

# CHEMISTRY

## 1. CHEMISTRY

### Toss Up: Multiple Choice

Which of these compounds is not a saturated compound?

- W) ethane
- X) propanol
- Y) butanal
- Z) acetylene

**Toss Up Answer: Z**

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### Bonus: Short Answer

What are the two compounds formed when ethanoic acid and ethanol react?

**Bonus Answer: Ethyl ethanoate and water**

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## 2. CHEMISTRY

### Toss Up: Multiple Choice

What is the fourth most abundant element on Earth?

- W) Oxygen
- X) Carbon
- Y) Sulfur
- Z) Argon

**Toss Up Answer: X**

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### Bonus: Short Answer

What metal forms compounds that give a grayish-white color?

**Bonus Answer: Lead**

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## 3. CHEMISTRY

### Toss Up: Short Answer

How many mL of 0.5 M Barium Hydroxide are needed to neutralize 500 mL of 1 M Hydrochloric Acid completely?

**Bonus Answer: 500 mL**

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### Bonus: Short Answer

Calculate the pOH of a solution given the  $H^+$  concentration is  $1.0 \times 10^{-5}$

**Bonus Answer: 9**

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## 4. CHEMISTRY

### Toss Up: Multiple Choice

How many carbon atoms and hydrogen atoms are present in one molecule of hexane?

- W) 6 hydrogen, 14 carbon
- X) 6 carbon, 14 hydrogen
- Y) 6 carbon, 12 hydrogen
- Z) 6 carbon, 10 hydrogen

**Toss Up Answer: X**

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### Bonus: Short Answer

Identify which of the following statements about carbon dioxide are true: 1) It has a molar mass of approximately 44 g/mol 2) It is a polar molecule 3) It has two double bonds

**Bonus Answer: 1 and 3**

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## 5. CHEMISTRY

### Toss Up: Multiple Choice

What type of bond is formed between two atoms with an electronegativity difference of 1.0?

- W) Polar Covalent
- X) Nonpolar Covalent
- Y) Ionic
- Z) Hydrogen

Toss Up Answer: W

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### Bonus: Short Answer

Of the following, which increase with atomic number in group 5 of the periodic table? 1) Atomic Radius 2) Atomic mass 3) First Ionization Energy

Bonus Answer: 1 and 2

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## 6. CHEMISTRY

### Toss Up: Multiple Choice

How many electrons occupy the bonding molecular orbitals of a CN triple bond?

- W) 2
- X) 4
- Y) 6
- Z) 8

Toss Up Answer: Y

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### Bonus: Multiple Choice

Which of the following compounds would have the highest boiling point?

- W) CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>3</sub>
- X) CH<sub>3</sub>NH<sub>2</sub>
- Y) CH<sub>2</sub>F<sub>2</sub>
- Z) CH<sub>3</sub>OH

Bonus Answer: Z

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## 7. CHEMISTRY

### Toss Up: Multiple Choice

The H-C-O bond angle in H<sub>2</sub>C=O (formaldehyde) is approximately:

- W) 90
- X) 109
- Y) 120
- Z) 180

Toss Up Answer: Y

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### Bonus: Short Answer

In which compound does carbon have the highest oxidation state?

- 1. CH<sub>4</sub>
- 2. HCN
- 3. H<sub>2</sub>CO
- 4. CH<sub>2</sub>Cl<sub>2</sub>

Bonus Answer: 2. HCN

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## 8. CHEMISTRY

### Toss Up: Multiple Choice

Which of the following has the highest electronegativity?

- W) Francium
- X) Carbon
- Y) Fluorine
- Z) Oxygen

**Toss Up Answer: Y**

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### Bonus: Short Answer

How many times faster does hydrogen diffuse through a hole than oxygen?

**Bonus Answer: 4**

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## 9. CHEMISTRY

### Toss Up: Multiple Choice

What does Pauli's Exclusion Principle state?

- W) Electrons of an atom must have the same spin
- X) No two electrons of an atom travel in the same orbital
- Y) no two electrons in an atom can be at the same time in the same state or configuration
- Z) Electrons can switch spin automatically

**Toss Up Answer: Y**

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### Bonus: Short Answer

What law states that electrons in the same orbitals reorganize themselves to maximize spin?

**Bonus Answer: Hund's law**

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## 10. CHEMISTRY

### Toss Up: Short Answer

What is the largest ion with an equal amount of protons and neutrons?

**Bonus Answer: Ca<sup>20+</sup>**

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### Bonus: Short Answer

Who is regarded as the father of the modern periodic table? (1st and last name)

**Bonus Answer: Dmitri Mendeleev**

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## 11. CHEMISTRY

### Toss Up: Multiple Choice

Which of the following radioactive isotopes is used in the treatment of thyroid cancer?

- W) Carbon-12
- X) Iodine-131
- Y) Uranium-238
- Z) Technetium-99

**Toss Up Answer: X**

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### Bonus: Short Answer

If a radioactive isotope has a half life of 2 years, how long would it take for 1/8 of the original material to remain?

**Bonus Answer: 6 years**

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## 12. CHEMISTRY

### Toss Up: Short Answer

What element has the largest atomic radius?

**Bonus Answer: Francium**

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**Bonus: Multiple Choice**

What is the most electronegative element?

- W) Francium
- X) Beryllium
- Y) Fluorine
- Z) Lithium

**Bonus Answer: Y**

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### 13. CHEMISTRY

**Toss Up: Multiple Choice**

Which of the following isoelectronic ions has the largest ionic radius?

- W) Sulfur: 2-
- X) Chlorine: 1-
- Y) Potassium: 1+
- Z) Calcium: 2+

**Toss Up Answer: W**

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**Bonus: Short Answer**

Complete the sentence with one word: As the nuclear charge of an ion increases, the ionic radius \_\_\_\_\_.

**Bonus Answer: decreases (Do not accept decrease)**

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### 14. CHEMISTRY

**Toss Up: Multiple Choice**

Which of the following is false about metals?

- W) Metals are malleable and ductile
- X) Metals tend to lose electrons to become cations
- Y) Metallic reactivity increases as you go down a group.
- Z) All metals are solid at room temperature

**Toss Up Answer: Z**

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**Bonus: Multiple Choice**

Which of the following metals isn't solid at room temperature?

- W) Mercury
- X) Tantalum
- Y) Barium
- Z) Chromium

**Bonus Answer: W**

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### 15. CHEMISTRY

**Toss Up: Short Answer**

How many orientation of f orbitals are there?

**Bonus Answer: 7**

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**Bonus: Short Answer**

The Pauli Exclusion Principle states that at most how many electrons can occupy a single atomic orbital?

**Bonus Answer: 2**

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## 16. CHEMISTRY

**Toss Up: Short Answer**

Which group of the periodic table has a fully filled d orbital?

**Bonus Answer: Group 12**

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**Bonus: Short Answer**

Name 2 elements that behave both as a metal and non-metal

**Bonus Answer: Any 2: Boron, silicon, germanium, arsenic, antimony, tellurium, (polonium)**

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## 17. CHEMISTRY

**Toss Up: Short Answer**

Which group of elements has the lowest ionization energy?

**Bonus Answer: Alkali metals**

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**Bonus: Short Answer**

What are the elements in group 5 called?

**Bonus Answer: Pnictogens**

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## 18. CHEMISTRY

**Toss Up: Multiple Choice**

Which of the following elements are Lanthanides?

W) Lawrencium

X) Meltnerium

Y) Seaborgium

Z) Terbium

**Toss Up Answer: Z**

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**Bonus: Short Answer**

What unit does electronegativity use?

**Bonus Answer: No unit**

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## 19. CHEMISTRY

**Toss Up: Short Answer**

Order the following in terms of the rate of diffusion along them, from fastest to slowest. 1: Open Surface. 2: Through an amorphous material. 3: Through a crystal.

**Bonus Answer: 1, 3, 2**

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**Bonus: Multiple Choice**

Which of the following is a thermal conductor, but not an electrical one?

