

Round 34

1. 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%

2. 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: $1/x$

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. 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)

5. MATHEMATICS

Writer: Calvin Aw

Toss Up: Short Answer

What is the probability, in fractions, that after rolling two six-sided die, the sum of the numbers shown on top is 7?

Bonus Answer: $1/6$ (one-sixth or one over six is acceptable)

Bonus: Short Answer

Mr. SciBowl flips 2017 coins. What is the probability that exactly 50% of the coins show a heads?

Bonus Answer: 0

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6. MATHEMATICS

Writer: Calvin Aw

Toss Up: Short Answer

For natural numbers m and n , if 6 divides m evenly and 8 divides n evenly, what is the largest integer that divides mn evenly?

Bonus Answer: 48

Bonus: Short Answer

For natural numbers m and n , if mn is divisible by 48 and m is divisible by 6, what is the largest integer n is divisible by.

Bonus Answer: 1

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7. MATHEMATICS

Writer: Calvin Aw

Toss Up: Short Answer

If $A+B+C=10$ and $A-B-C=-6$, compute $B+C$

Bonus Answer: 8

Bonus: Short Answer

Given a right triangle with legs 12 and 16, find the length of the altitude to the hypotenuse.

Bonus Answer: 48/5 or 9.6

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8. MATHEMATICS

Writer: Mohammed Jamil

Toss Up: Short Answer

Find how many different 4-digit numbers can be formed from the digits

1, 3, 5, 6, 8 and 9 if each digit may be used only once.

Bonus Answer: 360

Bonus: Short Answer

A true or false test has six questions. If a person guesses the answers, how many different ways are there to answer the test?

Bonus Answer: 64

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9. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Short Answer

Ruminants have the ability to digest what substance due to microorganisms in the stomach?

Bonus Answer: Cellulose

Bonus: Short Answer

What is the main site of methane production in ruminants?

Bonus Answer: Rumen, accept first chamber/stomach

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10. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Multiple Choice

What does it mean when an organism that can self-fertilize is true breeding?

- W) the organism will produce offspring that are genetically identical to it
- X) the organism's offspring will all be genetically identical to each other
- Y) the organism is heterozygous for the gene that controls that trait
- Z) the organism's offspring will have the same phenotype for a certain trait

Toss Up Answer: Z

Bonus: Short Answer

Gregor Mendel is known as the father of modern genetics due to his work with pea plants. Which of the following traits did he study: plant height, pod color, leaf shape, flower position?

Bonus Answer: All except leaf shape

11. 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

12. BIOLOGY

Writer: Jason Weng

Toss Up: Short Answer

What is the process of removing the base of a nucleotide?

Bonus Answer: Depurination

Bonus: Short Answer

Out of the 3, which of them uses an electron transport system: fermentation, anaerobic respiration, aerobic respiration

Bonus Answer: anaerobic respiration, aerobic respiration (2,3)

13. BIOLOGY

Writer: Olivia Gallager

Toss Up: Multiple Choice

Which of the following describes the inheritance pattern of Huntingtons Disease?

- W) Autosomal Recessive
- X) X Linked Recessive
- Y) Y linked
- Z) Autosomal dominant

Toss Up Answer: Z

Bonus: Short Answer

Cystic fibrosis is a genetic disease that affects the lungs and other mucus membranes through the absence or deformation of certain ion channels. Which ion do these channels allow to flow, in people without cystic fibrosis?

Bonus Answer: Chloride, accept chlorine

14. BIOLOGY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

If all fungi in an environment that perform decomposition were to suddenly die, then which group of organisms should benefit most, due to the fact that their fungal competitors have been removed?

- W) Prokaryotes
- X) Plants
- Y) animals
- Z) fungi

Toss Up Answer: X

Bonus: Multiple Choice

When a mycelium infiltrates an unexploited source of dead organic matter, what are most likely to appear within the food source soon thereafter?

- W) sores
- X) fungal enzymes
- Y) fungal haustoria
- Z) larger bacterial populations

Bonus Answer: X

15. BIOLOGY

Writer: Ahmad Alnasser

Toss Up: Short Answer

Both fungus-farming ants and their fungi can synthesize the same structural polysaccharide from the β -glucose. What is this polysaccharide?

Bonus Answer: Chitin

Bonus: Short Answer

Plasmogamy can directly result in which of the following? 1. cells with a single haploid nucleus 2. heterokaryotic cells 3. dikaryotic cells 4. cells with two diploid nuclei

Bonus Answer: 2 and 3

16. BIOLOGY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

The structure of bone tissue suits the function. Which of the following bone tissues is adapted to support weight and withstand tension stress?

- W) Spongy bone
- X) Irregular bone
- Y) Compact bone
- Z) Trabecular bone

Toss Up Answer: Y

Bonus: Short Answer

Which hormone increases osteoclast activity to release more calcium ions into the bloodstream?

Bonus Answer: Parathyroid Hormone

17. BIOLOGY

Writer: Olivia Gallager

Toss Up: Short Answer

Bob's mother had Cystic Fibrosis, and his father was a carrier, but Bob is unaffected. If Cynthia's parents were both carriers of Cystic Fibrosis, then what is the probability, expressed as a simple fraction, of Bob and Cynthia having a child with CF?

Bonus Answer: 1/8

Bonus: Multiple Choice

Marfan's Syndrome exhibits which Mendelian inheritance pattern?

