

Round 5

1. 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

2. MATHEMATICS

Writer: Nten Nylam

Toss Up: Short Answer

What is the value of $(11! - 10!)/9!$?

Bonus Answer: 100

Bonus: Short Answer

Baker 1 bakes a batch of cupcakes every 20 minutes, Baker 2 bakes a batch of cupcakes every 30 minutes. Together, how many batches of cupcakes can they bake in 5 hours?

Bonus Answer: 25 batches (NOTE: accept 25)

3. PHYSICS

Writer: Shantanu Jha

Toss Up: Short Answer

Which of the 6 quarks is the lightest?

Bonus Answer: Up

Bonus: Multiple Choice

What is the "formal" SI unit of elementary particle spin?

- W) joule-second
- X) spin-h (planck constant)
- Y) joule-plancktime
- Z) spinor-second

Bonus Answer: W

4. MATHEMATICS

Writer: Calvin Aw

Toss Up: Short Answer

Find the sum of the first six positive perfect squares.

Bonus Answer: 91

Bonus: Short Answer

Find the sum of the first 7 positive cubes.

Bonus Answer: 784

5. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What quantity of a magnet determines the torque it will experience in an external magnetic field?

- W) Multipole Expansion
- X) Dipole Inversion
- Y) Magnetic Moment
- Z) Hysteresis Loop

Toss Up Answer: Y

Bonus: Multiple Choice

What Dutch physicist, living from 1626-1695, pioneered the use of the pendulum in clocks?

- W) Willems Gravesande
- X) Hans Christian Oersted
- Y) Nicolas Hartsoeker
- Z) Christiaan Huygens

Bonus Answer: Z

6. MATHEMATICS

Writer: Banpreet Singh

Toss Up: Short Answer

What is the derivative of $\tan(x)$

Bonus Answer: $\sec^2(x)$

Bonus: Short Answer

What is the derivative of $\ln(x)$

Bonus Answer: $1/x$

7. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

Who discovered radioactivity in 1896?

- W) Wilhelm Rontgen
- X) Henri Becquerel
- Y) Marie Curie
- Z) Albert Einstein

Toss Up Answer: X

Bonus: Multiple Choice

What is made by joining an N-type and P-type semiconductor material?

- W) Transistor
- X) Diode
- Y) Capacitor
- Z) Collector

Bonus Answer: X

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8. MATHEMATICS

Writer: Nten Nylam

Toss Up: Short Answer

What is the greatest common factor of $12x^3 + 171x^2 + 516x$

Bonus Answer: $3x$

Bonus: Short Answer

If 50% of x is equal to 25% of y, and 40% of y is equal to 60% of z, then what percent of z is x?

Bonus Answer: 75%

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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

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10. BIOLOGY

Writer: Matthew Lee

Toss Up: Multiple Choice

A person with type A blood has children with a person with type AB blood. What possible blood types can their offspring be?

- W) A only
- X) A and AB
- Y) A, B, and AB
- Z) A, AB, and O

Toss Up Answer: Y

Bonus: Multiple Choice

What sex chromosome system determines gender in birds?

- W) X-Y system
- X) X-0 system (read as X-zero)
- Y) Z-W system
- Z) haplo-diploid system

Bonus Answer: Y

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11. CHEMISTRY

Writer: Shantanu Jha

Toss Up: Multiple Choice

What term describes a particular way that ions and molecules bind metal ions?

- W) Chelation
- X) Supposition
- Y) Coordination
- Z) Fluxing

Toss Up Answer: W

Bonus: Multiple Choice

Crystals which acquire a charge when compressed, twisted or distorted are said to be what?

- W) Ceramic
- X) Transduced
- Y) Magnetostricted
- Z) Piezoelectric

Bonus Answer: Z

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12. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Where does the electrical signal in the heart start

- W) sinoatrial node
- X) atrioventricular node
- Y) atrioventricular bundle
- Z) purkinje fibers

Toss Up Answer: W

Bonus: Multiple Choice

Which valve separates the right atrium from the right ventricle

- W) Mitral Valve
- X) Tricuspid valve
- Y) Bicuspid Valve
- Z) Semi-lunar valves

Bonus Answer: X

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13. CHEMISTRY

Writer: Prangon Ghose

Toss Up: Short Answer

What is the most abundant element in the human body by mass?

Bonus Answer: Oxygen

Bonus: Short Answer

What naturally occurring radioactive element is so common in homes that testing for its presence is often advisable?

Bonus Answer: Radon (accept: Rn)

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14. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Which of the following is not one of the basic tastes

W) sweetness

X) saltiness

Y) umami

Z) spiciness

Toss Up Answer: Z

Bonus: Multiple Choice

In classical conditioning, an unlearned, inborn reaction to an unconditioned stimulus is a(n)

W) unconditioned stimulus

X) conditioned stimulus

Y) conditioned response

Z) unconditioned response

Bonus Answer: Z

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15. CHEMISTRY

Writer: Prangon Ghose

Toss Up: Short Answer

What element is in all alloys classified as amalga?