W) Graphite

X) Graphene

Y) Diamond

Z) Polystyrene

**Bonus Answer: Y**

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## 20. CHEMISTRY

**Toss Up: Short Answer**

If you have a 1 L of a 10 M solution of HCl and you want 2 L of a 5 M solution of HCl, how much water must you add?

**Bonus Answer: 1 L**

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**Bonus: Short Answer**

If the pOH of a solution is 6, what is the concentration of H<sup>+</sup> ions?

**Bonus Answer:  $1.0 \times 10^{-8}$  (also 0.00000001)**

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## 21. CHEMISTRY

**Toss Up: Short Answer**

Roger Y. Tsien, Osamu Shimomura, and Martin Chalfie were awarded the 2008 Nobel Prize in Chemistry for the discovery and development of which protein?

**Bonus Answer: Green Fluorescent Protein, GFP**

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**Bonus: Multiple Choice**

Which organism was the Green Fluorescent Protein first isolated from?

W) Anglerfish

X) Jellyfish

Y) Squids

Z) Gulper Eels

**Bonus Answer: X**

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## 22. CHEMISTRY

**Toss Up: Multiple Choice**

Which element is most electronegative?

W) Chlorine

X) Fluorine

Y) Astatine

Z) Cesium

**Toss Up Answer: X**

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**Bonus: Multiple Choice**

What is the range of electronegativity values?

W) 0.0 to 1.0

X) 0.0 to 2.0

Y) 0.0 to 3.0

Z) 0.0 to 4.0

**Bonus Answer: Z**

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## 23. CHEMISTRY

**Toss Up: Multiple Choice**

How many orbitals does the p sublevel have?

W) 1

X) 2

Y) 3

Z) 4

**Toss Up Answer: Y**

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**Bonus: Short Answer**

which element has the electron configuration  $1s^2 2s^2 2p^6 3s^1$  in its ground state?

**Bonus Answer: Sodium, Na**

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**24. CHEMISTRY**

**Toss Up: Short Answer**

Where does oxidation occur in an electrochemical cell?

**Bonus Answer: Anode**

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**Bonus: Short Answer**

In the redox reaction  $2H_2 + O_2 \rightarrow 2H_2O$  how many electrons are transferred?

**Bonus Answer: 4**

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**25. CHEMISTRY**

**Toss Up: Multiple Choice**

When 50 mL of stock solution of 6M NaCl (aq) is diluted into a 150 mL solution what will be the molarity of the diluted solution?

W) 3M

X) 2M

Y) 1M

Z) 6M

**Toss Up Answer: X**

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**Bonus: Short Answer**

What is the given equation for calculating molarity?

**Bonus Answer: Moles of solute divided by liters of solution**

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**26. CHEMISTRY**

**Toss Up: Multiple Choice**

Given the following ions,  $Na^+$ ,  $Br^-$ ,  $Ag^+$ , and  $Cu^{2+}$  which ion has the greatest atomic radius?

W)  $Na^+$

X)  $Br^-$

Y)  $Ag^+$

Z)  $Cu^{2+}$

**Toss Up Answer: Y**

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**Bonus: Short Answer**

Name the group of elements with the least electronegativity.

**Bonus Answer: Noble gases (Group 18)**

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**27. CHEMISTRY**

**Toss Up: Multiple Choice**

Choose the strongest acid from the choices below.

W) Hydrochloric acid

X) Hydrobromic acid

Y) Hydroiodic acid

Z) Hydrofluoric acid

**Toss Up Answer: Y**

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**Bonus: Short Answer**

What are the conjugate bases of HCl, HBr, and HI?

**Bonus Answer: Cl-, Br-, I-**

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**28. CHEMISTRY**

**Toss Up: Multiple Choice**

From what two molecules is an ester synthesized?

- W) alcohol and ester
- X) alcohol and aldehyde
- Y) carboxylic acid and ester
- Z) carboxylic acid and alcohol

**Toss Up Answer: Z**

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**Bonus: Short Answer**

If one mole of an acid is dissolved in a liter of water, and the acid has a pKa of 10, what is the pH of the solution?

**Bonus Answer: 7**

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**29. CHEMISTRY**

**Toss Up: Multiple Choice**

Which of the following exhibits diamagnetism?

- W) bronze
- X) water
- Y) liquid oxygen
- Z) diamond

**Toss Up Answer: X**

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**Bonus: Short Answer**

Order the following by second ionization energy, from lowest to highest: Sodium, Magnesium, Aluminum

**Bonus Answer: Magnesium, Aluminum, Sodium**

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**30. CHEMISTRY**

**Toss Up: Multiple Choice**

Why is diamond a thermal conductor, even though it isn't an electrical conductor?

- W) heat vibrations can move along the rigid structure
- X) carbon has a low heat capacity
- Y) there are no impurities which increase resistance
- Z) carbon has a high heat capacity

**Toss Up Answer: W**

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**Bonus: Multiple Choice**

Which of the following has the highest carbon content?

- W) wrought iron
- X) cast iron
- Y) pig iron
- Z) slag

**Bonus Answer: Y**

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**31. CHEMISTRY**



**Toss Up: Multiple Choice**

Which of the following describes the carbon dioxide molecule?

- W) Polar and Linear
- X) Polar and Bent
- Y) Nonpolar and Linear
- Z) Nonpolar and Bent

**Toss Up Answer: Y**

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**Bonus: Short Answer**

What hybridization is typically found in linear molecules?

**Bonus Answer: sp**

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**32. CHEMISTRY**

**Toss Up: Multiple Choice**

In the reaction  $A + B \rightarrow C + D$ , which of the following occurs when reactant B is added?

- W) The concentration of A decreases
- X) The concentration of C decreases
- Y) The concentration of D decreases
- Z) The reaction shifts to the left

**Toss Up Answer: W**

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**Bonus: Short Answer**

Given the specific heat capacity of water is 4.18 Joule/gram $^{\circ}$ C, if you have 20 grams of water and want to heat it from 10 degrees C to 15 degrees C, how many joules must be added?

**Bonus Answer: 418 Joules**

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**33. CHEMISTRY**

**Toss Up: Multiple Choice**

The conjugate base of HCl is which of the following?

- W) A weak acid
- X) A strong acid
- Y) A weak base
- Z) A strong base

**Toss Up Answer: Y**

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**Bonus: Short Answer**

How many sigma and pi bonds does carbon dioxide have?

**Bonus Answer: 2 sigma, 2 pi**

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**34. CHEMISTRY**

**Toss Up: Multiple Choice**

Which of the following substances cannot be decomposed further chemically?

- W) Carbon Dioxide
- X) Water
- Y) Silicon
- Z) Ammonia

**Toss Up Answer: Y**

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**Bonus: Short Answer**

If 0.5 moles of NaCl are dissolved in 2 kg of water, what is the molality of the resulting solution?

Bonus Answer: 0.25 or 1/4

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### 35. CHEMISTRY

Toss Up: Short Answer

What is the oxidation number of chromium in the dichromate ion?

Bonus Answer: +6

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Bonus: Short Answer

Name the following:  $\text{CuCr}_2\text{O}_7$ .

Bonus Answer: Copper (II) dichromate; or Cupric dichromate

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### 36. CHEMISTRY

Toss Up: Multiple Choice

What is the most reasonable pH of the solution when the salt formed by reacting hydrochloric acid and aluminum hydroxide is dissolved in water?

W) 7

X) 4

Y) 10

Z) 0

Toss Up Answer: X

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Bonus: Short Answer

125 mL from a 4M perchloric acid stock solution is reacted with excess sodium hydroxide. How many moles of the salt are formed if the system is 50% efficient?

Bonus Answer: 0.25 mol; 1/4 mol

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### 37. CHEMISTRY

Toss Up: Short Answer

How many hydrogen atoms does a molecule of acetone have?

Bonus Answer: 6

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Bonus: Short Answer

What is the electron configuration of  $\text{Cr}^{3+}$  using noble gas notation?

Bonus Answer:  $[\text{Ar}]3d^3$

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### 38. CHEMISTRY

Toss Up: Multiple Choice

The relation between pressure and temperature of two ideal gases is stated in

W) Gay-Lussac's Law

X) Boyle's Law

Y) Charles's Law

Z) Avogadro's Law

Toss Up Answer: W

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Bonus: Short Answer

What are the dimensions of the gas constant R in SI base units?

