

**TOSS-UP**

1) MATH *Short Answer* What is the sum of the first 100 positive integers?

ANSWER: 5050

**BONUS**

1) MATH *Short Answer* What is the acute angle between the minute and hour hand of an analog clock at 6:30?

ANSWER: 15 degrees

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**TOSS-UP**

2) EARTH & SPACE *Short Answer* One parsec is equal to how many light years?

ANSWER: 3.26 (light years)

**BONUS**

2) EARTH & SPACE *Multiple Choice* Which of the following waves can travel through all states of matter?

W) Longitudinal Waves

X) Transverse Waves

Y) Shear Waves

Z) Love Waves

ANSWER: W) Longitudinal Waves

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**TOSS-UP**

3) BIOLOGY *Multiple Choice* What do you call similar structures in two species that are derived from a common ancestor?

W) Analogous structures

X) Homologous structures

Y) Convergent structures

Z) Identical structures

ANSWER: W) Homologous structures

**BONUS**

3) BIOLOGY *Short Answer* Which node is the pacemaker of the heart?

ANSWER: SA node (accept: Sinoatrial)

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**TOSS-UP**

4) PHYSICS *Short Answer* Chad pushes a box with a mass of 840 kg. However, he doesn't move the box. How much work in joules has Chad done on the box?

ANSWER: 0 J

**BONUS**

4) PHYSICS *Multiple Choice* An oscillating system that reaches equilibrium in minimum time is said to be:

W) Well-damped

X) Not damped

Y) Critically damped

Z) Underdamped

ANSWER: Y) Critically damped

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**TOSS-UP**

5) CHEMISTRY *Short Answer* A container contains a sample of gas with pressure 3 atm (read as: atmospheres) and volume 2 L, if the volume of the container is increased to 3 L, what is the new pressure of the gas in atm?

ANSWER: 2 atm

**BONUS**

5) CHEMISTRY *Multiple Choice* A graph relating pressure to what other variable would be linear?

W) V (read as: volume)

X)  $V^2$  (read as: volume squared)

Y)  $1/V$  (read as: one over the volume)

Z)  $1/V^2$  (read as: one over the volume squared)

ANSWER: Y)  $1/V$

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**TOSS-UP**

6) MATH *Short Answer* A circle is inscribed in a right triangle with side lengths of 9, 12 and 15. What is the area of the circle?

ANSWER: 9

**BONUS**

6) MATH *Short Answer* What is  $113_6 + 222_7$  (read as: one one three base 6 plus two two two base seven) equal to? Express your answer as a base 10 numeral.

ANSWER: 159

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**TOSS-UP**

6) EARTH & SPACE *Short Answer* What is the boundary between the Earth's mantle and crust?

ANSWER: Mohorovicic Discontinuity (Accept: Moho)

**BONUS**

6) EARTH & SPACE *Multiple Choice* Which of the following Hawaiian Islands is oldest?

W) Maui

X) Kauai

Y) Molokai

Z) Oahu

ANSWER: X) Kauai

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**TOSS-UP**

8) BIOLOGY *Multiple Choice* What type of cell junction connects plant cells?

W) Gap junction

X) Tight junction

Y) Desmosome

Z) Plasmodesmata

ANSWER: Z) Plasmodesmata

**BONUS**

8) BIOLOGY *Short Answer* What is the most common enzyme in the world?

ANSWER: Rubisco

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**TOSS-UP**

9) PHYSICS *Short Answer* What type of friction is between two solid objects that are not moving relative to each other?

ANSWER: Static friction (ACCEPT: Static)

**BONUS**

9) PHYSICS *Short Answer* Using  $g = 10 \text{ m/s}^2$ , what is the potential energy, in joules, of a 5 kg object that is 14 meters above the surface of the Earth

ANSWER: 700 joules

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**TOSS-UP**

10) CHEMISTRY *Short Answer* Which French chemist established the law of conservation of mass?

ANSWER: Antoine Lavoisier

**BONUS**

10) CHEMISTRY *Multiple Choice* In addition to Hydrogen, Lavoisier also named which other element?

W) Boron

X) Oxygen

Y) Tin

Z) Tellurium

ANSWER: X) Oxygen

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**TOSS-UP**

11) MATH *Short Answer* How many distinct real solutions are there to the equation  $x^2+4x+4 = 0$

ANSWER: 1

**BONUS**

11) MATH *Multiple Choice* Which of the following expressions would give the sum of the first  $n$  perfect cubes?

W)  $\frac{n(n+1)(2n+1)}{6}$

X)  $\frac{n^2(n+1)^2}{4}$

Y)  $\frac{2n^2(n+1)(n-1)}{3}$

$$Z) \frac{n(2n-1)(3n+2)}{6}$$

$$\text{ANSWER: X) } \frac{n^2(n+1)^2}{4}$$

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**TOSS-UP**

12) EARTH & SPACE *Multiple Choice* Each unit of Richter magnitude roughly equates to how large of an energy increase? (Karen)

W) 10 times

X) 20 times

Y) 30 times

Z) 40 times

ANSWER: Y) 30 times

**BONUS**

12) EARTH & SPACE *Short Answer* What is the loss of water-soluble plant nutrients from the soil called?

ANSWER: Leaching

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**TOSS-UP**

13) BIOLOGY *Multiple Choice* Which of the following types of blood vessels covers the most area in the body?

W) Arteries

X) Arterioles

Y) Capillaries

Z) Veins

ANSWER: Y) Capillaries

**BONUS**

13) BIOLOGY *Multiple Choice* A deficiency in what hormone causes pellagra?

