

## Round 34

### 1. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

The constant potential difference across a 2 ohm resistor is 20 volts. How many watts of power are dissipated by this resistor?

Bonus Answer: 200 Watts

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Bonus: Multiple Choice

Which of the following scientists is responsible for the exclusion principle which states that two objects may NOT occupy the same space at the same time? Was it:

W) Heisenberg

X) Bohr

Y) Teller

Z) Pauli

Bonus Answer: Z

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### 2. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

What is the name of the first American physicist to win two Nobel prizes? (very random lol)

Bonus Answer: John Bardeen (can accept just last name?)

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Bonus: Multiple Choice

If the resultant force acting on a body of constant mass is zero, the body's momentum is:

W) constant

X) 0

Y) increasing

Z) decreasing

Bonus Answer: W

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### 3. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

A 40 kilogram girl climbs a vertical distance of 5 meters in twenty seconds at a constant velocity. How much work has the girl done?

Bonus Answer: 2000 joules / 1960 joules (accept either)

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Bonus: Short Answer

A machine performs 8 Joules of work in 2 seconds. How much power is delivered by this machine?

Bonus Answer: 4 Watts

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### 4. PHYSICS

Writer: Aaron Gee

**Toss Up: Multiple Choice**

If the distance between two objects, each of mass 'M', is tripled, the force of attraction between the two objects is

- W)  $1/2$  original force
- X)  $1/3$  original force
- Y)  $1/9$  original force
- Z) unchanged

**Toss Up Answer: Y**

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**Bonus: Multiple Choice**

In physics, a radian per second is a unit of:

- W) angular displacement
- X) angular velocity
- Y) angular acceleration
- Z) angular momentum

**Bonus Answer: X**

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**5. PHYSICS**

**Writer: Aaron Gee**

**Toss Up: Multiple Choice**

A certain spring is known to obey Hooke's Law. If a force of 10 newtons stretches the spring 2 meters, how far will a 30 newton force stretch the spring?

- W) 1 meter
- X) 60 meters
- Y) 6 meters
- Z) 16 meters

**Toss Up Answer: Y**

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**Bonus: Multiple Choice**

A block of metal which weighs 60 newtons in air and 40 newtons under water has a density, in kilograms per meter cubed, of:

- W) 1000
- X) 3000
- Y) 5000
- Z) 7000

**Bonus Answer: X**

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**6. MATHEMATICS**

**Writer: Hanna Yang**

**Toss Up: Short Answer**

What is the slope of a line parallel to  $45x=9y+5$ ?

**Bonus Answer: 5**

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**Bonus: Multiple Choice**

How many vertical asymptotes does  $f(x)=(x^2+2x+1)/(x^3-x)$  have?

- W) 0
- X) 1
- Y) 2
- Z) 3

Bonus Answer: Y

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## 7. MATHEMATICS

Writer: Hanna Yang

Toss Up: Short Answer

Compute:  $\sqrt{(3^4 \cdot 5 - 60)^2}$

Bonus Answer: 0

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Bonus: Short Answer

Compute  $(34/17 - 2 + 5) * (96 + -144) * (1/(46 - 130/5))$

Bonus Answer: -12

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## 8. MATHEMATICS

Writer: Hanna Yang

Toss Up: Multiple Choice

Simplify:  $(24 \cdot 63)/(72 \cdot 21)$

- W) 1
- X) 3
- Y) 7
- Z) 1/3

Toss Up Answer: W

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Bonus: Short Answer

Simplify  $(333(x^4 - x^2))/(9(x^2 + 2x + 1)(x^2))$

Bonus Answer:  $(x-1)/((37)(x+1))$

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## 9. MATHEMATICS

Writer: Jason Weng

Toss Up: Multiple Choice

Given  $P(x) = x^2 + ax + b$  and  $P(1) = 9$ , what is  $a + b$ ?

- W) 8
- X) 10
- Y) 9
- Z) 1

Toss Up Answer: W

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Bonus: Multiple Choice

Factor the following completely:  $(4x^4) - (20x^2) + 16$

- W)  $(x+1)(x-1)(x+2)(x-2)$
- X)  $(x+1)(x+1)(x-2)(x-2)$
- Y)  $4(x+1)(x-1)(x+2)(x-2)$
- Z)  $4(x+1)(x+1)(x-2)(x-2)$

Bonus Answer: Y

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## 10. BIOLOGY

Writer: Olivia Gallager

Toss Up: Short Answer

Defects in the myelin sheath lead to what disease?

**Bonus Answer: Multiple Sclerosis**

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**Bonus: Short Answer**

From which parent do we inherit mitochondrial DNA?

**Bonus Answer: Mothers, maternal**

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## 11. BIOLOGY

Writer: Olivia Gallager

Toss Up: Short Answer

What part of the brain controls the interaction between the two hemispheres?

**Bonus Answer: corpus callosum**

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**Bonus: Short Answer**

Which lobe of the brain is known for spatial reasoning and navigation?

**Bonus Answer: parietal lobes**

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## 12. BIOLOGY

Writer: Olivia Gallager

Toss Up: Multiple Choice

Which of the following enzymes makes C4 and CAM species more efficient in hotter, dryer climates?

W) phosphofructokinase

X) Rubisco

Y) DNA polymerase

Z) PEP Carboxylase

**Toss Up Answer: Z**

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**Bonus: Short Answer**

During the light dependent reactions, on what membrane does ATP synthesis take place via ATP Synthase?

**Bonus Answer: thylakoid, thylakoid membrane**

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## 13. BIOLOGY

Writer: Sean Vaysburd

Toss Up: Short Answer

What is the name of the proteins in cell membranes that allow for rapid transport of water into and out of the cell?

