Round 20

1. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

In what branch of physics would you expect to find the worm-like chain model?

W) Wormhole Physics

X) Newtonian Physics

Y) Plasma Physics

Z) Polymer Physics

Toss Up Answer: Z

Bonus: Short Answer

By name or number, name which of the following muon decay can produce.

1. Electron
2. Muon Neutrino
3. Electron Neutrino
4. Positron

Bonus Answer: 1,3,4; Electron, Electron Neutrino, Positron

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2. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What kind of lens has a different optical power and focal length in two orientations perpendicular to each other?

W) Toric

X) Parabolic

Y) Cylindrical

Z) Ellipsoid

Toss Up Answer: W

Bonus: Multiple Choice

Einstein's Field Equations are a set of how many equations in his theory of general relativity?

W) 7

X) 9

Y) 10

Z) 11

Bonus Answer: Y

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3. PHYSICS

Writer: Elias Milborn

Toss Up: Short Answer

A person standing on a scaffolding lowers an object with weight 250 newtons by means of a rope, at constant speed. If the weight of the ropes is negligible, what is the force in newtons that the person exerts on the rope?

Bonus Answer: 250

Bonus: Short Answer

Green light has a wavelength of 500 nanometers. What is its associated frequency in hertz?

Bonus Answer: 6x10^14

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4. PHYSICS

Writer: Elias Milborn

Toss Up: Multiple Choice

As an object falls to the earth with air resistance present, what happens to the acceleration of the object?

W) It remains a constant 9.8 m/s^2

X) It increases from 0 to 9.8 m/s^2

Y) It remains at a constant 0 m/s^2

Z) It decreases from 9.8 to 0 m/s^2

Toss Up Answer: Z

Bonus: Multiple Choice

Mary and Joe are on a merry-go-round. Mary is seated near the center of rotation and Joe is on the outer edge. Which of the following BEST describes their motion?

W) Mary has a greater acceleration than Joe

X) Joe has a greater acceleration than Mary

Y) neither Joe nor Mary are accelerating

Z) both Mary and Joe have the same acceleration

Bonus Answer: X

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5. PHYSICS

Writer: Elias Milborn

Toss Up: Multiple Choice

When a resistor, inductor, and capacitor are connected in series to an AC generator, the current through the capacitor must be in phase with the voltage across which of the following?

W) The capacitor

X) The inductor

Y) The entire circuit

Z) The inductor

Toss Up Answer: Z

Bonus: Short Answer

Which lower case letter is commonly used to denote planck's constant?

Bonus Answer: h

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6. MATHEMATICS

Writer: Mohammed Haque

Toss Up: Short Answer

How many degrees are in a 79-gon

Bonus Answer: 13860 degrees

Bonus: Multiple Choice

The sum of the measures of the exterior angles of n-gon is _____

W) 720 degrees

X) 360 degrees

Y) 1440 degrees

Z) non of the above

Bonus Answer: X

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7. MATHEMATICS

Writer: Benjamin Avrahami

Toss Up: Multiple Choice

What is the smallest positive 'taxicab' number?

W) 87

X) 91

Y) 95

Z) 100

Toss Up Answer: X

Bonus: Short Answer

To what power do you have to raise any number for it to be 0, 1, or -1 in mod 7?

Bonus Answer: 3

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8. MATHEMATICS

Writer: Brian Lim

Toss Up: Short Answer

What is the value of sqrt(20 + sqrt(20 + sqrt(20 + ...)))?

[Read as "the nested radical expression square root 20 plus square root 20 + square root 20 repeating"]

Bonus Answer: 5

Bonus: Short Answer

How many asymptotes are in the graph of y = (x^4 + 1)/(x^3 + 3x^2 - 9x -27)?

Bonus Answer: 3

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9. MATHEMATICS

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

In the Christmas carol “The 12 Days of Christmas”, the singer says that for every day of Christmas, their significant other gives them a quantity of a new gift equal to the current day of Christmas, plus the previous gifts given. For example, on the second day onward, the singer receives 2 turtledoves on each day until the end of Christmas. What is the greatest quantity of a single gift given during the 12 days?

W) 36

X) 40

Y) 42

Z) 48

Toss Up Answer: Y

Bonus: Short Answer

How many total gifts are given in the 12 days of Christmas?

Bonus Answer: 364

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10. BIOLOGY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

How many carbon atoms are fed into the citric acid cycle as a result of the oxidation of one molecule of pyruvate?

W) 3

X) 1

Y) 2

Z) 6

Toss Up Answer: Y

Bonus: Multiple Choice

In the absence of oxygen, yeast cells can obtain energy by fermentation, resulting in the production of

W) reduction of acetaldehyde to ethanol (ethyl alcohol).

X) oxidation of pyruvate to acetyl CoA.

Y) oxidation of ethanol to acetyl CoA

Z) reduction of ethanol to pyruvate.

Bonus Answer: W

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11. BIOLOGY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

When electrons move closer to a more electronegative atom, what happens?

W) The more electronegative atom is reduced, and energy is consumed.

X) The more electronegative atom is reduced, and energy is released.

Y) The more electronegative atom is oxidized, and energy is released.

Z) The more electronegative atom is oxidized, and energy is consumed.

Toss Up Answer: X

Bonus: Short Answer

Where does glycolysis take place in eukaryotic cells?

Bonus Answer: Cytosol

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12. BIOLOGY

Writer: Benjamin Avrahami

Toss Up: Multiple Choice

Which one of these is an enzyme?

W) Inositol

X) Lyase

Y) Alanine

Z) Butyric Acid

Toss Up Answer: X

Bonus: Multiple Choice

Which molecule is not involved in the Calvin cycle?

