

TOSS-UP

1) BIOLOGY *Multiple Choice* Which organelle in the cell is responsible for the modification and packaging of proteins and lipids which are then subsequently transported out of the cell?

W) Endoplasmic Reticulum

X) Golgi Apparatus

Y) Mitochondria

Z) Lysosome

ANSWER: X) Golgi Apparatus

BONUS

1) BIOLOGY *Short Answer* Anka is using a microscope to identify different organelles within a eukaryotic cell. She identifies one organelle to be the endoplasmic reticulum, but she notices that one type of ER has stud-like beads on its surface. What are these “beads” known as?

ANSWER: Ribosomes

TOSS-UP

2) CHEMISTRY *Multiple Choice* Which subatomic particle has a negative charge?

W) Electron

X) Neutrino

Y) Neutron

Z) Proton

ANSWER: W) Electron

BONUS

2) CHEMISTRY *Short Answer* Which scientist is credited with the discovery of the electron through the use of a cathode ray tube?

ANSWER: J.J. Thomson

TOSS-UP

4) EARTH & SPACE *Short Answer* In which two layers of the atmosphere does temperature decrease with increasing altitude?

ANSWER: Troposphere, Mesosphere (must have both)

BONUS

4) EARTH & SPACE *Multiple Choice* Which of the following best explains why the stratosphere experiences heating with increasing altitude

W. Subsiding air causes a temperature inversion that reverses the normal temperature gradient

X. Sunlight bouncing off clouds in the troposphere warms the air

Y. Ultraviolet light absorbed by ozone increases the temperature

Z. Hot air rises, so all of the hot air from below rises until it is trapped in the troposphere

ANSWER: Y

TOSS-UP

4) PHYSICS *Multiple Choice* Which law of thermodynamics states that it is impossible for anything to reach 0 K?

W.) Zeroth Law of Thermodynamics

X.) First Law of Thermodynamics

Y.) Second Law of Thermodynamics

Z.) Third Law of Thermodynamics

ANSWER: Z.) Third Law of Thermodynamics

BONUS

4) PHYSICS *Short Answer* What is the term usually used to refer to a system that remains at a constant pressure?

ANSWER: Isobaric

TOSS-UP

5) MATH *Short Answer* How many consecutive zeroes are at the end of 10 factorial?

ANSWER: 2

BONUS

5) MATH *Short Answer* Find the floor function of the following 3 numbers: 0, pi, negative e.

ANSWER: 0, 3, -3

TOSS-UP

6) BIOLOGY *Short Answer* Name the scientist who is known as ‘the father of microbiology.’

ANSWER: Anton Von Leeuwenhoek (ACCEPT: Leeuwenhoek)

BONUS

6) BIOLOGY *Multiple Choice* One day, you visit Wagon Wheel and find a maize leaf which is rather purplish in color. Which mineral is this leaf most likely to be deficient in?

W) Phosphate

X) Potassium

Y) Zinc

Z) Nitrogen

ANSWER: W) Phosphate

TOSS-UP

7) CHEMISTRY *Multiple Choice* A proton donor is known by what scientific term?

W) Arrhenius Acid

X) Arrhenius Base

Y) Bronsted Lowry Acid

Z) Bronsted Lowry Base

ANSWER: Y) Bronsted Lowry Acid

BONUS

7) CHEMISTRY *Short Answer* What is the pH of a substance that has a H^+ concentration of 1×10^{-6} (read as: "1 times 10 to the power of -6")

ANSWER: 6

TOSS-UP

8) EARTH & SPACE *Short Answer* What star, also known as Alpha Ursae Minoris, is useful in navigation due to its extreme proximity to the celestial north pole?

ANSWER: Polaris (grudgingly accept: North Star)

BONUS

8) EARTH & SPACE *Short Answer* What constellation contains the figure commonly known as the Big Dipper?

ANSWER: Ursa Major

TOSS-UP

9) PHYSICS *Short Answer* What is the acceleration of a 5 kilogram block if a force of 60 newtons is applied to it?

ANSWER: 12 m/s^2

BONUS

9) PHYSICS *Multiple Choice* Which of the following is true if the distance between two objects is tripled?

W) The gravitational force between them is tripled

X) The gravitational force between them is nine times greater

Y) The gravitational force between them is one third as strong

Z) The gravitational force between them is one ninth as strong

ANSWER: Z) The gravitational force between them is one ninth as strong

TOSS-UP

10) MATH *Short Answer* A fair coin is tossed 5 times in a row. Find the probability that it does not land on heads a single time.

ANSWER: $1/32$

BONUS

10) MATH *Short Answer* Rectangle ABCD has side lengths $AB=8$ and $BC=13$. A point P is picked uniformly at random from the interior of ABCD. Find the probability that the area of triangle CDP is at least 20.

ANSWER: $8/13$

TOSS-UP

11) BIOLOGY *Multiple Choice* What group of tissues does blood belong to?

- W) Epithelial
- X) Connective
- Y) Muscular
- Z) Neural

ANSWER: X) Connective

BONUS

11) BIOLOGY *Short Answer* What is the scientific name for a red blood cell?

ANSWER: Erythrocyte

TOSS-UP

12) CHEMISTRY *Multiple Choice* Neon and xenon are examples of

- W) alkaline earth metals
- X) alkali metals
- Y) halogens
- Z) noble gases

ANSWER: Z) noble gases

BONUS

12) CHEMISTRY *Short Answer* By name or number, order the following five inert gases from smallest to largest atomic size

1. Xe
2. Ne
3. He
4. Ar
5. Kr

ANSWER: 3, 2, 4, 5, 1

TOSS-UP

13) EARTH & SPACE *Short Answer* What feature at the mouth of a river, so named due to its triangular shape, is the result of deposition of sediments as the river empties into the ocean and slows down?

