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State Competition Practice Test

Section I – Chemical Formulas

Q 1. Which of the following is true:

- A. An atom does not gain or lose any electrons when it chemically combines with another element
- B. Nonmetal atoms tend to lose electrons
- C. When the outermost energy level of an atom contains eight valence electrons, the atom is very unstable.
- D. A neutral atom that loses electrons acquires a positive oxidation number

Answer is D on page 5

Q 2. In writing chemical formulas, the name of the element

- A. with the negative oxidation number is written first
- B. with the positive oxidation number is written first
- C. for the non-metal is written first
- D. for the salt is written first

Answer is B on page 5

Q 3. The chemical name for common table sugar is sucrose and its chemical formula is

- A. $C_{10}H_{20}O_{10}$
- B. $C_{12}H_{21}O_{12}$
- C. $C_{12}H_{22}O_{11}$
- D. $C_{11}H_{22}O_{12}$

Answer is C on page 6

Section II – Forces of Attraction

Q 4. The force of gravity on earth will make an object fall to the ground when it is thrown because

- A. the mass of the sun is greater than the earth's
- B. the mass of the stone is less than the person who threw the stone
- C. the mass of the person who threw the stone is more than the stone's
- D. the mass of the earth is greater than the person who threw the stone

Answer is D on page 7

Q 5. Which of the following is true:

- A. All metals have magnetic properties
- B. Opposite poles of magnets repel each other
- C. The chemical formula for the mineral magnetite in lodestone rocks is Fe_4O_3
- D. Some magnets have a stronger magnetic force than others

Answer is D on page 9

Q 6. The forces of attraction that create chemical bonds are described by:

- A. Coulomb's Law
- B. Newton's Law
- C. Boyle's Law
- D. Lewis' Law

Answer is A on page 10

Q 7. Valence electrons are:

- A. in the innermost energy level of an atom
- B. in the outermost energy level of an atom
- C. in any energy level of an atom
- D. not in an energy level of an atom

Answer is B on page 11

Q 8. Which of the following is correct about electronegativity?

- A. It increases from left to right across the periodic table
- B. It increases from top to bottom of the periodic table
- C. Francium is the most electronegative element
- D. The most electronegative elements have the lowest ionization energies

Answer is A on pages 11-12

Q 9. Which of the following is NOT correct?

- A. Ionic bonds occur when two nearby atoms share electrons
- B. Covalent bonds occur when two nearby atoms share electrons
- C. Metallic bonds form when the atoms in a metal share their electrons spanning the entire object

D. Metallic bonds form in elements that have high ionization energies

Answer is A on pages 13 – 16

Q 10. Which of the following correct?

- A. Silver and gold are precious metals because they are more reactive than most other metals
- B. Luster is the ability to reflect heat
- C. Metals have good electrical conductivity because their neutrons cannot move easily throughout
- D. Metals have good thermal conductivity because their electrons are very good at carrying excited energy around

Answer is D on page 16

Q 11. Copper is commonly used in wiring because:

- A. It is highly malleable and ductile
- B. It is not a precious metal
- C. It is in group 11 of the Periodic Table
- D. It turns green if exposed to air for too long

Answer is A on page 17

Q 12. Which of the following is NOT true about Sir Isaac Newton:

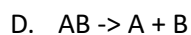
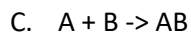
- A. He proposed that white light is made of a mixture of different colored rays
- B. He invented the reflecting telescope
- C. He is known for his law of conservation of mass
- D. He is known for his theory of fluids

Answer is C on page 8

Section III – Chemical Reactions

Q 13. Using A, B, C, and D to represent chemical elements and compounds, a single replacement or displacement reaction can be represented by:

- A. $AB + CD \rightarrow AD + CB$
- B. $A + BC \rightarrow AC + B$



Answer is B on page 20

Q 14. Which of the following is correct?

- A. An oxidation-reduction or redox reaction is a chemical reaction in which the oxidation number of the atoms does not change
- B. A redox reaction results in a net gain or loss of electrons
- C. Combustion and corrosion are examples of redox reactions that do not involve oxygen
- D. Redox reactions are common

Answer is D on page 21

Q 15. Which of the following is NOT correct?