W) OAA

X) RuBP

Y) G3P

Z) PGA

Bonus Answer: W

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13. BIOLOGY

Writer: Benjamin Avrahami

Toss Up: Short Answer

Which animal phylum was the first to develop true coelems?

Bonus Answer: Annelids (or earthworms)

Bonus: Multiple Choice

Which one of these molecules helps break down some of your food?

W) Hydrochloric Acid

X) Pepsinogen

Y) Trypsin

Z) Mucus

Bonus Answer: Y

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14. BIOLOGY

Writer: Olivia Gallager

Toss Up: Short Answer

Which scientist, born in 1920, is known for the discovery of DNA's double helical structure using X-ray crystallography?

Bonus Answer: Rosalind Franklin

Bonus: Short Answer

True or false?: Viruses can have DNA.

Bonus Answer: true.

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15. BIOLOGY

Writer: Yae June Lee

Toss Up: Short Answer

What is another name for phinocytosis

?

Bonus Answer: Cell drinking.

Bonus: Multiple Choice

Sugar molecules can enter cells through

W) Exocytosis

X) Facilitated diffusion.

Y) Osmosis.

Z) ATP Synthase.

Bonus Answer: X

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16. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

What is the typical size range for a prokaryote?

W) .1 - 1.0 micrometer

X) .5 - 5.0 micrometer

Y) 1-10 micrometer

Z) 10-100 micrometer

Toss Up Answer: X

Bonus: Short Answer

What is the name for the factor that allows a bacteria to become a donor during conjugation?

Bonus Answer: F factor (accept fertility factor)

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17. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which of these does not result in recombinant bacteria?

W) Transformation

X) Insertion

Y) Transduction

Z) Conjugation

Toss Up Answer: X

Bonus: Short Answer

What serves as an intermediate in transduction?

Bonus Answer: Virus (accept viruses)

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18. CHEMISTRY

Writer: Banpreet Singh

Toss Up: Multiple Choice

Which gas effuses at approximately one half as fast as ammonia?

W) He

X) CO_2

Y) Cl_2

Z) CH_4

Toss Up Answer: Y

Bonus: Multiple Choice

For which of two gases are the rates of effusion 2:1?

W) Ne and Kr

X) He and O_2

Y) H_2 and He

Z) N_2 and Ar

Bonus Answer: W

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19. CHEMISTRY

Writer: Banpreet Singh

Toss Up: Multiple Choice

As the temperature is raised from 20 degrees Celsius to 40 degrees Celsius, the average energy of a sample of neon atoms changes by a factor of

W) 1/2

X) sqrt(313/293)

Y) 313/293

Z) 2

Toss Up Answer: Y

Bonus: Short Answer

A sample of oxygen gas occupies 8.00 L at 127 degrees Celsius and 775 mmHg. It is heated at constant pressure and

expands to 20.00 L. In Celsius what is the new temperature?

Bonus Answer: 727 degrees celsius

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20. CHEMISTRY

Writer: Banpreet Singh

Toss Up: Multiple Choice

Under what conditions would 1.0 mol of CO_2(g) behave most like an ideal gas?

W) 100 K and 100 atm

X) 800 K and 0.1 atm

Y) 800 K and 1 atm

Z) 800 K and 100 atm

Toss Up Answer: X

Bonus: Short Answer

A sample of 9.00 grams Al(s) is added to excess HCl(aq). What is the volume of the hydrogen gas produced at STP?

Bonus Answer: 11.2 L

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21. CHEMISTRY

Writer: Andrew Chen (Senior)

Toss Up: Short Answer

Please balance the given equation ___ CO3^2- + 2H^+ ---> ___H2O + ___CO2

Bonus Answer: 1,1,1

Bonus: Multiple Choice

There are various pieces of chemical equipment. What is a piece of glassware designed specifically for usage in creating solutions?

W) Erlenmeyer flask

X) Florence flask

Y) Volumetric flask

Z) Graduated cylinder

Bonus Answer: Y

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22. CHEMISTRY

Writer: Andrew Chen (Senior)

Toss Up: Multiple Choice

Certain compounds are insoluble in solution. Which of the following choices below is soluble in aqueous solution?

W) BaSO4

X) AgCl

Y) AgNO3

Z) NiCO3

Toss Up Answer: Y

Bonus: Short Answer

There is a variety of lab techniques that could be used to separate precipitates from the supernatant liquid. Which of the following lab techniques: centrifuge, distillation, chromatography, and titration can be used to separate them.

Bonus Answer: Centrifuge (1)

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23. EARTH and SPACE

Writer: Yevgeniy Gorbachev

Toss Up: Short Answer

Which planet has a group of asteroids at its L5 point?

Bonus Answer: Jupiter

Bonus: Multiple Choice

Which one of Jupiter's moons is predominantly covered in ice and has a subsurface ocean?

W) Io

X) Callisto

Y) Europa

Z) Lysithea

Bonus Answer: Y

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24. EARTH and SPACE

Writer: Mohammed Haque

Toss Up: Multiple Choice

How many days (24 hours) does it take for Mars to make one full rotation around the Sun?

W) 687 days

X) 997

Y) 453

Z) 503

Toss Up Answer: W

Bonus: Multiple Choice

Why does Mars appear to have a red tint when looking through a telescope?

W) It's atmosphere is composed of Argon

X) The iron within the dust reacts with the Oxygen in the air.

Y) The neon in it's atmosphere.

Z) Non of the above.

Bonus Answer: X

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25. EARTH and SPACE

Writer: Yevgeniy Gorbachev

Toss Up: Short Answer

What is the fourth most common element in the universe?

Bonus Answer: Oxygen.

Bonus: Multiple Choice

The maximum mass for a white dwarf is:

W) 3 solar masses

X) 5 solar masses

Y) 1.4 solar masses

Z) .5 solar masses

Bonus Answer: Y

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