

## **ROUND 1**

### **TOSS-UP**

1) BIOLOGY *Multiple Choice* What proteins have a cysteine residue at their active site and are responsible for apoptosis in animal cells?

- W) Kinesins
- X) Proteases
- Y) Caspases
- Z) Kinases

ANSWER: Y) CASPASES

### **BONUS**

1) BIOLOGY *Short Answer* IAP is a family of proteins thought to inhibit apoptosis. What does the acronym IAP stand for?

ANSWER: INHIBITOR OF APOPTOSIS

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### **TOSS-UP**

2) CHEMISTRY *Multiple Choice* What type of intermolecular interactions exists between noble gas solids?

- W) Delocalized covalent bonds
- X) London dispersion forces
- Y) Directional covalent bonds
- Z) Ionic bonds

ANSWER: X) LONDON DISPERSION FORCES

### **BONUS**

2) CHEMISTRY *Short Answer* What is the only element in the periodic table that does NOT freeze at 1 atm?

ANSWER: HELIUM

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### **TOSS-UP**

3) PHYSICS *Short Answer* What type of friction results from the deformation of an object moving across a line?

ANSWER: ROLLING FRICTION

### **BONUS**

3) PHYSICS *Multiple Choice* Assuming gravity is  $10 \text{ m/s}^2$ , what is the minimum coefficient of friction necessary between an object and a surface if the object is traveling at  $5 \text{ m/s}$  in a uniform circular path with a radius of 5 meters?

- W) 0.25

X) 0.5

Y) 0.6

Z) 0.75

ANSWER: X) 0.5

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### **TOSS-UP**

4) EARTH AND SPACE *Multiple Choice* Which of the following Galilean moons is the only one known to have its own magnetic field?

W) Callisto

X) Io

Y) Ganymede

Z) Europa

ANSWER: Y) GANYMEDE

### **BONUS**

4) EARTH AND SPACE *Multiple Choice* What is the largest of Jupiter's inner satellites?

W) Amalthea

X) Thebe

Y) Adrastea

Z) Metis

ANSWER: W) AMALTHEA

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### **TOSS-UP**

5) MATHEMATICS *Multiple Choice* What type of prime number is formed when one takes a power of 2 and subtracts 1?

W) Goldbach prime

X) Euclidean prime

Y) Mersenne prime

Z) Euler's prime

ANSWER: Y) MERSENNE PRIME

### **BONUS**

5) MATHEMATICS *Short Answer* What is the sum of the first five prime numbers?

ANSWER: 28

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### **TOSS-UP**

6) ENERGY *Multiple Choice* What is the world's largest tidal power station as of January 2014?

W) Rance Tidal Power Station

X) Sihwa Tidal Power Station

- Y) Race Rocks Tidal Power Station  
Z) Annapolis Royal Generating Station  
ANSWER: X) SIHWA TIDAL POWER STATION

**BONUS**

- 6) ENERGY *Short Answer* In ebb generation, what structure fills a basin at high tide and releases seawater to generate energy?

ANSWER: SLUICE GATE

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**TOSS-UP**

- 7) BIOLOGY *Multiple Choice* Which of the following hormones is produced and released by the posterior pituitary gland?

- W) Oxytocin  
X) Prolactin  
Y) Growth hormone  
Z) Luteinizing hormone  
ANSWER: W) OXYTOCIN

**BONUS**

- 7) BIOLOGY *Short Answer* What structure of the brain is responsible for regulating hormone secretion by the anterior pituitary gland?

ANSWER: HYPOTHALAMUS

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**TOSS-UP**

- 8) CHEMISTRY *Multiple Choice* What scientist devised an electronegativity scale and won Nobel Prizes in both chemistry and peace?

- W) Amedeo Avogadro  
X) Archibald Scott Couper  
Y) John Dalton  
Z) Linus Pauling  
ANSWER: Z) LINUS PAULING

**BONUS**

- 8) CHEMISTRY *Short Answer* Ions that contain the same number of electrons are referred to by what term?