Bonus Answer:  $\text{kg m}^2 \text{mol}^{-1} \text{K}^{-1} \text{s}^{-2}$  (accept as a fraction)

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### 39. CHEMISTRY

Toss Up: Multiple Choice

Which of the following describes the reaction that involves a hydrocarbon chain and H<sub>2</sub> gas yielding two shorter hydrocarbon chains?

W) Synthesis

X) Cracking

Y) Hydrocracking

Z) Substitution

**Toss Up Answer: Y**

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**Bonus: Short Answer**

What electron geometry does ammonia(NH<sub>3</sub>) have?

**Bonus Answer: tetrahedral, tetrahedron also accepted**

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## 40. CHEMISTRY

**Toss Up: Multiple Choice**

Which of the following has the largest ionic radius?

W) Li

X) Be

Y) Na

Z) Mg

**Toss Up Answer: X**

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**Bonus: Short Answer**

Why does Oxygen have a smaller atomic radius than boron?

**Bonus Answer: Effective nuclear charge**

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## 41. CHEMISTRY

**Toss Up: Short Answer**

What are the numbers of sigma bonds and pi bonds, in ethyne, respectively?

**Bonus Answer: 3 sigma bonds, 2 pi bonds**

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**Bonus: Short Answer**

Pi bonds are created by the overlap of what type of orbital?

**Bonus Answer: p, p orbitals**

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## 42. CHEMISTRY

**Toss Up: Multiple Choice**

The shape of a PCl<sub>3</sub> molecule is described as

W) bent

X) trigonal pyramidal

Y) linear

Z) trigonal planar

**Toss Up Answer: X**

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**Bonus: Short Answer**

Twenty-five percent of element X exists as <sup>210</sup>X and 75 percent of it exists as <sup>214</sup>X. What is the atomic weight of element X?

**Bonus Answer: 211**

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## 43. CHEMISTRY

**Toss Up: Short Answer**

Is HCL a strong acid?

**Bonus Answer: Yes**

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**Bonus: Short Answer**

Is NAOH a strong base?

**Bonus Answer: Yes**

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#### 44. CHEMISTRY

**Toss Up: Multiple Choice**

Which of the following species is amphoteric?

W)  $\text{Na}_3\text{PO}_4$

X)  $\text{HSO}_4^-$

Y) KOH

Z)  $\text{HNO}_3$

**Toss Up Answer: X**

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**Bonus: Short Answer**

A 600-milliliter container holds 2 moles of  $\text{O}_2(\text{g})$ , 3 moles of  $\text{H}_2(\text{g})$ , and 1 mole of  $\text{He}(\text{g})$ . Total pressure within the container is 760 torr. What is the partial pressure of  $\text{O}_2$ ?

**Bonus Answer: 253 torr**

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#### 45. CHEMISTRY

**Toss Up: Multiple Choice**

What is the correct term(s) used to determine if a system has come to equilibrium?

W)  $K_a$  and  $Q$

X)  $K_{sp}$

Y)  $Q$

Z)  $K_c$

**Toss Up Answer: Y**

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**Bonus: Multiple Choice**

Chemical equilibrium may be used to describe

W) gas phase chemical reactions

X) acid and based ionization

Y) Solubility

Z) All of the Above

**Bonus Answer: Z**

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#### 46. CHEMISTRY

**Toss Up: Multiple Choice**

The term(s) most useful in determining the solubility of a substance is (are)

W)  $K_a$  and  $Q$

X)  $K_{sp}$

Y)  $Q$  and Le Chatelier's Principle

Z)  $K_c$

**Toss Up Answer: X**

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**Bonus: Multiple Choice**

The effect of temperature on a chemical system is best described using

- W)  $K_a$  and  $Q$
- X)  $K_{sp}$
- Y) Le Chatelier's Principle
- Z)  $K_c$

**Bonus Answer: Y**

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**47. CHEMISTRY**

**Toss Up: Multiple Choice**

Which of the following is closest in mass to a proton?

- W) Alpha Particle
- X) Positron
- Y) Neutron
- Z) Hydrogen Molecule

**Toss Up Answer: Y**

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**Bonus: Short Answer**

What is the amount of calories of heat transferred to the water is when the temperature of a 20-gram sample of water is increased from 10°C to 30°C?

**Bonus Answer: 400**

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**48. CHEMISTRY**

**Toss Up: Multiple Choice**

Which of the following elements has the largest number of possible oxidation states?

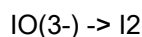
- W) Fe
- X) Cl
- Y) Ca
- Z) Mn

**Toss Up Answer: X**

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**Bonus: Multiple Choice**

What is the minimum number of electrons needed to balance the following half-reaction with whole number coefficients?



- W) 1 e<sup>-</sup>
- X) 2 e<sup>-</sup>
- Y) 5 e<sup>-</sup>
- Z) 10 e<sup>-</sup>

**Bonus Answer: Z**

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**49. CHEMISTRY**

**Toss Up: Short Answer**

In 12.4 hours, a 100 gram sample of an element decays so that its mass is 25 grams. What is the approximate half-life of this radioactive substance?

**Bonus Answer: 6.2 hours**

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**Bonus: Multiple Choice**

Which of the following will raise the boiling point of a sample of water?

- W) Heat the water
- X) Mix gasoline into the water
- Y) Bring the water to a higher altitude
- Z) Dissolve table sugar in the water

**Bonus Answer: Z**

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**50. CHEMISTRY**

**Toss Up: Multiple Choice**

What kind of process is the loss of electrons?

- W) electrolysis
- X) thermodynamically favored
- Y) reduction
- Z) oxidation

**Toss Up Answer: Z**

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**Bonus: Multiple Choice**

Which of the following metals does not react with water to produce hydrogen?

- W) Zn
- X) Li
- Y) Ca
- Z) Na

**Bonus Answer: W**

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**51. CHEMISTRY**

**Toss Up: Multiple Choice**

Which of the following is not commonly produced by eletrolysis?

- W) NaOCl
- X) Al
- Y) Fe
- Z) NaOH

**Toss Up Answer: Y**

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**Bonus: Multiple Choice**

Which of the following pairs of constants are not mathematically related to eachother?

- W) Equilibrium constant and Gibbs Free Energy
- X) Rate Constant and Activation Energy
- Y) Standard Cell Voltage and Equilibrium Constant
- Z) Standard Cell Voltage and Rate Constant

**Bonus Answer: Z**

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**52. CHEMISTRY**

**Toss Up: Short Answer**

An ideal gas in a closed inflexible container has a pressure of 6 atmospheres and a temperature of 27°C. What will be the new pressure of the gas if the temperature is decreased to -73°C?

**Bonus Answer: 4 atmospheres**

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**Bonus: Multiple Choice**

When CO<sub>2</sub> is bubbled through distilled water at 25°C, which of the following is most likely to occur?

- W) Solid carbon will form
- X) The pH of the solution will be reduced
- Y) The water will boil
- Z) Methane gas will be formed

**Bonus Answer: X**

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**53. CHEMISTRY**

**Toss Up: Multiple Choice**

Which would be the easiest way to burn an iron nail?

- W) Hold an iron nail with crucible tongs, and heat strongly in the flame of a bunsen burner.
- X) Use the above method with an oxyacetylene torch to reach highest temperatures.
- Y) Grind the nail into very small, dust-sized particles and spray them into a flame.
- Z) Dissolve the nail in acid to make the oxide.

**Toss Up Answer: Y**

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**Bonus: Multiple Choice**

What is a reasonable and safe substitute for zinc in reduction reactions in aqueous solutions?

- W) S
- X) F<sub>2</sub>
- Y) K
- Z) Cd

**Bonus Answer: Z**

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**54. CHEMISTRY**

**Toss Up: Multiple Choice**

Which of the following is a nonpolar molecule?

