

Round 10

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 π 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 π

Toss Up Answer: W

Bonus: Short Answer

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

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

2. PHYSICS

Writer: Kerwin Chen

Toss Up: Short Answer

What are substances that deform continuously when subjected to shearing called?

Bonus Answer: fluids

Bonus: Short Answer

Which class of lasers is the most dangerous?

Bonus Answer: Class 4

3. MATHEMATICS

Writer: Hussain Waris

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4. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

In which state is the oldest North American lake located?

W) California

X) Minnesota

Y) Ohio

Z) Utah

Toss Up Answer: W

Bonus: Short Answer

What is the densest naturally occurring element?

Bonus Answer: Osmium

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5. MATHEMATICS

Writer: Hussain Waris

Toss Up: Multiple Choice

What conic section is described by the following: the intersection of a cone and some plane parallel to that cone's side such that that intersection is non-empty?

- W) Circle
- X) Parabola
- Y) A point
- Z) Ellipse

Toss Up Answer: X

Bonus: Short Answer

Respectively, give the vertex and the focus of the following parabola: $(y - 3)^2 = 8(x - 5)$?

Bonus Answer: vertex: (5,3); focus: (7,3)

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6. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

When outside of the lymph vessel, the lymph is called

- W) Interstitial Fluid
- X) Hemocel
- Y) Plasma
- Z) Blood

Toss Up Answer: W

Bonus: Multiple Choice

Which of the following is not true about platelets

- W) They are involved in blood clotti
- X) They are present in blood
- Y) They are cells that broke away from megakaryocytes
- Z) They have cytoplasm

Bonus Answer: Y

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7. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

The principal mineral in most sand beaches is

- W) quartz
- X) orthoclase
- Y) magnetite
- Z) muscovite

Toss Up Answer: W

Bonus: Short Answer

What geological event will allow you to see Bishop's ring?

Bonus Answer: a volcanic eruption

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8. MATHEMATICS

Writer: Steven Litvack-Winkler

Toss Up: Multiple Choice

Find the points of intersection of the following curves:

$$y = \sqrt{x^2 - x + 29}$$

$$y = x + 2$$

W) (5,7)

X) $(\sqrt{2} - 1, \sqrt{2} + 1)$

Y) $(\sqrt{29} - 1, \sqrt{29} + 1)$

Z) (2,4)

Toss Up Answer: W

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Bonus: Multiple Choice

Which of the following expressions is not divisible by 9

W) $5^3 + 7^3$

X) $4^5 + 2^5$

Y) $10^3 - 7^3$

Z) $9^7 - 6^7$

Bonus Answer: W

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9. PHYSICS

Writer: Kerwin Chen

Toss Up: Short Answer

What type of surface does diffuse reflection occur on?

Bonus Answer: rough

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Bonus: Short Answer

What type of scattering is responsible for the blue color of our sky?

Bonus Answer: Rayleigh scattering

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10. BIOLOGY

Writer: Henry Zheng

Toss Up: Multiple Choice

How many mature egg cells result from mitosis?

W) 0

X) 1

Y) 2

Z) 3

Toss Up Answer: W

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Bonus: Multiple Choice

How many mature egg cells result from meiosis?

W) 0

X) 1

Y) 2

Z) 3

Bonus Answer: X

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11. PHYSICS

Writer: Kerwin Chen

Toss Up: Multiple Choice

Which of the following accurately describes the setup of Young's double slit experiment?

- W) single light source, monochromatic
- X) multiple light sources, monochromatic
- Y) single light source, polychromatic
- Z) multiple light sources, polychromatic

Toss Up Answer: W

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Bonus: Short Answer

Which scientist is famous for their single slit diffraction experiment?

Bonus Answer: Fraunhofer, Joseph Fraunhofer, Joseph von Fraunhofer

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12. BIOLOGY

Writer: Henry Zheng

Toss Up: Short Answer

Small, circular, double-stranded DNA molecules that naturally exist in bacterial cells and provide bacteria antibiotic resistance are called:

Bonus Answer: plasmids

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Bonus: Multiple Choice

Small and round bacteria that grow in a chain are called

- W) streptococci
- X) staphylobacilli
- Y) spirillum
- Z) diplococci

Bonus Answer: W

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13. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

As a pendulum is raised to higher altitudes, its period?

Bonus Answer: Increases

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Bonus: Short Answer

The SI unit of pressure is?

Bonus Answer: Pascal

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14. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

Which one of these is NOT true?

- W) All planets revolve in the same direction.
- X) All planets rotate in the same direction.

- Y) The orbits of the planets are all ellipses.
Z) The orbits of the planets are nearly in the same plane.

