

ROUND 17A

TOSS-UP

1) Energy – *Multiple Choice* Which of the following is a neutron moderator?

- W) Sulfur
- X) Plutonium
- Y) Uranium
- Z) Water

ANSWER: Z) WATER

BONUS

1) Energy – *Short Answer* What is the term for the simultaneous production of electricity and heat, used by many industries to reduce their energy costs?

ANSWER: COMBINED HEAT AND POWER (ACCEPT: CHP OR COGENERATION)

TOSS-UP

2) Math – *Short Answer* A group of 16 people took a trivia test. Barney's score of 58 ranked him 9th on the list, right after Betty. If the median of all scores was 62.5, what was Betty's score?

ANSWER: 67

BONUS

2) Math – *Multiple Choice* Which of the following is a factor of the polynomial $2x^3 + 9x^2 + x - 12$?

- W) $x + 1$
- X) $x + 2$
- Y) $x + 3$
- Z) $x + 4$

ANSWER: Z) $x + 4$

TOSS-UP

3) Earth and Space – *Multiple Choice* Which of the four major oceans is the shallowest, on average?

- W) Arctic
- X) Atlantic
- Y) Indian
- Z) Pacific

ANSWER: W) ARCTIC

BONUS

3) Earth and Space – *Short Answer* What non-luminous interstellar clouds are composed of neutral atomic hydrogen?

ANSWER: H-ONE REGIONS (ACCEPT: HYDROGEN CLOUD, H I REGION)

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### **TOSS-UP**

4) General Science – *Multiple Choice* Which of the following should be done with a wire inoculation loop before transferring bacteria cultures?

- W) Heat it but stop before it gets red hot so as to not kill the culture
- X) Heat it until it becomes red hot to ensure sterilization
- Y) Immediately place it in liquid culture while still hot to maximize transfer success
- Z) Only use loops with inoculating films when transferring bacteria cultures to prevent contamination

ANSWER: X) HEAT IT UNTIL IT BECOMES RED HOT TO ENSURE STERILIZATION

### **BONUS**

4) General Science – *Short Answer* What laboratory equipment is used to prevent contamination of cell culture lines while they are being handled?

ANSWER: LAMINAR FLOW HOOD (DO NOT ACCEPT: FUME HOOD)

### **TOSS-UP**

5) Physical Science – *Multiple Choice* 400 joules of energy are required to boil 2 kilograms of nitrogen liquid at its boiling point. What is the heat of vaporization of nitrogen in joules per kilogram?

- W) 50
- X) 100
- Y) 200
- Z) 400

ANSWER: Y) 200

### **BONUS**

5) Physical Science – *Short Answer* What is the term for the energy required to transform a substance from liquid to gas at a given pressure?

ANSWER: HEAT OF VAPORIZATION

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TOSS-UP

6) Life Science – *Multiple Choice* If a population initially exhibits logistic growth, which of the following bests describes the net population growth rate after the population reaches the carrying capacity?

- W) Increasing
- X) Zero
- Y) Decreasing
- Z) Indeterminate

ANSWER: X) ZERO

BONUS

6) Life Science – *Short Answer* Anoles and other species in its class are often referred to as "cold-blooded." However, their blood is not actually cold. What is a more appropriate term to describe how their temperature is regulated?

ANSWER: ECTOTHERMIC (ACCEPT: ECTOTHERM, ECTOTHERMIC POIKIOTHERM)

TOSS-UP

7) Physical Science – *Multiple Choice* During beta decay, carbon-14 decays into nitrogen-14 along with an electron and what other particle?

- W) Neutrino
- X) Antineutrino
- Y) Positron
- Z) Proton

ANSWER: X) ANTINEUTRINO

BONUS

7) Physical Science – *Short Answer* What is the name of the phenomenon by which certain solids will emit light when they break?

ANSWER: TRIBOLUMINESCENCE

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### **TOSS-UP**

8) Math – *Short Answer* In triangle A-B-C, angle C measures 22 degrees and angle A measures 130 degrees. What is the degree measure of one of the exterior angles formed at vertex B?

ANSWER: 152

### **BONUS**

8) Math – *Short Answer* Express 2 to the 18<sup>th</sup> power in scientific notation with one significant digit.

ANSWER: 3 times 10<sup>5</sup>

### **TOSS-UP**

9) General Science – *Multiple Choice* Which of the following is always true of scientific theories?

