

Round 24

1. MATHEMATICS

Writer: Hussain Waris

Toss Up: Multiple Choice

Which of the following best characterizes every transcendental number?

W) Irrational

X) A linear combination of e or pi in which the coefficients are non-zero

Y) A real number that is not a root of any non-zero polynomial with rational coefficients

Z) e or pi

Toss Up Answer: W

Bonus: Short Answer

Which of the following numbers are transcendental numbers: 1) e; 2) $\sqrt{2}$; 3) i^i ; 4) pi?

Bonus Answer: e, i^i , pi [Accept any permutation of 1, 3, and 4]

2. EARTH and SPACE

Writer: Benjamin Avrahami

Toss Up: Short Answer

From least to greatest, order these minerals in order of pressure needed to create it: Schist, Phyllite, Gneiss, Slate

Bonus Answer: 3, 2, 4, 1

Bonus: Short Answer

During what era did oxygen begin to enter the atmosphere in abundance?

Bonus Answer: Early Proterozoic or Proterozoic

3. MATHEMATICS

Writer: Benjamin Avrahami

Toss Up: Short Answer

What is the volume of a hole 2 meters by 2 meters by 2 meters after 1 cubic meter of dirt has been added to it?

Bonus Answer: 1 cubic meter

Bonus: Multiple Choice

Avogadro's number is approximately 6.022×10 to what power

W) -23

X) -11

Y) 11

Z) 23

Bonus Answer: Z

4. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Kuru is a disease caused by what type of microbe?

W) Bacteria

X) Virus

Y) Prion

Z) Viroid

Toss Up Answer: Y

Bonus: Short Answer

Give the genus and species name of the microbe that causes peptic ulcer disease.

Bonus Answer: *Helicobacter pylori*

=====

5. MATHEMATICS

Writer: Benjamin Avrahami

Toss Up: Short Answer

If the capstone is taken off the Great Pyramid of Giza, then it is no longer a pyramid but a what?

Bonus Answer: A frustum

Bonus: Multiple Choice

Which one of these is Euclid's parallel postulate?

W) If a line intersects one of two parallel lines, both of which are coplanar with the original line, then it will also intersect with the other line.

X) If a line segment intersects two straight lines forming two interior angles on the same side that sum to less than two right angles, then the two lines, if extended indefinitely, meet on the side on which the angles sum to less than two right angles.

Y) In a plane, given a line and a point not on it, exactly one line parallel to the given line can be drawn through the point.

Z) For any acute angle A and any point D in the interior of angle A, there exists a line through D and not through A which intersects both sides of angle A.

Bonus Answer: X

=====

6. EARTH and SPACE

Writer: Prangon Ghose

Toss Up: Short Answer

What is the name of the largest volcanic mountain on Mars?

Bonus Answer: Olympus Mons

Bonus: Short Answer

Which spacial event marks the beginning of spring in the Northern Hemisphere

Bonus Answer: Vernal Equinox (Accept: Spring Equinox)

=====

7. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which term describes organisms that can only tolerate a narrow range of temperatures?

W) Eurythermal

X) Stenothermal

Y) Acrithermal

Z) Anglothermal

Toss Up Answer: X

Bonus: Multiple Choice

What is the name of the ecological phenomenon, related to the Small Population hypothesis, that describes a species' path to extinction due to inbreeding and genetic drift?

W) Inbreeding depression

X) Outbreeding depression

Y) Extinction cascade

Z) Extinction vortex

Bonus Answer: Z

=====

8. EARTH and SPACE

Writer: Prangon Ghose

Toss Up: Multiple Choice

Which planet's tilt of the axis is closest to that of Mars?

W) Mercury

X) Venus

Y) Earth

Z) Jupiter

Toss Up Answer: Y

Bonus: Multiple Choice

Which planet rotates the fastest in our solar system?

W) Earth

X) Jupiter

Y) Pluto

Z) Uranus

Bonus Answer: X

=====

9. CHEMISTRY

Writer: Josh Tish

Toss Up: Multiple Choice

Dissolution of which salt in water results in a decrease in the temperature of the solution?

W) KHSO_4

X) NaOH

Y) AlCl_3

Z) NH_4NO_3

Toss Up Answer: Z

Bonus: Multiple Choice

What is observed when equal volumes of 0.1 M aqueous HCl and 0.01 M aqueous Na_2SO_3 are mixed?

W) Colorless solution and a white precipitate

X) Colored solution and a white precipitate

Y) Colorless solution and a colored precipitate

Z) Colorless solution, no precipitate, and gas evolution

Bonus Answer: Z

=====

10. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

In a compound gearing arrangement where a 40-tooth gear drives an 80-tooth gear which is directly connected to a 50-tooth gear that drives a 100-tooth gear, the total reduction is a factor of:

- W) 2
- X) 6
- Y) 4
- Z) 21

Toss Up Answer: Y

Bonus: Multiple Choice

Elastic deformation is BEST described as ...

- W) the linear portion of a stress/strain curve
- X) 99% elongation
- Y) strength of a material
- Z) deformation

Bonus Answer: W

11. BIOLOGY

Writer: Elias Milborn

Toss Up: Short Answer

What is the main respiratory pigment of skeletal muscle cells?

Bonus Answer: Myoglobin

Bonus: Multiple Choice

If a parent organism experiences a mutation, then all subsequent offspring of that individual will:

- W) always carry the mutated gene, but only as a recessive.
- X) Always carry the gene, but never express it phenotypically
- Y) only carry the mutated gene if it is heritable
- Z) never carry the gene as mutations can never be heritable

Bonus Answer: Y

12. CHEMISTRY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Given the pressure and temperature of gas A and the temperature of gas B, which law would be most efficient in determining the pressure of gas B?

