Round 3

1. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

An infinitely long wire carries a current of three amps. How does the magnetic field outside the wire look like?

Bonus Answer: Circles the wire

Bonus: Short Answer

Iron is what type of magnetic material?

Bonus Answer: ferromagnetic

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2. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

A 10 farad capacitor is used in a circuit. The voltage difference between the plates of the capacitor is 20 volts. What is the magnitude of the charge on each of the capacitor's plates?

Bonus Answer: 200 Coloumbs

Bonus: Multiple Choice

A circuit which employs a DIRECT CURRENT source has a branch which contains a capacitor. After the circuit has reached a steady state, what is the magnitude of the current in the circuit branch which contains the capacitor?

W) 0
X) Infinity
Y) Nonexistant
Z) 1

Bonus Answer: W

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3. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

Two forces have magnitudes of 11 newtons and 5 newtons. What's the highest value of their magnitude?

Bonus Answer: 16 N

Bonus: Short Answer

A toy train moves in a circle of 8 meters radius with a speed of 4 meters per second. What is the magnitude of the acceleration of the train?

Bonus Answer: 2 m/s^2

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4. PHYSICS

Writer: Aaron Gee

Toss Up: 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) 2400
X) 1000
Y) 3000
Z) 5000

Toss Up Answer: Y

Bonus: Multiple Choice

A ball leaves a girl's hand with an upward velocity of 6 meters per second. What is the maximum height of the ball above the girl's hand?

W) 10
X) 6
Y) 1.8
Z) 2.8

Bonus Answer: Y

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5. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

A heated 8 kg ring with a radius of 4m cools as it rotates, causing it to shrink to a radius of 2m. If it was initially rotating at 6 rad/s, what is it's final angular velocity?

Bonus Answer: 24 rad/s

Bonus: Short Answer

A 120-N child sits on a light swing and is pulled back and held with a horizontal force of 90 N. What is the magnitude of the tension force in each of the two supporting ropes?

Bonus Answer: 75 N

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6. MATHEMATICS

Writer: Calvin Aw

Toss Up: Short Answer

If (x-1)(x+1)=15, find x^2.

Bonus Answer: 16

Bonus: Short Answer

Find all the roots of the cubic: x^3-25x

Bonus Answer: -5, 0, and 5 (in no particular order)

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7. MATHEMATICS

Writer: Calvin Aw

Toss Up: Short Answer

What is the most descriptive name for a quadrilateral whose sides are all congruent to one another?

Bonus Answer: Rhombus

Bonus: Short Answer

Given a cyclic quadrilateral whose sides are 5 units long and one of its diagonals is 5 sqrt 2 units long, find the other diagonal.

Bonus Answer: 5 sqrt 2

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8. MATHEMATICS

Writer: Calvin Aw

Toss Up: Short Answer

If 4^x=256, find x^4.

Bonus Answer: 256

Bonus: Short Answer

If 5^x = 300, find 5^(x-2) [5 to the power of the quantity x minus 2]

Bonus Answer: 12

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9. MATHEMATICS

Writer: Calvin Aw

Toss Up: Short Answer

Let a and b be positive numbers. Find the maximum value of ab if a+b=8.

Bonus Answer: 16

Bonus: Short Answer

Let a, b, and c be positive numbers. Find the minimum value of a+b+c if abc=27.

Bonus Answer: 9

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10. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Which of the following types of cells do not exhibit density-dependent inhibition concerning reproduction?

W) neurons

X) cells in your liver

Y) cells in a malignant tumor

Z) cells surrounding your stomach

Toss Up Answer: Y

Bonus: Short Answer

Which cell part is most directly responsible for detecting the cell density of its surrounding area in order for the cell to exhibit density-dependent inhibition?

Bonus Answer: extracellular matrix

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11. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

The MPF protein complex turns itself off in the cell cycle by

W) activating a process that destroys its cyclin components

X) activating an enzyme that stimulates cyclin

Y) binding to chromatin

Z) activating the anaphase-promoting complex

Toss Up Answer: W

Bonus: Short Answer

The cyclin component of MPF is destroyed toward the end of which cell cycle phase?

Bonus Answer: M phase (ACCEPT: mitosis, mitotic phase)

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12. BIOLOGY

Writer: Calvin Vuong

Toss Up: Short Answer

Which cyclin-CdK complex triggers the cell's passage past the G2 checkpoint into mitosis?

Bonus Answer: MPF (ACCEPT: mitosis promoting factor, maturation promoting factor)

Bonus: Short Answer

In which cell cycle phase does the most important checkpoint, also called the restriction point, occur?

Bonus Answer: G1 (ACCEPT: between G1 and S)

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13. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Which of the following proteins are involved in binary fission as well as eukaryotic mitotic division?

