

**TOSS UP**

1) MATHEMATICS *Short Answer* What is the fifth term in the geometric sequence starting with 1, 3, and 9?

ANSWER: 81

**BONUS**

2) MATHEMATICS *Multiple Choice* Which conic section is formed by the cross section of a plane parallel to the base of the cone?

- W) Hyperbola
- X) Circle
- Y) Parabola
- Z) Ellipse

ANSWER: X) Circle

**TOSS UP**

3) PHYSICS *Multiple Choice* Which law states that entropy of an isolated system never decreases?

- W) Zeroth Law of Thermodynamics
- X) First Law of Thermodynamics
- Y) Second Law of Thermodynamics
- Z) Third Law of Thermodynamics

ANSWER: Y) Second Law of Thermodynamics

**BONUS**

4) PHYSICS *Short Answer* Captain Kirk is cruising at  $0.5c$  relative to Planet X. If the length of Captain Kirk's ship is 1 km, what is the apparently length of the ship to a stationary observer on Planet X?

ANSWER:  $0.5\sqrt{3}$  km

**TOSS UP**

5) CHEMISTRY *Short Answer* Which law states that  $P_1V_1 = P_2V_2$ ?

ANSWER: Boyle's Law

**BONUS**

6) CHEMISTRY *Short Answer* By name or number, give all of the four atomic numbers whose corresponding elements cannot be found naturally.

I) 43

II) 92

III) 93

IV) 94

ANSWER: I, III, IV

**TOSS UP**

7) BIOLOGY *Multiple Choice* If a mother has a gene of Aa and the father has a gene of Aa, which gene is the offspring most likely to obtain?

W) aa

X) Aa

Y) AA

Z) They are all the same

ANSWER: X) Aa

**BONUS**

8) BIOLOGY *Short Answer* To which genus does the red panda belong to?

ANSWER: Ailuridae

**TOSS UP**

9) EARTH AND SPACE *Short Answer* What is the age of the sun, rounded to the nearest billion years?

ANSWER: 5 billion years

**BONUS**

10) EARTH AND SPACE *Multiple Choice* Which major body of water is currently shrinking due to plate tectonics?

W) Pacific Ocean

X) Atlantic Ocean

Y) Dead Sea

Z) Mediterranean Sea

ANSWER: W) Pacific Ocean

**TOSS UP**

11) ENERGY *Short Answer* What is the maximum efficiency of a heat engine with a heat source of 100 K and a heat sink of 10?

ANSWER: 90%

**BONUS**

12) ENERGY *Short Answer* What is the delta G of a closed system with a spontaneous reaction?

ANSWER: 0

**TOSS UP**

13) MATHEMATICS *Short Answer* What is the 11th term of the arithmetic sequence that starts with 1, 7, and 13?

ANSWER: 61

**BONUS**

14) MATHEMATICS *Multiple Choice* What is the decimal representation of the addition of the binary numbers 11010101 and 101010101?

- W) 210
- X) 211
- Y) 212
- Z) 213

ANSWER: Z) 213

**TOSS UP**

15) PHYSICS *Multiple Choice* What is the temperature at which all motion stops?

- W) 0°F
- X) 0°C
- Y) 0 K
- Z) -273 K

ANSWER: Y) 0 K

**BONUS**

16) PHYSICS *Short Answer* By name or number, give all of the four equations that are correct.

I)  $P = IR^2$

II)  $R_{\text{series}} = R_1 + R_2$

III)  $C_{\text{series}} = C_1 + C_2$

IV)  $V = IR$

ANSWER: I, III

**TOSS UP**

17) CHEMISTRY *Short Answer* What are the coefficients of the balanced form of the equation  $\text{Na} + \text{H}_2\text{O} \rightarrow \text{NaOH} + \text{H}_2$

ANSWER: 2,2,2,1

**BONUS**

18) CHEMISTRY *Multiple Choice* What is the element with the smallest radius?

ANSWER: Helium

**TOSS UP**

19) BIOLOGY *Multiple Choice* Which of the following is not an isomer of 5-methyl nonane?

W) Decane

X) 2-methyl nonane

Y) 4-ethyl octane

Z) 3-methyl heptane

ANSWER: Z) 3-methyl heptane

**BONUS**

20) BIOLOGY *Short Answer* Which amino acid replaces glutamic acid in sickle cell anemia?

ANSWER: Valine

**TOSS UP**

21) EARTH AND SPACE *Short Answer* What is the term for magma that has reached the Earth's surface?

ANSWER: Lava

**BONUS**

22) EARTH AND SPACE *Multiple Choice* Which of the following galaxies is closest to the Milky Way?

- W) Large Magellanic Cloud
- X) Small Magellanic Cloud
- Y) Draco Dwarf
- Z) Andromeda II

ANSWER: W) Large Magellanic Cloud

**TOSS UP**

23) ENERGY *Multiple Choice* Which of the following properties of electricity is the deadliest?

- W) Voltage
- X) Current
- Y) Amplitude
- Z) AC vs DC

ANSWER: X) Current

**BONUS**

24) ENERGY *Short Answer* Which country generates the most power through solar power?

ANSWER: Germany