- W) They are open to revision
- X) They are always true
- Y) They are true only in specific cases
- Z) They are unchallenged

ANSWER: W) THEY ARE OPEN TO REVISION

### **BONUS**

9) General Science – *Short Answer* Place the following four discoveries in microbiology in chronological order from earliest to most recent: 1) The first known zoonotic disease, babesiosis; 2) The process of phagocytosis in cells; 3) The process of transduction, the transfer of genetic information by viruses; 4) The double helix structure of DNA.

ANSWER: 2, 1, 3, 4

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TOSS-UP

10) Energy – *Multiple Choice* Which of the following is NOT part of clean coal technology?

- W) Coal washing
- X) Wet scrubbers
- Y) Electrostatic precipitators
- Z) Nitrogen capture

ANSWER: Z) NITROGEN CAPTURE

BONUS

10) Energy – *Short Answer* What structure is formed in marine sediments when methane is under high pressure and cold temperatures?

ANSWER: HYDRATE (ACCEPT: METHANE HYDRATE, CLATHRATE)

TOSS-UP

11) Life Science – *Multiple Choice* Introducing rabbits in Australia that eat the same food and use the same space for burrows as native marsupials is what type of species interaction?

- W) Aggression
- X) Mutualism
- Y) Competition
- Z) Predation

ANSWER: Y) COMPETITION

BONUS

11) Life Science – *Multiple Choice* Which of the following correctly describes the use of crystal violet in a biology lab?

- W) Used to determine the absorption profile of a material
- X) A staining agent to visualize bacteria
- Y) A standard cell used to compare the color of protein crystals
- Z) An electrode to use in protein chemistry experiments

ANSWER: X) A STAINING AGENT TO VISUALIZE BACTERIA

TOSS-UP

12) Earth and Space – *Multiple Choice* Which of the following is NOT a mineral commonly associated with mafic igneous rocks?

- W) Orthoclase
- X) Olivine
- Y) Biotite
- Z) Clinopyroxene

ANSWER: W) ORTHOCLASE

BONUS

12) Earth and Space – *Short Answer* Identify all of the following three facts about the moon that are true: 1) The moon formed around 4.5 billion years ago; 2) The moon likely formed after a Mars-sized body collided with the early Earth; 3) The distance between the Earth and the moon increases by approximately 4 centimeters each year.

ANSWER: 1, 2, 3 (ACCEPT: ALL OF THEM)

TOSS-UP

13) Life Science – *Multiple Choice* Which of the following errors in human meiosis would LEAST likely affect the resulting offspring?

- W) Nondisjunction
- X) Trisomy
- Y) Gene duplication in a transcriptionally-silent region of the chromosome
- Z) Gene duplication in a transcriptionally-active region of the chromosome

ANSWER: Y) GENE DUPLICATION IN A TRANSCRIPTIONALLY-SILENT REGION OF THE CHROMOSOME

BONUS

13) Life Science – *Multiple Choice* Which of the following best describes a thallus?

- W) A cellular connective structure found only in mammals
- X) A plant-like body consisting of undifferentiated tissue
- Y) A process that bacteria undergo when infecting a host
- Z) A small rodent found only in Australia

ANSWER: X) A PLANT-LIKE BODY CONSISTING OF UNDIFFERENTIATED TISSUE

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### **TOSS-UP**

14) Math – *Short Answer* The line with equation  $y = -2x + 5$  contains points in each quadrant except which one?

ANSWER: 3 (ACCEPT: THIRD)

### **BONUS**

14) Math – *Short Answer* A right circular cone has volume 36. A second cone has 3 times the radius and one-fourth the height of the first. What is the volume of the second cone?

ANSWER: 81

### **TOSS-UP**

15) Physical Science – *Short Answer* A radioactive sample emits alpha, beta, and gamma radiation. The sample is placed so the radiation must pass through electrically-charged plates. Which type or types of radiation will be affected by the charged plates?

ANSWER: ALPHA AND BETA

### **BONUS**

15) Physical Science – *Short Answer* What is the specific name of the law that states that a line segment connecting a planet and the Sun will sweep out equal areas during equal intervals of time?

ANSWER: KEPLER'S SECOND LAW (DO NOT ACCEPT: KEPLER'S LAW)

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TOSS-UP

16) General Science – *Multiple Choice* Which of the following is NOT a best practice for treating third-degree burns?