W) Thiamin

X) Riboflavin

Y) Niacin

Z) Cobalamin

ANSWER: Y) Niacin

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TOSS-UP

14) PHYSICS *Short Answer* Compute the number of joules in 7 kWh (read as: kilowatt-hour).

Express your answer in scientific notation with three significant figures

ANSWER:  $2.52 \times 10^7 J$

BONUS

14) PHYSICS *Short Answer* The index of refraction of water is \_\_\_\_\_ the index of refraction of air

1. equal to
2. less than
3. greater than

ANSWER: 3

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TOSS-UP

15) CHEMISTRY *Multiple Choice* Water is most dense at what temperature at atmospheric pressure?

W) -24 C

X) 4 C

Y) 25 C

Z) 100 C

ANSWER: X) 4 C

BONUS

15) CHEMISTRY *Multiple Choice* Water boils at around what temperature at the top of Mount Everest?

W) 70 C

X) 100 C

Y) 130 C

Z) 160 C

ANSWER: W) 70 C

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**TOSS-UP**

16) MATH *Short Answer* How many ways are there to color a tetrahedron with 2 colors if rotations are considered the same?

ANSWER: 5

**BONUS**

16) MATH *Short Answer* How many ways are there to color the faces of a cube with 2 colors if rotations are considered the same?

ANSWER: 10

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**TOSS-UP**

17) EARTH AND SPACE *Short Answer* What is the largest moon in the solar system?

ANSWER: Ganymede

**BONUS**

17) EARTH AND SPACE *Multiple Choice* Triton is the largest moon of which of the following planets?

W) Jupiter

X) Saturn

Y) Uranus

Z) Neptune

ANSWER: Z) Neptune

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**TOSS-UP**

18) BIOLOGY *Multiple Choice* How many ATP are produced by 1 NADH in cellular respiration?

W) 3

X) 2

Y) 1

Z) 0

ANSWER: W) 3

**BONUS**

18) BIOLOGY *Short Answer* Name a ruminant animal

ANSWER: (Accept any of: cattle, sheep, goats, buffalo, deer, elk, giraffes and camels)

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**TOSS-UP**

19) PHYSICS *Short Answer* What term in physics, associated with circles, means “center-seeking”?

ANSWER: Centripetal

**BONUS**

19) PHYSICS *Short Answer* What is the period of a wave in nanoseconds with a frequency of 1 million Hertz?

ANSWER: 1000

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**TOSS-UP**

20) CHEMISTRY *Short Answer* By name or number, identify the following four compounds that are bases

1. AgCl
2. Ca(OH)<sub>2</sub>
3. NH<sub>3</sub>
4. HClO<sub>3</sub>

ANSWER: 2, 3

**BONUS**

20) CHEMISTRY *Short Answer* Resistors in electrical circuits are most commonly made of what element?

ANSWER: Carbon

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**TOSS-UP**

21) MATH *Short Answer* John acquires a TV every 12 minutes. Thomas acquires 2 TVs every 40 minutes. How many hours will it take them to acquire a total of 552 TVs?

ANSWER: 69



**BONUS**

21) MATH *Short Answer* How many digits are in  $3^{50}$  in base 12 if  $4^{50}$  has 28 digits in base 12?

ANSWER: 23

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**TOSS-UP**

22) EARTH AND SPACE *Multiple Choice* Which of the following is NOT an effect of El Nino Southern Oscillation?

- W) Trade winds are weak
- X) Decreased upwelling off the coast of Peru
- Y) The Indonesian low pressure moves eastward
- Z) Northern US and Canada experience colder winters

ANSWER: Z) Northern US and Canada experience colder winters

**BONUS**

22) EARTH AND SPACE *Short Answer* Which of the following is true for both mid-latitude cyclones and hurricanes?

1. Both storms need cold and warm air masses to form
2. Both storms usually form around 30 to 60 degrees latitude, as it is warmer there than at the poles
3. Both storms are near the center of a low pressure system

ANSWER: 3 only

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**TOSS-UP**

23) BIOLOGY *Multiple Choice* Which form of glucose is the storage form in human cells?

- W) Cellulose
- X) Starch
- Y) Amylose
- Z) Glycogen

ANSWER: Z) Glycogen

**BONUS**

23) BIOLOGY *Multiple Choice* What term describes a person with the genotype: XXY?

- W) Klinefelter's syndrome  
Y) Turner's syndrome  
X) Down syndrome  
Z) Doesn't exist!

ANSWER: W) Klinefelter's syndrome

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**TOSS-UP**

24) PHYSICS *Short Answer* How many types of nucleons exist in an atom of the most abundant isotope of hydrogen?

ANSWER: 1

**BONUS**

24) PHYSICS *Short Answer* What is the kinetic energy of an object travelling at 5 meters per second and with a mass of 14 kilograms, in Joules?

ANSWER: 175 Joules

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**TOSS-UP**

25) CHEMISTRY *Short Answer* John has discovered a new element named Girlfriendium which has a half life of 4 days. If John initially starts with a sample of 20g of Girlfriendium, after how many days will the total mass of his sample reach 5g?

ANSWER: 8 days

**BONUS**

25) CHEMISTRY *Multiple Choice* All of the following can be appreciably dissolved in water except

- W) NaCl  
X) C<sub>12</sub>H<sub>22</sub>O<sub>11</sub>  
Y) CaCO<sub>3</sub>  
Z) LiCl

ANSWER: Y) CaCO<sub>3</sub>

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