W) cyclins

X) Cdks (read as an acronym)

Y) condensins

Z) actin and tubulin

Toss Up Answer: Z

Bonus: Short Answer

The materials used to synthesize a new cell wall in plant cell cytokinesis comes primarily from which plant cell organelle?

Bonus Answer: Golgi apparatus (ACCEPT: Golgi complex, Golgi body, Golgi)

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14. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Which of the following is required for motor proteins to function in the movement of chromosomes toward the poles of the mitotic spindle?

W) intact centromeres

X) a kinetochore attached to the metaphase plate

Y) ATP as an energy source

Z) synthesis of cohesin

Toss Up Answer: Y

Bonus: Short Answer

At which phase are centrioles beginning to move apart in animal cell mitosis?

Bonus Answer: prophase (DO NOT ACCEPT: prometaphase)

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15. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Where do the microtubules of the spindle originate during mitosis in both plant and animal cells?

W) centromere

X) centrosome

Y) centriole

Z) kinetochore

Toss Up Answer: Y

Bonus: Multiple Choice

If cells in the process of dividing are subjected to colchicine, at which stage will mitosis be arrested?

W) anaphase

X) prophase

Y) metaphase

Z) interphase

Bonus Answer: Y

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16. BIOLOGY

Writer: Jason Weng

Toss Up: Short Answer

What is the process called by which tumor spreads to other parts of the body?

Bonus Answer: Metastasis

Bonus: Short Answer

How many subunits does tubulin have?

Bonus Answer: 2

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17. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

In the genetic pathway containing genes A, B, and C, gene A negatively regulates gene B, which in turn negatively regulates gene C. If a loss-of-function mutation were introduced into gene B, what would be the resulting effect on the expression of gene C?

W) Decreased expression of gene C.

X) No effect on expression of gene C.

Y) Changes in expression levels of gene C would be the same as those for gene A.

Z) Increased expression of gene C.

Toss Up Answer: Z

Bonus: Multiple Choice

Concentration of urine is essential to the survival of many vertebrates. Which class of vertebrates would you expect does not use this mechanism for homeostasis?

W) Aves

X) Lepidosauria

Y) Mammalia

Z) Osteichthyes

Bonus Answer: Z

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18. CHEMISTRY

Writer: Ashneel Das

Toss Up: Short Answer

What is the name of the molecule containing 4 carbon and 10 hydrogen atoms?

Bonus Answer: Butane

Bonus: Multiple Choice

Which of the following has the highest Van't Hoff factor?

W) NaCl

X) $CaCl_2$

Y) H_2O

Z) CH_4

Bonus Answer: Y

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19. CHEMISTRY

Writer: Ashneel Das

Toss Up: Short Answer

What is the hybridization of methane?

Bonus Answer: sp3

Bonus: Short Answer

How many sigma bonds does methane have?

Bonus Answer: 4

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20. CHEMISTRY

Writer: Shanjeed Ali

Toss Up: Short Answer

What is the energy level and orbital of the outermost electrons in a ground state sulfur atom?

Bonus Answer: 3p

Bonus: Short Answer

What is the maximum number of covalent bonds sulfur can form?

Bonus Answer: 6

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21. CHEMISTRY

Writer: Shanjeed Ali

Toss Up: Multiple Choice

Which element has the highest ionization energy?

W) Chlorine

X) Bromine

Y) Selenium

Z) Technetium

Toss Up Answer: W

Bonus: Short Answer

What are the periodic table trends for ionization energy?

Bonus Answer: Increases left to right and decreases from the top to the bottom

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22. CHEMISTRY

Writer: Ashneel Das

Toss Up: Short Answer

Convert 25 degrees Celsius to Kelvin

Bonus Answer: 298

Bonus: Short Answer

What is the molecular geometry of methane?

Bonus Answer: Tetrahedral

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23. EARTH and SPACE

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

Which of the following are sheet silicates?

W) Micas and clay minerals

X) pyroxenees and amphobles

Y) olivine and feldspar

Z) staurolite and quartz

Toss Up Answer: W

Bonus: Multiple Choice

The most common intermediate volcanic rock is

W) Andesite

X) Basalt

Y) Rhyolite

Z) Diorite

Bonus Answer: W

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24. EARTH and SPACE

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

Which is not a silicate

W) Quartz

X) Halite

Y) Feldspar

Z) Mica

Toss Up Answer: X

Bonus: Multiple Choice

Which of these mineral groups has the best cleavage?

W) Silicates

X) Sulfides

Y) Oxides

Z) Carbonates

Bonus Answer: Z

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25. EARTH and SPACE

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

The ozone is in what layer

W) Stratosphere

X) Troposphere

Y) Hydrosphere
Z) Mesosphere

Toss Up Answer: W

Bonus: Multiple Choice

Atmospheric convection is driven by
W) Ocean currents
X) Evaporation of oceans
Y) Unequal heating by the sun
Z) Fluctuations of the Earth's magnetic field

Bonus Answer: Y

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