

TOSS-UP

1) CHEMISTRY *Multiple Choice* Ionic bonds are formed between a _____ and a _____

W) metal, metal

X) metal, non-metal

Y) metalloid, metalloid

Z) non-metal, non-metal

ANSWER: X) metal, non-metal

BONUS

1) CHEMISTRY *Multiple Choice* When the pH of a substance decreases from 4 to 3, its hydrogen ion concentration

W) Increases two-fold

X) Decreases two-fold

Y) Increases ten-fold

Z) Decreases ten-fold

ANSWER: Y) Increases ten-fold

TOSS-UP

2) EARTH AND SPACE SCIENCE *Short Answer* Of the three types of fossil fuels, which type is in the solid state?

ANSWER: Coal

BONUS

2) EARTH AND SPACE SCIENCE *Multiple Choice* Which of the following is not a mechanism of heat transfer?

W) Convection

X) Radiation

Y) Conduction

Z) Reduction

ANSWER: Z) Reduction

TOSS-UP

3) MATH *Multiple Choice* The units digit of 3^{240} (read as: 3 to the 240 power) is

W) 3

X) 9

Y) 7

Z) 1

ANSWER: Z) 1

BONUS

3) MATH *Short Answer* How many ways are there to pick a president, vice president, secretary and treasurer in a class of 20 people if no student may hold more than one office?

ANSWER: 4845

TOSS-UP

4) PHYSICS *Multiple Choice* Which of the following scenarios is NOT what the second law of thermodynamics demonstrates?

W) Heat death of the universe

X) The impossibility of a heat engine of 100 percent efficiency

Y) Entropy of a crystal at absolute zero is always zero

Z) Irreversibility of most complex natural processes

ANSWER: Y) Entropy of a crystal at absolute zero is always zero

BONUS

4) PHYSICS *Short Answer* According to the ideal gas law, if pressure increases while volume and mass remains constant, what value increases?

ANSWER: Temperature

TOSS-UP

5) BIOLOGY *Multiple Choice* What organelle is likely to be defective in a person with chronic fatigue and muscle weakness?

W) Mitochondria

X) Lysosomes

Y) Smooth ER

Z) Golgi apparatus

ANSWER: W) Mitochondria

BONUS

5) BIOLOGY *Short Answer* What is the largest gland in the body?

ANSWER: Liver

TOSS-UP

6) CHEMISTRY *Short Answer* How many rows and columns respectively are there on the periodic table?

ANSWER: 7, 18

BONUS

6) CHEMISTRY *Short Answer* Any element whose atomic number is greater than 82 is radioactive. What element is element 82?

ANSWER: Lead

TOSS-UP

7) EARTH AND SPACE SCIENCE *Short Answer* During which month are Earth's pressure belts located the furthest south?

ANSWER: December

BONUS

7) EARTH AND SPACE SCIENCE *Short Answer* Which two elements formed within the first few minutes after the Big Bang?

ANSWER: Hydrogen and helium

TOSS-UP

8) MATH *Short Answer* The 25-member Lexington High School DOE Team eats ice cream together. If each member can choose 1 of 5 flavors and 2 of 3 toppings, how many different types of ice cream can one member make?

ANSWER: 15

BONUS

8) MATH *Short Answer* The 25-member Lexington High School DOE Team has sleepovers together at Derik's house, where there are 24 beds. What mathematical principle dictates that there will be at least one bed with 2 people?

ANSWER: Pigeonhole Principle (ACCEPT: Dirichlet's box principle)

TOSS-UP

9) PHYSICS *Multiple Choice* Which of the following is an example of a velocity?

W) 3 m

X) 3 m/s

Y) - 3 m/s

Z) 3 m/s west

ANSWER: Z) 3 m/s west

BONUS

9) PHYSICS *Short Answer* What is the acceleration of a 3kg block with a net force of 9 N applied to it?

ANSWER: 3 m/s²

TOSS-UP

10) BIOLOGY *Short Answer* What organelle in the cell contains hydrolytic enzymes that aid the cell in digestion?

ANSWER: Lysosome

BONUS

10) BIOLOGY *Multiple Choice* What term describes the process in which liquid droplets are ingested by living cell”?

W) Exocytosis

X) Endocytosis

Y) Phagocytosis

Z) Pinocytosis

ANSWER: Z) Pinocytosis

TOSS-UP

11) CHEMISTRY *Multiple Choice* Which of the following elements has the most number of protons?

W) Hydrogen

X) Tellurium

Y) Cadmium

Z) Boron

ANSWER: X) Tellurium

BONUS

11) CHEMISTRY *Multiple Choice* Which of the following is element 21 on the periodic table?

W) Mercury

X) Bronze

Y) Tellurium

Z) Scandium

ANSWER: Z) Scandium

TOSS-UP

12) EARTH & SPACE *Multiple Choice* Which of the following is not necessary for a material to be considered a mineral?

W) It must be solid

X) It must be naturally occurring

Y) It must be inorganic

Z) It must have cleavage

ANSWER: Z) It must have cleavage

BONUS

12) EARTH & SPACE *Short Answer* List the top 4 most abundant elements in the crust, in decreasing order of abundance.

