

ROUND 9

TOSS-UP

1) LIFE SCIENCE *Multiple Choice* Why is hair a good candidate for conducting sequencing of ancient DNA?

- W) Hair contains high quantity DNA
- X) Keratin in hair protects DNA from degradation
- Y) The presence of melanin yields better sequencing data
- Z) DNA in hair is free from mutations

ANSWER: X) KERATIN IN HAIR PROTECTS DNA FROM DEGRADATION

BONUS

1) LIFE SCIENCE *Short Answer* What metabolic pathway that produces ATP is common to both aerobic cellular respiration and alcoholic fermentation?

ANSWER: GLYCOLYSIS

TOSS-UP

2) GENERAL SCIENCE *Multiple Choice* Nodules containing nitrogen-fixing bacteria would most likely be found in which of the following?

- W) Peas and beans
- X) Grasses
- Y) Pine trees
- Z) Chrysanthemums and zinnias

ANSWER: W) PEAS AND BEANS

BONUS

2) GENERAL SCIENCE *Short Answer* Rank the following four choices from smallest typical genome to largest typical genome: 1) free-living bacteria, 2) multicellular organisms, 3) obligate symbiotic bacteria, 4) viruses.

ANSWER: 4, 3, 1, 2 (ACCEPT: VIRUSES, OBLIGATE SYMBIOTIC BACTERIA, FREE-LIVING BACTERIA, MULTICELLULAR ORGANISMS)

TOSS-UP

3) MATH *Short Answer* The minute hand of a clock is 2 inches long. How many inches does its tip travel in 30 minutes?

ANSWER: 2π

BONUS

3) MATH *Short Answer* A rectangle is 20 inches on its shorter side. Its diagonal makes an angle of 30° with the longer side. How long in inches is the diagonal?

ANSWER: 40

TOSS-UP

4) ENERGY *Multiple Choice* When calculating the efficiency of a solar collector, it is very important to know the incident angle. The angle depends directly on which of the following?

- W) Solar irradiance only
- X) Solar altitude only
- Y) Solar altitude and solar irradiance
- Z) Solar altitude and the orientation of the collector

ANSWER: Z) SOLAR ALTITUDE AND THE ORIENTATION OF THE COLLECTOR

BONUS

4) ENERGY *Short Answer* A 100-watt incandescent light bulb runs for 2000 hours. A compact fluorescent light (CFL) bulb of the same light output also runs for 2000 hours. Assuming that CFL bulbs use 20% of the energy that incandescent bulbs consume and given the electricity cost is \$0.10 per kilowatt hour, what is the difference in operating cost of the two lights over each bulb's lifespan to the nearest dollar?

ANSWER: \$16.00

TOSS-UP

5) EARTH AND SPACE *Short Answer* How will the rate of movement of wind-driven sea ice with an uneven surface compare to the rate of movement of wind-driven sea ice with an even surface?

ANSWER: SEA ICE WITH AN UNEVEN SURFACE WILL MOVE FASTER

BONUS

5) EARTH AND SPACE *Short Answer* What two natural processes are responsible for most of the variation in carbon dioxide concentration across an annual cycle?

ANSWER: PHOTOSYNTHESIS AND RESPIRATION

TOSS-UP

6) PHYSICAL SCIENCE *Short Answer* What is the momentum in newton seconds of an object with a mass of 25 kilograms moving at a velocity of 25 meters per second?

ANSWER: 625

BONUS

6) PHYSICAL SCIENCE *Multiple Choice* The National Institute of Standards and Technology (NIST) classifies physical constants into various categories. Which of the following is NOT considered a universal physical constant?

- W) Planck constant
- X) Speed of light in a vacuum
- Y) Electric constant
- Z) Alpha particle mass

ANSWER: Z) ALPHA PARTICLE MASS

TOSS-UP

7) LIFE SCIENCE *Multiple Choice* Which of the following membrane-bounded vesicles contains hydrolytic enzymes used for intracellular digestion?

