

**REGIONAL COMPETITION - ROUND 9**

**TOSS-UP**

1. ERSC; Multiple Choice: Of the following, which one represents the direction in which winds always blow?
  - a) from higher to lower air pressure
  - b) from land to sea
  - c) from highlands to lowlands
  - d) from high latitudes to low latitudes

ANSWER: A--FROM HIGHER TO LOWER AIR PRESSURE

**BONUS**

1. ERSC; Short Answer: In what state of the U.S. is the most geothermal power being produced?

ANSWER: CALIFORNIA

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**TOSS-UP**

2. BIOL; Short Answer: Biochemists know that our chromosomes contain deoxyribonucleic acid (DNA). The DNA molecule is usually depicted as a long, spiral structure, having a repetitive pattern of 4 sets of chemical building blocks. What are they?

ANSWER: ADENINE, GUANINE, THYMINE, CYTOSINE

**BONUS**

2. BIOL; Multiple Choice: Which of DNA's building blocks pair with each other?
  - a) adenine/guanine; thymine/cytosine
  - b) adenine/cytosine; thymine/guanine
  - c) adenine/thymine; guanine/cytosine
  - d) adenine/guanine; cytosine/thymine

ANSWER: C--ADENINE/THYMINE; GUANINE/CYTOSINE

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**TOSS-UP**

3. COMP; Short Answer: What is the hexadecimal sum of the hexadecimal numbers 2C and 1A?

ANSWER: 46

**BONUS**

3. COMP; Short Answer: What is the octal equivalent of the hexadecimal number 0F (pron: zero F)?

ANSWER: 17

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**TOSS-UP**

4. PHYS; Multiple Choice: The term "laminar flow" is most often associated with the description of:
- a) conduction of sound by waves
  - b) current flow in transistors
  - c) effects of viscosity of liquids
  - d) passage of light rays through a liquid

ANSWER: C--EFFECTS OF VISCOSITY OF LIQUIDS

**BONUS**

4. PHYS; Short Answer: Who invented the barometer?

ANSWER: TORRICELLI

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**TOSS-UP**

5. GENR; Short Answer: A food calorie is bigger than a calorie as defined by physics. How many times bigger is it?

ANSWER: 1000

**BONUS**

5. GENR; Short Answer: The manatee is a marine animal that is in danger of becoming extinct. In what state in the U.S. is this animal found?

ANSWER: FLORIDA

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**TOSS-UP**

6. CHEM; Multiple Choice: Which of the following is not a polyunsaturated fatty acid?
- a) linoleic acid
  - b) linolenic acid
  - c) palmitolenic acid
  - d) palmitic acid

ANSWER: D--PALMITIC ACID

**BONUS**

6. CHEM; Multiple Choice: What is the molecular weight of stearic acid?
- a) 184 atomic mass units
  - b) 284 atomic mass units
  - c) 384 atomic mass units
  - d) 484 atomic mass units

ANSWER: B--284 ATOMIC MASS UNITS

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**TOSS-UP**

7. ASTR; Multiple Choice: Which of these planets is never visible overhead with the naked eye?
- a) Mars
  - b) Jupiter
  - c) Saturn
  - d) Mercury

ANSWER: D--MERCURY

**BONUS**

7. ASTR; Short Answer: Which planet has a retrograde or backwards rotation compared to the other eight planets?

ANSWER: VENUS

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**TOSS-UP**

8. BIOL; Short Answer: What do biologists call the passive process by which water is able to enter and exit a cell?

ANSWER: OSMOSIS

**BONUS**

8. BIOL; Multiple Choice: What are the two transport processes by which cells actively take in substances?
- a) centrosome and basal transport
  - b) vacuoles and vesicles diffusion
  - c) pinocytosis and phagocytosis
  - d) osmosis and diffusion

ANSWER: B--PINOCYTOSIS AND PHAGOCYTOSIS

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**TOSS-UP**

9. MATH; Multiple Choice: Persons are classified according to their blood types as O, A, B, and AB. It is known that the probability that a randomly picked person is of type O is 40%, of type A is 30%, of type B is 20%, and of type AB is 10%. If two persons are picked at random, the probability that none is of type O is:
- a) 40%
  - b) 20%
  - c) 36%
  - d) 82%

ANSWER: C-- $[(100\%-40\%)^2 = 36\%]$

**BONUS**

9. MATH; Short Answer: To determine pi, black dots were dropped randomly on a square table of area 4.0 ft<sup>2</sup>, in which a circle of radius 1.0 ft was drawn. Three quarters of the dots fell on the circle. What is the estimate of pi?

