

Round 10

1. PHYSICS

Writer: Kerwin Chen

Toss Up: Short Answer

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

Bonus Answer: fluids

Bonus: Short Answer

Which class of lasers is the most dangerous?

Bonus Answer: Class 4

2. 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]

3. 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

4. MATHEMATICS

Writer: Hussain Waris

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5. 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

6. 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)

7. 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

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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8. 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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9. 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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10. 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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11. 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

12. 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

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

13. 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

14. 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

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

15. 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

16. 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

17. 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

18. 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

19. CHEMISTRY

Writer: Josh Tish

Toss Up: Multiple Choice

Which of the following is a nonelectrolyte in aqueous solution?

- W) H_2SO_4
X) $\text{NaC}_2\text{H}_3\text{O}_2$
Y) K_2CO_3
Z) CH_2O

Toss Up Answer: Z

Bonus: Multiple Choice

An aqueous solution of potassium sulfate has a freezing point of $-2.24\text{ }^\circ\text{C}$. What is its molality?

($K_f = 1.86\text{ }^\circ\text{C}\cdot\text{m}^{-1}$)

- 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: Multiple Choice

What type of plant has seeds?

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

Toss Up Answer: X

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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

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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

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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

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22. 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

23. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

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

Bonus Answer: Increases

Bonus: Short Answer

The SI unit of pressure is?

Bonus Answer: Pascal

24. 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

25. 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