- W) Abe Lincoln
- X) X-linked recessive
- Y) Autosomal Recessive
- Z) Autosomal Dominant

Bonus Answer: Z

18. CHEMISTRY

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

Identify the INCORRECT statement below:

- W) In the most fundamental sense, the properties of the elements are periodic functions of their atomic weight.
- X) The vertical columns of the periodic chart are called groups, sharing similar properties.
- Y) Elements with atomic numbers of 9, 17, 35, and 53 are members of the halogen family, meaning "salt formers."
- Z) Elements Li, B, N and F are all in the same period.

Toss Up Answer: W

Bonus: Multiple Choice

All of the following statements are true EXCEPT:

- W) the enthalpy change of an endothermic reaction is positive.
- X) at constant pressure the heat flow for a reaction equals the change in enthalpy.
- Y) ΔH for a reaction is equal in magnitude but opposite in sign to ΔH for the reverse reaction.
- Z) enthalpy change is dependent upon the number of steps in a reaction.

Bonus Answer: Z

19. CHEMISTRY

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

In which of the lists below are the atoms arranged in order of increasing size (increasing atomic radius)?

- W) Si In Ge N
- X) N In Ge Si
- Y) In Ge N Si

Z) N Si Ge In

Toss Up Answer: Z

Bonus: Multiple Choice

Which of the following matched pairs of name and formula has an error?

- W) H_3PO_4 , phosphoric acid
- X) H_2SO_3 , sulfurous acid
- Y) HNO_3 , nitrous acid
- Z) HClO_4 , perchloric acid

Bonus Answer: Y

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20. CHEMISTRY

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

The longest wavelength absorption in the UV visible spectrum of acetone, CH_3COCH_3 , occurs at 335 nm. Predict the energy required to excite an electron from a lone pair orbital on the oxygen atom to an antibonding orbital centred on the carbonyl group.

- W) 3.7 eV
- X) .27 eV
- Y) 2.99 eV
- Z) 1.67 eV

Toss Up Answer: W

Bonus: Multiple Choice

The Pauling electronegativities of fluorine and chlorine are 4.0 and 3.0 respectively. Estimate the dipole moment of chlorine monofluoride, ClF.

- W) 4 D
- X) 3 D
- Y) 1.6 D
- Z) 1 D

Bonus Answer: Z

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21. CHEMISTRY

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

The hydrolysis of t-bromobutane, $\text{C}_4\text{H}_9\text{Br}$, by hydroxide, OH^- , ions in aqueous solution follows an $\text{S}_\text{N}1$ reaction mechanism in which the rate-determining step is the loss of a bromide, Br^- , ion, followed by rapid reaction with hydroxide ions. Which of the following rate laws is consistent with this mechanism?

- W) $\text{Rate} = k[\text{C}_4\text{H}_9\text{Br}]$
- X) $\text{Rate} = k[\text{C}_4\text{H}_9\text{Br}][\text{OH}^-]$
- Y) $\text{Rate} = k[\text{C}_4\text{H}_9\text{Br}]^2$
- Z) $\text{Rate} = k[\text{OH}^-]$

Toss Up Answer: W

Bonus: Multiple Choice

Which of the following would be correct units for the rate constant of a reaction that is second order overall?

W) s^{-1}

X) $\text{mol}^{-1} \text{dm}^3 \text{s}^{-1}$

Y) $\text{mol cm}^{-3} \text{s}^{-1}$

Z) $\text{mol}^{-2} \text{dm}^6 \text{s}^{-1}$

Bonus Answer: X

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22. CHEMISTRY

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

Radiation from a mercury lamp source is of energy 2.845 eV. Calculate the wavelength of the radiation.

W) 579 nm

X) 355 nm

Y) 405 nm

Z) 436 nm

Toss Up Answer: Z

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Bonus: Multiple Choice

The force constant of the bond in a hydrogen chloride, HCl, molecule is 516 N m^{-1} . Calculate the vibrational potential energy of an HCl molecule with a bond that is extended from its equilibrium length by 0.11 \AA .

W) $3.1 \times 10^{-20} \text{ J}$

X) $6.2 \times 10^{-20} \text{ J}$

Y) $1.5 \times 10^{-20} \text{ J}$

Z) $2.6 \times 10^{-20} \text{ J}$

Bonus Answer: W

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23. EARTH and SPACE

Writer: Larry Wong

Toss Up: Short Answer

How many Dwarf planets are in the solar system?

Bonus Answer: 3

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Bonus: Short Answer

What is the approximate date for the Earth's formation?

Bonus Answer: 4.5 billion BC

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24. EARTH and SPACE

Writer: Ivan Zhang

Toss Up: Multiple Choice

What is the name given to planets that lie within a habitable zone of a star?

W) Extraneous Planets

X) Habitable Planets

Y) Goldilocks Planet

Z) Temperate Planets

Toss Up Answer: Y

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Bonus: Short Answer

What is the name given to a cloud of dust and gas in outer space?

Bonus Answer: nebula

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25. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

What volcano has erupted in the years 79 A.D., 1139, 1631, 1779, 1793, 1872, 1906, and 1944?

Bonus Answer: Vesuvius

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Bonus: Short Answer

What is the name of the very old mountain belt located in southern Missouri and Northern Arkansas?

Bonus Answer: the ozarks

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