- W) Carbon dioxide
- X) Water
- Y) Ammonia
- Z) Hydrochloric acid

**Toss Up Answer: W**

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**Bonus: Short Answer**

Which of the following forms of radioactive decay has (or have) no electrical charges? 1) Alpha Decay 2) Beta Decay 3) Gamma Decay

**Bonus Answer: 3 only**

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**55. CHEMISTRY**

**Toss Up: Multiple Choice**

Which of these gases is expected to condense at the lowest pressure, assuming that the temperature is constant?

- W) Bromomethane

- X) Dibromomethane
- Y) Tetrabromomethane
- Z) They all condense at the same temperature

**Toss Up Answer: Y**

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**Bonus: Short Answer**

Which attractive force is the major cause of condensation?

**Bonus Answer: London Dispersion Forces (accept: London Forces)**

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**56. CHEMISTRY**

**Toss Up: Multiple Choice**

The evaporation of any liquid is expected to have

- W) a positive  $\Delta H$  and a negative  $\Delta S$
- X) a negative  $\Delta H$  and a negative  $\Delta S$
- Y) a positive  $\Delta H$  and a positive  $\Delta S$
- Z) a positive  $\Delta H$  and a negative  $\Delta S$

**Toss Up Answer: Y**

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**Bonus: Multiple Choice**

The rate of reaction will be large if

- W)  $\Delta G$  is a large negative number
- X)  $\Delta S$  is a large negative number
- Y)  $\Delta H$  is a large negative number
- Z) None of the above

**Bonus Answer: Z**

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**57. CHEMISTRY**

**Toss Up: Multiple Choice**

Which of the following can be precisely determined for a chemical substance?

- W) Entropy
- X) Enthalpy
- Y) Free Energy
- Z) All of the Above

**Toss Up Answer: W**

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**Bonus: Short Answer**

In a rate law, what are the units of  $k$  when the order is 3?

**Bonus Answer:  $L^2 \text{ mol}^{-2} \text{ s}^{-1}$**

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**58. CHEMISTRY**

**Toss Up: Multiple Choice**

Which of the following statements is NOT true for the element of sodium?

- W) It has an oxidation state of +1
- X) It forms a basic solution with water
- Y) It gives off a bright red color when burned
- Z) It reacts with a halogen to form a salt

**Toss Up Answer: Y**

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**Bonus: Short Answer**

Which of the following are products made from the reaction  $\text{H}_2\text{SO}_4(\text{aq}) + \text{Ba}(\text{OH})_2(\text{aq}) \rightarrow ?$  I)  $\text{O}_2(\text{g})$  II)  $\text{H}_2\text{O}(\text{l})$  III)  $\text{BaSO}_4(\text{s})$

**Bonus Answer: II and III**

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**59. CHEMISTRY**

**Toss Up: Short Answer**

In a rate law, what are the units of k when the order is 1?

**Bonus Answer:  $\text{s}^{-1}$**

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**Bonus: Short Answer**

In a rate law, what are the units of k when the order is 5?

**Bonus Answer:  $\text{L}^4 \text{mol}^{-4} \text{s}^{-1}$**

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**60. CHEMISTRY**

**Toss Up: Short Answer**

What is the chemical formula of tetraphosphorus decaoxide?

**Bonus Answer:  $\text{P}_4\text{O}_{10}$**

-----

**Bonus: Short Answer**

What is the bond order of the central atom in  $\text{CO}_3^{2-}$ ?

**Bonus Answer: 4/3 (accept: 1 1/3)**

=====

**61. CHEMISTRY**

**Toss Up: Multiple Choice**

What happens in a hydrogen atom when an electron jumps from an excited energy state to a more stable energy state?

- W) electromagnetic radiation is emitted by the atom
- X) electromagnetic radiation is absorbed by the atom
- Y) the atom becomes a positively charged ion
- Z) the atom becomes a negatively charged ion

**Toss Up Answer: W**

-----

**Bonus: Short Answer**

A closed 5-liter vessel contains a sample of neon gas. The temperature inside the container is  $25^\circ\text{C}$ , and the pressure is 1.5 atmospheres. (The gas constant, R, is equal to  $0.08 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}$ .) If the neon gas in the vessel is replaced with an equal molar quantity of helium gas, which of the following properties of the gas in the container will be changed?

- I. Pressure
- II. Temperature
- III. Density

**Bonus Answer: III only**

=====

**62. CHEMISTRY**

**Toss Up: Multiple Choice**

A solution of  $\text{H}_2\text{SO}_3$  is found to have a hydrogen ion concentration of  $1 \times 10^{-3}$  molar at  $25^\circ\text{C}$ . What is the hydroxide ion concentration in the solution?

- W)  $1 \times 10^{-1}$
- X)  $1 \times 10^{-3}$
- Y)  $1 \times 10^{-11}$
- Z)  $1 \times 10^{-13}$

**Toss Up Answer: Y**

---

**Bonus: Short Answer**

If the pH of a solution is changed from 1 to 3 with the addition of an antacid, what percentage of [H+] was neutralized?

**Bonus Answer: 99%**

---

### 63. CHEMISTRY

**Toss Up: Short Answer**

What is the molecular geometry of ammonia (NH<sub>3</sub>)?

**Bonus Answer: Trigonal Pyramidal**

---

**Bonus: Multiple Choice**

How many lone pairs are in Xenon tetrafluoride (XeF<sub>4</sub>)?

W) 0

X) 1

Y) 2

Z) 3

**Bonus Answer: Y**

---

### 64. CHEMISTRY

**Toss Up: Multiple Choice**

Which of the following does not exhibit resonance stabilization?

W) Ozone

X) SO<sub>2</sub>

Y) NO<sub>3</sub>

Z) H<sub>2</sub>O

**Toss Up Answer: Z**

---

**Bonus: Short Answer**

What is the bond order of H<sub>2</sub>O?

**Bonus Answer: 2**

---

### 65. CHEMISTRY

**Toss Up: Short Answer**

At room temperature, what is the only metal that is in liquid form?

**Bonus Answer: Mercury (Hg)**

---

**Bonus: Multiple Choice**

What is the third most common gas found in the air in the atmosphere?

W) Argon

X) Hydrogen

Y) Oxygen

Z) Helium

**Bonus Answer: W**

---

### 66. CHEMISTRY

**Toss Up: Multiple Choice**

A molecule is considered a Lewis acid if

- W) accepts a pair of electrons to form a bond
- X) accepts a proton from water
- Y) donates a pair of electrons to form a bond
- Z) donates a proton to water

**Toss Up Answer: W**

---

**Bonus: Multiple Choice**

Which of the following is a binary compound?

- W) Hydrogen Sulfate
- X) Hydrogen Sulfide
- Y) Ammonium Sulfide
- Z) Ammonium Sulfate

**Bonus Answer: X**

---

## 67. CHEMISTRY

**Toss Up: Short Answer**

What is the name for a molecule with tetrahedral electron geometry but only three substituent groups?

**Bonus Answer: trigonal pyramidal**

---

**Bonus: Multiple Choice**

Which of the following is not an ionic compound?

- W) NaCl
- X) HF
- Y) FeCl<sub>3</sub>
- Z) H<sub>2</sub>SO<sub>4</sub>

**Bonus Answer: X**

---

## 68. CHEMISTRY

**Toss Up: Multiple Choice**

cis 1,2 chloro-ethene and trans 1,2 chloro-ethene differ in which of the following?

- W) electron geometry
- X) enthalpy
- Y) entropy
- Z) boiling point

**Toss Up Answer: Z**

---

**Bonus: Short Answer**

In an acid/base reaction, which (acid or base) is the electrophile?

