

**TOSS-UP**

1) MATH *Multiple Choice* A cosine function has a period of 3. Which of the following is a possible function?

W)  $\cos(3x)$  (read as: cosine of the quantity \*read what's inside\*)

X)  $\cos\left(\frac{2\pi}{3x}\right)$

Y)  $\cos\left(\frac{2\pi x}{3}\right)$

Z)  $\cos\left(\frac{\pi}{3}\right)$

ANSWER: Y)  $\cos\left(\frac{2\pi x}{3}\right)$

**BONUS**

1) MATH *Short Answer* Given that  $f(t) = 5\cos(4t + 1)$ , what is the second derivative of  $f(t)$  in terms of  $f(t)$ ?

ANSWER:  $-16f(t)$

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**TOSS-UP**

2) BIOLOGY *Short Answer* What snail-shaped organ in the inner ear converts sound waves to electrical signals?

ANSWER: Cochlea

**BONUS**

2) BIOLOGY *Multiple Choice* What kind of selection favors extreme traits and often results in polymorphism in a population?

W) Disruptive Selection

X) Stabilizing Selection

Y) Directional Selection

Z) Purifying Selection

ANSWER: W) Disruptive Selection

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**TOSS-UP**

3) PHYSICS *Short Answer* What temperature scale has 0 at absolute zero, the lowest possible temperature any object can have, and its increments of 1 is equivalent to a degree Celsius?

ANSWER: Kelvin

**BONUS**

3) PHYSICS *Short Answer* Convert 25 °C to Fahrenheit.

ANSWER: 77 °F

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**TOSS-UP**

4) CHEMISTRY *Short Answer* Now many neutrons are in one atom of Boron-11?

ANSWER: 6

**BONUS**

4) CHEMISTRY *Multiple Choice* When copper(II) chloride (read as: copper two chloride) is dissolved in water, what colour will the solution be?

W) Colourless

X) Red

Y) Blue

Z) Violet

ANSWER: Y) Blue

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**TOSS-UP**

5) EARTH AND SPACE *Short Answer* In a volcano, magma moves towards a surface vent through a fissure known as what?

ANSWER: Conduit (accept: Pipe)

**BONUS**

5) EARTH AND SPACE *Multiple Choice* The region of the solar system in which small icy bodies and dwarf planets such as Pluto are found is known as the:

W) Oort Cloud

X) Kuiper Belt

Y) Asteroid Belt

Z) Heliosphere

ANSWER: X) Kuiper Belt

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**TOSS-UP**

6) MATH *Short Answer* How many ways can you arrange the letters in CHAIR if the first letter has to be a vowel?

ANSWER: 48

**BONUS**

6) MATH *Short Answer* How many complex solutions does  $x^{30}=1$  have? (Jeffrey Chang)

ANSWER: 30

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**TOSS-UP**

7) BIOLOGY *Multiple Choice* What phase of mitosis involves the separation of sister chromatids to opposite poles of the cell?

W) Prophase

X) Metaphase

Y) Anaphase

Z) Telophase

ANSWER: Y) Anaphase

**BONUS**

7) BIOLOGY *Short Answer* What two proteins are directly responsible for muscle contraction?

ANSWER: Actin, Myosin

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**TOSS-UP**

8) PHYSICS *Short Answer* What is the name of the law that states that the elastic force of a spring is directly proportional to the distance that the spring stretched?

ANSWER: Hooke's Law

**BONUS**

8) PHYSICS *Short Answer* The sum of an object's potential energy with its kinetic energy is known as what?

ANSWER: Mechanical Energy

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**TOSS-UP**

9) CHEMISTRY *Multiple Choice* Which of these is never a redox reaction?

- W) Combustion
- X) Decomposition
- Y) Single Replacement
- Z) Double Replacement

ANSWER: Z) Double Replacement

**BONUS**

9) CHEMISTRY *Short Answer* In the compound  $Fe_2O_3$ , what is the oxidation number of iron?