ANSWER: ISOELECTRONIC IONS

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**TOSS-UP**

- 9) PHYSICS *Multiple Choice* In special relativity, the lowercase gamma is used to symbolize what quantity?

- W) Speed of light
  - X) Inertial reference frame
  - Y) Lorentz factor
  - Z) Euclidean factor
- ANSWER: Y) LORENTZ FACTOR

### BONUS

9) PHYSICS *Short Answer* What happens to an individual's apparent weight, when viewed by an outside observer, as the individual travels near the speed of light?

ANSWER: INCREASES

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### TOSS-UP

10) EARTH AND SPACE *Multiple Choice* The Matterhorn exemplifies what type of glacial formation that results in an angular mountaintop?

- W) Glacial striations
- X) Arete
- Y) Glacial horn
- Z) Cirque

ANSWER: Y) GLACIAL HORN

### BONUS

10) EARTH AND SPACE *Short Answer* What type of landform results from the glacial deposition of unstratified and unsorted material?

ANSWER: MORAINES

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### TOSS-UP

11) MATHEMATICS *Multiple Choice* What is the coefficient of the 4th term in the following expression:  $(3x + 2y)^5$ ?

- W) 320
  - X) 720
  - Y) 1440
  - Z) 1680
- ANSWER: X) 720

### BONUS

11) MATHEMATICS *Short Answer* List the terms that exist in the 5th row of Pascal's Triangle.

ANSWER: 1, 5, 10, 10, 5, 1

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### TOSS-UP

12) ENERGY *Multiple Choice* Humphry Davy created the first incandescent light bulb using what metal?

- W) Tungsten
- X) Iridium
- Y) Platinum
- Z) Molybdenum

ANSWER: Y) PLATINUM

### BONUS

12) ENERGY *Short Answer* What does the acronym ITER, a nuclear fusion research facility, stand for?

ANSWER: INTERNATIONAL THERMONUCLEAR EXPERIMENTAL REACTOR

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### TOSS-UP

13) BIOLOGY *Multiple Choice* What enzyme is responsible for splicing out errors in DNA replication?

- W) Ligase
- X) Primase
- Y) Helicase
- Z) Nuclease

ANSWER: Z) NUCLEASE

### BONUS

13) BIOLOGY *Short Answer* What enzyme compensates for the shortening of chromosomal endings during eukaryotic cell replication and plays an important role in aging and cancer?

ANSWER: TELOMERASE

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### TOSS-UP

14) CHEMISTRY *Multiple Choice* According to Le Chatelier's principle, what effect would a catalyst have on the rate of a chemical reaction?

- W) Increase forward reaction
- X) Increase backward reaction
- Y) Increase forward and backward reactions equally
- Z) Have no influence on reaction rates

ANSWER: Y) INCREASE FORWARD AND BACKWARD REACTIONS EQUALLY

### BONUS

14) CHEMISTRY *Short Answer* If heat is added to an endothermic reaction, in which direction does the equilibrium shift?

ANSWER: RIGHT OR TOWARD THE PRODUCTS

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### **TOSS-UP**

15) PHYSICS *Multiple Choice* If the charge on one plate of a capacitor is +15 Coulombs and the capacitance is 25000 microfarads, what is the potential energy stored in the capacitor?

W) 9000 Joules

X) 8000 Joules

Y) 4500 Joules

Z) 18000 Joules

ANSWER: Y) 4500 JOULES

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### **BONUS**

15) PHYSICS *Short Answer* What is the potential energy stored in a spring that is compressed 4 meters from its rest position given that  $k=50 \text{ N/m}$ ?

ANSWER: 400 JOULES

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### **TOSS-UP**

16) EARTH AND SPACE *Multiple Choice* A massive star fuses with which element before undergoing core collapse and becoming a supernova?

W) Silicon

X) Oxygen

Y) Platinum

Z) Iron

ANSWER: Z) IRON

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### **BONUS**

16) EARTH AND SPACE *Short Answer* White dwarfs typically transform into what type of supernova because they lack hydrogen?

ANSWER: TYPE I

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### **TOSS-UP**

17) MATHEMATICS *Multiple Choice* What is the fourth prime term in the Fibonacci sequence?