**Bonus Answer: acid**

---

## 69. CHEMISTRY

**Toss Up: Short Answer**

During glycolysis, electrons removed from glucose are passed to

**Bonus Answer: NAD<sup>+</sup>**

---

**Bonus: Multiple Choice**

A biological redox reaction always involves

- W) an oxidizing agent
- X) a gain of electrons
- Y) a reducing agent
- Z) All of the Above

**Bonus Answer: Z**

=====

**70. CHEMISTRY**

**Toss Up: Multiple Choice**

For the unfolding reaction of Protein G,  $\Delta H^\circ = 210.6 \text{ kJ/mol}$ , this means that

- W) unfolding is favored enthalpically
- X) unfolding is favored enthalpically
- Y) the entropy is positive at all temperatures
- Z) the entropy is negative at all temperatures

**Toss Up Answer: X**

=====

**Bonus: Multiple Choice**

At the midpoint of a temperature transition curve,

- W) half of the protein is denatured
- X)  $K_{eq} = 1.0$  and  $\Delta G = 0$
- Y)  $[Native] = [Unfolded]$  (Read as concentration of Native = concentration of Unfolded)
- Z) All of these

**Bonus Answer: Z**

=====

**71. CHEMISTRY**

**Toss Up: Multiple Choice**

The Standard Gibbs free energy,  $\Delta G^\circ$ , is

- W) the residual energy present in the reactants at equilibrium
- X) the residual energy present in the products at equilibrium
- Y) the energy required to convert one mole of reactants to one mole of products
- Z) the difference in the residual energy of reactants and products at equilibrium

**Toss Up Answer: X**

=====

**Bonus: Multiple Choice**

If the enthalpy change for a reaction is zero,  $\Delta G^\circ$  is equal to

- W)  $T\Delta S^\circ$
- X)  $T\Delta S^\circ$
- Y)  $-\Delta H^\circ$
- Z)  $\ln K_{eq}$

**Bonus Answer: X**

=====

**72. CHEMISTRY**

**Toss Up: Multiple Choice**

What is the oxidation state of Manganese in the permanganate ion?

- W) +5
- X) +7
- Y) +2
- Z) -2

**Toss Up Answer: X**

---

**Bonus: Short Answer**

What is the oxidation state of molecular oxygen?

**Bonus Answer: 0**

---

## 73. CHEMISTRY

**Toss Up: Multiple Choice**

Which of the following hydrocarbons have the highest boiling point.

- W) CH<sub>4</sub>
- X) C<sub>2</sub>H<sub>6</sub>
- Y) C<sub>3</sub>H<sub>8</sub>
- Z) C<sub>4</sub>H<sub>10</sub>

**Toss Up Answer: Z**

---

**Bonus: Multiple Choice**

Alloys are mixtures of metallic substances. Which of the following pairs are matched INCORRECTLY?

- W) Steel - iron and copper
- X) Brass - copper and zinc
- Y) Pewter - tin, copper, bismuth, and antimony
- Z) Sterling silver - silver and copper

**Bonus Answer: W**

---

## 74. CHEMISTRY

**Toss Up: Multiple Choice**

Which is the strongest type of intermolecular force?

- W) Hydrogen bonding
- X) Dipole-dipole
- Y) Van der Waals
- Z) Metallic bonding

**Toss Up Answer: X**

---

**Bonus: Short Answer**

By name or number, which of the following elements can form hydrogen bonds?

Oxygen, Chlorine, Fluorine, Nitrogen, Sulfur

**Bonus Answer: Oxygen, Fluorine, Nitrogen or (1, 3, and 4)**

---

## 75. CHEMISTRY

**Toss Up: Multiple Choice**

What is the principal quantum number of Sodium?

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

Z) 3

**Toss Up Answer: Z**

---

**Bonus: Short Answer**

What are the possible angular momentum quantum numbers for sodium?

**Bonus Answer: 0, 1, 2**

---

## 76. CHEMISTRY

**Toss Up: Short Answer**

What is the common name of the chemical with formula  $C_{9}H_{8}O_{4}$

**Bonus Answer: Aspirin**

---

**Bonus: Short Answer**

What is the molar mass, to the nearest whole number, of three molecules of the above chemical?

**Bonus Answer: 540 g/mol**

---

## 77. CHEMISTRY

**Toss Up: Multiple Choice**

Which of the one of the following salts is insoluble?

W)  $NH_4Cl$

X)  $Ca(NO_3)_2$

Y)  $BaCO_3$

Z)  $Na_2S$

**Toss Up Answer: Y**

---

**Bonus: Short Answer**

What is the empirical formula for glucose?

**Bonus Answer:  $CH_2O$**

---

## 78. CHEMISTRY

**Toss Up: Short Answer**

What is the common oxidation state of Oxygen?

**Bonus Answer: -2**

---

**Bonus: Multiple Choice**

Which of the following elements is a halogen?

W) Lithium

X) Potassium

Y) Neon

Z) Chlorine

**Bonus Answer: Z**

---

## 79. CHEMISTRY

**Toss Up: Multiple Choice**

What is the name given to the equation  $P_1V_1=P_2V_2$ ?

W) Ideal Gas Law

X) Charles's Law

Y) Boyle's Law

Z) Gay-Lussac's Law

**Toss Up Answer: Y**

---

**Bonus: Short Answer**

What are bond angles of a tetrahedral?

**Bonus Answer: 109.5 degrees**

---

## **80. CHEMISTRY**

**Toss Up: Short Answer**

What is the hybridization of CH<sub>4</sub>?

**Bonus Answer: sp<sup>3</sup>**

---

**Bonus: Short Answer**

What intermolecular forces exist in HF?

**Bonus Answer: Hydrogen Bonding**

---

## **81. CHEMISTRY**

**Toss Up: Multiple Choice**

How many moles of nitrogen are in 35 grams of nitrogen?

- W) 3
- X) 3.5
- Y) 4
- Z) 2.5

**Toss Up Answer: Z**

---

**Bonus: Short Answer**

What group is Magnesium a part of?

**Bonus Answer: Alkaline Earth Metals**

---

## **82. CHEMISTRY**

**Toss Up: Multiple Choice**

According to VSEPR theory, which of the following molecules DOES NOT have a trigonal pyramidal geometry?

- W) NH<sub>3</sub> (read as: Ammonia)
- X) BF<sub>3</sub> (read as: Barium trifluoride)
- Y) XeF<sub>3</sub> (read as: Xenon trifluoride)
- Z) PCl<sub>3</sub> (read as: Phosphorus trichloride)

**Toss Up Answer: X**

---

**Bonus: Short Answer**

By name of number, which of the following molecules have a bent molecular structure? SO<sub>2</sub>, CO<sub>2</sub>, OF<sub>2</sub>

**Bonus Answer: SO<sub>2</sub> and OF<sub>2</sub> (accept 1 and 3)**

---

## **83. CHEMISTRY**

**Toss Up: Multiple Choice**

A lead chromate solution is typically what color?

- W) blue
- X) red
- Y) yellow
- Z) green

**Toss Up Answer: Y**

---

**Bonus: Multiple Choice**

Which of the following molecules exhibits a dipole moment?

W) CH<sub>4</sub>

X) H<sub>2</sub>S

Y) CO<sub>2</sub>

Z) SO<sub>3</sub>

**Bonus Answer: X**

---

**84. CHEMISTRY**

**Toss Up: Short Answer**

List the following atoms in order of increasing electronegativity: fluorine, chlorine, and bromine

**Bonus Answer: Fluorine**

---

**Bonus: Short Answer**

Which element has the highest electronegativity?

**Bonus Answer: Fluorine**

---

**85. CHEMISTRY**

**Toss Up: Short Answer**

What term describes the process when a solid phase changes directly to the gas phase?

**Bonus Answer: Sublimation**

---

**Bonus: Short Answer**

The angle between any two boron-hydrogen bonds in a boron trihydride molecule is how many degrees?

**Bonus Answer: 120 degrees**

---

**86. CHEMISTRY**

**Toss Up: Short Answer**

A stable suspension of fine particles in a liquid is called a:

**Bonus Answer: colloid**

---

**Bonus: Multiple Choice**

Which of the following compounds is used as a fuel additive in what is commonly known as "dry gas" by solubilizing water to reduce its contamination in gasoline?

W) isooctane

X) glycerol

Y) MTBE

Z) isopropyl alcohol

**Bonus Answer: Z**

---

**87. CHEMISTRY**

**Toss Up: Short Answer**

Using noble gas abbreviation, what is the electron configuration of a silver atom?

**Bonus Answer: [Kr] 4d<sup>10</sup> 5s<sup>1</sup>**

---

**Bonus: Short Answer**

What is the most electropositive element in group 1A?



