

## ROUND 9A

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### TOSS-UP

1) PHYSICAL SCIENCE *Multiple Choice* How many neutrons does fluorine-19 have?

- W) 8
- X) 9
- Y) 10
- Z) 11

ANSWER: Y) 10

### BONUS

1) PHYSICAL SCIENCE *Multiple Choice* What is the frequency of a wave with a velocity of 10 meters per second and wavelength of 20 meters?

- W) 0.1 Hz
- X) 0.5 Hz
- Y) 5 Hz
- Z) 10 Hz

ANSWER: X) 0.5 Hz

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### TOSS-UP

2) EARTH AND SPACE *Short Answer* What is the term for the dark, broad plains on the surface of the Moon?

ANSWER: MARIA (ACCEPT: MARES)

### BONUS

2) EARTH AND SPACE *Multiple Choice* A long stretch of beach is east facing with a southerly longshore current. The construction of an artificial groin will lead to which of the following?

- W) Increased erosion on both sides of the groin
- X) Loss of beach south of the groin
- Y) Sand bar formation south of the groin
- Z) Change in the direction of the longshore current

ANSWER: X) LOSS OF BEACH SOUTH OF THE GROIN

### TOSS-UP

3) MATH *Multiple Choice* A jar contains only red marbles and green marbles. If a marble is selected at random from the jar, the probability that a red marble will be selected is  $\frac{2}{3}$ . If there are 36 green marbles in the jar, how many red marbles are there in the jar?

- W) 18
- X) 24
- Y) 54
- Z) 72

ANSWER: Z) 72

### BONUS

3) MATH *Short Answer* What is the base-ten equivalent of the base-six number “four five”?

ANSWER: 29

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### TOSS-UP

4) ENERGY *Multiple Choice* Photovoltaic [**foh-toh-vol-TAY-ik**] solar trackers can track which of the following in order to further increase power production?

- W) Azimuth angle [**AZ-uh-muhth**]
- X) Power angle
- Y) Power factor
- Z) Declination angle

ANSWER: W) AZIMUTH ANGLE

### BONUS

4) ENERGY *Short Answer* How much energy is released when converting 1.5 kilograms of iron oxide to iron if the heat of fusion is 272 kilojoules per kilogram?

ANSWER: 0

### TOSS-UP

5) LIFE SCIENCE *Multiple Choice* Bacteria are commonly used to produce which of the following?

- W) Gelatin
- X) Wine
- Y) Pasteurized milk
- Z) Vinegar

ANSWER: Z) VINEGAR

### BONUS

5) LIFE SCIENCE *Multiple Choice* Which of the following terms is used to define benthic organisms that live in the spaces between particles of sediment?

- W) Epifauna
- X) Infauna
- Y) Meiofauna [*my-uh-FAW-nuh*]
- Z) Sessile

ANSWER: Y) MEIOFAUNA

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### TOSS-UP

6) GENERAL SCIENCE *Multiple Choice* Many ducks have oils on their feathers so that their feathers do not get wet. What type of interaction is occurring between the feathers and water?

- W) Hydrophobic
- X) Hygroscopic
- Y) Hydrophilic
- Z) Heliophobic

ANSWER: W) HYDROPHOBIC

### BONUS

6) GENERAL SCIENCE *Multiple Choice* Which cambium [*KAM-bee-uhm*] layer gives rise to secondary phloem [*FLOH-em*] and secondary xylem [*ZY-luhm*]?

- W) Primary
- X) Secondary
- Y) Tertiary
- Z) Pro

ANSWER: X) SECONDARY

### TOSS-UP

7) PHYSICAL SCIENCE *Multiple Choice* Which of the following is a force that will always decrease the efficiency of a mechanical system?

- W) Gravity
- X) Spring force
- Y) Magnetic force
- Z) Friction

ANSWER: Z) FRICTION

### BONUS

7) PHYSICAL SCIENCE *Multiple Choice* The mass of most distant stars is estimated by astronomers by measuring which of the following?

