the limit as x approaches 0 of x^x ?

Bonus Answer: Does not exist. (NOT 1)

Bonus: Short Answer

Let $f(x)$ be a function with no real roots. If $f(3) = 4$, then in what quadrants can $f(x)$ be in?

Bonus Answer: All four quadrants (b.c. there's no specification f has to be continuous)

7. MATHEMATICS

Writer: Seiji Yawata

Toss Up: Multiple Choice

Unknown to be algebraic or transcendental

- W) Rational
- X) Algebraic irrational

Y) Transcendental
Z) Impossible to tell
Toss Up Answer: Y

Bonus: Short Answer

Let $f(x) = ax^7 + bx^3 + cx - 5$, where a, b , and c are real numbers. What is the value of $f(7)$ if $f(-7) = 8$?

Bonus Answer: -18

8. MATHEMATICS

Writer: Amrit Hingorani

Toss Up: Multiple Choice

Which of the following distances is longest?

- W) Half a kilometer
- X) Half a decimeter
- Y) 600 meters
- Z) 40 decameters

Toss Up Answer: Y

Bonus: Short Answer

What is the name of a line that intersects two or more coplanar lines in different points?

Bonus Answer: Transversal

9. MATHEMATICS

Writer: Seiji Yawata

Toss Up: Short Answer

Completely expand $(x-2y)^3$

Bonus Answer: $x^3 - 6x^2y + 12xy^2 - 8y^3$

Bonus: Short Answer

What is the sum of all the terms in the seventh row of Pascal's triangle?

Bonus Answer: 128

10. BIOLOGY

Writer: Amrit Hingorani

Toss Up: Multiple Choice

Which part of the brain is associated with coordinated movement?

- W) Cerebrum
- X) Cerebellum
- Y) Diencephalon
- Z) Corpus Callosum

Toss Up Answer: X

Bonus: Short Answer

What is the major excitatory neurotransmitter in the brain?

Bonus Answer: Glutamate

11. BIOLOGY

Writer: Amrit Hingorani

Toss Up: Multiple Choice

Which of the following is most closely related to sharks?

- W) Trout
- X) Blue Gill
- Y) Manta Ray
- Z) Octopus

Toss Up Answer: Y

Bonus: Short Answer

Who invented the polio vaccine?

Bonus Answer: Jonas Salk

12. BIOLOGY

Writer: Amrit Hingorani

Toss Up: Multiple Choice

Which of these human diseases is not caused by roundworms?

- W) Filariasis
- X) Ancylostomiasis
- Y) Ascariasis
- Z) Typhoid fever

Toss Up Answer: Z

Bonus: Short Answer

What hormone causes vesicles carrying aquaporins to embed in the membranes of cells in the collecting duct?

Bonus Answer: ADH (Antidiuretic hormone)

13. BIOLOGY

Writer: Amrit Hingorani

Toss Up: Multiple Choice

How many cotyledons do dicots have?

- W) 5
- X) 1
- Y) 0
- Z) 2

Toss Up Answer: Z

Bonus: Short Answer

How many stages in a butterfly's life cycle?

Bonus Answer: Four (4)

14. CHEMISTRY

Writer: Raafiul Hossain

Toss Up: Short Answer

What is the fuel additive in what is commonly known as "dry-gas" by solubilizing water to reduce contamination in gasoline:

Bonus Answer: Isopropyl Alcohol

Bonus: Multiple Choice

The latent heat of vaporization for water at its boiling point and in kJ per mole is:

- W) 6.01
- X) 42.7
- Y) 40.7

Z) 40,000,000

Bonus Answer: Y

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15. CHEMISTRY

Writer: Raafiul Hossain

Toss Up: Short Answer

What is the general name for a hypothetical gas that does not obey Boyles's law at all temperatures and pressures?

Bonus Answer: non ideal

Bonus: Short Answer

Gypsum is calcium sulfate hydrated with two water molecules. Gypsum is what percent water by weight? (atomic mass of calcium = 40; sulfur = 32 and oxygen = 16.)

