PRACTICE EXAM 15: PHYSICAL SETTING/CHEMISTRY SIMULATION (85 QUESTIONS)

1. The center of an atom, which contains protons and neutrons, is called the _____.

A. electron cloud

B. orbital

C. valence shell

D. nucleus

2. The number of _____ in an atom determines its identity as a particular element.

A. neutrons

B. electrons

C. energy levels

D. protons

3. An electron carries a _____ electrical charge.

A. positive

B. negative

C. neutral

D. variable

4. Atoms of the same element that differ in their number of neutrons are called _____.

A. ions

B. molecules

C. isotopes

D. compounds

5. Elements in the same vertical column, or group, of the periodic table tend to have similar _____.

A. chemical properties

B. atomic masses

C. numbers of neutrons

D. colors

6. When metals react, they tend to _____ electrons to form positive ions.

A. gain

B. share

C. destroy

D. lose

7. When nonmetals react, they tend to _____ electrons to form negative ions.

A. lose

B. destroy

C. gain

D. release

8. A bond formed by the transfer of electrons between a metal and a nonmetal is called a(n) _____ bond.

A. covalent

B. ionic

C. metallic

D. hydrogen

9. A bond formed when two nonmetal atoms share electrons is called a(n) _____ bond.

A. ionic

B. metallic

C. hydrogen

D. covalent

10. One mole of any substance contains _____ particles.

A. 6.02×10^{23}

B. 3.01×10^{23}

C. 1.00×10^{23}

D. 12×10^{23}

11. At STP, one mole of any gas occupies a volume of _____.

A. 1.0 L

B. 11.2 L

C. 100 L

D. 22.4 L

12. A balanced chemical equation must have the same number of each type of _____ on both sides.

A. molecule

B. coefficient

C. charge

D. atom

13. A reaction that releases heat to its surroundings is described as _____.

A. endothermic

B. exothermic

C. neutral

D. nuclear

14. A substance that speeds up a reaction without being used up is called a(n) _____.

A. reactant

B. inhibitor

C. catalyst

D. product

15. The minimum energy needed for a reaction to begin is called the _____ energy.

A. bond

B. ionization

C. kinetic

D. activation

16. According to the Arrhenius theory, an acid is a substance that produces _____ ions in solution.

A. hydrogen

B. hydroxide

C. chloride

D. sodium

17. According to the Arrhenius theory, a base is a substance that produces _____ ions in solution.

A. hydrogen

B. hydroxide

C. sulfate

D. nitrate

18. A solution with a pH of exactly 7 is described as _____.

A. acidic

B. basic

C. neutral

D. saturated

19. In a redox reaction, oxidation is defined as the _____ of electrons.

A. loss

B. gain

C. sharing

D. doubling

20. In a redox reaction, reduction is defined as the _____ of electrons.

A. loss

B. sharing

C. gain

D. removal

21. The time it takes for half of a radioactive sample to decay is called its _____.

A. decay constant

B. reaction time

C. half-life

D. lifetime

22. An alpha particle is identical to the nucleus of a _____ atom.

A. hydrogen

B. carbon

C. neon

D. helium

23. A substance in the _____ state has both a definite shape and a definite volume.

A. liquid

B. solid

C. gas

D. plasma

24. A substance in the gas state has neither a definite shape nor a definite volume and will _____ its container.

A. expand to fill

B. sink to the bottom of

C. crystallize within

D. shrink away from

25. The change of state from a solid to a liquid is called _____.

A. freezing

B. boiling

C. sublimation

D. melting

26. The change of a substance directly from a solid to a gas is called _____.

A. melting

B. condensation

C. freezing

D. sublimation

27. Temperature is a measure of the average _____ energy of the particles in a sample.

A. potential

B. chemical

C. kinetic

D. nuclear

28. The concentration unit equal to moles of solute per liter of solution is called _____.

A. density

B. molarity

C. molality

D. percent

29. A solution that contains the maximum amount of dissolved solute at a given temperature is said to be _____.

A. unsaturated

B. saturated

C. dilute

D. neutral

30. For most solids, solubility _____ as the temperature of the solvent increases.

A. increases

B. decreases

C. stays the same

D. drops to zero

31. The measure of an atom's ability to attract the electrons in a bond is called _____.

A. ionization energy

B. atomic radius

C. density

D. electronegativity

32. As you move from left to right across a period, the atomic radius generally _____.

A. increases

B. stays the same

C. decreases

D. doubles

33. As you move down a group, the first ionization energy generally _____.

A. increases

B. stays the same

C. decreases

D. becomes negative

34. A reaction in which two or more substances combine to form a single product is called a _____ reaction.