ANSWER: +3

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**TOSS-UP**

10) EARTH SCIENCE *Multiple Choice* Which of the following is NOT an example of an igneous rock?

- W) Granite
- X) Andesite
- Y) Anthracite
- Z) Gabbro

ANSWER: Y) Anthracite

**BONUS**

10) EARTH SCIENCE *Short Answer* The high pressure zones located at around 30 N and 30 S of the equator are known as what?

ANSWER: Subtropical Highs

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**TOSS-UP**

11) MATH *Short Answer* How many ways are there for a president and vice president to be chosen from a class of 20 students if no one may hold more than one office?

ANSWER: 190

**BONUS**

11) MATH *Multiple Choice* Don makes 25 dollars per hour, Mark makes 22 dollars per hour, and Theodore makes 20 dollars per hour. Yesterday, Don worked 8 hours, Mark worked 9 hours, and Theodore worked 10 hours. Which of the following statements about yesterday is NOT true?

- W) Don made more money than Mark.  
X) Don made the same amount of money as Theodore.  
Y) Mark more money than Theodore.  
Z) Mark made the least amount of money.  
ANSWER: Y) Mark made more money than Theodore.
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**TOSS-UP**

- 12) BIOLOGY *Multiple Choice* Which part of the cell is important for detoxifying substances like alcohol and drugs?  
W) Smooth ER  
X) Golgi apparatus  
Y) Rough ER  
Z) Nucleus

ANSWER: W) Smooth ER

**BONUS**

- 12) BIOLOGY *Short Answer* What is the waxy, waterproof, outer covering of a plant called?  
ANSWER: Cuticle
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**TOSS-UP**

- 13) PHYSICS *Multiple Choice* Which of the following is not a longitudinal wave?  
W) Sound  
X) Seismic P-waves  
Y) Seismic S-waves  
Z) Pressure waves

ANSWER: Y) Seismic S-waves

**BONUS**

- 13) PHYSICS *Short Answer* How many quarks does a proton have?  
ANSWER: 3
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**TOSS-UP**

14) CHEMISTRY *Multiple Choice* Which of the following is not a mixture?

W) Bronze

X) Air

Y) Salad dressing

Z) Carbon dioxide

ANSWER: Z) Carbon dioxide

**BONUS**

14) CHEMISTRY *Short Answer* What is the empirical formula for benzene?

ANSWER: CH

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**TOSS-UP**

15) EARTH & SPACE *Multiple Choice* Which of the following scales is used to categorize hurricanes based on wind speed?

W) Enhanced Fujita Scale

X) Saffir Simpson Scale

Y) Richter Scale

Z) Danjon Scale

ANSWER: X) Saffir Simpson Scale

**BONUS**

15) EARTH & SPACE *Multiple Choice* What is the most destructive part of the hurricane?

W) Eyewall

X) Eye

Y) Inner band winds

Z) Outer band winds

ANSWER: W) Eyewall

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**TOSS-UP**

16) MATH *Short Answer* How many ways are there to distribute five letters among five mailboxes so that no letter is in the correct mailbox and each mailbox gets one letter?

ANSWER: 44

**BONUS**

16) MATH *Short Answer* Molly flipped two fair coins, one of which landed heads up. What is the probability, expressed as a fraction, that both coins landed heads up?

ANSWER: 1/3

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**TOSS-UP**

17) BIOLOGY *Multiple Choice* What plant hormone is mainly responsible for the ripening of fruit?

W) Ethylene

X) Cytokinins

Y) Auxin

Z) Doesn't exist

ANSWER: W) Ethylene

**BONUS**

17) BIOLOGY *Multiple Choice* Which phase of mitosis takes the least amount of time?

W) Prophase

X) Metaphase

Y) Anaphase

Z) Telophase

ANSWER: Y) Anaphase

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**TOSS-UP**

18) PHYSICS *Short Answer* What is the SI unit of the strength of a magnetic field?

