

Round 27

1. CHEMISTRY

Writer: Ivan Zhang

Toss Up: Short Answer

What is the name given to the point at which a substance can exist in all 3 phases of matter?

Bonus Answer: Triple Point

Bonus: Short Answer

What is the name given to group 16 elements?

Bonus Answer: Chalcogens

2. EARTH and SPACE

Writer: Shantanu Jha

Toss Up: Short Answer

What is the average temperature of the universe today to the nearest Kelvin?

Bonus Answer: 3K

Bonus: Short Answer

What is the most common star in the Milky Way Galaxy?

Bonus Answer: Red Dwarf

3. CHEMISTRY

Writer: Andrew Chen (Senior)

Toss Up: Multiple Choice

Certain compounds are insoluble in solution. Which of the following choices below is soluble in aqueous solution?

W) BaSO_4

X) AgCl

Y) AgNO_3

Z) NiCO_3

Toss Up Answer: Y

Bonus: Short Answer

There is a variety of lab techniques that could be used to separate precipitates from the supernatant liquid. By name or number, which of the following lab techniques can be used to separate them:

1. centrifuge

2. distillation

3. chromatography

4. titration

Bonus Answer: Centrifuge (1)

4. PHYSICS

Writer: Shantanu Jha

Toss Up: Short Answer

A step-down transformer has a turns ratio less than

Bonus Answer: One

Bonus: Multiple Choice

By design, wires with the highest resistance are built into

W) Clocks

X) Toasters

- Y) Telephones
Z) Stereo Speakers

Bonus Answer: X

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5. BIOLOGY

Writer: Olivia Gallager

Toss Up: Short Answer

Out of the following, by name or number, which are considered gram positive: Influenza, Bacillus Anthracis, Escherischia Coli, and Bordetella Pertussis

Bonus Answer: 2, Bacillus Anthracis

Bonus: Short Answer

What is the main immunoglobulin found in mucous secretions?

Bonus Answer: IgA, immunoglobulin A

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6. MATHEMATICS

Writer: Steven Litvack-Winkler

Toss Up: Short Answer

In Triangle ABC the angle bisector of A intersects BC at D. Given AB=9, AC=21, and DB=15, compute DC.

Bonus Answer: 35

Bonus: Short Answer

In triangle ABC, AB=14, AC=13, and BC=15. Let the incenter be I. Compute CI in simplest radical form.

Bonus Answer: square root of 65

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7. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What French physicist, living from 1623-1662, discovered the basic principles of pressures on fluids?

- W) Andre Marie Ampere
X) Charles-Augustin de Coulomb
Y) Joseph-Louis Lagrange
Z) Blaise Pascal

Toss Up Answer: Z

Bonus: Multiple Choice

Supersymmetry is a proposed extension of space-time symmetry relating what 2 basic classes of elementary particles?

- W) Bosons and Fermions
X) Hadrons and Leptons
Y) Leptons and Mesons
Z) Fermions and Mesons

Bonus Answer: W

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8. MATHEMATICS

Writer: Justin Lam

Toss Up: Multiple Choice

Which of the following are prime factors of the number 5304?

- W) 19
- X) 7
- Y) 5
- Z) 13

Toss Up Answer: Z

Bonus: Short Answer

What integer satisfies the equation $y = x^3 - 1$ [Read as: x to the third power subtracted by 1] when $y = 0$?

Bonus Answer: $x = 1$

(Explanation: The factors of the equation is $y = (x - 1)(x^2 + x + 1)$. We want to find an integer solution, so we take the factor $x - 1$ and set it to zero. By adding one to both sides, we see that $x = 1$.)

9. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which type of microscopy takes advantage of differences in the refractive index of biological materials and the surrounding medium to create an image without a stain?

- W) scanning electron
- X) transmission electron
- Y) fluorescence
- Z) phase-contrast

Toss Up Answer: Z

Bonus: Short Answer

What does MRSA stand for?

Bonus Answer: Methicillin-resistant Staphylococcus Aureus

10. CHEMISTRY

Writer: Elias Milborn

Toss Up: Multiple Choice

What is the mass of an electron relative to a proton?

- W) 9.1×10^{-31}
- X) 8.2×10^{-14}
- Y) 1/1836
- Z) 0.51

Toss Up Answer: Y

Bonus: Multiple Choice

Which of the following is not a component of a phospholipid?

- W) water
- X) glycerol
- Y) fatty acid
- Z) phosphate group

Bonus Answer: W

11. 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

12. MATHEMATICS

Writer: Justin Lam

Toss Up: Short Answer

Factor the following equation: $x^3 + 8(x^2) + 8x + 64$

Bonus Answer: $(x + 8)(x + 8)(x^2 + 8)$ or $(x^2 + 8)[(x + 8)^2]$

Bonus: Multiple Choice

Which of the following is a primitive Pythagorean triple?

- W) 9, 12, 15
- X) 10, 24, 26
- Y) 3, 4, 5
- Z) 16, 30, 34

Bonus Answer: Y

13. EARTH and SPACE

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

Which of these is till?

- W) fine flacial lake clay
- X) well-sorted outwash sand
- Y) a polished rock outcrop
- Z) unsorted sand, gravel, and clay in a moraine

Toss Up Answer: Z

Bonus: Short Answer

There are 5 officially recognized dwarf planets in our solar system. Name 3 of them.

