Round 2

1. PHYSICS

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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2. PHYSICS

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

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3. PHYSICS

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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4. PHYSICS

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

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5. PHYSICS

Toss Up: Short Answer

A box is initially at rest on a horizontal, frictionless table. If a force of 10 Newtons acts on the box for 3 seconds, what is the momentum of the box at the end of the 3 second interval?

Bonus Answer: 30 N (newton) seconds

Bonus: Short Answer

A 10 kilogram body initially moving with a velocity of 10 meters per second makes a head-on collision with a 15 kilogram body initially at rest. The two objects stick together. What is the velocity of the combined system just after the collision?

Bonus Answer: 4 meters per seconds

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6. MATHEMATICS

Toss Up: Multiple Choice

If a regular hexagon has a side length of 2, what is its area?
W) 3*sqrt(6)
X) 6*sqrt(3)
Y) sqrt(18)
Z) 6*sqrt(2)

Toss Up Answer: X

Bonus: Multiple Choice

If f(x) is (ln (x^2))/(e^x), what is f'(x) in simplest form?
W) (((x^2)/2x) + ln(x^2))/(e^2x)
X) ((2/x) - ln(x^2))/(e^2)
Y) (ln (4/x))/(e^2x)

Z) ((2x/(x^2)) - ln (x^2))/(e^2x)

Bonus Answer: X

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7. MATHEMATICS

Toss Up: Short Answer

Write an equation for a sine function with an amplitude of 5/3 , a period of pi/2, and a vertical shift of 4 units up.

Bonus Answer: y = (5/3)sin(4 x) + 4

Bonus: Short Answer

Two large and 1 small pumps can fill a swimming pool in 4 hours. One large and 3 small pumps can also fill the same swimming pool in 4 hours. How many hours will it take 4 large and 4 small pumps to fill the swimming pool.

Bonus Answer: 1 hour and 40 minutes

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8. MATHEMATICS

Toss Up: Short Answer

Find the derivative of: 4x^3 + 18x + 2

Bonus Answer: 8x^2 + 18

Bonus: Short Answer

At what point is the slope of the tangent line to the parabola y= 3x^2 + 5x + 23 equal to 0?

Bonus Answer: (-5/6 , 441/36)

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9. MATHEMATICS

Toss Up: Short Answer

Given y = | x - 6 | , what is the derivative at x = 6?

Bonus Answer: The derivative does not exist

Bonus: Short Answer

Find the derivative of x^3 / x^2

Bonus Answer: 1

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10. BIOLOGY

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

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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11. BIOLOGY

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

Bonus: Short Answer

What membrane bound structures in cells are important for exocytosis?

Bonus Answer: transport vesicles

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12. BIOLOGY

Toss Up: Short Answer

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

Bonus Answer: Fluid Mosaic Model

Bonus: Short Answer

Who came up with the fluid mosaic model?

Bonus Answer: SJ Singer and GL Nicolson

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13. BIOLOGY

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

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14. BIOLOGY

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

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15. BIOLOGY

Toss Up: Short Answer

What is the central dogma?

Bonus Answer: DNA to RNA to Protein.

Bonus: Short Answer

What types of RNA are used in translation.

Bonus Answer: mRNA and tRNA

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16. BIOLOGY

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)

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17. CHEMISTRY

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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18. CHEMISTRY

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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19. CHEMISTRY

Toss Up: Multiple Choice

Which of the following does not exhibit resonance stabilization?

W) Ozone

X) SO_2

Y) NO_3

Z) H_2O

Toss Up Answer: Z

Bonus: Short Answer

What is the bond order of H_2O?

Bonus Answer: 2

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20. CHEMISTRY

Toss Up: Short Answer

What is the molecular geometry of ammonia (NH3)?

Bonus Answer: Trigonal Pyramidal

Bonus: Multiple Choice

How many lone pairs are in Xenon tetrafluoride (XeF4)?

W) 0

X) 1

Y) 2

Z) 3

Bonus Answer: Y

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21. CHEMISTRY

Toss Up: Multiple Choice

A solution of H2SO3 is found to have a hydrogen ion concentration of 1 × 10–3 molar at 25°C. What is the hydroxide ion concentration in the solution?

W) 1 x 10^-1

X) 1 x 10^-3

Y) 1 x 10^-11

Z) 1 x 10^-13

Toss Up Answer: Y

Bonus: Short Answer

If the pH of a solution is changed from 1 to 3 with the addition of an antacid, what percentage of [H+] was neutralized?

Bonus Answer: 99%

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22. CHEMISTRY

Toss Up: Multiple Choice

What happens in a hydrogen atom when an electron jumps from an excited energy state to a more stable energy state?

W) electromagnetic radiation is emitted by the atom

X) electromagnetic radiation is absorbed by the atom

Y) the atom becomes a positively charged ion

Z) the atom becomes a negatively charged ion

Toss Up Answer: W

Bonus: Short Answer

A closed 5-liter vessel contains a sample of neon gas. The temperature inside the container is 25°C, and the pressure is 1.5 atmospheres. (The gas constant, R, is equal to 0.08 L?atm/mol?K.) If the neon gas in the vessel is replaced with an equal molar quantity of helium gas, which of the following properties of the gas in the container will be changed?

I. Pressure

II. Temperature

III. Density

Bonus Answer: III only

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23. EARTH and SPACE

Toss Up: Short Answer

Name the soil horizon that contains a mixture of organic matter and highly altered mineral matter and is dark in color.

Bonus Answer: A-horizon

Bonus: Short Answer

By name or number, which of the following phenomena cause acidification in agricultural soils:

1) Leaching of excess nitrate

2) Build-up in mostly plant-based organic matter

3) Removal of plant and animal products

4) Addition of nitrogen based fertilisers

Bonus Answer: All of them (accept 1,2,3,4)

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24. EARTH and SPACE

Toss Up: Short Answer

In which atmospheric level does the "good" ozone preside?

Bonus Answer: Stratosphere

Bonus: Short Answer

In which atmospheric level does the "bad" ozone preside?

Bonus Answer: Troposphere

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25. EARTH and SPACE

Toss Up: Short Answer

What spectral type does the star Betelgeuse fall into?

Bonus Answer: M

Bonus: Multiple Choice

When was the last major supernova in the Milky Way detected?

W) 1604

X) 1863

Y) 1973

Z) 1989

Bonus Answer: W

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