

Round 9

1. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

A helicopter is ascending vertically with a constant speed of 6 meters per second relative to the ground. At the instant the helicopter is 60 meters above the ground it releases a package.

What is the magnitude and direction of the velocity of the package, relative to the ground, the instant the package is released by the helicopter?

Bonus Answer: 6 meters/second up

Bonus: Multiple Choice

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

- W) increasing
- X) decreasing
- Y) always 0
- Z) Constant!

Bonus Answer: Z

2. BIOLOGY

Writer: Sean Vaysburd

Toss Up: Multiple Choice

Which is not a part of the nucleus?

- W) nuclear envelope
- X) nucleolus
- Y) chromatin
- Z) plasmodesmata

Toss Up Answer: Z

Bonus: Multiple Choice

Which is not a part of the cytoskeleton?

- W) microfilaments
- X) intermediate filaments
- Y) microtubules
- Z) gap junctions

Bonus Answer: Z

3. CHEMISTRY

Writer: Ahmad Alnasser

Toss Up: Short Answer

At room temperature, what is the only metal that is in liquid form?

Bonus Answer: Mercury (Hg)

Bonus: Multiple Choice

What is the third most common gas found in the air in the atmosphere?

- W) Argon
- X) Hydrogen

Y) Oxygen

Z) Helium

Bonus Answer: W

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4. 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

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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5. CHEMISTRY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

A molecule is considered a lewis acid if

W) accepts a pair of electrons to form a bond

X) accepts a proton from water

Y) donates a pair of electrons to form a bond

Z) donates a proton to water

Toss Up Answer: W

Bonus: Multiple Choice

Which of the following is a binary compound?

W) Hydrogen Sulfate

X) Hydrogen Sulfide

Y) Ammonium Sulfide

Z) Ammonium Sulfate

Bonus Answer: X

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6. BIOLOGY

Writer: Siam Muquit

Toss Up: Short Answer

The enzyme catalase is associated with which cell organelle?

Bonus Answer: Peroxisome

Bonus: Short Answer

What dangerous product of fatty acid oxidation does catalase act on?

Bonus Answer: Hydrogen peroxide

7. 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

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

8. MATHEMATICS

Writer: Raafiul Hossain

Toss Up: Multiple Choice

A statement about a relationship between natural quantities. The statement has been tested many times, and has not been contradicted. What is it?

- W) Fact
- X) Hypothesis
- Y) Law
- Z) Theory

Toss Up Answer: Y

Bonus: Multiple Choice

A framework that includes many well-tested and verified hypotheses about one or more aspects of the natural world.

- W) Fact
- X) Hypothesis
- Y) Law
- Z) Theory

Bonus Answer: Z

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9. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Short Answer

What is the name for a molecule with tetrahedral electron geometry but only three substituent groups?

Bonus Answer: trigonal pyramidal

Bonus: Multiple Choice

Which of the following is not an ionic compound?

W) NaCl

X) HF

Y) FeCl₃

Z) H₂SO₄

Bonus Answer: X

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10. BIOLOGY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

What structure in plant cells is similar to gap junctions in animal cells?

W) Cell wall

X) Central Vacuole

Y) Plasmodesmata

Z) Thylakoid

Toss Up Answer: Y

Bonus: Multiple Choice

If, on average, 46% of the loci in a species' gene pool are heterozygous, then the average homozygosity of the species should be

W) 23%

X) 46%

Y) 54%

Z) There is not enough information to say.

Bonus Answer: Y

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11. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Multiple Choice

cis 1,2 chloro-ethene and trans 1,2 chloro-ethene differ in which of the following?

W) electron geometry

X) enthalpy

Y) entropy

Z) boiling point

Toss Up Answer: Z

Bonus: Short Answer

In an acid/base reaction, which (acid or base) is the electrophile?

Bonus Answer: acid

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12. MATHEMATICS

Writer: Raafiul Hossain

Toss Up: Short Answer

The surface area of a sphere is how many times the area of a circle?

Bonus Answer: 4

Bonus: Short Answer

What is the area of a cone?

Bonus Answer: $(\pi)r^2h$

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13. EARTH and SPACE

Writer: Shantanu Jha

Toss Up: Short Answer

What physical quantity is the Schwarzschild radius of a Black Hole most dependent on?

Bonus Answer: Mass

Bonus: Multiple Choice

If the event horizon of a black hole is 10 km, then what is the radius of its photon sphere?

W) 10km

X) 15km

Y) 20km

Z) 25km

Bonus Answer: X

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14. 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)

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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15. EARTH and SPACE

Writer: Shantanu Jha

Toss Up: Short Answer

What phenomena best explains why the sky is blue?

Bonus Answer: Rayleigh Scattering

Bonus: Short Answer

What are the high intensity spots of light at the horizontal points of the 22 degree halo that may form around the sun due to ice crystals in the air called?

Bonus Answer: Parhelia (ALSO ACCEPT: Sun Dogs, Parhelion)

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16. BIOLOGY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

A trend toward the decrease in the size of plants on the slopes of mountains as altitudes increase is an example of

- W) a cline
- X) a bottleneck
- Y) relative fitness
- Z) geographic variation

Toss Up Answer: W

Bonus: Short Answer

If thermoregulation is considered to be a secondary function of the large ears of jackrabbits, then the primary function of the ears is

Bonus Answer: to detect predators

17. MATHEMATICS

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

What type of number is defined as a number that is not a root of a polynomial with rational coefficients?

Bonus Answer: Transcendental numbers

Bonus: Short Answer

Of the following, which of these numbers are transcendental? π , e , i , ϕ , $e \times i$, $2^{\sqrt{2}}$

Bonus Answer: π , e , $e \times i$, $2^{\sqrt{2}}$

18. BIOLOGY

Writer: Ahmad Alnasser

Toss Up: Short Answer

An ecologist recorded 12 white-tailed deer, *Odocoileus virginianus*, per square mile in one woodlot and 20 per square mile in another woodlot. What was the ecologist comparing?

Bonus Answer: density

Bonus: Short Answer

Why do populations grow more slowly as they approach their carrying capacity?

Bonus Answer: Density-dependent factors lead to fewer births and increased mortality. (Accept Density-Dependent factors)

19. CHEMISTRY

Writer: Jason Mohabir

Toss Up: Short Answer

During glycolysis, electrons removed from glucose are passed to

Bonus Answer: NAD⁺

Bonus: Multiple Choice

A biological redox reaction always involves

- W) an oxidizing agent
- X) a gain of electrons
- Y) a reducing agent
- Z) All of the Above

Bonus Answer: Z

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20. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

If we could observe all forms of radiation, what would the brightest star be?

Bonus Answer: Betelgeuse

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Bonus: Multiple Choice

In 12000 years, which star will take the place of our North Star?

W) Aldebaran

X) Vega

Y) Sirius

Z) Rigel

Bonus Answer: X

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21. 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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22. 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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23. 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

Bonus: Short Answer

Do prokaryotic cells have ribosomes?

Bonus Answer: Yes

24. 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

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

25. BIOLOGY

Writer: Sean Vaysburd

Toss Up: Short Answer

Where is prokaryotic genetic material located?

Bonus Answer: plasmids

Bonus: Short Answer

Do prokaryotic cells have cell walls?

Bonus Answer: Yes