ANSWER: Oxygen, Silicon, Aluminum, Iron (accept in this order only)

TOSS-UP

13) MATH *Short Answer* The 25-member Lexington High School DOE team has parties at Frank's house. The number of people who came to the last 5 parties have been 2, 1, 1, 1 and 1. To the nearest tenth, what was the average number of people who came to the last 5 parties?

ANSWER: 1.2

BONUS

13) MATH *Multiple Choice* The 25-member Lexington High School DOE team goes shopping together in the Mall of DiMasi. If the Mall of DiMasi is in the shape of a kite with diagonals of length $40\sqrt{2}$ and $20\sqrt{2}$, what is the area of the mall?

ANSWER: 800

TOSS-UP

14) PHYSICS *Short Answer* How many fundamental forces of nature are there?

ANSWER: 4

BONUS

14) PHYSICS *Multiple Choice* What is the weakest fundamental force of nature?

W) Weak Force

X) Strong Force

Y) Electromagnetism

Z) Gravity

ANSWER: Z) Gravity

TOSS-UP

1) BIOLOGY *Multiple Choice* What protein is the main constituent of hair?

W) Collagen

X) Keratin

Y) Casein

Z) Myosin

ANSWER: X) Keratin

BONUS

1) BIOLOGY *Short Answer* What type of asexual reproduction is characterized by the development of offspring from unfertilized eggs?

ANSWER: Parthenogenesis

TOSS-UP

16) CHEMISTRY *Multiple Choice* Which of the following is closest to the ratio of the mass of the proton to the mass of the electron?

W) 10^2 (read as: ten to the second power)

X) 10^3

Y) 10^4

Z) 10^5

ANSWER: X) 10^3

BONUS

16) CHEMISTRY *Short Answer* The property of equilibrium shifting to compensate/adapt to the alternations of the conditions in a reaction system is due to which of the following?

W) Avogadro's Molecular Theory

X) Rate Law

Y) Le Chatelier's Principle

Z) Raoult's Law

ANSWER: Y) Le Chatelier's Principle

TOSS-UP

17) EARTH & SPACE *Multiple Choice* Which of the following types of plankton is smallest?

W) Picoplankton

X) Nanoplankton

Y) Microplankton

Z) Femtoplankton

ANSWER: Z) Femtoplankton

BONUS

17) EARTH & SPACE *Multiple Choice* Which of the following plates does not touch the others?

W) Cocos Plate

X) Nazca Plate

Y) Caribbean Plate

Z) Scotia Plate

ANSWER: Z) Scotia Plate

TOSS-UP

18) MATH *Short Answer* The 25-member Lexington High School DOE Team has pool parties in Eric's kiddie pool. If Eric's pool is a circle with radius 5 feet, what is the area of Eric's pool?

ANSWER: 25π

BONUS

18) MATH *Short Answer* The 25-member Lexington High School DOE Team makes new life together. If the team starts out with one bacterium on Monday and the population doubles every day, on what day of the week will the population go above 1000 bacteria?

ANSWER: Thursday

TOSS-UP

19) PHYSICS *Short Answer* Newton had how many laws of motion?

ANSWER: 3

BONUS

19) PHYSICS *Short Answer* Which law of motion states that for every force, there is an equal and opposite reaction force?

ANSWER: Newton's 3rd Law

TOSS-UP

20) BIOLOGY *Multiple Choice* Which of the following is not found in plant cells?

W) Cell Wall

X) Chloroplast

Y) Vacuole

Z) Centrosome

ANSWER: Z) Centrosome

BONUS

20) BIOLOGY *Short Answer* Given that the DNA of a certain cell in Jason's body has 10% Adenine, what will be the percentage Guanine?

ANSWER: 40%

TOSS-UP

21) CHEMISTRY *Short Answer* What element has the smallest atomic radius?

ANSWER: Helium

BONUS

21) CHEMISTRY *Short Answer* How many sigma bonds exist in one molecule of ethane?

ANSWER: 1

TOSS-UP

13) EARTH SCIENCE *Short Answer* What is the name of the deepest trench on Earth?

ANSWER: Mariana's Trench

BONUS

13) EARTH SCIENCE *Multiple Choice* What is the topmost layer of the soil horizon?

W) A horizon

X) B horizon

Y) E horizon

Z) O horizon

ANSWER: Z) O horizon

TOSS-UP

23) MATH *Short Answer* Find the slope of the line $2y + 4x = -3$.

ANSWER: -2

BONUS

23) MATH *Short Answer* Find the number of factors of the number 12^3 (read as: twelve to the third power).

ANSWER: 36

TOSS-UP

24) PHYSICS *Short Answer* Suppose I walk 3 m forward, 2 m backwards, and then 5 m forward. What is my displacement?

ANSWER: 6 m forward (accept: 6 m)

BONUS

24) PHYSICS *Multiple Choice* Which of the following physicists did not win a Nobel Prize?

W) Isaac Newton

X) Albert Einstein

Y) Enrico Fermi

Z) Peter Higgs

ANSWER: W) Isaac Newton

TOSS-UP

25) BIOLOGY *Multiple Choice* What is the name of the enzyme which restores telomeres to their original length after DNA replication?

W) DNA ligase

X) DNA polymerase

Y) Nuclease

Z) Telomerase

ANSWER: Z) Telomerase

BONUS

25) BIOLOGY *Short Answer* Which enzyme transfers phosphate groups from ATP to a protein?

ANSWER: Protein kinase