Bonus Answer: Francium

=====

## 88. CHEMISTRY

Toss Up: Short Answer

What is the last element of the periodic table to occur naturally on Earth?

Bonus Answer: Plutonium, element 94

-----

Bonus: Short Answer

Which element is most abundant in the entire Earth?

Bonus Answer: Iron (do not accept Oxygen, that's just the crust)

=====

## 89. CHEMISTRY

Toss Up: Multiple Choice

A precipitation reaction is an example of which of the following reactions?

W) Combustion

X) Substitution

Y) Single Displacement

Z) Double Displacement

Toss Up Answer: Z

-----

Bonus: Short Answer

By name or number, which of the following would be a precipitate in aqueous solution? Silver sulfide, Potassium nitrate, Strontium hydroxide, Lead(II) fluoride

Bonus Answer: Silver sulfide, Lead(II) fluoride OR (1, 4 only)

=====

## 90. CHEMISTRY

Toss Up: Multiple Choice

Which of these is a weak electrolyte?

W) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>

X) MgCl<sub>2</sub>

Y) NaC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>

Z) NH<sub>4</sub>OH

Toss Up Answer: Z

-----

Bonus: Short Answer

By name or number, which of the following can conduct electricity in solution? Hydrocarbons, salts, weak acids, strong acids?

Bonus Answer: Salts, weak acids, strong acids (2, 3, and 4 only)

=====

## 91. CHEMISTRY

Toss Up: Multiple Choice

What is the pH of distilled water?

W) 6.5

X) 6.7

Y) 7

Z) Depends on the temperature

Toss Up Answer: Z

-----

Bonus: Multiple Choice

What is one of the hydrolysis product when Magnesium carbide is hydrolysed with water?

- W) Propadiene
- X) Propyne
- Y) Methane
- Z) There is insufficient information

**Bonus Answer: Z**

=====

## 92. CHEMISTRY

**Toss Up: Multiple Choice**

Which of the following molecules has the greatest Van't Hoff factor?

- W)  $\text{CaCl}_2$
- X)  $\text{NaCl}$
- Y)  $\text{C}_6\text{H}_{12}\text{O}_6$
- Z)  $\text{KBr}$

**Toss Up Answer: W**

-----

**Bonus: Multiple Choice**

Which of the following has the highest melting point?

- W)  $\text{NaCl}$
- X) Carbon
- Y) Water
- Z) Helium

**Bonus Answer: X**

=====

## 93. CHEMISTRY

**Toss Up: Multiple Choice**

Which of the following is an example of a strong nucleophile but a weak base?

- W)  $\text{CH}_3\text{OH}$
- X)  $\text{OH}^-$
- Y)  $\text{I}^-$
- Z)  $\text{F}^-$

**Toss Up Answer: Y**

-----

**Bonus: Short Answer**

By name or number, which of the following are second order reactions?  $\text{Sn}1$ ,  $\text{Sn}2$ ,  $\text{E}1$ ,  $\text{E}2$

**Bonus Answer:  $\text{Sn}2$  and  $\text{E}2$  only (accept 2, 4 only)**

=====

## 94. CHEMISTRY

**Toss Up: Short Answer**

By name or number, which of the following is associated with inversion of stereochemistry?  $\text{Sn}1$ ,  $\text{Sn}2$ ,  $\text{E}1$ ,  $\text{E}2$

**Bonus Answer:  $\text{Sn}2$  only (2 only)**

-----

**Bonus: Short Answer**

Which rule states that in  $\text{E}1$  and  $\text{E}2$  reactions, the more substituted double bond is more likely to occur?

**Bonus Answer: Saytzeff rule**

=====

## 95. CHEMISTRY

**Toss Up: Multiple Choice**

If 2 moles of Ar and 5 moles of Xe are placed into one container. What is the partial pressure of Ar if the container is at 14 atm?

W) 2 atm  
X) 5 atm  
Y) 4 atm  
Z) 10 atm

**Toss Up Answer: Y**

---

**Bonus: Short Answer**

How much faster is the effusion of helium gas compared to ammonia gas, to the nearest whole number?

**Bonus Answer: 2**

---

**96. CHEMISTRY**

**Toss Up: Multiple Choice**

What is the second most electronegative element?

- W) Fluorine  
X) Oxygen  
Y) Chlorine  
Z) Neon

**Toss Up Answer: X**

---

**Bonus: Multiple Choice**

Which of the following is a weak electrolyte?

- W) Ammonium Hydroxide  
X) Glucose  
Y) Water  
Z) Nitric Acid

**Bonus Answer: W**

---

**97. CHEMISTRY**

**Toss Up: Multiple Choice**

Which of the following is insoluble in water?

- W) Magnesium Chloride  
X) Ammonium Hydroxide  
Y) Potassium Carbonate  
Z) Barium Sulfate

**Toss Up Answer: Z**

---

**Bonus: Short Answer**

What is the chemical name and formula of the compound that makes up quartz?

**Bonus Answer: Silicon Dioxide SiO<sub>2</sub>**

---

**98. CHEMISTRY**

**Toss Up: Multiple Choice**

Which of the following is the lightest element with no stable isotopes?

- W) Tellurium  
X) Technetium

Y) Promethium

Z) Radon

**Toss Up Answer: X**

---

**Bonus: Multiple Choice**

Which of the following is the strongest intermolecular force?

W) Hydrogen Bonding

X) Ionic Bonding

Y) London Dispersion Force

Z) Covalent Bonding

**Bonus Answer: W**

---

## 99. CHEMISTRY

**Toss Up: Short Answer**

Name the most reactive nonmetal.

**Bonus Answer: Fluorine**

---

**Bonus: Short Answer**

Name the transition metal whose carbide is known to be one of the hardest, is used in drills, saws, and lightbulbs, and has the highest melting point of all pure metals.

**Bonus Answer: Tungsten**

---

## 100. CHEMISTRY

**Toss Up: Short Answer**

Name the most reactive member of the alkaline earth metals.

**Bonus Answer: Radium**

---

**Bonus: Short Answer**

By name or by number, Identify the ion(s) that has/have the smallest ionic radius?

Ca  $2+$ , Sr  $2+$ , Mg  $2+$ , Na  $+$ , F  $-$

**Bonus Answer: Mg  $2+$**

---

## 101. CHEMISTRY

**Toss Up: Multiple Choice**

Which of the following is a polar molecule?

W) SO<sub>2</sub>

X) CH<sub>4</sub>

Y) SF<sub>6</sub>

Z) BF<sub>4</sub>

**Toss Up Answer: W**

---

**Bonus: Short Answer**

Fill in the blanks in the following statement to make it true. Ionic compounds are \_\_\_\_ conductors in their solid state, but \_\_\_\_ conductors when dissolved in water.

**Bonus Answer: poor; good**

---

## 102. CHEMISTRY

**Toss Up: Multiple Choice**

Which scientist performed an experiment in which he fired alpha particles at a thin sheet of gold foil?

- W) Niels Bohr
- X) Ernest Rutherford
- Y) J.J. Thomson
- Z) Max Planck

**Toss Up Answer: X**

---

**Bonus: Multiple Choice**

What is the name of the compound FeO?

- W) iron monoxide
- X) iron oxide
- Y) iron (I) oxide
- Z) iron (II) oxide

**Bonus Answer: Z**

---

## 103. CHEMISTRY

**Toss Up: Multiple Choice**

Which of the following is amphoteric?

- W) hydrogen fluoride
- X) ammonia
- Y) water
- Z) magnesium oxide

**Toss Up Answer: Y**

---

**Bonus: Short Answer**

What is the molecular geometry of nitrogen trichloride?

**Bonus Answer: trigonal pyramidal (also accept trigonal pyramid)**

---

## 104. CHEMISTRY

**Toss Up: Short Answer**

Which group of elements produce colored ions?

**Bonus Answer: Transition metals**

---

**Bonus: Short Answer**

Which scientist won a Nobel prize in Physics in 1918, whose constant is used to determine the amount of energy, given the wavelength of a wave?

**Bonus Answer: Max Planck, Planck**

---

## 105. CHEMISTRY

**Toss Up: Multiple Choice**

Certain atoms exhibit paramagnetic or diamagnetic bonding. Of the following below which choice is classified as paramagnetic?

