

ROUND 12

TOSS-UP

1) EARTH AND SPACE *Short Answer* Identify all of the following factors that are inversely related to the strength of sea ice: 1) salinity, 2) porosity, 3) temperature.

ANSWER: ALL (ACCEPT 1, 2, and 3)

BONUS

1) EARTH AND SPACE *Multiple Choice* Which of the following is a first sign that the ocean surface is freezing?

- W) Slushy, thick soupy consistency of surface
- X) Oily appearance on surface due to needle-like ice crystals
- Y) Thin sheets of pancake ice radiating across surface
- Z) Detectable color change of sea surface from dark to white

ANSWER: X) OILY APPEARANCE ON SURFACE DUE TO NEEDLE-LIKE ICE CRYSTALS

TOSS-UP

2) LIFE SCIENCE *Multiple Choice* The Latin phrase *in vitro* now commonly means what?

- W) In an artificial environment
- X) In an open environment
- Y) In a living organism
- Z) In a dead cell

ANSWER: W) IN AN ARTIFICIAL ENVIRONMENT

BONUS

2) LIFE SCIENCE *Short Answer* Green algae are plantlike protists that can reproduce both sexually and asexually. When they reproduce sexually, they alternate between gametophyte [**guh-MEE-tuh-fyt**] and sporophyte [**SPOHR-uh-fyt**] generations. They can also reproduce asexually through what process?

ANSWER: FRAGMENTATION (ACCEPT: MITOSIS, VEGETATIVE PROPOGATION, CLONING)

TOSS-UP

3) MATH *Short Answer* In the coordinate plane, the coordinates of P are (1, 4) and the coordinates of Q are (5, 0). What are the coordinates of the midpoint of segment PQ?

ANSWER: (3, 2)

BONUS

3) MATH *Short Answer* A certain bacterium doubles every 30 minutes. If originally there were 100 bacteria, how many bacteria exist after two hours?

ANSWER: 1600

TOSS-UP

4) ENERGY *Multiple Choice* Which of the following statements is NOT true about Florida's Gulf Stream?

- W) It has 21,000 times the energy of Niagara Falls
- X) It has the fastest and most powerful ocean currents in the world
- Y) Its currents are capable of generating the same amount of energy as four nuclear power plants
- Z) It is a southward accelerating current off the East Coast

ANSWER: Z) IT IS A SOUTHWARD ACCELERATING CURRENT OFF THE EAST COAST

BONUS

4) ENERGY *Multiple Choice* For residential cooling equipment, such as ground source heat pumps, the seasonal energy efficiency ratio can be calculated. What is the typical value for a ground source heat pump with good performance?

- W) 8
- X) 10
- Y) 17
- Z) 25

ANSWER: Y) 17

TOSS-UP

5) PHYSICAL SCIENCE *Multiple Choice* In nuclear reactors, control rods are used to absorb free neutrons without undergoing fission themselves. Which of the following is a frequently used substance to make control rods?

- W) Boron
- X) Carbon
- Y) Iron
- Z) Water

ANSWER: W) BORON

BONUS

5) PHYSICAL SCIENCE *Short Answer* Arrange the following four elements in order of increasing atomic radius: 1) carbon, 2) beryllium, 3) magnesium, 4) oxygen.

ANSWER: 4, 1, 2, 3 (ACCEPT: OXYGEN, CARBON, BERYLLIUM, MAGNESIUM)

TOSS-UP

6) GENERAL SCIENCE *Multiple Choice* The water vascular system is found in which of the following phyla **[FY-luh]**?

- W) Echinodermata **[i-ky-nuh-DUHR-muht-uh]**
- X) Arthropoda
- Y) Mollusca
- Z) Lophophorata **[LOF-uh-fawr-a-tuh]**

ANSWER: W) ECHINODERMATA

BONUS

6) GENERAL SCIENCE *Multiple Choice* Which of the following is NOT considered an elementary particle?

- W) Quark
- X) Neutron
- Y) Photon
- Z) Electron

ANSWER: X) NEUTRON

TOSS-UP

7) EARTH AND SPACE *Multiple Choice* What occurs to the water mass immediately surrounding the first ice crystals that form in ocean water?

