Round 24

1. CHEMISTRY

Writer: George Papastefanou

Toss Up: Short Answer

Using noble gas abbreviation, what is the electron configuration of a silver atom?

Bonus Answer: [Kr] 4d^10 5s^1

Bonus: Short Answer

What is the most electropositive element in group 1A?

Bonus Answer: Francium

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2. BIOLOGY

Writer: Matthew Lee

Toss Up: Short Answer

Which of the following are classified as Type III hypersensitivity? (Note more than one answer may apply.)

I. Systemic Lupus Erythematosus

II. Farmer's lung

III. Erythroblastosis fetalis

IV. Glomerulonephritis

Bonus Answer: I, II, and IV

Accept: Systemic Lupus Erythematosus, Erythroblastosis fetalis, Glomerulonephritis

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Bonus: Multiple Choice

Erythroblastosis fetalis can kill the baby in any pregnancy of the mother but the first. This fatal condition occurs when

W) The mother is Rh(-) and the fetus from her first pregnancy is Rh(-)

X) The mother is Rh(-) and the fetus from her first pregnancy is Rh(+)

Y) The mother is Rh(+) and the fetus from her first pregnancy is Rh(-)

Z) The mother is Rh(+) and the fetus from her first pregnancy is Rh(+)

Bonus Answer: X

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3. MATHEMATICS

Writer: Steven Litvack-Winkler

Toss Up: Multiple Choice

Which of the following expressions in x grows fastest?

W) 3^x [3 to the x]

X) 10(3/2)^x [10 times three halves to the x]

Y) x^2 [x squared]

Z) 2^(2x) [2 to the 2x]

Toss Up Answer: Z

Bonus: Short Answer

Given 504=2^3 x 3^2 x 7 [504 equals 2 cubed times 3 squared times 7], compute the sum of the positive divisors of 504

Bonus Answer: 1560

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4. EARTH and SPACE

Writer: Matthew Lee

Toss Up: Short Answer

The time delay between maximum or minimum insolation and maximum or minimum air temperature is known as:

Bonus Answer: insolation-temperature lag (accept seasonal lag)

Bonus: Short Answer

What area near the equator is known colloquially by sailors as the doldrums, where the trade winds meet?

Bonus Answer: Intertropical Convergence Zone

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5. 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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6. EARTH and SPACE

Writer: Shanjeed Ali

Toss Up: Multiple Choice

How much of the total mass of the solar system is found in the Sun?

W) between 60.0% and 60.1%

X) between 78.5% and 78.6%

Y) between 98.2% and 98.3%

Z) between 99.8% and 99.9%

Toss Up Answer: Z

Bonus: Multiple Choice

What is the temperature at the Sun’s core?

W) 5 million degrees Celsius

X) 10 million degrees Celsius

Y) 15 million degrees Celsius

Z) 20 million degrees Celsius

Bonus Answer: Y

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7. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

Assume that Earth is in circular orbit around the Sun with kinetic energy K and potential energy U, taken to be zero for infinite separation. What is the relationship between K and U?

Bonus Answer: K = -U/2 (accept equivalent forms)

Bonus: Multiple Choice

A planet is in circular orbit around the Sun. Its distance from the Sun is four times the average distance of Earth from the Sun. The period of this planet, in Earth years, is:

W) 4
X) 8
Y) 16
Z) 64

Bonus Answer: X

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8. BIOLOGY

Writer: Janine Goh

Toss Up: Short Answer

What is the purpose of SSBs (single strand binding proteins) in DNA replication?

Bonus Answer: To prevent hybridisation of original parent strands

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Bonus: Short Answer

What is the origin of replication called?

Bonus Answer: Ori

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9. EARTH and SPACE

Writer: George Papastefanou

Toss Up: Short Answer

How long does it take for a satellite in geosynchronous orbit to travel once around the Earth?

Bonus Answer: One day

Bonus: Short Answer

What is the orbital period, to the nearest year, of Halley's Comet?

Bonus Answer: 75 years

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10. BIOLOGY

Writer: Hanna Yang

Toss Up: Short Answer

What is the name of the process wherein osteoblasts lay down new bone material?

Bonus Answer: Ossification, Osteogenesis, Bone Tissue Formation

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Bonus: Short Answer

What is the name of the structure within a bone that creates a network containing blood vessels?

Bonus Answer: Haversian Canals

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11. EARTH and SPACE

Writer: Jan Wojcik

Toss Up: Short Answer

By name or number, which of the following is not a mineral: diamond, gold, coal, silt

Bonus Answer: Coal and silt (accept 3 and 4)

Bonus: Short Answer

The Mohs scale is used to measure mineral hardness. By name or number order the following minerals in increasing order: Fluorite, Gypsum, Quartz, Talc

Bonus Answer: Talc, Gypsum, Fluorite, Quartz (accept 1 2 3 4, in that order)

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12. CHEMISTRY

Writer: Elias Milborn

Toss Up: Multiple Choice

Which of the following elements, in gaseous state, has the highest electron affinity?

W) Fluorine

X) bromine

Y) sulfur

Z) chlorine

Toss Up Answer: W

Bonus: Multiple Choice

In order to calculate the heat of fusion for a piece of ice placed in warm water, you must know:

W) The energy released by the warm water and the mass of the water

X) The energy released by the warm water and the mass of the ice

Y) the energy released by the ice and the mass of the warm water

Z) the energy released by the ice and the mass of the ice

Bonus Answer: X

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13. MATHEMATICS

Writer: Steven Litvack-Winkler

Toss Up: Multiple Choice

Simplify (sin15cos75-cos15sin75)/(cos15cos75+sin15sin75)

W) negative square root of 3

X) 1/2

Y) -1/2

Z) square root 6 minus square root 2 all over 2

Toss Up Answer: W

Bonus: Short Answer

Compute (2+2sqrt(3)i)^6. [2+2 times the square root of 3, i to the 6th power]

Bonus Answer: 4096

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14. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

The coefficient of linear expansion of a certain steel is 0.000034 per C◦ (READ AS: celsius degree). What is the exact coefficient of volume expansion, in (C◦) ^ (−1) (READ AS: celsius degree to the negative 1)?

