

## ROUND 11

### TOSS-UP

1) PHYSICS *Multiple Choice* Which of the following musical instruments can produce a pure tone:

- W) violin
- X) clarinet
- Y) piano
- Z) electronic synthesizer

ANSWER: Z) ELECTRONIC SYNTHESIZER

### BONUS

1) PHYSICS *Short Answer* What is the centripetal force required for a 6 kilogram body traveling at 2 m/s in a perfect circle with a radius of 4 meters?

ANSWER: 6 NEWTONS

(Solution:  $CF = m v^2 / r = 6 \times 2^2 / 4 = 6$ )

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### TOSS-UP

2) BIOLOGY *Multiple Choice* The initial step in the preparation of recombinant DNA is to cut both DNA strands using enzymes known as:

- W) snurps
- X) restriction ligases
- Y) restriction endonucleases
- Z) restriction vectors

ANSWER: Y) RESTRICTION ENDONUCLEASES

### BONUS

2) BIOLOGY *Short Answer* Assuming brown eyes is dominant over blue eyes and there is no polygenesis, if a mother is blue eyed and her husband is brown eyed heterozygous, what are the chances that any of the children will be blue eyed?

ANSWER: 50%

### TOSS-UP

3) CHEMISTRY *Multiple Choice* Which of the following does NOT describe alkanes:

- W) alkanes with a carbon-carbon double bond are called straight-chain alkanes
- X) all alkanes are saturated hydrocarbons
- Y) the molecular formula  $C_2H_6$  is one example of an alkane
- Z) crude oil contains a wide variety of alkanes

ANSWER: W) ALKANES WITH A CARBON-CARBON DOUBLE BOND ARE CALLED STRAIGHT-CHAIN ALKANES

(Solution: W is an example of an alkene)

### BONUS

3) CHEMISTRY *Short Answer* How many molecules of diatomic hydrogen would have to be added to a molecule of benzene to produce cyclohexane?

ANSWER: 3

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### TOSS-UP

4) ASTRONOMY *Multiple Choice* The atmosphere of the Saturn's moon Titan is mostly composed of what gas:

- W) carbon dioxide
- X) methane
- Y) hydrogen
- Z) nitrogen

ANSWER: Z) NITROGEN

### BONUS

4) ASTRONOMY *Short Answer* Which two planets have no known satellites:

ANSWER: MERCURY AND VENUS

### TOSS-UP

5) MATH *Multiple Choice* Matrix C is the product of Matrix A times Matrix B. Which of the following must be TRUE:

- W) the number of rows of A = the number of rows of B
- X) the number of columns of A = the number of columns of B
- Y) the number of rows of A = the number of columns of B
- Z) the number of columns of A = the number of rows of B

ANSWER: Z) THE NUMBER OF COLUMNS OF A = THE NUMBER OF ROWS OF B

### BONUS

5) MATH *Short Answer* A rectangular family room is twice as long as it is wide and its perimeter is 84 feet. What are the dimensions of the room?

ANSWER: W = 14 and L = 28

(Solution:  $2W + 2L = \text{perimeter}$ ,  $2W + 2(2W) = 84$ ,  $6W = 84$ )

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### TOSS-UP

6) EARTH SCIENCE *Multiple Choice* Which of the following is NOT an example of a pluton:

- W) cobble
- X) laccolith
- Y) volcanic pipe
- Z) dike

ANSWER: W) COBBLE

### BONUS

6) EARTH SCIENCE *Multiple Choice* The Earth's mantle is approximately how many miles thick:

- W) 1000
- X) 1200
- Y) 1500
- Z) 1800

ANSWER: Z) 1800

**TOSS-UP**

7) GENERAL SCIENCE *Multiple Choice* A major function of a refractory is:

- W) as a source of flux material for slag formation
- X) the conduction of heat
- Y) as a source of essential reactants for smelting
- Z) for heat insulation

ANSWER: Z) FOR HEAT INSULATION

**BONUS**

7) GENERAL SCIENCE *Short Answer* How many square inches are in 9 square feet?

ANSWER: 1296

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**TOSS-UP**

8) GENERAL SCIENCE *Multiple Choice* What kind of program was developed to allow the user to store, modify, organize and display data in a meaningful form:

- W) firmware
- X) database
- Y) graphics
- Z) word processing

ANSWER: X) DATABASE

**BONUS**

8) GENERAL SCIENCE *Multiple Choice* How much data can be transmitted at once in typical parallel communications:

- W) 1 bit
- X) 4 bits
- Y) 1 byte
- Z) 1 kilobyte

ANSWER: Y) 1 BYTE

### TOSS-UP

9) PHYSICS *Multiple Choice* Which of the following physical attributes makes aluminum unsuitable for jets traveling at speeds greater than Mach 2:

- W) its weight
- X) its level of resistance to corrosion
- Y) its strength at different temperatures
- Z) its cost

ANSWER: Y) ITS STRENGTH AT DIFFERENT TEMPERATURES

### BONUS

9) PHYSICS *Short Answer* What scientist was the first to theorize that space and time were only generalizations created from observations, and that the properties of space did not exist independently?