- W) Lysosome [**LY-suh-sohm**]
- X) Peroxisome
- Y) Mitochondria [**my-tuh-KON-dree-uh**]
- Z) Endoplasmic reticulum [**EN-duh-plaz-mik ri-TIK-yuh-luhm**]

ANSWER: W) LYSOSOME

BONUS

7) LIFE SCIENCE *Multiple Choice* Which of the following statements about human intestinal fluid is NOT true?

- W) It is a clear, yellow fluid
- X) Five or six liters of intestinal fluid are produced each day
- Y) It has a slightly basic pH of 7.6
- Z) It is mostly water

ANSWER: X) FIVE OR SIX LITERS OF INTESTINAL FLUID ARE PRODUCED EACH DAY

TOSS-UP

8) GENERAL SCIENCE *Multiple Choice* By mass, which of the following ecosystems represents the largest pool of carbon?

- W) Oceans
- X) Rainforests
- Y) Sea ice
- Z) Temperate forests

ANSWER: W) OCEANS

BONUS

8) GENERAL SCIENCE *Short Answer* When human mRNA is being translated, 3-letter sequences known as codons are used to code for amino acids. How many different codons actually code for an amino acid?

ANSWER: 61

TOSS-UP

9) MATH *Short Answer* What is the equation of the line tangent to the circle $x^2 + y^2 = 9$ at the point with coordinates (3, 0)?

ANSWER: $x = 3$

BONUS

9) MATH *Short Answer* The angle of elevation of the top of a tall building from a point 600 feet from its base is 60° . To the nearest 50 feet, how tall is the building?

ANSWER: 1050

TOSS-UP

10) ENERGY *Multiple Choice* Which of the following increases the entropy of water molecules?

- W) Sublimation
- X) Condensation
- Y) Deposition
- Z) Freezing

ANSWER: W) SUBLIMATION

BONUS

10) ENERGY *Short Answer* What are the three components of an RLC circuit?

ANSWER: RESISTOR, INDUCTOR, CAPACITOR

TOSS-UP

11) EARTH AND SPACE *Multiple Choice* Where does sea ice form first?

- W) Open water, far from coast
- X) Deep water, near coast
- Y) Shallow water, near coast
- Z) Shallow water, far from coast

ANSWER: Y) SHALLOW WATER, NEAR COAST

BONUS

11) EARTH AND SPACE *Multiple Choice* Which of the following is NOT thought to have initiated the Permian-Triassic mass extinction?

- W) Changing climate
- X) Mass volcanism
- Y) Meteor impact
- Z) Disease

ANSWER: Z) DISEASE

TOSS-UP

12) PHYSICAL SCIENCE *Short Answer* A sound wave has a frequency of 8 beats in one second. What is its period in seconds?

ANSWER: 1/8 (ACCEPT: 0.125)

BONUS

12) PHYSICAL SCIENCE *Short Answer* If the velocity of all the particles in a substance doubled, by what factor would you expect the temperature of that substance to be multiplied?

ANSWER: 4

TOSS-UP

13) LIFE SCIENCE *Short Answer* A single-cell organism, *Escherichia coli* [**e-schuh-ri-KEE-uh koh-LY**], contains DNA molecules of about 5×10^6 nucleotides [**NOO-kee-uh-tyds**]. What is the shape of nuclear material in *E. coli*?

ANSWER: CIRCULAR

BONUS

13) LIFE SCIENCE *Multiple Choice* Which of the following statements about Duchenne muscular dystrophy is NOT true?

- W) It is a sex linked, inherited, muscle-destroying disorder
- X) It involves degeneration of individual muscle fibers
- Y) It usually presents with an unequal weakness of voluntary muscles on both sides
- Z) It involves a progressive atrophy of skeletal muscle

ANSWER: Y) IT USUALLY PRESENTS WITH AN UNEQUAL WEAKNESS OF VOLUNTARY MUSCLES ON BOTH SIDES

TOSS-UP

14) GENERAL SCIENCE *Multiple Choice* Which of the following isotopes is most useful in geological dating of zircon minerals and meteorites?

- W) Iodine-131
- X) Uranium-238
- Y) Radium-226
- Z) Carbon-14

ANSWER: X) URANIUM-238

BONUS

14) GENERAL SCIENCE *Multiple Choice* Which of the following statements does NOT accurately characterize the Earth's revolution around the Sun, according to Milankovitch's theory?