- W) The speed at which a star is rotating on its axis
- X) The distance between Earth and the star
- Y) The gravitation attraction of the star and nearby planetary objects
- Z) The speed of light traveling from that star to Earth

ANSWER: Y) THE GRAVITATION ATTRACTION OF THE STAR AND NEARBY PLANETARY OBJECTS

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### TOSS-UP

8) ENERGY *Short Answer* What element is being produced in abundance by the nuclear reaction in the Sun?

ANSWER: HELIUM

### BONUS

8) ENERGY *Multiple Choice* What mineral is used in its molten state as a necessary part of the Hall-Heroult process?

- W) Cryolite [**KRY-uh-lyt**]
- X) Kaolin
- Y) Bentonite
- Z) Malachite [**MAL-uh-kyt**]

ANSWER: W) CRYOLITE

### TOSS-UP

9) EARTH AND SPACE *Multiple Choice* What is the period of semi-diurnal tides?

- W) 11 hours and 22 minutes
- X) 12 hours
- Y) 12 hours and 25 minutes
- Z) 13 hours and 5 minutes

ANSWER: Y) 12 HOURS AND 25 MINUTES

### BONUS

9) EARTH AND SPACE *Multiple Choice* What ocean floor feature is found along the South Pacific Ocean that is not found along the South Atlantic Ocean?

- W) Abyssal plain [*uh-BIS-uhl*]
- X) Mid-ocean ridge
- Y) Deep-ocean trench
- Z) Continental shelf

ANSWER: Y) DEEP-OCEAN TRENCH

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### TOSS-UP

10) MATH *Multiple Choice* For two particular numbers  $x$  and  $y$ , the values of  $x - y$  and  $2x - y$  are consecutive odd integers in increasing order. What is the value of  $x$ ?

- W) -1
- X) 0
- Y) 1
- Z) 2

ANSWER: Z) 2

### BONUS

10) MATH *Short Answer* Simplify the expression:  $\frac{3}{5 - \sqrt{10}}$  [**3 divided by the quantity 5 minus the square root of 10**].

ANSWER:  $1 + \sqrt{10}/5$  (ACCEPT:  $(5 + \sqrt{10})/5$ )

### TOSS-UP

11) LIFE SCIENCE *Short Answer* Within the chloroplast, where do the light-dependent reactions and light-independent reactions occur, respectively?

ANSWER: THYLAKOID MEMBRANES (ACCEPT: THYLAKOID), STROMA

### BONUS

11) LIFE SCIENCE *Multiple Choice* A photosynthetic cell might have more of what organelle than a non-photosynthetic cell?

- W) Peroxisomes [*puh-ROK-suh-sohms*]
- X) Mitochondria [*my-tuh-KON-dree-uh*]
- Y) Free ribosomes [*RY-buh-sohms*]
- Z) Cytosol [*SY-tuh-sol*]

ANSWER: W) PEROXISOMES

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### TOSS-UP

12) GENERAL SCIENCE *Short Answer* Ribosomes [*RY-buh-sohms*] are cellular structures critical for protein synthesis. In what specific structure in the nucleus are ribosomes produced?

ANSWER: NUCLEOLUS

### BONUS

12) GENERAL SCIENCE *Multiple Choice* El Niño Southern Oscillation can cause all EXCEPT which of the following?

- W) Increased productivity in South American fisheries
- X) Increased rainfall in the Western Pacific
- Y) Weakened equatorial trade winds
- Z) A deeper thermocline in the south-eastern Pacific

ANSWER: W) INCREASED PRODUCTIVITY IN SOUTH AMERICAN FISHERIES

### TOSS-UP

13) PHYSICAL SCIENCE *Multiple Choice* Why does the pressure exerted by a gas against a sealed container increase as the temperature increases?

- W) The gas molecules move faster and strike the container wall more frequently
- X) The gas molecules gain more entropy and hence produce more pressure
- Y) The gas molecules generate more collision energy
- Z) The increased kinetic energy increases the rate of chemical reactions between gas particles

ANSWER: W) THE GAS MOLECULES MOVE FASTER AND STRIKE THE CONTAINER WALL MORE FREQUENTLY

### BONUS

13) PHYSICAL SCIENCE *Multiple Choice* During winter in the northern hemisphere, what is the northernmost latitude at which the Sun is visible above the horizon?