- W) Gay-Lussac's Law
- X) Boyle's Law
- Y) Charles's Law
- Z) Combined Gas Law

Toss Up Answer: W

Bonus: Short Answer

What is the metric equivalence of 760 mm Hg?

Bonus Answer: 101325 Pascals

13. BIOLOGY

Writer: Elias Milborn

Toss Up: Short Answer

What scientist in 1936, building on the discoveries of Szent-Gyorgyi [SENT-GEE-or-gee], postulated the basic reactions of the tricarboxylic acid cycle?

Bonus Answer: Krebs

Bonus: Short Answer

If a plant that is heterozygous for each of three independently-assorting traits is allowed to self-fertilize, what portion of the offspring would be heterozygous for all three traits?

Bonus Answer: 1/8

14. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

What specific type of semiconductor is produced by adding phosphorus to silicon?

Bonus Answer: N-Type

Bonus: Short Answer

How many turns are in the secondary coil of a transformer that has a primary coil with 20,000 turns and is designed to step down 12,000 volts AC to 120 volts AC?

Bonus Answer: 200

15. BIOLOGY

Writer: Zoe Orlin

Toss Up: Short Answer

The broad climatic zones that Earth's environments are organized into are called

Bonus Answer: BIOMES

Bonus: Short Answer

What biome makes up the majority of NY State?

Bonus Answer: Forest biome :)

16. CHEMISTRY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Which of the following has the greatest entropy?

W) Gaseous Substances

X) Gases

Y) Liquids

Z) Solids

Toss Up Answer: X

Bonus: Short Answer

What is the name of the equation used to determine if a reaction is spontaneous or not?

Bonus Answer: Gibbs-Free Energy Equation

17. BIOLOGY

Writer: Zoe Orlin

Toss Up: Short Answer

What is climax vegetation?

Bonus Answer: The dominant type of vegetation in a biome

Bonus: Short Answer

What is the climax vegetation of the tundra?

Bonus Answer: Mosses and/or lichens :D

18. PHYSICS

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Which statement describes a situation when polarization could not occur?

- W) Light waves are reflected.
- X) Light waves are scattered.
- Y) Microwaves pass through a metal grid.
- Z) Sound waves pass through a metal grid.

Toss Up Answer: Z

Bonus: Multiple Choice

An electromagnetic wave has a wavelength that is numerically of the same order of magnitude as the diameter of a nucleus.

In which region of the electromagnetic spectrum does the wave occur?

- W) Gamma ray
- X) X-ray
- Y) Visible light
- Z) Infra-red

Bonus Answer: W

19. 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

20. BIOLOGY

Writer: Zoe Orlin

Toss Up: Multiple Choice

What is the main function of a vacuole in a cell?

- W) storage
- X) coordination
- Y) synthesis of molecules
- Z) release of energy

Toss Up Answer: W

Bonus: Multiple Choice

If 15% of a DNA sample is made up of thymine, T, what percentage is made up of cytosine, C?

- W) 15%
- X) 35%
- Y) 70%
- Z) 85%

Bonus Answer: X

=====

21. CHEMISTRY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Which of the following element is not a newly named (as of November 2016) element?

- W) nihonium
- X) paostinism
- Y) moscovium
- Z) tennessine

Toss Up Answer: X

Bonus: Multiple Choice

Who reorganized the periodic table based on atomic number?

- W) Mendeleev
- X) Moseley
- Y) Pablo
- Z) Escobar

Bonus Answer: X

=====

22. BIOLOGY

Writer: Zoe Orlin

Toss Up: Multiple Choice

Global warming has been linked to a decrease in

- W) the size of polar icecaps
- X) temperature of Earth
- Y) rate of species extinction
- Z) rate of carbon dioxide production

Toss Up Answer: W

Bonus: Multiple Choice

Why is a mushroom a heterotroph?

- W) it manufactures its own food
- X) It divides by mitosis
- Y) It transforms light energy into chemical energy
- Z) It obtains nutrients from the environment

Bonus Answer: Z

=====

23. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

What is the resulting electrical potential, in volts, when a charge of 12 coulombs is applied to a 1 farad capacitor?

Bonus Answer: 12 volts

Bonus: Short Answer

If 1000 pounds is applied to a spring with spring constant of 100 pounds per inch on top of a hydraulic piston, how many pounds of force is transferred to the piston?

Bonus Answer: 1,000

24. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

Whose principle or law states that each point on a wavefront may be considered a new wave source?

- W) Snell's Law
- X) Huygen's principle
- Y) Young's Law
- Z) Hertz's Law

Toss Up Answer: X

Bonus: Multiple Choice

The wave nature of light is demonstrated by which of the following?

- W) Diffraction
- X) Color
- Y) Length
- Z) Speed of light

Bonus Answer: W

25. PHYSICS

Writer: Mohammed Jamil

Toss Up: Short Answer

Given that the specific heat capacity of water is 11 times that of copper, calculate the mass of copper at a temperature of 100 °C required to raise the temperature of 200 g of water from 20.0 °C to 24.0 °C, assuming no energy is lost to the surroundings.

Bonus Answer: 0.116 kg

Bonus: Short Answer

1 kg of water at a temperature of 45 °C is mixed with 1.5 kg of alcohol at 20 °C. Find the final temperature of the mixture.

Take the specific heat capacity of water to be 4200 J kg⁻¹ K⁻¹ and the specific heat capacity of alcohol to be 2400 J kg⁻¹ K⁻¹. Assume no other exchange of heat occurs.

Bonus Answer: 33°C