Toss Up Answer: X

Bonus: Multiple Choice

Coal is believed to have been principally formed in which of the following types of environment?

- W) river beds
X) swamps
Y) volcanic regions
Z) deserts

Bonus Answer: X

15. CHEMISTRY

Writer: Kerwin Chen

Toss Up: Short Answer

How many neutrons are in an alpha particle?

Bonus Answer: 2

Bonus: Short Answer

Which scientist working in Canada discovered the alpha particle?

Bonus Answer: Rutherford, Ernest Rutherford

16. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

A 10 volt battery connected to a capacitor delivers a charge of 0.5 coulombs. The capacitance of the capacitor is

Bonus Answer: 5 times 10⁻² Farads

Bonus: Short Answer

To convert a galvanometer to a voltmeter, you should add what to a series?

Bonus Answer: high resistance

17. 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) KHSO₄
X) NaOH
Y) AlCl₃
Z) NH₄NO₃

Toss Up Answer: Z

Bonus: Multiple Choice

What is observed when equal volumes of 0.1 M aqueous

HCl and 0.01 M aqueous Na₂SO₃ 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

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18. BIOLOGY

Writer: Henry Zheng

Toss Up: Short Answer

A gene that is phenotypically expressed in the homozygous state but has its expression masked in the presence of a dominant gene is called:

Bonus Answer: recessive

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Bonus: Multiple Choice

Sequences of DNA that are easily and naturally copied from one location in the genome and inserted elsewhere are called

- W) jumping genes
- X) crossing over genes
- Y) recessive genes
- Z) deletion genes

Bonus Answer: W

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19. CHEMISTRY

Writer: Josh Tish

Toss Up: Multiple Choice

Which of the following is a nonelectrolyte in aqueous solution?

- W) H₂SO₄
- X) NaC₂H₃O₂
- Y) K₂CO₃
- Z) CH₂O

Toss Up Answer: Z

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Bonus: Multiple Choice

An aqueous solution of potassium sulfate has a freezing point of -2.24 °C. What is its molality?

(K_f = 1.86 °C·m⁻¹)

- W) 0.401 m
- X) 0.602 m
- Y) 1.20 m
- Z) 4.17 m

Bonus Answer: W

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20. BIOLOGY

Writer: Henry Zheng

Toss Up: Short Answer

What type of joint allows for rotational movement?

Bonus Answer: ball-and-socket joint

Bonus: Short Answer

What type of joint allows for gliding or sliding movement?

Bonus Answer: plane joint

21. CHEMISTRY

Writer: Josh Tish

Toss Up: Multiple Choice

How much $\text{Sr}(\text{OH})_2 \cdot 8 \text{H}_2\text{O}$ ($M = 265.76$) is needed to prepare 250.0 mL of solution in which $[\text{OH}^-] = 0.100 \text{ M}$?

- W) 3.32 g
- X) 6.64 g
- Y) 9.97 g
- Z) 13.3 g

Toss Up Answer: W

Bonus: Multiple Choice

A 10.00 g sample of a compound containing only carbon, hydrogen, and oxygen forms 23.98 g CO_2 and 4.91 g H_2O upon complete combustion. What is the empirical formula of the compound?

- W) C_2HO
- X) $\text{C}_3\text{H}_3\text{O}$
- Y) $\text{C}_6\text{H}_3\text{O}_2$
- Z) $\text{C}_6\text{H}_6\text{O}$

Bonus Answer: X

22. BIOLOGY

Writer: Henry Zheng

Toss Up: Multiple Choice

Microspores of gymnosperms eventually develop into

- W) seeds
- X) cotyledons
- Y) female gametophytes
- Z) pollen grains

Toss Up Answer: Z

Bonus: Multiple Choice

Microspores of angiosperms eventually develop into

- W) cotyledons
- X) female gametophytes
- Y) pollen grains
- Z) archegonia

Bonus Answer: Y

23. 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

24. BIOLOGY

Writer: Henry Zheng

Toss Up: Multiple Choice

What type of plant has seeds?

- W) Sperm
- X) Angiosperm
- Y) Gymnosperm
- Z) Egg

Toss Up Answer: X

Bonus: Short Answer

By name or number, identify the characteristics that gymnosperms and angiosperms share from this list: leaves, stems, roots, and seeds

Bonus Answer: all of them

25. BIOLOGY

Writer: Henry Zheng

Toss Up: Short Answer

What is the powerhouse of the cell?

Bonus Answer: Mitochondria

Bonus: Short Answer

Where does photosynthesis take place?

Bonus Answer: Chloroplast