- W) Tropic of Cancer
- X) Tropic of Capricorn
- Y) Arctic Circle
- Z) Antarctic Circle

ANSWER: Y) ARCTIC CIRCLE

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### TOSS-UP

14) EARTH AND SPACE *Short Answer* What kind of telescope lens will focus two colors of light at the same distance?

ANSWER: ACHROMATIC (ACCEPT: ACHROMAT)

### BONUS

14) EARTH AND SPACE *Multiple Choice* Which of the following margins is considered active?

- W) Eastern North American
- X) Western African
- Y) Eastern Indian
- Z) Northeastern Eurasian

ANSWER: Z) NORTHEASTERN EURASIAN

### TOSS-UP

15) MATH *Short Answer* Casey poured sand into a box measuring 4 inches by 16 inches by 8 inches until it was completely full. She then dumped all the sand into a plastic cube and discovered that the cube held the exact same amount of sand. In inches, how long was the edge of the cube?

ANSWER: 8

### BONUS

15) MATH *Multiple Choice* Provided  $x$  is a value for which it is defined, simplify the expression  $(x\sqrt{8} - \sqrt{32}) / (x^2 - 4)$  **[the fraction with numerator  $x$  times the square root of 8 minus the square root of 32, and denominator  $x$  squared minus 4]**

W)  $(x+2)/(x\sqrt{2})$  **[the fraction with numerator  $x$  plus 2 and denominator  $x$  times the square root of 2]**

X)  $(2\sqrt{2})/(x+2)$  **[the fraction with numerator 2 times the square root of 2 and denominator  $x$  plus 2]**

Y)  $(2-x)/(2\sqrt{2})$  **[the fraction with numerator 2 minus  $x$  and denominator 2 times the square root of 2]**

Z)  $(x-2)/(2\sqrt{2})$  **[the fraction with numerator  $x$  minus 2 and denominator 2 times the square root of 2]**

ANSWER: X)  $(2\sqrt{2})/(x+2)$

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### TOSS-UP

16) LIFE SCIENCE *Multiple Choice* A sea dragon mimics what to stay camouflaged?

- W) Rock
- X) Coral
- Y) Seaweed
- Z) Kelp

ANSWER: Y) SEAWEED

### BONUS

16) LIFE SCIENCE *Short Answer* What is the term for the process of breaking up a molecule with water?

ANSWER: HYDROLYSIS

### TOSS-UP

17) GENERAL SCIENCE *Multiple Choice* Which of the following lists the primary gases found in the Earth's atmosphere from the most to the least common?

- W) Argon, nitrogen, oxygen, carbon dioxide
- X) Oxygen, carbon dioxide, nitrogen, argon
- Y) Nitrogen, oxygen, carbon dioxide, argon
- Z) Nitrogen, oxygen, argon, carbon dioxide

ANSWER: Z) NITROGEN, OXYGEN, ARGON, CARBON DIOXIDE

### BONUS

17) GENERAL SCIENCE *Short Answer* Rank the following mountain chains from shortest to longest: Andes, Himalayas, Trans-Arctic, Urals.

ANSWER: URALS, TRANS-ARCTIC, HIMALAYAS, ANDES

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### TOSS-UP

18) PHYSICAL SCIENCE *Short Answer* Air drag opposes any motion of an object through air and is proportional to the velocity of the object. In free fall, what is the common name for the speed at which the drag force equates the gravitational force acting on a given object?

ANSWER: TERMINAL VELOCITY

### BONUS

18) PHYSICAL SCIENCE *Multiple Choice* A modern camera allows light to hit its sensor through a circular opening called an aperture. Assuming the amount of light per area is uniform; by what factor must the radius of the aperture be multiplied to double the amount of light hitting the sensor?

- W)  $1/2$
- X)  $\sqrt{2}$
- Y) 2
- Z) 4

ANSWER: X)  $\sqrt{2}$

### TOSS-UP

19) ENERGY *Multiple Choice* What is the theoretical maximum voltage that can be produced from a hydrogen fuel cell?