- W) The tilt of the Earth's axis fluctuates between 22° and 24.5° from vertical
- X) The Earth follows an elliptical orbit around the Sun
- Y) The Earth wobbles as it spins
- Z) The plane of Earth's orbit is constant

ANSWER: Z) THE PLANE OF EARTH'S ORBIT IS CONSTANT

TOSS-UP

15) MATH *Short Answer* Find the value of k for which the quadratic equation $x^2 - x + k = 0$ has a repeated root.

ANSWER: $k = \frac{1}{4}$

BONUS

15) MATH *Short Answer* A jar contains 50 buttons. Exactly 10% are green, 20% are blue, 30% are yellow, and the rest are orange. What is the probability of randomly picking first a blue button, replacing it, and then picking an orange button?

ANSWER: $\frac{2}{25}$ (ACCEPT: 0.08 OR 8%)

TOSS-UP

16) ENERGY *Multiple Choice* What is the energy efficiency range of a typical photovoltaic solar panel in production?

- W) 0 to 40%
- X) 40 to 70%
- Y) 70 to 90%
- Z) 90 to 100%

ANSWER: W) 0 TO 40%

BONUS

16) ENERGY *Multiple Choice* How does a pumped-storage plant differ from a conventional hydropower plant?

- W) The water is pumped up from underneath the dam through turbines to the top of the dam in order to create electricity
- X) It has two reservoirs instead of one
- Y) Its generators rotate a series of magnets inside coils of wire to create an electric current
- Z) Its transformer converts AC into higher-voltage current

ANSWER: X) IT HAS TWO RESERVOIRS INSTEAD OF ONE

TOSS-UP

17) EARTH AND SPACE *Multiple Choice* Through what energy transfer process is ocean water below surface ice frozen?

- W) Convection
- X) Conduction
- Y) Mechanical
- Z) Radiation

ANSWER: X) CONDUCTION

BONUS

17) EARTH AND SPACE *Multiple Choice* Lakes can develop suboxic or anoxic layers under certain conditions. Which of the following factors can help create anoxic conditions?

- W) Steady winds on the lake surface
- X) Low nutrient concentrations
- Y) Low level of primary production
- Z) Stratification

ANSWER: Z) STRATIFICATION

TOSS-UP

18) PHYSICAL SCIENCE *Multiple Choice* What quantity represents the ratio of charge to potential difference between conductors?

- W) Equipotential
- X) Capacitance
- Y) Charge separation
- Z) Voltage

ANSWER: X) CAPACITANCE

BONUS

18) PHYSICAL SCIENCE *Short Answer* Dr. Eeneics strikes again! He's begun converting all the carbons in the world to silicon, all the nitrogens into phosphorous, and all the oxygens into sulfur! If he succeeds, what chemicals will carbon dioxide, water, and ammonia become?

ANSWER: SILICON DISULFIDE, HYDROGEN SULFIDE, AND PHOSPHINE (ACCEPT FOR PHOSPHINE: PHOSPHORUS TRIHYDRIDE, PHOSPHANE)

TOSS-UP

19) LIFE SCIENCE *Multiple Choice* What is the protein that binds nuclear material in DNA?

- W) Histone
- X) Nucleosome [**NOO-klee-uh-sohm**]
- Y) Chromatin
- Z) Ribonucleotides [**ry-boh-NOO-klee-uh-tyds**]

ANSWER: W) HISTONE

BONUS

19) LIFE SCIENCE *Multiple Choice* *Plasmodium falciparum* [**plaz-MOH-dee-uhm fal-see-PUH-room**] is one of four causative agents of malaria in humans and, like the other three, is which of the following?

- W) A virus
- X) A protozoan parasite
- Y) A fungal parasite
- Z) A bacterial parasite

ANSWER: X) A PROTOZOAN PARASITE

TOSS-UP

20) GENERAL SCIENCE *Multiple Choice* In which of the following habitats would you be most likely to find an animal that has a short but intense reproductive period only once a year?