Bonus Answer: 21

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16. CHEMISTRY

Writer: Raafiul Hossain

Toss Up: Short Answer

If the electronegativity difference in the bonding atoms is between 0.4 and 1.7, what type of bond is formed?

Bonus Answer: polar covalent

Bonus: Short Answer

what is the formula for potassium perchlorate?

Bonus Answer: KClO_4

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17. CHEMISTRY

Writer: Raafiul Hossain

Toss Up: Short Answer

How many calories of heat are required to vaporize one gram of water?

Bonus Answer: 540

Bonus: Short Answer

What is the name for the straight-chain alkane containing 5 carbons?

Bonus Answer: pentane

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18. CHEMISTRY

Writer: Raafiul Hossain

Toss Up: Short Answer

1)An aqueous solution with amount of OH^- ions is greater than that of H^+ ions is what

Bonus Answer: basic

Bonus: Short Answer

3)Charles law talks about what?

Bonus Answer: Hot air rising after being heated

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19. CHEMISTRY

Writer: Prangon Ghose

Toss Up: Short Answer

In the standard notation for a voltaic cell, the double vertical line "||" represents

Bonus Answer: A standard Hydrogen Electrode (Accept: Hydrogen Electrode)

Bonus: Short Answer

Approximately how long must a current of 5.0 amperes be maintained to electroplate 60 g of calcium from molten Calcium Chloride (Molar Mass = 111 g/mol)? Answer in hours.

Bonus Answer: 16 hours

20. EARTH and SPACE

Writer: Wilson Berkow

Toss Up: Multiple Choice

Stars in which portion of an Hertzsprung-Russell diagram are most likely to have supernova deaths?

- W) Bottom right
- X) Bottom left
- Y) Top right
- Z) Center

Toss Up Answer: Y

Bonus: Multiple Choice

What characteristics do stars in this region of the diagram have compared to those in the other regions?

- W) Hot surface temperature and bright
- X) Cool surface temperature and bright
- Y) Hot surface temperature and dim
- Z) Cool surface temperature and dim

Bonus Answer: X

21. EARTH and SPACE

Writer: Wilson Berkow

Toss Up: Multiple Choice

What is closest to the ratio of the total mass of the asteroids of the asteroid belt to the mass of the moon?

- W) 100
- X) 10
- Y) 1
- Z) 0.1

Toss Up Answer: Z

Bonus: Short Answer

What is currently believed to be the reason that the asteroid belt, rather than another planet, formed in that region of the solar system?

Bonus Answer: Gravitational disturbance by Jupiter prevented sufficient accretion of matter

22. EARTH and SPACE

Writer: Andrew Chen

Toss Up: Short Answer

What is the name for a section of the Earth's crust that has been displaced, but that still maintains its internal structure?

Bonus Answer: massif

Bonus: Multiple Choice

Which of the following is a metamorphic form of shale?

- W) quartzite
- X) slate
- Y) marble
- Z) schist

Bonus Answer: X

23. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

What star class is used to characterize the hottest stars?

- W) A
- X) B
- Y) M
- Z) O

Toss Up Answer: Z

Bonus: Short Answer

Which two moons are larger than the smallest planet in our solar system?

Bonus Answer: Ganymede and Titan

24. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

In which constellation is the closest Cepheid variable to Earth?

- W) Ursa Minor
- X) Lyra
- Y) Carina
- Z) Sagittarius

Toss Up Answer: W

Bonus: Short Answer

Polaris will be further to the north celestial pole in 3000 AD than Altai. What phenomenon is mostly responsible for this?

Bonus Answer: Precession of the equinoxes

25. ENERGY

Writer: Amrit Hingorani

Toss Up: Multiple Choice

A metal coin and a plastic coin are heated to the same temperature. The two coins have the same size and shape, are dropped into the same tub of cold water at the same time, and are left for 30 seconds. Which coin will have the lower temperature?

- W) Metal coin
- X) Plastic Coin
- Y) Both coins will have the same temperature
- Z) Cannot be determined

Toss Up Answer: W

Bonus: Short Answer

What is the general name for material that is used to block the flow of heat?

Bonus Answer: Insulator