- W) Zinc (Zn)
- X) Krypton (Kr)
- Y) Helium (He)
- Z) Oxygen (O)

**Toss Up Answer: Z**

---

**Bonus: Short Answer**

Melting point is effected by bond strength. Order the following compounds in increasing order of melting point: graphite, methane, lithium, sodium chloride.

**Bonus Answer: Methane, lithium, sodium chloride, graphite (2, 3 , 4, 1)**

=====

**106. CHEMISTRY**

**Toss Up: Short Answer**

What activates pepsinogen to change into pepsin?

**Bonus Answer: Hydrochloric acid**

-----

**Bonus: Short Answer**

What is the pH of gastric juice?

**Bonus Answer: 1.5 to 2.5 (or any number in between)**

=====

**107. CHEMISTRY**

**Toss Up: Short Answer**

What colour does Xenon release when energised?

**Bonus Answer: White light (all colours)**

-----

**Bonus: Short Answer**

What is the difference between electronegativity and electron affinity?

**Bonus Answer: Electron affinity: the amount of energy in kJ/mol needed to add an electron to an element**

**Electronegativity: how much an atom wants an electron (no unit)**

=====

**108. CHEMISTRY**

**Toss Up: Short Answer**

Each element has its own electron configuration. What is the electron configuration of chromium (Cr).

**Bonus Answer: [Ar] 3d<sup>5</sup> 4s<sup>1</sup> (Also accept 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>6</sup> 3s<sup>2</sup> 3p<sup>6</sup> 3d<sup>5</sup> 4s<sup>1</sup>)**

-----

**Bonus: Multiple Choice**

There are various numbers of pi and sigma bonds in certain compounds. Which of the choices below best describes the number of pi and sigma bonds ethyne (acetylene) has?

W) 2 pi bonds and 1 sigma bonds

X) 3 pi bonds and 2 sigma bonds

Y) 2 pi bonds and 3 sigma bonds

Z) 4 pi bonds

**Bonus Answer: Y**

=====

**109. CHEMISTRY**

**Toss Up: Multiple Choice**

Who discovered electronegativity?

W) Linus Pauling

X) Ernest Rutherford

Y) Harold Urey

Z) Carl Bosch

**Toss Up Answer: W**

-----

**Bonus: Short Answer**

List 2 gases used in the Miller-Urey experiment

Bonus Answer: Hydrogen, Water, Ammonia, Methane

=====

## 110. CHEMISTRY

Toss Up: Short Answer

In organisms, the bonds in polypeptide chains are formed between which two ends of the amino acid?

Bonus Answer: Carboxyl, amino OR the side with the NH<sub>2</sub> group, the side with the COOH group

=====

Bonus: Short Answer

Fatty acids have three carbon chains attached to what type of molecule?

Bonus Answer: glycerol

=====

## 111. CHEMISTRY

Toss Up: Multiple Choice

Which of the following is a strong nucleophile?

- W) ethanol
- X) butanol
- Y) Bromide
- Z) t-butoxide

Toss Up Answer: Y

=====

Bonus: Multiple Choice

What causes Coordination compounds to be different colors

- W)  $\Delta E$
- X) s orbital overlap
- Y) VESPR
- Z) p orbital overlap

Bonus Answer: W

=====

## 112. CHEMISTRY

Toss Up: Multiple Choice

The modified form of the Ideal Gas Law includes which of the following?

- W) Higher pressure, Higher Volume
- X) Higher pressure, Lower volume
- Y) Lower Pressure, Higher volume
- Z) Lower pressure, Lower volume

Toss Up Answer: Y

=====

Bonus: Short Answer

Rank the following gases in order from least ideal to most ideal: He, N<sub>2</sub>, HCl, SF<sub>6</sub>

Bonus Answer: He, N<sub>2</sub>, SF<sub>6</sub>, HCl (accept 1,2,4,3)

=====

## 113. CHEMISTRY

Toss Up: Multiple Choice

Which of the following is the most electronegative element?

- W) Carbon
- X) Vanadium
- Y) Selenium
- Z) Fluorine

**Toss Up Answer: Z**

---

**Bonus: Short Answer**

What is the name given to the hybrid orbital created with a steric number of 3?

**Bonus Answer:  $2sp^2$**

---

## 114. CHEMISTRY

**Toss Up: Multiple Choice**

Which of the following forces is the only force that bonds noble gases?

W) Dipole-Dipole

X) Ionic

Y) Covalent

Z) London Dispersion Forces

**Toss Up Answer: Z**

---

**Bonus: Short Answer**

What term is used to describe the energy released by the bonding of gaseous ions to form one mole of a substance?

**Bonus Answer: lattice energy**

---

## 115. CHEMISTRY

**Toss Up: Multiple Choice**

Which of the following elements has the highest reflectivity?

W) Gold

X) Silver

Y) Mercury

Z) Gallium

**Toss Up Answer: X**

---

**Bonus: Short Answer**

What is Avogadro number to the nearest ten-thousandths?

**Bonus Answer:  $6.0221 \times 10^{23}$**

---

## 116. CHEMISTRY

**Toss Up: Multiple Choice**

Which element breaks the octet rule?

W) Ga

X) Xe

Y) Cu

Z) F

**Toss Up Answer: X**

---

**Bonus: Short Answer**

What is the empirical formula of  $C_6H_{11}$ ?

**Bonus Answer:  $C_6H_{11}$**

---

## 117. CHEMISTRY

**Toss Up: Short Answer**

For E2 reactions to occur, the Hydrogen has to be what to the leaving group?

**Bonus Answer: antiperiplanar**

---



**Bonus: Short Answer**

List the following formations in order of lowest stability to highest: Trans, Geminal, Cis

**Bonus Answer: cis, geminal, trans**

=====

**118. CHEMISTRY**

**Toss Up: Multiple Choice**

In the following redox reaction:  $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$  which compound is the oxidizing agent?

- W)  $\text{O}_2$
- X)  $\text{CH}_4$
- Y)  $\text{CO}_2$
- Z)  $\text{H}_2\text{O}$

**Toss Up Answer: W**

=====

**Bonus: Short Answer**

Given the organic molecule  $\text{C}_6\text{H}_{14}$  how many different structural isomers can be formed?

**Bonus Answer: Five**

=====

**119. CHEMISTRY**

**Toss Up: Multiple Choice**

Certain compounds are insoluble in solution. Which of the following choices below is soluble in aqueous solution?

- W)  $\text{BaSO}_4$
- X)  $\text{AgCl}$
- Y)  $\text{AgNO}_3$
- Z)  $\text{NiCO}_3$

**Toss Up Answer: Y**

=====

**Bonus: Short Answer**

There is a variety of lab techniques that could be used to separate precipitates from the supernatant liquid. Which of the following lab techniques: centrifuge, distillation, chromatography, and titration can be used to separate them.

**Bonus Answer: Centrifuge (1)**

=====

**120. CHEMISTRY**

**Toss Up: Short Answer**

Please balance the given equation  $\text{CO}_3^{2-} + 2\text{H}^+ \rightarrow \text{H}_2\text{O} + \text{CO}_2$

**Bonus Answer: 1,1,1**

=====

**Bonus: Multiple Choice**

There are various pieces of chemical equipment. What is a piece of glassware designed specifically for usage in creating solutions?

- W) Erlenmeyer flask
- X) Florence flask
- Y) Volumetric flask
- Z) Graduated cylinder

**Bonus Answer: Y**

=====

**121. CHEMISTRY**

**Toss Up: Multiple Choice**

Under what conditions would 1.0 mol of  $\text{CO}_2(\text{g})$  behave most like an ideal gas?

- W) 100 K and 100 atm

- X) 800 K and 0.1 atm
- Y) 800 K and 1 atm
- Z) 800 K and 100 atm

**Toss Up Answer: X**

---

**Bonus: Short Answer**

A sample of 9.00 grams Al(s) is added to excess HCl(aq). What is the volume of the hydrogen gas produced at STP?