ANSWER: 3.0

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**TOSS-UP**

10. PHYS; Short Answer: The random motion of particles suspended in a fluid is called:

ANSWER: C--BROWNIAN MOTION

**BONUS**

10. PHYS; Multiple Choice: The law that relates the electric field at the surface of a region to the amount of charge inside the region is called:

- a) Coulomb's Law
- b) Faraday's Law
- c) Gauss' Law
- d) Biot-Savart Law

ANSWER: C--GAUSS' LAW

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**TOSS-UP**

11. CHEM; Multiple Choice: The process by which chromium oxide is converted to chromium metal by reaction with aluminum is called:
- a) the Haber process
  - b) the Goldschmidt reduction process
  - c) the Bessemer process
  - d) the LeBlanc process

ANSWER: B--THE GOLDSCHMIDT REDUCTION PROCESS

**BONUS**

11. CHEM; Short answer: In the balanced equation for the reaction of chromium hydroxide and sodium hydroxide, how many water molecules are produced?

ANSWER: THREE (3)

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**TOSS-UP**

12. COMP; Short Answer: What is the hexadecimal sum of the hexadecimal numbers 20 (pron: 2-zero) and 15?

ANSWER: THIRTY-FIVE (35)

**BONUS**

12. COMP; Short Answer: What is the octal equivalent of the decimal number 12?

ANSWER: FOURTEEN (14)

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TOSS-UP

13. BIOL; Multiple Choice; The weight of a cell is mostly provided by water, the exact percentage depends on the type of cell. In the human body, red blood cells are approximately what percentage water?
- a) 60 percent
  - b) 70 percent
  - c) 85 percent
  - d) 90 percent

ANSWER: A--60 PERCENT

BONUS

13. BIOL; Short Answer: Darwin's theory of evolution sparked another scientist to observe that embryo seems to pass through a succession of stages during development that resemble the stages through which the species evolved. Name either the theory or the person responsible for it.

ANSWER: THE PRINCIPLE OF RECAPITULATION OR (E.H.) HAECKEL (ACCEPT ONTOGENY RECAPITULATES PHYLOGENY)

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TOSS-UP

14. ASTR; Multiple Choice: What approximate diameter would the Earth need to be compressed to make it turn into a blackhole?
- a) 5 km
  - b) 760 cm
  - c) 165 cm
  - d) 2 cm

ANSWER: D-- 2 cm

BONUS

14. ASTR; Multiple Choice: If while orbiting a blackhole a safe distance away, an observer sent a probe into the blackhole, what would the observer see when the probe reached the event horizon of the blackhole? Would the probe:
- a) reach the speed of light and disappear at event horizon
  - b) slow down and stop at the event horizon forever
  - c) explode
  - d) exceed the speed of light and disappear at event horizon

ANSWER: B-- SLOW DOWN AND STOP AT THE EVENT HORIZON FOREVER

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TOSS-UP

15. PHYS; Multiple Choice: In order for fiber optics to work, the incident light inside the fiber must hit the wall of the fiber at:
- a) 90 degrees
  - b) 45 degrees
  - c) an angle greater than the critical angle
  - d) 0 degrees

ANSWER: C -- AN ANGLE GREATER THAN THE CRITICAL ANGLE

BONUS

15. PHYS; Short Answer: In AC Circuit Theory, the term that replaces the resistance is:

ANSWER: IMPEDANCE

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TOSS-UP

16. CHEM; Multiple Choice: Which of the following is not an isomer of decane?
- a) 2,3,5-trimethylheptane
  - b) 2-methyl-3-ethylhexane
  - c) 3,4-diethylhexane
  - d) 2,3-dimethylheptane

ANSWER: b) 2-METHYL-3-ETHYLHEXANE

BONUS

16. CHEM; Short answer: How many isomers are possible for hexane?

ANSWER: FIVE (5)

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TOSS-UP

17. ERSC; Short Answer: Common environmental pollutants are known as DNAPLs (Dee-Napels). What does "DNAPL" stand for?

ANSWER: DENSE, NON-AQUEOUS PHASE LIQUIDS

BONUS

17. ERSC; Multiple Choice: Some scientists believe that the surface temperature of Mars could be raised during "terraforming" operations from -75 degrees to livable temperatures by producing a gas on the surface and releasing it into the atmosphere. This gas is

- a) argon
- b) a nitrogen oxide
- c) a chlorofluorocarbon
- d) sulfur dioxide

ANSWER: C-- A CHLOROFLUOROCARBON

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TOSS-UP

18. GENR; Multiple Choice: What physical chemical principle underlies the mass production of potable water from sea water?

