

## ROUND 7

### TOSS-UP

20) ENERGY Short Answer Cadmium and boron are used in a nuclear reactor to absorb which subatomic particle?

ANSWER: NEUTRON

### BONUS

20) ENERGY Multiple Choice Which of the elements, used as a nuclear fuel, is most abundant in the Earth's crust?

W) Uranium

X) Plutonium

Y) Thorium

Z) Americium

ANSWER: Y) THORIUM

### TOSS-UP

8) PHYSICS Multiple Choice Pascal's law governs the actions of forces in which of the following?

W) Gases

X) Solids

Y) Incompressible fluids

Z) A vacuum

ANSWER: Y) INCOMPRESSIBLE FLUIDS

### BONUS

8) PHYSICS Short Answer What current, in amperes, is carried in a lightning stroke that lasts 0.5 seconds and transfers 100 coulombs of charge?

ANSWER: 200

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17) CHEMISTRY Short Answer What element has the following four characteristics: 1) it occurs naturally only in combination with other elements in minerals; 2) it is used primarily as a

hardening agent in alloys; 3) its dust is highly toxic, and 4) it is an alkaline [AL-kuh-lyn] earth metal.

ANSWER: BERYLLIUM

BONUS

17) CHEMISTRY Short Answer Identify all of the following four compounds that are ionic: 1) sodium sulfate, 2) methane, 3) ammonium chloride, 4) beryllium iodide.

ANSWER: 1 AND 3 (ACCEPT: SODIUM SULFATE AND AMMONIUM CHLORIDE)

TOSS-UP

12) MATH Short Answer The perimeters of two similar figures have a ratio of 5:7. What is the ratio of their areas?

ANSWER: 25:49 (ACCEPT: 25/49)

BONUS

12) MATH Short Answer After 40 times at bat, BJ has 9 hits. What is the least number of hits he would need in his next 30 times at bat so that he has hits in at least 31% of his total at-bats?

ANSWER: 13

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TOSS-UP

8) ENERGY Multiple Choice Which of the following effects does lowering the temperature have on the decay rate of a sample of radioactive material?

W) The decay will speed up

X) The decay will slow down

Y) There is no change

Z) There is an inverse relationship between temperature and fission

ANSWER: Y) THERE IS NO CHANGE

BONUS

8) ENERGY Multiple Choice FutureGen 2.0 power plants will reduce carbon dioxide production by burning coal in which of the following ways?

W) With a mixture of oxygen and carbon dioxide instead of air to produce concentrated carbon dioxide

X) With an enhanced concentration of oxygen instead of air to produce less carbon dioxide per ton of coal burned

Y) In a catalytic chamber that scrubs the carbon dioxide out of the emissions

Z) Using carbon dioxide reduced coal in an 80% nitrogen and 18% oxygen mixture

ANSWER: W) WITH A MIXTURE OF OXYGEN AND CARBON DIOXIDE INSTEAD OF AIR TO PRODUCE CONCENTRATED CARBON DIOXIDE

TOSS-UP

24) CHEMISTRY Short Answer In the balanced equation  $2\text{Ag}^+ + \text{Cu}$  [yields]

$2\text{Ag} + \text{Cu}^{2+}$ ,

what is the reducing agent?

ANSWER: COPPER (DO NOT ACCEPT: COPPER 2+)

BONUS

24) CHEMISTRY Multiple Choice Converting carbon dioxide to carbon monoxide through reduction would be effective method for reducing harmful levels of atmospheric carbon dioxide.

However, this conversion is very difficult for which of the following reasons?

W) There is a limited supply of rhenium in the world

X) Not all steps of the reduction have been completely determined

Y) The final step takes an extremely long time

Z) The carbon dioxide is too difficult to harness

ANSWER: W) THERE IS A LIMITED SUPPLY OF RHENIUM IN THE WORLD

TOSS-UP

11) CHEMISTRY Multiple Choice Which of the following adjectives describes the reaction of a strong base with a strong acid?

W) Precipitation

X) Synthesis

Y) Redox

Z) Neutralization

ANSWER: Z) NEUTRALIZATION

BONUS

11) CHEMISTRY Multiple Choice Which of the following is NOT a strong acid?

W) Nitric acid

X) Perchloric acid

Y) Formic acid

Z) Hydroiodic acid

ANSWER: Y) FORMIC ACID

TOSS-UP

2) EARTH AND SPACE Multiple Choice Which of the following best describes where the salt in ocean water comes from?

W) Melting of glacial ice

X) Weathering of continental rocks

Y) Decomposition of plants and animals

Z) Precipitation of salty rain

ANSWER: X) WEATHERING OF CONTINENTAL ROCKS

BONUS

2) EARTH AND SPACE Multiple Choice Cayes [KAYS] are small sandy islands formed on the surface of coral reefs in tropical areas like the coast of Belize. The sand on these cayes is primarily composed of which of the following?

W) Silicate

X) Calcium carbonate

Y) Sulfide

Z) Halide

ANSWER: X) CALCIUM CARBONATE

TOSS-UP

8) EARTH AND SPACE Short Answer What type of event marks the end of major geologic eras such as the Paleozoic and Mesozoic?