W) 3

X) 7

Y) 13

Z) 89

ANSWER: Y) 13

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### **BONUS**

17) MATHEMATICS *Short Answer* Leonardo Fibonacci considered the idealized population of what animal as a model for his sequence?

ANSWER: RABBITS

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**TOSS-UP**

18) ENERGY *Multiple Choice* As of January 2014, what is the largest capacity that a hydroelectric power station can generate in megawatts?

- W) 2,000
- X) 4,000
- Y) 10,000
- Z) 20,000

ANSWER: Z) 20,000

**BONUS**

18) ENERGY *Short Answer* What is the name of the facility in Livermore, California, that uses laser based inertial confinement to attempt nuclear fusion?

ANSWER: NATIONAL IGNITION FACILITY (ACCEPT NIF)

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**TOSS-UP**

19) BIOLOGY *Multiple Choice* What gaseous hormone promotes fruit ripening and flowering in pineapples?

- W) Ethylene
- X) Methylene
- Y) Cytokinins
- Z) Abscisic acid

ANSWER: W) ETHYLENE

**BONUS**

19) BIOLOGY *Short Answer* What is the predominant natural auxin in plants called?

ANSWER: INDOLEACETIC ACID OR IAA

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**TOSS-UP**

20) CHEMISTRY *Multiple Choice* What indicator is blue above a pH of 7.6, and yellow below a pH of 6.0?

- W) Bromophenol Blue
- X) Litmus
- Y) Bromothymol Blue
- Z) Phenolphthalein

ANSWER: BROMOTHYMOL BLUE

**BONUS**

20) CHEMISTRY *Short Answer* What type of titration is used when the endpoint of a normal titration is difficult to identify?

ANSWER: BACK/REVERSE TITRATION

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**TOSS-UP**

21) PHYSICS *Multiple Choice* A single fission reaction with uranium-235 produces approximately how much energy?

W) 100 MeV

X) 200 MeV

Y) 300 MeV

Z) 400 MeV

ANSWER: X) 200 MeV

**BONUS**

21) PHYSICS *Short Answer* What chemical element has an atomic number 90, is named after a Norse god, and is used as a substitute nuclear fuel?

ANSWER: THORIUM

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**TOSS-UP**

22) EARTH AND SPACE *Multiple Choice* What planet has the highest albedo in the solar system?

W) Earth

X) Mars

Y) Mercury

Z) Venus

ANSWER: Z) VENUS

**BONUS**

22) EARTH AND SPACE *Short Answer* An albedo value of 0 indicates that a surface has what property?

ANSWER: PERFECT/IDEAL ABSORPTION

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**TOSS-UP**

23) MATHEMATICS *Multiple Choice* If set A contains all factors of 12 and set B contains all prime numbers, what numbers are in the intersection of set A and set B?

W) 1,2,4

X) 2,3,6

Y) 2,3

Z) 2,3,6,7

ANSWER: Y) 2,3

**BONUS**

23) MATHEMATICS *Short Answer* What principle states that a proper subset of S is any subset of S other than S itself?

ANSWER: PRINCIPLE OF EXTENSIONALITY

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**TOSS-UP**

24) ENERGY *Multiple Choice* What type of batteries depend on the reaction between zinc and manganese dioxide?

- W) Lithium-ion batteries
- X) Daniell batteries
- Y) Alkaline batteries
- Z) Bunsen batteries

ANSWER: Y) ALKALINE BATTERIES

**BONUS**

24) ENERGY *Short Answer* What is the atomic mass of the plutonium isotope most commonly used in nuclear fission?

ANSWER: 239

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**TOSS-UP**

25) BIOLOGY *Multiple Choice* What hormone stimulates the release of digestive enzymes from the pancreas?

- W) Secretin
- X) Cholecystokinin
- Y) Cytokinins
- Z) Gastrin

ANSWER: X) CHOLECYSTOKININ

**BONUS**

25) BIOLOGY *Short Answer* What hormone promotes the breakdown of glycogen in the liver and the release of glucose into the blood?

ANSWER: GLUCAGON