- A. A chain reaction is a series of chemical reactions that never terminate
- B. Both products and reactants may be present at the same time in a reversible reaction
- C. The concentrations of the reactants and products do not change if the reaction is in equilibrium
- D. The equilibrium of a reaction can be manipulated

Answer is A on page 22

Q 16. Which of the following is correct?

- A. Endothermic reactions give off energy, often as heat
- B. Exothermic reactions give off energy, often as heat
- C. A catalyst can change the rate of reaction but is not consumed or changed
- D. The rate of a chemical reaction is not commonly affected by the concentration of the reactants

Answer is C on page 25

Q 17. Which of the following is NOT correct?

- A. Heat is sometimes released during a chemical reaction
- B. Heat is never required to initiate a chemical reaction
- C. A secondary product of a chemical reaction may not be a desired product
- D. The rate of a chain reaction is always very fast

Answer is C on page 19

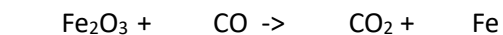
Section IV – Balancing Chemical Equations

Q 18. Which of following is NOT correct?

- A. There are no exceptions to the law of conservation of matter or mass
- B. Antoine Lavoisier changed chemistry from a qualitative science to a quantitative one.
- C. In a chemical reaction the reactants are shown on the left side of the equation and the products on the right
- D. Balancing chemical reaction equations is similar to solving mathematical ones

Answer is A on page 27

Q 19. Balance the following chemical reaction equation:



Answer is $\text{Fe}_2\text{O}_3 + 3 \text{CO} \rightarrow 3 \text{CO}_2 + 2 \text{Fe}$

Q 20. Balance the following chemical reaction equation:



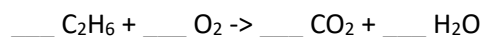
Answer is $2 \text{NO}_2 \rightarrow \text{N}_2 + 2 \text{O}_2$

Q 21. Balance the following chemical reaction equation:



Answer is $2 \text{N}_2\text{O}_5 \rightarrow 2 \text{N}_2 + 5 \text{O}_2$

Q 22. Balance the following chemical reaction equation:



Answer is $2 \text{C}_2\text{H}_6 + 7 \text{O}_2 \rightarrow 4 \text{CO}_2 + 6 \text{H}_2\text{O}$

Section V – Chemicals by Mass

Q 23. The weighted average mass of all of an element's isotopes compared with 1/12 the mass of one atom of carbon-12 is the

- A. Atomic mass
- B. Relative atomic mass
- C. Relative atomic density
- D. Mass

Answer is B on page 30

Q 24. Which of the following is the correct value for Avogadro's Number?

- A. 6.022×10^{23}
- B. 6.025×10^{25}

C. 6.020×10^{20}

D. 6.021×10^{21}

Answer is A on page 31

Q 25. Which of the following is correct?

A. A mole of hydrogen contains Avogadro's number of atoms of hydrogen

B. A mole of carbon contains 12 times this number because carbon is 12 times heavier than hydrogen

C. Mole Day parties for chemists start in third week of June at 10:23 am

D. Avogadro's Law states that for equal volumes of gases at the same temperature and pressure the gases will not have same numbers of molecules

Answer is A on page 31

Q 26. Which instrument is used to figure out the relative masses of atoms?

A. Mass photometer

B. Mass spectrometer

C. Mass balance

D. Mass electrogram

Answer is A on page 30

Section VI – Chemicals by Volume – Solutions

Q 27. In a solution of sugar water, which component would be considered the solute?

A. Water

B. Sugar

C. Water and sugar

D. None of the above

Answer is B on page 33

Q 28. 0.25 L of milk first only had 10 ml of chocolate syrup. What will happen if 3 ml of milk are added?

A. The concentration of syrup increases

B. The concentration of syrup decreases

C. The concentration of milk increases

D. The concentration of milk decreases

Answer is B on page 34

Q 29. An equal volume of a 10% salt water solution is mixed with a 30% salt water solution. What is the final concentration of the combined salt water solution?

- A. 25 %
- B. 30 %
- C. 10 %
- D. 20 %

Answer is D on page 33

Q 30. What would be most likely to happen to a solution if it is super saturated?

