

Round 5

1. 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)

2. 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)

3. 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

4. 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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5. 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: $1/x$

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6. 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

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7. 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

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8. 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

9. 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%

10. 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

11. 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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12. 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

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13. 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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14. 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

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15. 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

16. 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

17. 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)

18. 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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19. 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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20. 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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21. 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

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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

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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)

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23. BIOLOGY

Writer: Banpreet Singh

Toss Up: Short Answer

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

Bonus Answer: skeletal

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Bonus: Short Answer

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

Bonus Answer: involuntary

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24. 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

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Bonus: Multiple Choice

Which enzyme is not involved in DNA replication?

- W) Lipase
- X) Gyrase
- Y) Helicase
- Z) DNA polymerase

Bonus Answer: W

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25. 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)