Bonus Answer: 0.000102 (DO NOT ACCEPT APPROXIMATIONS)

Bonus: Multiple Choice

The energy given off as heat by 300 g of an alloy as it cools through 50C◦(READ AS: 50 celsius degree) raises the temperature of 300 g of water from 30◦C (READ AS: 30 degrees celsius) to 40◦ C. The specific heat of the alloy (in cal/g · C◦) is:

W) 0.0015
X) 0.1
Y) 0.2
Z) 1

Bonus Answer: Y

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15. CHEMISTRY

Writer: Shanjeed Ali

Toss Up: Short Answer

What is the net ionic reaction for the reaction between silver nitrate and potassium chloride?

Bonus Answer: Ag+ + Cl- — > AgCl

Bonus: Short Answer

Which of the following compounds are insoluble in water: potassium nitrate, barium chromate, nickel(II) hydroxide, and magnesium chloride?

Bonus Answer: Barium chromate and nickel(II) hydroxide

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16. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

If an object attached to one end of a spring makes 20 complete oscillations in 2*PI s, what is its angular frequency?

Bonus Answer: 20 rad/s

Bonus: Multiple Choice

A 1-kg object attached to a spring whose spring constant is 400N/m executes simple harmonic motion. If its maximum speed is 5.0m/s, find the amplitude of its oscillation.

W) 0.1
X) 0.25 m
Y) 0.45
Z) 0.75

Bonus Answer: X

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17. CHEMISTRY

Writer: Elias Milborn

Toss Up: Short Answer

What is the IUPAC name for $SnCl_2 \cdot 6H_2O$?

Bonus Answer: Tin (II) Chloride Hexahydrate

Bonus: Multiple Choice

Which of the following elements has the valence electron configuration of 3s2 3p3?

W) Phosphorous
X) Oxygen
Y) Bromine
Z) Nitrogen

Bonus Answer: W

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18. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

The circuit breaker in a typical household light circuit is rated for how many amps?

W) 2

X) 20

Y) 200

Z) 2000

Toss Up Answer: X

Bonus: Short Answer

Most power lines carry high voltages. Before the electricity is fed into your home, it must be put through what device that lowers the voltage to 110 volts?

Bonus Answer: Transformer

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19. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Multiple Choice

Which of the following has a coordinate covalent bond?

W) butanol

X) CO_2

Y) Methane

Z) NH_4^+

Toss Up Answer: Z

Bonus: Short Answer

What is the formal charge of Nitrogen in an ammonia molecule?

Bonus Answer: 0

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20. BIOLOGY

Writer: Hanna Yang

Toss Up: Multiple Choice

Some birds, such as pigeons and doves secrete "milk" that they feed to their children. From which of the following organs does it come from?

W) Crop

X) Gizzard

Y) Mammary Gland

Z) Stomach

Toss Up Answer: W

Bonus: Short Answer

What is the common name for Columba livia?

Bonus Answer: Feral/City/Street pigeon

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21. MATHEMATICS

Writer: Steven Litvack-Winkler

Toss Up: Multiple Choice

Compute $3C1+4C2+5C3+6C4+7C5$. [3 choose 1 + 4 choose 2 + 5 choose 3 + 6 choose 4 + 7 choose 5]

W) 55

X) 336

Y) 240
Z) 56
Toss Up Answer: W

Bonus: Short Answer
Compute the square root of 5476
Bonus Answer: 74

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22. PHYSICS

Writer: Shantanu Jha
Toss Up: Multiple Choice
What was the first object created by people that produces a sonic boom (albeit a very small one)?
W) Bullet
X) Bullwhip
Y) Slingshot
Z) Jet Plane

Toss Up Answer: X

Bonus: Multiple Choice
What kind of semiconductors are essentially all pure semiconductor material?
W) p-type
X) n-type
Y) intrinsic
Z) extrinsic

Bonus Answer: Y

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23. MATHEMATICS

Writer: Steven Litvack-Winkler
Toss Up: Short Answer
Compute the dot product of the following vectors:
<2,1,3> and <10,-1,-5>
Bonus Answer: 4

Bonus: Multiple Choice
(64 + 196 + 81)(49 + 256 + 49) > (56 + 224 + 63)^2 [Read "the quantity 64+196+81 times the quantity 49+256+49 strictly greater than the quantity 56+224+63 squared] is most directly an example of what inequailty?
W) Triangle inequality
X) Power Mean Inequality
Y) Cauchy-Schwarz inequality [COW-SHEE sch-WARTS]
Z) Jensen's inequality [YEN-SIN]

Bonus Answer: Y

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24. BIOLOGY

Writer: Hanna Yang
Toss Up: Multiple Choice
Which of the following cells come from megakaryocytes?
W) Erythrocytes

X) Leukocytes
Y) Blood Thrombocytes
Z) Osteocytes

Toss Up Answer: Y

Bonus: Multiple Choice

Which of the following diseases is caused by a point mutation?
W) Huntington's Disease
X) Hemophilia B
Y) Cystic Fibrosis
Z) Tay-Sachs Disease

Bonus Answer: X

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