- W) It becomes saltier
- X) It becomes more stratified
- Y) It become fresher
- Z) It becomes colder

ANSWER: W) IT BECOMES SALTIER

BONUS

7) EARTH AND SPACE *Short Answer* Organize the following four snow types according to increasing insulating effect: 1) hard packed snow; 2) extremely cold, wind-swept snow; 3) newly fallen soft snow; 4) slightly settled snow.

ANSWER: 2, 1, 4, 3 (ACCEPT: EXTREMELY COLD, WIND-SWEPT SNOW; HARD PACKED SNOW; SLIGHTLY SETTLED SNOW; NEWLY FALLEN SOFT SNOW)

TOSS-UP

8) LIFE SCIENCE *Multiple Choice* Which of the following is a central mechanism for homeostasis in which the product of a metabolic or physiological pathway regulates its production by inhibiting an earlier step in its own production?

- W) Synergistic excitation
- X) Positive stimulation
- Y) Negative feedback
- Z) Up regulation

ANSWER: Y) NEGATIVE FEEDBACK

BONUS

8) LIFE SCIENCE *Short Answer* By number, identify all of the following four statements regarding cyanobacteria [*sy-uh-noh-bak-TEER-ee-uh*] that are true: 1) they belong to the kingdom Protista; 2) they are photosynthetic; 3) they were the first organisms to produce oxygen; 4) they are found in both fresh water and marine environments.

ANSWER: 2, 3, 4

TOSS-UP

9) MATH *Short Answer* If two standard dice are rolled and two coins are flipped, how many equally likely outcomes are in the sample space?

ANSWER: 144

BONUS

9) MATH *Short Answer* Solve the following equation for x over the real numbers: $x^2 + 8x = 4$.

ANSWER: $-4 \pm 2\sqrt{5}$

TOSS-UP

10) ENERGY *Short Answer* When lightning strikes, what type of energy in the atmosphere is transformed into thermal energy, light, and sound?

ANSWER: ELECTRIC POTENTIAL ENERGY

BONUS

10) ENERGY *Short Answer* A pendulum [**PEN-juh-luhm**] with a mass of one kilogram attached to a string one meter long is released from 2 meters above the ground. Neglecting air resistance and providing your answer to the nearest tenth, how many joules of kinetic energy will the pendulum have at the bottom of its swing?

ANSWER: 19.6

TOSS-UP

11) PHYSICAL SCIENCE *Multiple Choice* What phase of matter can NOT be found in a fluorescent light that is powered on?

- W) Solid
- X) Liquid
- Y) Gas
- Z) Plasma

ANSWER: X) LIQUID

BONUS

11) PHYSICAL SCIENCE *Short Answer* A car accelerates constantly from 0 meters per second to 90 meters per second in 12 seconds. What is its average acceleration in meters per second squared to two significant figures?

ANSWER: 7.5

TOSS-UP

12) GENERAL SCIENCE *Multiple Choice* Which of the following is a strong acid?

- W) Hydrosulfuric acid ***[hy-droh-suhl-FYOO-rik]***
- X) Acetic acid
- Y) Phosphoric acid
- Z) Sulfuric acid

ANSWER: Z) SULFURIC ACID

BONUS

12) GENERAL SCIENCE *Short Answer* Providing your answer to the nearest hundredth, what is the force in newtons needed to vertically lift a 5.0 kilogram bowling ball at a constant speed to a height of 0.76 meters?

ANSWER: 49.00

TOSS-UP

13) EARTH AND SPACE *Short Answer* Mt Fuji is an active example of what type of volcano?

ANSWER: STRATO (ACCEPT: COMPOSITE)

BONUS

13) EARTH AND SPACE *Multiple Choice* Meteor showers are caused by periodic comets. These comets are periodic for which of the following reasons?

- W) They are being ejected by the same source
- X) Areas of Earth's orbit are more comet-dense than others
- Y) They orbit the Sun in elliptical paths
- Z) They occur when Earth and Jupiter are on opposite sides of the Sun

ANSWER: Y) THEY ORBIT THE SUN IN ELLIPTICAL PATHS

TOSS-UP

14) LIFE SCIENCE *Multiple Choice* Which of the following terms best describes the inheritance of the A and B antigen genes in human blood?