**Bonus Answer: Aquaporins**

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**Bonus: Short Answer**

What membrane bound structures in cells are important for exocytosis?

**Bonus Answer: transport vesicles**

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## 14. BIOLOGY

Writer: Sean Vaysburd

Toss Up: Short Answer

What is the most current model of the cell membrane called?

**Bonus Answer: Fluid Mosaic Model**

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**Bonus: Short Answer**

Who came up with the fluid mosaic model?

**Bonus Answer: SJ Singer and GL Nicolson**

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**15. BIOLOGY**

**Writer: Sean Vaysburd**

**Toss Up: Short Answer**

Where is prokaryotic genetic material located?

**Bonus Answer: plasmids**

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**Bonus: Short Answer**

Do prokaryotic cells have cell walls?

**Bonus Answer: Yes**

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**16. BIOLOGY**

**Writer: Sean Vaysburd**

**Toss Up: Multiple Choice**

Which of the following places contains ribosomes?

W) Rough endoplasmic reticulum

X) Smooth endoplasmic reticulum

Y) Cell wall

Z) lysosomes

**Toss Up Answer: W**

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**Bonus: Short Answer**

Do prokaryotic cells have ribosomes?

**Bonus Answer: Yes**

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**17. BIOLOGY**

**Writer: Sean Vaysburd**

**Toss Up: Short Answer**

What is the central dogma?

**Bonus Answer: DNA to RNA to Protein.**

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**Bonus: Short Answer**

What types of RNA are used in translation.

**Bonus Answer: mRNA and tRNA**

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**18. CHEMISTRY**

**Writer: Prangon Ghose**

**Toss Up: Multiple Choice**

Which would be the easiest way to burn an iron nail?

W) Hold an iron nail with crucible tongs, and heat strongly in the flame of a bunsen burner.

X) Use the above method with an oxyacetylene torch to reach highest temperatures.

Y) Grind the nail into very small, dust-sized particles and spray them into a flame.

Z) Dissolve the nail in acid to make the oxide.

**Toss Up Answer: Y**

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**Bonus: Multiple Choice**

What is a reasonable and safe substitute for zinc in reduction reactions in aqueous solutions?

- W) S
- X) F<sub>2</sub>
- Y) K
- Z) Cd

**Bonus Answer: Z**

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**19. CHEMISTRY**

**Writer: Nicholas Adit**

**Toss Up: Short Answer**

An ideal gas in a closed inflexible container has a pressure of 6 atmospheres and a temperature of 27°C. What will be the new pressure of the gas if the temperature is decreased to -73°C?

**Bonus Answer: 4 atmospheres**

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**Bonus: Multiple Choice**

When CO<sub>2</sub> is bubbled through distilled water at 25°C, which of the following is most likely to occur?

- W) Solid carbon will form
- X) The pH of the solution will be reduced
- Y) The water will boil
- Z) Methane gas will be formed

**Bonus Answer: X**

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**20. CHEMISTRY**

**Writer: Prangon Ghose**

**Toss Up: Multiple Choice**

Which of the following is not commonly produced by eletrolysis?

- W) NaOCl
- X) Al
- Y) Fe
- Z) NaOH

**Toss Up Answer: Y**

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**Bonus: Multiple Choice**

Which of the following pairs of constants are not mathematically related to eachother?

- W) Equilibrium constant and Gibbs Free Energy
- X) Rate Constant and Activation Energy
- Y) Standard Cell Voltage and Equilibrium Constant
- Z) Standard Cell Voltage and Rate Constant

**Bonus Answer: Z**

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**21. CHEMISTRY**

**Writer: Prangon Ghose**

**Toss Up: Multiple Choice**

What kind of process is the loss of electrons?

- W) electrolysis

- X) thermodynamically favored
- Y) reduction
- Z) oxidation

**Toss Up Answer: Z**

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**Bonus: Multiple Choice**

Which of the following metals does not react with water to produce hydrogen?

- W) Zn
- X) Li
- Y) Ca
- Z) Na

**Bonus Answer: W**

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## **22. CHEMISTRY**

**Writer: Nicholas Adit**

**Toss Up: Short Answer**

In 12.4 hours, a 100 gram sample of an element decays so that its mass is 25 grams. What is the approximate half-life of this radioactive substance?

**Bonus Answer: 6.2 hours**

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**Bonus: Multiple Choice**

Which of the following will raise the boiling point of a sample of water?

- W) Heat the water
- X) Mix gasoline into the water
- Y) Bring the water to a higher altitude
- Z) Dissolve table sugar in the water

**Bonus Answer: Z**

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## **23. EARTH and SPACE**

**Writer: Shanjeed Ali**

**Toss Up: Short Answer**

In the stratosphere, what happens to the temperature as altitude increases?

**Bonus Answer: increases**

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**Bonus: Short Answer**

What does radar stand for?

**Bonus Answer: RAdio Detection And Ranging**

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## **24. EARTH and SPACE**

**Writer: George Papastefanou**

**Toss Up: Multiple Choice**

How is the ISS powered?

- W) Solar Energy from photovoltaic cells
- X) Nuclear Power
- Y) A combination of solar energy and nuclear power
- Z) Rocket fuel

**Toss Up Answer: W**

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**Bonus: Short Answer**

Who was the first American astronaut in space?

**Bonus Answer: Alan Shepard**

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**25. EARTH and SPACE**

**Writer: Shanjeed Ali**

**Toss Up: Short Answer**

The Ring of Fire surrounds which ocean?

**Bonus Answer: Pacific Ocean**

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**Bonus: Multiple Choice**

What kind of volcano is Mauna Loa?

W) cone

X) shield

Y) subglacial

Z) stratovolcano

**Bonus Answer: X**

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