ANSWER: ERNST MACH

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### TOSS-UP

10) BIOLOGY *Multiple Choice* Bacteria that cannot grow in the presence of oxygen are:

- W) aerobes
- X) obligate anaerobes
- Y) facultative anaerobes
- Z) obligate aerobes

ANSWER: X) OBLIGATE ANEROBES

### BONUS

10) BIOLOGY *Short Answer* The acromion (pronounced: AH-crome-ee-on) process is part of what human bone?

ANSWER: SCAPULA

### TOSS-UP

11) CHEMISTRY *Multiple Choice* Which of the following hydrocarbons is an example of an alkyne (pronounced: AL-kine):

- W) ethane
- X) ethylene
- Y) acetylene
- Z) benzene

ANSWER: Y) ACETYLENE

### BONUS

11) CHEMISTRY *Short Answer* What is the allotropic form of phosphorous that is a white waxy solid that reacts violently with air?

ANSWER: WHITE PHOSPHOROUS

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### TOSS-UP

12) ASTRONOMY *Multiple Choice* At the North and South poles, which of the following correctly describes apparent motion of the stars:

- W) they move in circles parallel with the horizon
- X) they rise and set vertically
- Y) they remain stationary
- Z) they rise and set at an angle to the horizon

ANSWER: W) THEY MOVE IN CIRCLES PARALLEL WITH THE HORIZON

### BONUS

12) ASTRONOMY *Short Answer* What is the region around the Earth occupied by the Earth's magnetic field:

ANSWER: MAGNETOSPHERE

### TOSS-UP

13) MATH *Short Answer* Convert  $-720^\circ$  into radians:

ANSWER:  $-4\pi$  rad (pronounced: minus 4 PIE radians)

(Solutions:  $-720^\circ \times \pi/180^\circ$ )

### BONUS

13) MATH *Short Answer* Find the x and y intercepts of the parabola  $y = 2x^2$  and its inverse:

ANSWER: (0, 0)

(Solution: the "inverse" of a curve is the curve reflected in the line  $y = x$ ;  $x = 2y^2$ . This has the same x and y intercept as the original)

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### TOSS-UP

14) EARTH SCIENCE *Multiple choice* The first sedimentary rocks were laid down some 3.7 billion years ago in what era:

- W) Precambrian
- X) Cambrian
- Y) Paleozoic
- Z) Phenerozoic

ANSWER: W) PRECAMBRIAN

### BONUS

14) EARTH SCIENCE *Multiple Choice* The supercontinent Pangea started to break apart into our present day continents approximately how many million years ago:

- W) 100
- X) 200
- Y) 300
- Z) 400

ANSWER: X) 200

### TOSS-UP

15) GENERAL SCIENCE *Multiple Choice* Bells are typically cast in which of the following:

- W) in a bronze alloy of about 75% copper and 25% zinc
- X) in a brass alloy of about 75% copper and 25% tin
- Y) in a bronze alloy of about 75% copper and 25% tin
- Z) in a brass alloy of about 75% copper and 25% zinc

ANSWER: Y) IN A BRONZE ALLOY OF ABOUT 75% COPPER AND 25% TIN

### BONUS

15) GENERAL SCIENCE *Short Answer* Uranium-238, uranium-235, and thorium-232 all undergo decay to form isotopes of this one element of the carbon group:

ANSWER: LEAD

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### TOSS-UP

16) GENERAL SCIENCE *Short Answer* The term SQL, which is sometimes pronounced "sequel", stands for what language?

ANSWER: STRUCTURED QUERY LANGUAGE.

### BONUS

16) GENERAL SCIENCE *Multiple Choice* Which of the following shows a superclass - subclass relation:

- W) holiday - Labor Day
- X) Labor day - holiday
- Y) car - wheel
- Z) wheel - car

ANSWER: W) HOLIDAY - LABOR DAY

**TOSS-UP**

17) PHYSICS *Multiple Choice* When marchers break step while crossing a bridge, they do so to avoid a possible bridge collapse, which is based mostly on this physical concept:

- W) isostacy
- X) inertia
- Y) resonance
- Z) chaos

ANSWER: Y) RESONANCE

**BONUS**

17) PHYSICS *Short Answer* The electromagnetic force is carried by this familiar boson:

ANSWER: PHOTON

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**TOSS-UP**

18) BIOLOGY *Multiple Choice* In plants, stomata are made up of which of the following:

- W) guard cells and collenchyma (pronounced: ko-LEN-key-ma) cells
- X) collenchyma cells and parenchyma cells
- Y) parenchyma cells and stomatal pores
- Z) guard cells and stomatal pores

ANSWER: Z) GUARD CELLS AND STOMATAL PORES

**BONUS**

18) BIOLOGY *Multiple Choice* Which of the following is NOT true:

- W) sperm and egg contribute equal amounts of genetic information to the zygote
- X) in the first meiotic division a polar body is formed
- Y) in deuterostomes, the blastopore forms the anus
- Z) most angiosperms and vertebrates are diploid

ANSWER: W) SPERM AND EGG CONTRIBUTE EQUAL AMOUNTS OF GENETIC INFORMATION TO THE ZYGOTE

(Solution: the mitochondrial genome is totally derived from the egg)

### TOSS-UP

19) CHEMISTRY *Multiple Choice* In the compound *n*-pentane, the *n* stands for:

- W) normal
- X) nano
- Y) nitro
- Z) non-isomer

ANSWER: W) NORMAL

(Solution: n is the straight chain isomer)

### BONUS

19) CHEMISTRY *Short Answer* Calculate the number of calories needed to raise the temperature of 20 grams of water from 20°C to 30°C:

ANSWER: 200 CALORIES

(Solution:  $20 \text{ g} \times (30^\circ\text{C} - 20^\circ\text{C}) \times 1.00 \text{ cal/g } ^\circ\text{C}$ )

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### TOSS-UP

20) ASTRONOMY *Short Answer* When high speed electrons or protons from the solar wind collide with gases in the Earth's upper atmosphere causing them to fluoresce, this results in what phenomena?

ANSWER: AURORA (ACCEPT: NORTHERN OR SOUTHERN LIGHTS; AURORA AUSTRALIS; OR AURORA BOREALIS)

### BONUS

20) ASTRONOMY *Short Answer* What is the astronomical term for the region of ionized hydrogen in interstellar space?

ANSWER: H II REGION

### TOSS-UP

21) EARTH SCIENCE *Multiple Choice* Which of the following is NOT a metamorphic rock:

- W) schist
- X) gneiss (pronounced: nice)
- Y) slate
- Z) shale

ANSWER: Z) SHALE

### BONUS

21) EARTH SCIENCE *Short Answer* The theory that suggests that earthquakes result from the release of stored elastic energy by slippage on faults is called:

ANSWER: ELASTIC REBOUND THEORY

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### TOSS-UP

22) GENERAL SCIENCE *Short Answer* A satellite that orbits the equatorial plane of the Earth at a speed matching the Earth's orbit is said to be in what kind of orbit?

ANSWER: GEOSYNCHRONOUS

### BONUS

22) GENERAL SCIENCE *Multiple Choice* After thorough cleaning and repeated applications of ammonium polysulfide followed by drying, the steel is then rubbed briskly with a cloth and sealed with linseed oil. This process describes which of the following:

- W) bluing of steel
- X) preparation of steel for cheap jewelry
- Y) long term storage preparation of high grade steel
- Z) preparation of steel for use in nuclear reactors

ANSWER: W) BLUING OF STEEL

### TOSS-UP

23) PHYSICS *Multiple Choice* Which of the following enables the aviation designer to extrapolate from the model to the prototype:

- W) Goddard equivalence
- X) Reynold's number
- Y) Mach's equivalence
- Z) Bernoulli's number

ANSWER: X) REYNOLD'S NUMBER

### BONUS

23) PHYSICS *Short Answer* Three capacitors, each rated at 1 microfarad, are connected in series. What is the total capacitance, in microfarads, rounded to the second decimal place?

ANSWER: 0.33 MICROFARADS

(Solution:  $C_t = 1/\#$  of capacitors;  $1/3 = 0.33$ )

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### TOSS-UP

24) BIOLOGY *Multiple Choice* Which of the following is TRUE about inactivated X chromosomes in humans:

- W) they are the cause of Turner's syndrome
- X) they are lethal
- Y) they are an expression of naked DNA
- Z) they result in the human female being a genetic mosaic

ANSWER: Z) THEY RESULT IN THE HUMAN FEMALE BEING A GENETIC MOSAIC

### BONUS

24) BIOLOGY *Multiple Choice* Tight junctions, adherens junctions, and desmosomes are:

- W) forms of intercellular attachment
- X) forms of communication between cells
- Y) all variations of gap junctions
- Z) methods of active transport

ANSWER: W) FORMS OF INTERCELLULAR ATTACHMENT

### TOSS-UP

25) CHEMISTRY *Multiple Choice* The characteristic bad odor emitted in skunk spray is caused by which of the following:

- W) thiols (pronounced: THIGH-ols)
- X) aldehydes
- Y) phenols
- Z) alkenes

ANSWER: W) THIOLS

### BONUS

25) CHEMISTRY *Short Answer* A gas tank has a mixture of oxygen gas at 0.5 atmospheres, nitrogen gas at 380 millimeters mercury, and helium at 760 torr. Calculate, in atmospheres and to the nearest whole number, the total pressure in the tank:

ANSWER: 2 ATMOSPHERES

(Solution:  $380 \text{ mm Hg} / 760 \text{ mm Hg} = 0.5 \text{ atm}$ ;  $760 \text{ torr} = 1 \text{ atm}$ ;  $0.5 + 0.5 + 1 = 2$ )