- W) Co-dominance
- X) Incomplete dominance
- Y) Penetrance
- Z) Expressivity

ANSWER: W) CO-DOMINANCE

BONUS

14) LIFE SCIENCE *Multiple Choice* Which of the following is NOT a baleen whale?

- W) Bryde's
- X) Minke
- Y) Pilot
- Z) Gray

ANSWER: Y) PILOT

TOSS-UP

15) GENERAL SCIENCE *Multiple Choice* Some colleagues decide to play a prank on you. They create a mixture of two elements, then tell you they have discovered a new element. They show you that this element has properties of both metals and nonmetals. Over time, however, it simply shows the properties of metals. Which of the following properties would the “new element” lose over time?

- W) Brittleness
- X) Ability to conduct heat
- Y) Magnetic attraction
- Z) Shine

ANSWER: W) BRITTLENESS

BONUS

15) GENERAL SCIENCE *Multiple Choice* Which of the following is NOT a measure of primary productivity?

- W) Oxygen production
- X) Oxygen consumption
- Y) Glucose production
- Z) Carbon dioxide consumption

ANSWER: X) OXYGEN CONSUMPTION

TOSS-UP

16) MATH *Short Answer* If $3 - 4i$ is a root of a quadratic equation with real coefficients, what must be the other root?

ANSWER: $3 + 4i$

BONUS

16) MATH *Short Answer* How many positive divisors does 400 have?

ANSWER: 15

TOSS-UP

17) PHYSICAL SCIENCE *Multiple Choice* You manufacture a chemical called Bowlinium that is a blue liquid at room temperature. You vigorously mix the Bowlinium with some yellow oil and clear water. Over time, two layers separate out: a green layer on top, and a clear layer on the bottom. Which of the following conclusions about this experiment is MOST correct?

- W) Bowlinium is less dense than water
- X) Bowlinium is more dense than water
- Y) Bowlinium is less dense than water and as dense as oil
- Z) Bowlinium has the same density as oil

ANSWER: Y) BOWLINIUM IS LESS DENSE THAN WATER AND AS DENSE AS OIL

BONUS

17) PHYSICAL SCIENCE *Short Answer* A car starts from rest and proceeds to travel 3.6 kilometers in 1 minute while steadily speeding up. What, respectively, was the car's acceleration in meters per second squared and final speed in meters per second for this trip?

ANSWER: ACCELERATION = 2, FINAL SPEED = 120

TOSS-UP

18) GENERAL SCIENCE *Multiple Choice* Which of the following is NOT needed to produce an electromagnet?

- W) A current source
- X) A conductive material
- Y) A magnetic core
- Z) A current sink

ANSWER: Y) A MAGNETIC CORE

BONUS

18) GENERAL SCIENCE *Short Answer* In vertebrates, what major bone houses the pituitary gland?

ANSWER: SPHENOID

TOSS-UP

19) LIFE SCIENCE *Short Answer* If you have both a male and female alien with genotypes DD [**big D big D**] and Dd [**big D little d**], what is the percent chance that any baby aliens they have will be of the Dd [**big D little d**] genotype?

ANSWER: 50%

BONUS

19) LIFE SCIENCE *Short Answer* The smallest of the marine mammals belongs to the order Carnivora. What is the common name for this animal?

ANSWER: SEA OTTER

TOSS-UP

20) EARTH AND SPACE *Multiple Choice* Gravity assist is a great way to save money on spacecraft fuel. Which of the following is one reason NASA might NOT be able to use it to send a spacecraft to Neptune?

- W) The planets are rarely lined up in the right places
- X) Gravity assist only works for small planets
- Y) The gravity of gas giant planets is difficult to predict
- Z) Neptune's orbit crossing with Pluto creates a chaotic system

ANSWER: W) THE PLANETS ARE RARELY LINED UP IN THE RIGHT PLACES

BONUS

20) EARTH AND SPACE *Multiple Choice* A geomagnetic storm adds heat to a part of Earth's atmosphere called the thermosphere. As the atmosphere rises, the density in low Earth orbit increases. Which of the following might this subsequently increase on a satellite?