- W) Elevate the burned area
- X) Treat the patient for shock
- Y) Cover the burn with a clean cloth
- Z) Remove any clothing from the burned area

ANSWER: Z) REMOVE ANY CLOTHING FROM THE BURNED AREA

BONUS

16) General Science – *Short Answer* In an acid-base titration experiment, identify all of the following three items that can be used to determine the endpoint of the reaction: 1) Indicator solution; 2) pH meter; 3) Conductivity meter.

ANSWER: ALL OF THEM

TOSS-UP

17) Earth and Space – *Multiple Choice* To maintain beaches that are rapidly losing sand to erosional processes, barriers are built at right angles to the beach to trap sand that is moving parallel to shore. What are these barriers called?

- W) Groins
- X) Breakwaters
- Y) Seawalls
- Z) Piers

ANSWER: W) GROINS

BONUS

17) Earth and Space – *Short Answer* Identify all of the following three statements that are true of tornadoes: 1) All tornadoes in the United States rotate clockwise; 2) All tornadoes in Australia rotate clockwise; 3) Some tornadoes have multiple vortices.

ANSWER: 3 ONLY

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### **TOSS-UP**

18) Physical Science – *Multiple Choice* Water flowing through a pipe of radius 10 is routed through a pipe of reduced radius 5. By what factor is the speed of the water multiplied?

- W) 1
- X) 2
- Y) 4
- Z) 8

ANSWER: Y) 4

### **BONUS**

18) Physical Science – *Short Answer* Name the process in which strong magnetic fields are used to align nuclear spins along a single axis and then short radio bursts are used to briefly knock the spins out of alignment.

ANSWER: MAGNETIC RESONANCE (ACCEPT: NUCLEAR MAGNETIC RESONANCE, NMR)

### **TOSS-UP**

19) Math – *Short Answer* Expressing your answer to the nearest 100, find the following sum: 476 + 748 + 657.

ANSWER: 1900

### **BONUS**

19) Math – *Short Answer* For a right triangle with legs of length 5 and 6, the length of the altitude to the hypotenuse can be expressed as a fraction times a simplified radical. What is the fraction?

ANSWER: 30/61

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TOSS-UP

20) Life Science – *Multiple Choice* Which of the following genetic traits would be most expected to increase in prevalence in the population over time?

- W) A genetic variant in a deer population that results in a skeletal difference that causes the deer to move more slowly
- X) A genetic variation that leads to behavioral changes due to a decreased fear of predators
- Y) A genetic mutation in a mammal that increases the nutrients available in the milk, so that the offspring grow stronger and faster
- Z) A genetic mutation that increases the size of the teeth in the mouth, reducing the space available for food in the mouth and eliminating some food choices.

ANSWER: Y) A GENETIC MUTATION IN A MAMMAL THAT INCREASES THE NUTRIENTS AVAILABLE IN THE MILK, SO THAT THE OFFSPRING GROW STRONGER AND FASTER

BONUS

20) Life Science – *Multiple Choice* What is the net ATP gain of glycolysis?

- W) 0
- X) 2
- Y) 8
- Z) 28

ANSWER: X) 2

TOSS-UP

21) Energy – *Short Answer* What Illinois-based particle accelerator was the second highest energy particle collider in the world until it ceased operations in 2011?

ANSWER: TEVATRON

BONUS

21) Energy – *Short Answer* Identify all of the following three statements about ethanol that are TRUE:

- 1) Ethanol is about 30% less energy dense than gasoline;
- 2) The addition of ethanol increases the octane rating of gasoline;
- 3) Ethanol can be made from wood or old newspapers.

ANSWER: ALL OF THEM

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### **TOSS-UP**

22) Physical Science – *Short Answer* What term is often used to describe different physical forms of an element, such as graphite versus diamond?

ANSWER: ALLOTROPES

### **BONUS**

22) Physical Science – *Short Answer* What is the name of the rule that states that the most stable arrangement of electrons in a subshell has the maximum number of parallel spins?

ANSWER: HUND'S RULE

### **TOSS-UP**

23) Earth and Space – *Short Answer* Identify all of the following three statements that are true regarding the K-T extinction event: 1) Most bony fish species went extinct during this time; 2) Most Cretaceous mammalian lineages went extinct during this time; 3) 20% of non-avian dinosaurs survived the K-T extinction.

ANSWER: NONE

### **BONUS**

23) Earth and Space – *Short Answer* Identify all of the following offshore regions where coral reefs can be found: 1) Northeast Australia; 2) Aleutian [*ah-LOO-shin*] Islands; 3) Coastal Chile; 4) South of Florida.

ANSWER: 1 AND 4