Bonus Answer: Mercury (accept: Hg)

Bonus: Short Answer

You have a solution of 5 molar Sodium Phosphate and n to prepare a solution of 500 millimolar Sodium Phosphate.

How much water would you add to 100 milliliter of the original 5 molar solution to produce the 500 millimolar solution?

Bonus Answer: 900 MILLILITERS (or 0.9 LITERS)

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16. BIOLOGY

Writer: Nten Nylam

Toss Up: Short Answer

What is the name of the process in which an RNA copy of a gene sequence is made, involving the enzyme RNA polymerase

Bonus Answer: Transcription

Bonus: Short Answer

What type of bonding is found in a disulfide bridge?

Bonus Answer: Covalent bonding (also accept covalent)

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17. CHEMISTRY

Writer: Prangon Ghose

Toss Up: Short Answer

What is the common oxidation state of Radium?

Bonus Answer: +2 (don't accept 2)

Bonus: Short Answer

List the following atoms in order of increasing electron affinity: oxygen, boron, and fluorine.

Bonus Answer: (1) BORON, (2) OXYGEN, (3) FLUORINE

18. BIOLOGY

Writer: Nten Nylam

Toss Up: Multiple Choice

What type of mutation does not change an organism's phenotype despite changing its genotype

W) Missense

X) Frameshift

Y) Silent

Z) Nonsense

Toss Up Answer: Y

Bonus: Multiple Choice

Which enzyme is not involved in DNA replication?

W) Lipase

X) Gyrase

Y) Helicase

Z) DNA polymerase

Bonus Answer: W

19. CHEMISTRY

Writer: Prangon Ghose

Toss Up: Short Answer

Who is credited with the discovery of the neutron in 1932?

Bonus Answer: James Chadwick (accept: Chadwick)

Bonus: Short Answer

Who patented the common dry cell?

Bonus Answer: GEORGES LECLANCHÉ (accept: LECLANCHÉ)

20. BIOLOGY

Writer: Banpreet Singh

Toss Up: Short Answer

When you alphabetize the major body systems, which is last?

Bonus Answer: skeletal

Bonus: Short Answer

Fill in the blank. The medulla oblongata controls blank muscle action

Bonus Answer: involuntary

21. EARTH and SPACE

Writer: Matthew Lee

Toss Up: Short Answer

Name the layers of the atmosphere, from lowest to highest altitude.

Bonus Answer: Troposphere, Stratosphere, Mesosphere, Thermosphere

Bonus: Short Answer

Through what city does the prime meridian run through?

Bonus Answer: Greenwich, England (accept: Greenwich)

22. BIOLOGY

Writer: Nten Nylam

Toss Up: Multiple Choice

In what region of the upper digestive tract does food become chyme?

W) The esophagus

X) The stomach

Y) The sublingual salivary glands

Z) The mouth

Toss Up Answer: X

Bonus: Short Answer

A codon in an mRNA sequence is 5'-AAC-3'. What is the corresponding tRNA anticodon?

Bonus Answer: 3'-GUU-5' (Note: do not accept GUU and ' stands for prime)

23. EARTH and SPACE

Writer: Matthew Lee

Toss Up: Short Answer

Potential evapotranspiration as measured on a town's water budget is most directly affected by what variable?

Bonus Answer: Air temperature

Bonus: Multiple Choice

Why is adiabatic warming on the leeward side of a mountain range rapid?

W) because of a decreased relative humidity

X) because of cloud formation

Y) because of a lower temperature on the windward side of the mountain range

Z) because of adiabatic expansion

Bonus Answer: W

24. BIOLOGY

Writer: Banpreet Singh

Toss Up: Short Answer

The Jabberwock lived in what wood?

Bonus Answer: tulgey wood

Bonus: Short Answer

Ancient insects were sometimes trapped in amber, a fossil resin from cone-bearing, evergreen, needle-leaved trees collectively known as

Bonus Answer: conifers

25. EARTH and SPACE

Writer: Matthew Lee

Toss Up: Multiple Choice

Between which two reference minerals from Moh's Scale of Hardness does the hardness of a steel file fall in between?

W) Fluorite and Apatite
X) Apatite and Feldspar
Y) Feldspar and Quartz
Z) Quartz and Topaz
Toss Up Answer: Y

Bonus: Short Answer

Name in order from smallest grain size to greatest grain size these rocks: Sandstone, Conglomerate, Shale.

Bonus Answer: Shale, Sandstone, Conglomerate