- W) Radiation
- X) Auroral light
- Y) Drag
- Z) Conductivity interference

ANSWER: Y) DRAG

TOSS-UP

21) MATH *Multiple Choice* If x lies between 1 and 2, which of the following is the smallest?

- W) $-\frac{1}{x}$
- X) $-x^2$
- Y) $-x$
- Z) $-\sqrt{x}$

ANSWER: X) $-x^2$

BONUS

21) MATH *Short Answer* Find all points of intersection of the graphs of the two equations $x^2 + y^2 = 20$ and $x - y = 2$.

ANSWER: (4, 2) AND (-2,-4)

TOSS-UP

22) ENERGY *Multiple Choice* Theoretically, an absolute maximum of how many ATP molecules can be produced from the complete oxidation of one glucose molecule through aerobic respiration?

- W) 33
- X) 38
- Y) 43
- Z) 48

ANSWER: X) 38

BONUS

22) ENERGY *Multiple Choice* Newton's law of cooling states that which of the following is true?

- W) The rate at which the temperature of an object changes can be determined if the difference between the temperature of the body and the ambient temperature is known
- X) A wire heats up whenever current passes through it
- Y) All molecular movement ceases at -100° Celsius
- Z) A circuit cools down as long as the wires attached to it have a specific number of turns

ANSWER: W) THE RATE AT WHICH THE TEMPERATURE OF AN OBJECT CHANGES CAN BE DETERMINED IF THE DIFFERENCE BETWEEN THE TEMPERATURE OF THE BODY AND THE AMBIENT TEMPERATURE IS KNOWN

TOSS-UP

23) MATH *Multiple Choice* A polyhedron [*pol-ee-HEE-druhn*] has six faces. Exactly five of these are triangles. Which of the following could this polyhedron be?

- W) A quadrilateral pyramid
- X) A quadrilateral prism
- Y) A pentagonal pyramid
- Z) A pentagonal prism

ANSWER: Y) A PENTAGONAL PYRAMID

BONUS

23) MATH *Multiple Choice* Katy wants to create several different 7-character screen names. She wants to use arrangements of the first 3 letters of her first name (K-A-T), followed by arrangements of the 4 digits in 1987, the year of her birth. How many different screen names can she create in this way?

- W) 72
- X) 144
- Y) 288
- Z) 576

ANSWER: X) 144

TOSS-UP

24) PHYSICAL SCIENCE *Short Answer* What is defined as a measurement of the average kinetic energy of all the particles in a substance?

ANSWER: TEMPERATURE

BONUS

24) PHYSICAL SCIENCE *Multiple Choice* In a nuclear reactor, moderators play a key role in helping to slow down rapidly moving neutrons. Which of the following is NOT a moderator frequently used in nuclear reactions?

- W) Deuterium oxide
- X) Water
- Y) Iron
- Z) Graphite [*gra-FYT*]

ANSWER: Y) IRON

TOSS-UP

25) LIFE SCIENCE *Multiple Choice* What phase is the stage of the cell cycle in which proteins are made in preparation for DNA replication?

- W) M
- X) S
- Y) G1
- Z) G2

ANSWER: Y) G1

BONUS

25) LIFE SCIENCE *Multiple Choice* Many diseases, including cystic fibrosis, are caused by recessive homozygosity [***hoh-muh-zy-GOS-i-tee***] of a particular gene. Since these diseases are caused by recessive genes, one might think that they should have been eliminated long ago. What is the leading theory on why diseases like cystic fibrosis still exist?

- W) Individuals with the disease are able to have children before the effects of the disease emerge
- X) A single recessive allele of the gene causing the disease may confer a selective advantage
- Y) Two copies of the recessive allele of the gene causing the disease may confer a selective advantage
- Z) Individuals that are heterozygous [***het-er-uh-ZY-guhs***] for the gene causing the disease are as healthy as normal individuals

ANSWER: X) A SINGLE RECESSIVE ALLELE OF THE GENE CAUSING THE DISEASE MAY CONFER A SELECTIVE ADVANTAGE