

## 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

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Bonus: Short Answer

Which class of lasers is the most dangerous?

Bonus Answer: Class 4

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### 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

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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]

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### 3. 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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### 4. MATHEMATICS

Writer: Hussain Waris

Toss Up: Multiple Choice

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## 5. 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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## 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

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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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## 7. 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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## 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: 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**

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**Bonus: Short Answer**

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

**Bonus Answer: high resistance**

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## 10. 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**

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**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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## 11. CHEMISTRY

**Writer: Kerwin Chen**

**Toss Up: Short Answer**

How many neutrons are in an alpha particle?

**Bonus Answer: 2**

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**Bonus: Short Answer**

Which scientist working in Canada discovered the alpha particle?

Bonus Answer: Rutherford, Ernest Rutherford

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## 12. 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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## 13. 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)  $\text{KHSO}_4$

X)  $\text{NaOH}$

Y)  $\text{AlCl}_3$

Z)  $\text{NH}_4\text{NO}_3$

Toss Up Answer: Z

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Bonus: Multiple Choice

What is observed when equal volumes of 0.1 M aqueous HCl and 0.01 M aqueous  $\text{Na}_2\text{SO}_3$  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

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## 14. 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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**15. CHEMISTRY**

**Writer: Josh Tish**

**Toss Up: Multiple Choice**

Which of the following is a nonelectrolyte in aqueous solution?

- W)  $\text{H}_2\text{SO}_4$
- X)  $\text{NaC}_2\text{H}_3\text{O}_2$
- Y)  $\text{K}_2\text{CO}_3$
- Z)  $\text{CH}_2\text{O}$

**Toss Up Answer: Z**

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**Bonus: Multiple Choice**

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

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

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

**Bonus Answer: W**

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**16. 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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**17. 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  $\text{CO}_2$  and 4.91 g  $\text{H}_2\text{O}$  upon complete combustion. What is the empirical formula of the compound?

- W)  $\text{C}_2\text{HO}$
- 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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## 18. BIOLOGY

**Writer: Henry Zheng**

**Toss Up: Short Answer**

What type of joint allows for rotational movement?

**Bonus Answer: ball-and-socket joint**

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**Bonus: Short Answer**

What type of joint allows for gliding or sliding movement?

**Bonus Answer: plane joint**

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## 19. 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  $\text{O}_2$  gas. What volume of  $\text{O}_2$  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**

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**Bonus: Multiple Choice**

When 30.0 mL of 0.10 M  $\text{AgNO}_3$  is added to 30.0 mL of 0.10 M  $\text{NaCl}$ , aqueous  $\text{NaNO}_3$  and solid  $\text{AgCl}$  are formed. How much solid  $\text{AgCl}$  is produced?

- W) 0.0030 mol

X) 0.0060 mol

Y) 0.030 mol

Z) 0.060 mol

**Bonus Answer: W**

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## 20. 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**

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**Bonus: Multiple Choice**

Microspores of angiosperms eventually develop into

W) cotyledons

X) female gametophytes

Y) pollen grains

Z) archegonia

**Bonus Answer: Y**

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## 21. 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**

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**Bonus: Short Answer**

What is the densest naturally occurring element?

**Bonus Answer: Osmium**

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## 22. 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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**23. 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**

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**Bonus: Short Answer**

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

**Bonus Answer: a volcanic eruption**

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**24. BIOLOGY**

**Writer: Henry Zheng**

**Toss Up: Short Answer**

What is the powerhouse of the cell?

**Bonus Answer: Mitochondria**

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**Bonus: Short Answer**

Where does photosynthesis take place?

**Bonus Answer: Chloroplast**

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**25. 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**

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**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**

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