- W) 0.41 volts per cell
- X) 0.75 volts per cell
- Y) 1.23 volts per cell
- Z) 2.54 volts per cell

ANSWER: Y) 1.23 VOLTS PER CELL

### BONUS

19) ENERGY *Short Answer* What is the total resistance of a circuit with the following resistors in series: 6 ohm, 0.5 ohm, 1.5 ohm, all in parallel with a 3 ohm resistor?

ANSWER: 24/11 OHMS

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### TOSS-UP

20) EARTH AND SPACE *Short Answer* What constellation occupies the largest area in the sky?

ANSWER: HYDRA (DO NOT ACCEPT: HYDRUS)

### BONUS

20) EARTH AND SPACE *Multiple Choice* The lack of foraminiferal [*fuh-ram-uh-NIF-er-uhl*] and other carbonate oozes at depths greater than 4 kilometers is explained by which of the following?

- W) Foraminifera or other shelled organisms cannot exist at this depth due to pressure
- X) Deep sea decomposers break down carbonate shells
- Y) Carbonate shells dissolve at depths below the carbonate compensation depth
- Z) Hydrothermal vent activity at depths exceeding 4 km create highly acidic deep ocean environments, limiting the ability for organisms to live

ANSWER: Y) CARBONATE SHELLS DISSOLVE AT DEPTHS BELOW THE CARBONATE COMPENSATION DEPTH

### TOSS-UP

21) MATH *Multiple Choice* For real values of  $n$  and  $k$ , which of the following expressions is equal to:  $5^n * 5^k$  **[5 raised to the power of  $n$  times 5 raised to the power of  $k$ ]**?

- W)  $5^{n+k}$  **[5 raised to the power of the quantity  $n$  plus  $k$ ]**
- X)  $5^{nk}$  **[5 raised to the power of the quantity  $n$  times  $k$ ]**
- Y)  $5^{n-k}$  **[5 raised to the power of the quantity  $n$  minus  $k$ ]**
- Z)  $5^{n/k}$  **[5 raised to the power of the quantity  $n$  over  $k$ ]**

ANSWER: W)  $5^{n+k}$

### BONUS

21) MATH *Short Answer* What is the tangent of angle  $A$  if the cosine of angle  $A$  measures  $3/5$  and the sine of angle  $A$  measures  $4/5$ ?

ANSWER:  $4/3$  (ACCEPT:  $1 \frac{1}{3}$ )

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### TOSS-UP

22) LIFE SCIENCE *Short Answer* What are the four traditional kingdoms of the domain Eukarya?

ANSWER: PROTISTA, PLANTAE, ANIMALIA, AND FUNGI

### BONUS

22) LIFE SCIENCE *Multiple Choice* What is the purpose of the Eustachian tube **[yoo-STAY-shuhn]**?

- W) It improves outer ear transmission of sound
- X) It improves vibration of the malleus
- Y) It assists in decreasing hearing
- Z) It clears mucous from the middle ear into the throat

ANSWER: Z) IT CLEARS MUCOUS FROM THE MIDDLE EAR INTO THE THROAT

### TOSS-UP

23) GENERAL SCIENCE *Multiple Choice* Which of the following models primary succession of a region?

- W) Soil, trees, grasses
- X) Grasses, trees, shrubs, flowering plants
- Y) Bare rock, pioneer community, climax community
- Z) Regolith [**REG-uh-lith**], colonial community, domestic community

ANSWER: Y) BARE ROCK, PIONEER COMMUNITY, CLIMAX COMMUNITY

### BONUS

23) GENERAL SCIENCE *Multiple Choice* What is the difference between basic and applied science?

- W) Basic science is less difficult than applied science
- X) Basic science describes fundamental phenomena while applied science seeks to address practical problems
- Y) Basic science seeks to address practical problems while applied science seeks to describe fundamental phenomena
- Z) Basic science is essential to understanding the world whereas applied science does not have practical implications

ANSWER: X) BASIC SCIENCE DESCRIBES FUNDAMENTAL PHENOMENA WHILE APPLIED SCIENCE SEEKS TO ADDRESS PRACTICAL PROBLEMS