ANSWER: Tesla

**BONUS**

18) PHYSICS *Multiple Choice* Which of the following is closest to the charge of the proton?

W)  $1.6 \times 10^{-17} C$  (read as: coulombs)

X)  $1.6 \times 10^{-19} C$

Y)  $1.6 \times 10^{-21} C$

Z)  $1.6 \times 10^{-23} C$

ANSWER: X)  $1.6 \times 10^{-19} C$

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**TOSS-UP**

19) CHEMISTRY *Short Answer* What is the name of the curve in the upper surface of a liquid close to the surface of the container caused by surface tension?

ANSWER: Meniscus

**BONUS**

19) CHEMISTRY *Multiple Choice* Bee stings are \_\_\_\_\_, and wasp stings are \_\_\_\_\_

W) acidic, acidic

X) acidic, basic

Y) basic, acidic

Z) basic, basic

ANSWER: X) acidic, basic

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**TOSS-UP**

20) EARTH AND SPACE SCIENCE *Multiple Choice* Which type of air mass is characterized by a high dew point and forms at low latitudes?

W) Maritime Tropical

X) Maritime Polar

Y) Continental Tropical

Z) Continental Polar

ANSWER: W) Maritime Tropical

**BONUS**

20) EARTH AND SPACE SCIENCE *Short Answer* What is the name for the rate at which the temperature decreases in the troposphere, which has the acronym ELR?

ANSWER: Environmental lapse rate

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**TOSS-UP**

21) MATH *Multiple Choice* Which of the following states that in a right triangle, the sum of the squares of the two legs is equal to the square of the hypotenuse?



- W) Euclid's Theorem
- X) Pythagorean Theorem
- Y) Extended Law of Sines
- Z) Gauss Hypothesis

ANSWER: X) Pythagorean Theorem

**BONUS**

21) MATH *Short Answer* What is the area of a triangle with side lengths 13, 14 and 15?

ANSWER: 84

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**TOSS-UP**

22) BIOLOGY *Multiple Choice* Which of the following organisms belongs in the phylum porifera?

- W) Flatworms
- X) Sponges
- Y) Earthworms
- Z) Jellyfish

ANSWER: X) Sponges

**BONUS**

22) BIOLOGY *Multiple Choice* Which process describes how bacteria divide?

- W) Binary fission
- X) Mitosis
- Y) Meiosis I
- Z) Meiosis II

ANSWER: W) Binary fission

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**TOSS-UP**

23) PHYSICS *Multiple Choice* 1 volt is equal to

- W) 1 joule per ohm
- X) 1 joule per coulomb

Y) 1 joule per watt

Z) 1 joule per ampere

ANSWER: X) 1 joule per coulomb

**BONUS**

23) PHYSICS *Short Answer* Bob has a mass of 60 kg and is running at a constant velocity of 6 m/s. Joe has a mass of 40kg and is running at a constant velocity of 4 m/s. How many times more kinetic energy does Bob have compared to Joe? Express your answer as a decimal rounded to the nearest hundredth.

ANSWER: 3.38

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**TOSS-UP**

24) CHEMISTRY *Short Answer* Dry ice is the solid form of what compound?

ANSWER: CO<sub>2</sub>

**BONUS**

24) CHEMISTRY *Short Answer* What is the term for a hydrogen atom with one neutron?

ANSWER: Deuterium

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**TOSS-UP**

1) EARTH AND SPACE SCIENCE *Multiple Choice* Which of the following is FALSE regarding ocean waves as they approach the shore?

W) The wave period stays constant.

X) The wavelength increases.

Y) The wave particle orbit becomes elliptical.

Z) The wave height increases.

ANSWER: X) The wavelength increases.

**BONUS**

25) EARTH AND SPACE SCIENCE *Multiple Choice* What is the average salinity of seawater in parts per thousand?

W) 0

X) 5

Y) 35

Z) 90

ANSWER: Y) 35

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