- W) Tundra
- X) Desert
- Y) Savanna
- Z) Tropical forest

ANSWER: W) TUNDRA

BONUS

20) GENERAL SCIENCE *Multiple Choice* Which of the following is NOT an annelid?

- W) Earthworm
- X) Tapeworm
- Y) Bearded fireworm
- Z) Leech

ANSWER: X) TAPEWORM

TOSS-UP

21) MATH *Multiple Choice* Two raised to what power is equal to $4^x \div 1/8$ [**4 to the power of x divided by one eighth**]?

- W) $2x - 6$
- X) $2x - 3$
- Y) $2x + 3$
- Z) $2x + 6$

ANSWER: Y) $2x + 3$

BONUS

21) MATH *Short Answer* Four students, DeShawn, Betty, Carlos, and Don, are sitting on chairs lined up in a row. What is the probability that a random seating results in Betty sitting on one of the two middle chairs?

ANSWER: $\frac{1}{2}$

TOSS-UP

22) EARTH AND SPACE *Multiple Choice* Which of the following scenarios would yield the slowest freezing of ocean water beneath existing sea ice?

- W) Sea ice with no snow cover
- X) Sea ice with a thin layer of slushy snow cover
- Y) Sea ice with a layer of soft, fluffy, new fallen snow cover
- Z) Sea ice with older, hard, compact snow

ANSWER: Y) SEA ICE WITH A LAYER OF SOFT, FLUFFY, NEW FALLEN SNOW COVER

BONUS

22) EARTH AND SPACE *Multiple Choice* The Burgess Shale in Canada is best known for providing scientists with fossils of which of the following?

- W) Dinosaurs
- X) Early humans
- Y) Multicellular marine organisms
- Z) The first land animals

ANSWER: Y) MULTICELLULAR MARINE ORGANISMS

TOSS-UP

23) PHYSICAL SCIENCE *Multiple Choice* Which of the following is an example of Newton's second law of motion?

- W) When a block is traveling at velocity v , it will continue unless acted upon by a force
- X) Angular momentum cannot be created or destroyed
- Y) When the same force is applied to a block of mass M as is applied to a block of mass $2M$, the block with a greater mass accelerates more slowly
- Z) When a block collides with another block, energy is transferred

ANSWER: Y) WHEN THE SAME FORCE IS APPLIED TO A BLOCK OF MASS M AS IS APPLIED TO A BLOCK OF MASS $2M$, THE BLOCK WITH A GREATER MASS ACCELERATES MORE SLOWLY

BONUS

23) PHYSICAL SCIENCE *Short Answer* While at the beach, you set up a wave machine, which generates waves that are out of phase from the waves hitting the beach. As your waves hit the beach waves, they cancel out, leaving the sea calm. What is the name for this process?

ANSWER: DESTRUCTIVE INTERFERENCE

TOSS-UP

24) LIFE SCIENCE *Short Answer* Name the class of accessory photosynthetic pigments that are reddish orange in color and found in most plants.

ANSWER: CAROTENOIDS

BONUS

24) LIFE SCIENCE *Short Answer* Name all of the following four animals that are marsupials: 1) duckbilled platypus, 2) koala, 3) wallaby, 4) wombat.

ANSWER: 2, 3, 4 (ACCEPT: KOALA, WALLABY, WOMBAT)

TOSS-UP

25) GENERAL SCIENCE *Multiple Choice* Whales of the suborder Mysticeti [*mis-ti-SEE-ti*] use what structure to capture their food?

- W) Baleen
- X) Teeth
- Y) Peduncle
- Z) Fluke

ANSWER: W) BALEEN

BONUS

25) GENERAL SCIENCE *Multiple Choice* Which of the following statements about the speed of sound is NOT true?

- W) Sound travels faster in water than in air
- X) The speed of sound in an ideal gas is independent of frequency
- Y) The speed of sound in an ideal gas is independent of temperature
- Z) Longitudinal and transverse waves from the same frequency can have different speeds

ANSWER: Y) THE SPEED OF SOUND IN AN IDEAL GAS IS INDEPENDENT OF TEMPERATURE