ANSWER: MASS EXTINCTION (ACCEPT: MAJOR EXTINCTION)

BONUS

8) EARTH AND SPACE Short Answer What seismologic feature led scientists to identify the Earth's liquid outer core?

ANSWER: S-WAVE SHADOW ZONE

TOSS-UP

16) MATH Multiple Choice The lines defined by  $y = 2x$  and  $2y = -x$  are which of the following?

W) Parallel

X) Perpendicular

Y) Horizontal

Z) Vertical

ANSWER: X) PERPENDICULAR

BONUS

16) MATH Short Answer Providing your answers as fractions in lowest terms, what are the x-intercepts of the graph of  $y = 12x^2 - 5x - 2$ ?

ANSWER:  $2/3$  AND  $-1/4$

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20) MATH Short Answer If a person walks 4 miles due north, 6 miles due east, then 4 miles due north, how far in miles is the person displaced from his or her original position?

ANSWER: 10

BONUS

20) MATH Short Answer In a standard deck of cards with no jokers, providing your answer as a fraction in lowest terms, what is the probability of picking a card that is black or a number less than 10 (which includes aces)?

ANSWER: 11/13

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TOSS-UP

1) CHEMISTRY Multiple Choice Which of the following transition metals has the smallest atomic radius?

W) Nickel

X) Iron

Y) Scandium

Z) Cadmium

ANSWER: W) NICKEL

BONUS

1) CHEMISTRY Short Answer Consisting of a fatty acid chain attached through an amide linkage to sphingosine [SFING-guh-seen], what is the fundamental structural unit common to all sphingolipids?

ANSWER: CERAMIDE

TOSS-UP

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TOSS-UP

11) PHYSICS Multiple Choice An object is suspended from a spring balance in an elevator. The reading of the balance is 200 newtons when the elevator is at rest. If the balance reading later is 190 newtons, which of the following best describes how the elevator could be moving at that time?

W) Downward at constant speed

X) Downward and increasing in speed

Y) Upward at constant speed

Z) Upward and increasing in speed

ANSWER: X) DOWNWARD AND INCREASING IN SPEED

BONUS

11) PHYSICS Multiple Choice A small object is 10 centimeters in front of a plane mirror. Standing 20 centimeters behind the object, 30 centimeters from the mirror, at what distance in centimeters must you focus your eyes to see the object's mirror image clearly?

W) 20

X) 30

Y) 40

Z) 50

ANSWER: Y) 40

TOSS-UP

10) ENERGY Short Answer What is the name for the layer in the center of a fuel cell which separates the anode and cathode and allows positive ions through but not electrons?

ANSWER: ELECTROLYTE (ACCEPT: MEMBRANE)

BONUS

10) ENERGY Short Answer Regular gasoline with an octane rating of 87 has the same anti-knock qualities as a mixture with what percentages of iso-octane and heptane, respectively?

ANSWER: ISO-OCTANE = 87%; HEPTANE = 13%

TOSS-UP

4) MATH Multiple Choice The equation  $-mx + 1 = 13 - 4(x + 3)$  [negative m x plus 1 equals 13 minus 4 times the quantity x plus 3] is an identity if m equals which of the following?

W) -4

X) -1

Y) 1

Z) 4

ANSWER: Z) 4

BONUS

4) MATH Multiple Choice If  $f(x) = -2x^2 + 8x - 4$ , which of the following is true?

W)  $f$  is not a one to one function

X) The graph of  $f$  opens upward

Y) The graph of  $f$  has no  $x$ -intercept

Z) The maximum value of  $f(x)$  is  $-4$

ANSWER: W)  $f$  IS NOT A ONE TO ONE FUNCTION

TOSS-UP

17) PHYSICS Short Answer What is the mathematical relationship between the period of a wave and the frequency of a wave?

ANSWER: INVERSE (ACCEPT: INVERSELY PROPORTIONAL)

BONUS

17) PHYSICS Short Answer If a radio station broadcasts with a wavelength of 2.5 meters, what is the frequency of the radio station in megahertz, given the speed of light as  $3 \times 10^8$  meters per second?

ANSWER: 120

TOSS-UP

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ANSWER: 25:49 (ACCEPT: 25/49)

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TOSS-UP

7) BIOLOGY Multiple Choice Which of the following is true of enzymes?

W) They increase the activation energy of metabolic reactions

X) They have active sites that bind to specific substrate molecules

Y) They are made of chitin [KY-tin] protein

Z) They generally act on a variety of substrate molecules

ANSWER: X) THEY HAVE ACTIVE SITES THAT BIND TO SPECIFIC SUBSTRATE MOLECULES

BONUS

7) BIOLOGY Multiple Choice Which of the following branches of science deals with study of the life and phenomena of inland standing waters, especially lakes and ponds?

W) Limnology [lim-NOL-uh-jee]

X) Hydrology

Y) Ichthyology [ik-thee-OL-uh-jee]

Z) Ecology



ANSWER: W) LIMNOLOGY