**Bonus Answer: 11.2 L**

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**122. CHEMISTRY**

**Toss Up: Multiple Choice**

As the temperature is raised from 20 degrees Celsius to 40 degrees Celsius, the average energy of a sample of neon atoms changes by a factor of

- W) 1/2
- X)  $\sqrt{313/293}$
- Y) 313/293
- Z) 2

**Toss Up Answer: Y**

---

**Bonus: Short Answer**

A sample of oxygen gas occupies 8.00 L at 127 degrees Celsius and 775 mmHg. It is heated at constant pressure and expands to 20.00 L. In Celsius what is the new temperature?

**Bonus Answer: 727 degrees celsius**

---

**123. CHEMISTRY**

**Toss Up: Multiple Choice**

Which gas effuses at approximately one half as fast as ammonia?

- W) He
- X) CO<sub>2</sub>
- Y) Cl<sub>2</sub>
- Z) CH<sub>4</sub>

**Toss Up Answer: Y**

---

**Bonus: Multiple Choice**

For which of two gases are the rates of effusion 2:1?

- W) Ne and Kr
- X) He and O<sub>2</sub>
- Y) H<sub>2</sub> and He
- Z) N<sub>2</sub> and Ar

**Bonus Answer: W**

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**124. CHEMISTRY**

**Toss Up: Short Answer**

At what temperature Kelvin does water freeze?

**Bonus Answer: 273 K**

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**Bonus: Short Answer**

Who came up with the caloric theory?

Bonus Answer: Antoine Lavoisier

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## 125. CHEMISTRY

Toss Up: Multiple Choice

Which of the following has a coordinate covalent bond?

W) butanol

X) CO<sub>2</sub>

Y) Methane

Z) NH<sub>4</sub><sup>+</sup>

Toss Up Answer: Z

=====

Bonus: Short Answer

What is the formal charge of Nitrogen in an ammonia molecule?

Bonus Answer: 0

=====

## 126. CHEMISTRY

Toss Up: Multiple Choice

Which of the following compounds does not exist?

W) PF<sub>5</sub>

X) P<sub>4</sub>O<sub>10</sub>

Y) P<sub>4</sub>O<sub>6</sub>

Z) PH<sub>5</sub>

Toss Up Answer: Y

=====

Bonus: Short Answer

Order the following hydrogen halides from the one with the lowest boiling point to one with the highest: HI, HCl, HBr, HF

Bonus Answer: HCl, HBr, HI, HF (2, 3, 1, 4)

=====

## 127. CHEMISTRY

Toss Up: Multiple Choice

Which of the following is the most acidic?

W) o-methoxy benzoic acid

X) benzoic acid

Y) m-methoxy benzoic acid

Z) p-methoxy benzoic acid

Toss Up Answer: W

=====

Bonus: Short Answer

What is the equivalent weight of HNO<sub>3</sub> in the reaction: Cu reacts with HNO<sub>3</sub>, forming Cu(NO<sub>3</sub>)<sub>2</sub>, NO and water.

Bonus Answer: 84

=====

## 128. CHEMISTRY

Toss Up: Multiple Choice

The last electron of lanthanum enters in the:

W) d orbital

X) s orbital

Y) p orbital

Z) f orbital

**Toss Up Answer: W**

---

**Bonus: Multiple Choice**

Which of the following is true for B<sub>3</sub>N<sub>3</sub>H<sub>6</sub>

- W) Its name is Nitroborane
- X) All the atoms are sp-hybridised
- Y) It has 3 lone pairs of electrons
- Z) It is isostructural with benzene

**Bonus Answer: Z**

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**129. CHEMISTRY**

**Toss Up: Multiple Choice**

Which of the following statements is true?

- W) Hydrogen peroxide has a planar structure
- X) Tritium is radioactive and emits alpha particles
- Y) H<sub>2</sub> is insoluble in water
- Z) Hydrogen constitutes 70% of the Earth's crust by mass

**Toss Up Answer: Y**

---

**Bonus: Multiple Choice**

Which of the following gas mixtures is not applicable to Dalton's law of Partial Pressures?

- W) CO<sub>2</sub> and N<sub>2</sub>
- X) CO<sub>2</sub> and CO
- Y) SO<sub>2</sub> and O<sub>2</sub>
- Z) N<sub>2</sub> and CO

**Bonus Answer: Y**

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**130. CHEMISTRY**

**Toss Up: Short Answer**

Given the equation  $\text{HCl (aq)} + \text{NaOH (aq)} \rightarrow \text{NaCl (aq)} + \text{H}_2\text{O (l)}$  and that 10.00 mL of 1.5 M HCl was reacted with 20.00 mL of 0.80 M of NaOH, which compound is the limiting reactant?

**Bonus Answer: HCl ( Hydrochloric acid)**

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**Bonus: Multiple Choice**

In organic chemistry what is the name of the functional group consisting of a central carbon singly bonded to two carbon atoms and doubly bonded to an oxygen atom?

- W) amine
- X) amide
- Y) ether
- Z) ketone

**Bonus Answer: Z**

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**131. CHEMISTRY**

**Toss Up: Short Answer**

How many sigma and pi bonds does 1,3 butdiene have, respectively?

**Bonus Answer: 3 sigma, 2 pi**

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**Bonus: Short Answer**

S orbital overlap has what shape?

**Bonus Answer: spherical, sphere**

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**132. CHEMISTRY**

**Toss Up: Short Answer**

What is the electron configuration for Fluorine?

**Bonus Answer:  $1s^2 2s^2 2p^5$**

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**Bonus: Short Answer**

What is the noble gas configuration of Fluorine ?

**Bonus Answer:  $[\text{He}]2s^2 2p^5$**

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**133. CHEMISTRY**

**Toss Up: Short Answer**

Which element is the more electronegative?

**Bonus Answer: Fluorine**

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**Bonus: Short Answer**

Name all the atoms that are diatomic.

**Bonus Answer: Hydrogen ( $\text{H}_2$ )**

**Nitrogen ( $\text{N}_2$ )**

**Oxygen ( $\text{O}_2$ )**

**Fluorine ( $\text{F}_2$ )**

**Chlorine ( $\text{Cl}_2$ )**

**Iodine ( $\text{I}_2$ )**

**Bromine ( $\text{Br}_2$ )**

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**134. CHEMISTRY**

**Toss Up: Short Answer**

How did Mendeleev arrange the elements of the periodic table?

**Bonus Answer: In order of increasing atomic mass.**

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**Bonus: Short Answer**

How did Moseley change the periodic table?

**Bonus Answer: He arranged the elements in increasing atomic numbers.**

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**135. CHEMISTRY**

**Toss Up: Short Answer**

What is the word that describes a substance that reacts with both strong acids and strong bases?

**Bonus Answer: Amphoteric**

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**Bonus: Multiple Choice**

The triple bond between the carbon atoms causes acetylene,  $\text{C}_2\text{H}_2$ , to have which of the following shapes?

W) Trigonal planar (pron: try-gon-al)

X) Linear

Y) Tetrahedral

Z) Trigonal bipyramidal

Bonus Answer: X

=====

### 136. CHEMISTRY

Toss Up: Short Answer

Find the molecular geometry for a  $\text{NH}_3$  ion

Bonus Answer: Trigonal Pyramidal

=====

Bonus: Short Answer

State all the group numbers which consist of the representative elements.

Bonus Answer: 1,2,13,14,15,16,17, and 18 (Accept 1-2, 13-18)

=====

### 137. CHEMISTRY

Toss Up: Short Answer

What is the name of a cyclic molecule with 6 carbons?

Bonus Answer: cyclohexane

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Bonus: Multiple Choice

Which of the following compounds contains a double bond?

W) butene

X) acetylene

Y) butane

Z) butyne

Bonus Answer: W

=====

### 138. CHEMISTRY

Toss Up: Multiple Choice

What is the name given to the non-superimposable mirror image forms of chiral compounds?

W) Diastereomers

X) Stereoisomers

Y) Enantiomers

Z) Cis-trans isomers

Toss Up Answer: Y

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Bonus: Short Answer

What metal is used as a reducing agent to obtain iron from iron oxide in the Thermite process?

Bonus Answer: Aluminum

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