- A. Form crystals
- B. Evaporate
- C. Sublime
- D. Condense

Answer is A on page 35

Q 31. Polar solvents usually

- A. have an even distribution of electrons
- B. have an uneven distribution of electrons
- C. have an average distribution of electrons
- D. have an uneven distribution of protons

Answer is B on page 35

Q 32. Membranes use osmotic pressure to separate a/an ____ from a solution

- A. Solute
- B. Solvent
- C. Molecule
- D. Ion

Answer is B on page 36

Q 33. Adding what material to water will increase its boiling point?

- A. Ice
- B. Soda
- C. Salt
- D. Hydrogen

Answer is C on page 36

Q 34. If pure water is mixed with another substance to form a solution, the boiling point of the new solution will be ____ than the boiling point of pure water

- A. Lower
- B. Higher
- C. The same
- D. The average of the two

Answer is B on page 36

Q 35. Which of the following is correct?

- A. A solution is a heterogeneous mixture of one or more substances dissolved in another
- B. The solvent is the active ingredient
- C. The solute is the active ingredient
- D. The solvent is the inert ingredient

Answer is D on page 33

Q 36. Which of the following is correct?

- A. The molarity of an 8 L solution containing 2 moles of NaCl is 0.25 M
- B. The molality of an 8 L solution containing 2 moles of NaCl is 0.25 M
- C. A concentrated solution contains a large amount of solvent compared to the amount of solute present
- D. The saturation point only changes significantly with temperature.

Answer is A on page 34

Section V11 – Acids, Bases, and pH

Q 37. Bases are solutions that are known to have an excess of ____

- A. Cations
- B. H⁺ ions
- C. Anions
- D. OH⁻ ions

Answer is D on page 39

Q 38. Bromothymol Blue (BTB) turns what color in the presence of an acid or base

- a. Yellow in acid, blue in base
- b. Pink in acid, green in base

- c. White in acid, yellow in base
- d. Blue in acid, white in base

Answer is A on page 40

Q 39. Which material would not be considered an indicator?

- A. Litmus paper
- B. Phenolphthalein solution
- C. Magnetic color paper
- D. Bromothymol Blue

Answer is C on page 40

Q 40. Acids are known to have an excess amount of

- A. H ions
- B. OH ions
- C. O ions
- D. Positive ions

Answer is A on page 38

Q 41. In regards to a pH scale, solutions with a pH of 7 are considered to be ____

- A. Basic
- B. Ionic
- C. Acidic
- D. Neutral

Answer is D on page 37

Q 42. In regards to a pH scale, solutions with a pH of 0 to 6 are considered to be ____

- A. Ionic
- B. Acidic
- C. Neutral
- D. Basic

Answer is B on page 37

Q 43. In regards to a pH scale, solutions with a pH of 8 to 14 are considered to be ____

- A. Basic
- B. Bases
- C. Alkalis
- D. All of the above

Answer is A on pages 37 and 39

Q 44. If the pH of a substance increases by 2 points, the acidity increases by

- A. 1000
- B. 100
- C. 10,000
- D. 10

Answer is B on page 37

Q 45. What color does litmus paper change to in the presence of a base?

- A. Red
- B. Blue
- C. Pink
- D. White

Answer is B on page 40

Q 46. Which of the following is correct?

- A. Highly acid rain has a pH above 7
- B. Clean rain has a pH of 5.6
- C. Vinegar has a pH of 5.6
- D. Milk has a pH of 5.6

Answer is B on page 38

Q 47. Which of the following is NOT correct?

- A. Acids have a bitter taste and bases have a sour taste
- B. Acids have a sour taste and bases have a bitter taste
- C. All alkalis are bases
- D. Bases feel slippery to the touch

Answer is B on pages 38-39

Q 48. Which of the following is correct?

- A. Cherries and beets appear red in acidic solutions but turn blue or purple in basic ones
- B. Cherries and beets appear red in basic solutions but turn blue or purple in acid ones
- C. Hydrangea flowers can be blue in either acidic or basic soil
- D. Hydrangea flowers can only be blue in basic soil

Answer is A on page 40

Q 49. Which of the following is NOT true?

- A. Ammonia is a base and an alkali
- B. Calcium carbonate is a base that is also an alkali
- C. Strong bases can be dangerous to your skin
- D. Bases are used to make soaps

Answer is A on page 39

Q 50. Which of the following is correct?

- a. Sea water is an acid
- b. Vinegar is an acid
- c. Coffee is a base
- d. Milk is a base

Answer is B on page 38