- a) molal pumping
- b) reverse osmosis
- c) serial filtration
- d) evapotranspiration

ANSWER: B-- REVERSE OSMOSIS

BONUS

18. GENR; Short Answer: One of the projects to improve scientific education is Project 2061, sponsored by the American Association for the Advancement of Science. What is significant about the year 2061 for astronomers?

ANSWER: HALLEY'S COMET RETURNS

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TOSS-UP

19. PHYS; Short Answer: Normal sunlight is non-polarized. Why are polarized sunglasses worn?

ANSWER: REFLECTED LIGHT FROM SMOOTH SURFACES IS POLARIZED

BONUS

19. PHYS; Short Answer: Name the three American physicists who developed the BCS theory of superconductivity.

ANSWER: (JOHN) BARDEEN, (LEON N.) COOPER, (J. ROBERT) SCHRIEFFER

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TOSS-UP

20. BIOL; Short Answer: What is the name for the analytical structure of the distribution of energy within the successive levels of organisms in a food chain or food web?

ANSWER: THE PYRAMID OF ENERGY (ACCEPT PYRAMID)

BONUS

20. BIOL; Multiple Choice: Postembryonic development of many animals and plants occurs at varying rates that, if charted, would yield which of the following?

- a) an S-shaped growth curve
- b) a U-shaped growth curve
- c) a horizontal growth curve
- d) a 45 degree growth curve

ANSWER: A--AN S-SHAPED GROWTH CURVE

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TOSS-UP

21. CHEM; Short answer: What is the name given to the group of elements that have atomic numbers from 58 to 71 inclusive?

ANSWER: LANTHANIDES

BONUS

21. CHEM; Short answer: What is the oxidation state of manganese in potassium permanganate?

ANSWER: 7 or +7

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TOSS-UP

22. PHYS; Short Answer: Who developed the Polaroid camera?

ANSWER: (JAMES H.) LAND

BONUS

22. PHYS; Multiple Choice: A 10 kilogram object falls from a cliff 100 meters high. At the midpoint of its fall its total energy is:

- a) 2450 Joules
- b) 4900 Joules
- c) 9,800 Joules
- d) 19,600 Joules

ANSWER: C -- 9,800 JOULES

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TOSS-UP

23. MATH; Multiple Choice: The probability that a person goes to a concert on Saturday is 40%, and that of going to a football game on Sunday is 60%. If the probability of going to either or both is 80%, what is the probability that the person goes to both?
- a) 100%
  - b) 80%
  - c) 24%
  - d) 20%

ANSWER: D--[ $20\% = 40\% + 60\% - 80\%$ ]

BONUS

23. MATH; Multiple Choice: What is the probability that the person goes to only one program?
- a) 60%
  - b) 80%
  - c) 45%
  - d) 20%

ANSWER: A--[ $60\% = 40\% + 60\% - 2 \times 20\%$ ]

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TOSS-UP

24. BIOL; Short Answer: Using the Linnaean classification system, classify humans according to class, genus and species.

ANSWER: CLASS-MAMMALIA; GENUS-HOMO; SPECIES-SAPIENS

BONUS

24. BIOL; Short Answer: RNA is similar to DNA; however, there is a substitution of a base. What is the substitution base and which DNA base does it substitute for?

ANSWER: URACIL SUBSTITUTES FOR THYMINE

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TOSS-UP

25. CHEM; Multiple Choice: Which of the following pairs of chemicals could NOT be used to prepare a buffer?
- a)  $\text{KH}_2\text{PO}_4$  and  $\text{Na}_2\text{HPO}_4$
  - b)  $\text{HCl}$  and  $(\text{CH}_2\text{OH})_3\text{CNH}_2$
  - c)  $\text{HNO}_3$  and  $\text{NaNO}_3$
  - d)  $\text{NH}_4\text{Cl}$  and  $\text{NH}_3$

ANSWER: C--  $\text{HNO}_3$  and  $\text{NaNO}_3$

BONUS

25. CHEM; Short answer: What volume of .1 molar phosphoric acid will neutralize 25 ml of .6 molar benzoic acid?

ANSWER: 50 ML

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