Bonus Answer: Accept 3 of the following: Ceres, Pluto, Haumea, Makemake and Eris

14. MATHEMATICS

Writer: Hanna Yang

Toss Up: Multiple Choice

If 8 moles dig 8 holes in 8 years, how many holes can 4 moles dig in 1461 days?

- W) 1
- X) 2
- Y) 4

Z) 8

Toss Up Answer: X

Bonus: Short Answer

If 9 moles dig 24 holes in 10 days, how many holes can 3 moles dig in 5 days?

Bonus Answer: 4

15. EARTH and SPACE

Writer: Zoe Orlin

Toss Up: Multiple Choice

Rounded to the nearest thousand, what is the circumference of the globe?

W) 25,000

X) 26,000

Y) 27,000

Z) 28,000

Toss Up Answer: W

Bonus: Short Answer

In which country are the oldest rocks on Earth located?

Bonus Answer: Canada

16. CHEMISTRY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

What is the name given to the non-superimposable mirror image forms of chiral compounds?

W) Diastereomers

X) Stereoisomers

Y) Enantiomers

Z) Cis-trans isomers

Toss Up Answer: Y

Bonus: Short Answer

What metal is used as a reducing agent to obtain iron from iron oxide in the Thermite process?

Bonus Answer: Aluminum

17. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

The sound intensity 3.0m from a point source is 22 W/m² (READ AS: 25 watts per meter squared). The power output of the source is:

W) 53

X) 396 π

Y) 168

Z) 300 π

Toss Up Answer: X

Bonus: Short Answer

A string has length L and mass M. If its fundamental frequency is f, find its tension in terms of L, M and f.

Bonus Answer: 4LMf² (READ AS: 4 times L times M times f squared)

18. CHEMISTRY

Writer: Josh Tish

Toss Up: Multiple Choice

A 20.0 g sample of mercury(II) oxide is heated strongly, causing it to decompose to metallic Hg and O₂ gas. What volume of O₂ gas is produced (measured at STP)?

- W) 1.03 L
- X) 2.07 L
- Y) 4.14 L
- Z) 14.0 L

Toss Up Answer: W

Bonus: Multiple Choice

When 30.0 mL of 0.10 M AgNO₃ is added to 30.0 mL of 0.10 M NaCl, aqueous NaNO₃ and solid AgCl are formed. How much solid AgCl is produced?

- W) 0.0030 mol
- X) 0.0060 mol
- Y) 0.030 mol
- Z) 0.060 mol

Bonus Answer: W

19. BIOLOGY

Writer: Aaron Gee

Toss Up: Multiple Choice

Which of the following most closely approximates the number of protein-coding genes in the human genome?

- W) 10,000
- X) 20,000
- Y) 50,000
- Z) 100,000

Toss Up Answer: X

Bonus: Short Answer

Arrange the following to depict the conduction pathway in the vertebrate heart: 1) atrioventricular node, 2) right and left bundle branches, 3) sinoatrial node, 4) Bundle of His, 5) Purkinje fibers.

Bonus Answer: 3) SINOATRIAL NODE

1) ATRIOVENTRICULAR NODE

4) BUNDLE OF HIS

2) RIGHT AND LEFT BUNDLE BRANCHES

5) PURKINJE FIBERS

20. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

Which famous astronomer created the "dirty snowball" hypothesis for comets, saying that comets were icy objects containing some dust and rock?

W) Fred Whipple
X) Fred Hoyle
Y) Carl Sagan
Z) Clyde Tombaugh
Toss Up Answer: W

Bonus: Short Answer

Which comet was dubbed the comet of the 20th century, reaching an absolute magnitude value of -0.8 at perihelion?

Bonus Answer: Comet Hale-Bopp

21. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Multiple Choice

Carpal tunnel syndrome is caused by

- W) wear of cartilage in the wrist
- X) stress in the lateral epicondyle
- Y) pressure on the median nerve
- Z) partial tear of the extensor digitorum

Toss Up Answer: Y

Bonus: Multiple Choice

Which of the following has not been shown to increase the likelihood of carpal tunnel syndrome?

- W) obesity
- X) repetitive wrist motion
- Y) rheumatoid arthritis
- Z) hyperextension

Bonus Answer: Z

22. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

An object is dropped from an altitude of one Earth radius above Earth's surface. In terms of M, the mass of Earth, and R, Earth's radius, what is the speed of the object just before it hits Earth?

Bonus Answer: $\sqrt{GM/R}$ (READ AS: square root of GM over R)

Bonus: Short Answer

Two particles, each of mass m, are a distance d apart. If an external force brings a third particle, with mass 2m, from far away to a resting point midway between the two particles, what is the work done by this force?

Bonus Answer: $-8Gm^2/d^2$

23. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Exocytotic vesicles are most frequently exported via the

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

Toss Up Answer: Z

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

24. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

A wave's equation is given as $y = 0.1 \sin(3x + 10t)$ (READ AS: y equals 0.1 times sine of open parentheses 3x plus 10t close parentheses). What is the angular wave number?

- W) 0.3
- X) 1
- Y) 10
- Z) 3

Toss Up Answer: Z

Bonus: Short Answer

An EM wave has a magnetic field with an amplitude of 200 Teslas. What is the amplitude of the wave's electric field in N/c (READ AS: newtons per coulomb)?

Bonus Answer: 6×10^{10} N/c