ANSWER: Delta

BONUS

13) EARTH & SPACE *Short Answer* What river has the highest discharge in the world?

ANSWER: Amazon

TOSS-UP

14) PHYSICS *Short Answer* How much work is done lifting a 2 kg block 5 meters above the ground?

ANSWER: 98 N (ACCEPT 100N?)

BONUS

14) PHYSICS *Multiple Choice* Which of the following has no electrical charge?

W) Proton

X) Electron

Y) Gluon

Z) Positron

ANSWER: Y) Gluon

TOSS-UP

15) MATH *Short Answer* Find the degree of the polynomial $(x^2+x-12)^{2017}$. [**read: the quantity x squared plus x minus 12 close quantity to the 2017**].

ANSWER: 4034

BONUS

15) MATH *Short Answer* Suppose that the Celtics win 40 out of their first 60 games. How many of their next 30 games must they win in order to achieve a total winning percentage of 70%?

ANSWER: 23

TOSS-UP

16) BIOLOGY *Short Answer* Which organelle is responsible for carrying out the citric acid cycle of cellular respiration?

ANSWER: Mitochondria

BONUS

16) BIOLOGY *Multiple Choice* Anaerobic respiration occurs when what element is not present?

W) Hydrogen

X) Carbon

Y) Oxygen

Z) Nitrogen

ANSWER: Y) Oxygen

TOSS-UP

17) CHEMISTRY *Short Answer* The amount of heat required to raise the temperature of the unit mass of a given substance by one degree is what?

ANSWER: Specific heat

BONUS

17) CHEMISTRY *Short Answer* What is the technical term for a thermally insulating wall?

ANSWER: Adiabatic wall

TOSS-UP

18) EARTH & SPACE *Multiple Choice* Despite being in the middle of a plate, the Hawaiian archipelago was able to form due to the presence of what?

W. Hot spot

X. Hole in the crust

Y. Fault

Z. Subduction zone

ANSWER: W. Hot Spot

BONUS

18) EARTH & SPACE *Short Answer* What is the most active shield volcano, located on the island of Hawaii?

ANSWER: Kilauea

TOSS-UP

19) PHYSICS *Short Answer* What force holds planets and stars in their orbits?

ANSWER: Gravity

BONUS

19) PHYSICS *Multiple Choice* Which one of Kepler's Laws states that the cube of the orbital radius of the orbit of a planet is directly proportional to the square of its period?

W) Kepler's First Law

X) Kepler's Second Law

Y) Kepler's Third Law

Z) Kepler's laws did not prove this result

ANSWER: Z) Kepler's Third Law

TOSS-UP

20) MATH *Short Answer* A right triangle has legs of length 9 and 40. What is the length of the hypotenuse?

ANSWER: 41

BONUS

20) MATH *Multiple Choice* Let $*$ [read: star] be a binary operation over the real numbers, and let a, b, c be arbitrary reals. Which of the following conditions is necessary for $*$ [read: star] to be commutative?

W) $a*b=b*a$

X) $a*(b*c)=(a*b)*c$ [read: a star the quantity b star c is equal to the quantity a star b close quantity star c]

Y) $a*a=0$

Z) $a*a=a$

ANSWER: W

TOSS-UP

21) BIOLOGY *Short Answer* A person who has Down's Syndrome has an abnormal number of copies of which chromosome?

ANSWER: 21 (DO NOT ACCEPT: trisomy 21)

BONUS

21) BIOLOGY *Multiple Choice* In humans, the majority of CO₂ in the blood is transported:

W) In the form of bicarbonate ions

X) In the form of carbonic acid

Y) Through hemoglobin

Z) Through blood plasma

ANSWER: W) In the form of bicarbonate ions

TOSS-UP

22) CHEMISTRY *Multiple Choice* In a galvanic cell, reduction occurs at the ____ and oxidation occurs at the ____.

W) anode, cathode

X) anode, anode

Y) cathode, cathode

Z) cathode, anode

ANSWER: Z) cathode, anode

BONUS

22) CHEMISTRY *Multiple Choice* In the salt bridge, anions will flow towards the ____ and cations will flow towards the ____.

W) anode, cathode

X) anode, anode

Y) cathode, cathode

Z) cathode, anode

ANSWER: W) anode, cathode

TOSS-UP

23) EARTH & SPACE *Short Answer* What is the name of the galaxy that is our home?

ANSWER: Milky Way

BONUS

23) EARTH & SPACE *Short Answer* What galaxy, found in its namesake constellation, is the closest to us?

ANSWER: Andromeda

TOSS-UP

24) PHYSICS *Multiple Choice* What process in stars fuses two hydrogen nuclei into a helium nucleus?

W) Nuclear fission

X) Nuclear fusion

Y) Supernova

Z) Gravitational coalescence

ANSWER: X) Nuclear fusion

BONUS

24) PHYSICS *Short Answer* What is the centripetal acceleration of a 5 kilogram object revolving around a circle with a radius of 25 meters if the object travels at 10 meters per second?

ANSWER: 4

TOSS-UP

25) MATH *Short Answer* What is the natural log of the square root of e?

ANSWER: 1/2, or 0.5

BONUS

25) MATH *Multiple Choice* Which of the following numbers is NOT prime?

W) 109

X) 127

Y) 139

Z) 161

ANSWER: Z) 161