A. synthesis

B. decomposition

C. single-replacement

D. double-replacement

35. A reaction in which a single compound breaks down into simpler substances is called a _____ reaction.

A. synthesis

B. decomposition

C. combustion

D. neutralization

36. The reaction between an acid and a base produces water and a(n) _____.

A. salt

B. metal

C. gas

D. acid

37. A pure substance made of only one type of atom is called a(n) _____.

A. compound

B. mixture

C. solution

D. element

38. A pure substance formed when two or more elements are chemically combined is called a(n) _____.

A. mixture

B. compound

C. alloy

D. isotope

39. A combination of substances that are only physically combined is called a(n) _____.

A. compound

B. element

C. molecule

D. mixture

40. A mixture that has a uniform composition throughout is described as _____.

A. homogeneous

B. heterogeneous

C. compound

D. pure

41. A change in which no new substance is formed is called a _____ change.

A. physical

B. chemical

C. nuclear

D. permanent

42. A change that produces one or more new substances is called a _____ change.

A. physical

B. chemical

C. phase

D. state

43. At constant temperature, increasing the pressure on a gas will cause its volume to _____.

A. decrease

B. increase

C. stay constant

D. become zero

44. At constant pressure, increasing the temperature of a gas will cause its volume to _____.

A. decrease

B. stay constant

C. become negative

D. increase

45. The _____ electrons, found in the outermost energy level, determine how an atom bonds.

A. valence

B. core

C. nuclear

D. paired

46. Noble gases are unreactive because they have a _____ outer electron shell.

A. half-empty

B. single

C. full

D. positive

47. Elements such as oxygen and nitrogen exist naturally as _____ molecules.

A. monatomic

B. triatomic

C. diatomic

D. ionic

48. The simplest whole-number ratio of atoms in a compound is given by its _____ formula.

A. empirical

B. molecular

C. structural

D. ionic

49. The sum of the atomic masses of all the atoms in a chemical formula is called the _____.

A. percent composition

B. molar volume

C. gram-formula mass

D. empirical mass

50. A substance that conducts electricity when dissolved in water is called a(n) _____.

A. insulator

B. electrolyte

C. solvent

D. nonelectrolyte

51. The complete combustion of a hydrocarbon produces carbon dioxide and _____.

A. hydrogen gas

B. oxygen gas

C. water

D. carbon monoxide

52. At _____, the rates of the forward and reverse reactions are equal.

A. completion

B. saturation

C. equilibrium

D. neutralization

53. Grinding a solid reactant into a powder increases the reaction rate by increasing its _____.

A. temperature

B. mass

C. concentration

D. surface area

54. Increasing the concentration of a reactant generally _____ the rate of a reaction.

A. decreases

B. stops

C. increases

D. reverses

55. A reaction that absorbs energy from its surroundings is described as _____.

A. exothermic

B. endothermic

C. combustion

D. spontaneous

56. An organic compound that contains only carbon and hydrogen is called a(n) _____.

A. carbohydrate

B. alcohol

C. hydrocarbon

D. ester

57. A hydrocarbon containing only single carbon-carbon bonds is called a(n) _____.

A. alkane

B. alkene

C. alkyne

D. aromatic

58. Compounds with the same molecular formula but different structures are called _____.

A. isotopes

B. isomers

C. allotropes

D. polymers

59. An ion with a positive charge is called a(n) _____.

A. anion

B. isotope

C. molecule

D. cation

60. An ion with a negative charge is called a(n) _____.

A. anion

B. cation

C. proton

D. nucleus

61. The amount of mass per unit volume of a substance is called its _____.

A. density

B. pressure

C. molarity

D. weight

62. Water can dissolve many ionic compounds because water molecules are _____.

A. nonpolar

B. polar

C. metallic

D. unreactive

63. The principle "like dissolves like" means that polar solvents tend to dissolve _____ solutes.

A. nonpolar

B. polar

C. metallic

D. gaseous

64. Adding salt to water _____ the freezing point of the water.

A. raises

B. doubles

C. has no effect on

D. lowers

65. Adding a nonvolatile solute to water _____ the boiling point of the solution.

A. lowers

B. raises

C. has no effect on

D. removes

66. Metals conduct electricity well because of their _____ electrons.

A. fixed

B. mobile

C. missing

D. shared-in-pairs

67. In an exothermic reaction, the products have _____ energy than the reactants.

A. more

B. the same

C. less

D. infinite

68. The number written in front of a formula in a chemical equation is called a _____.

A. coefficient

B. subscript

C. exponent

D. superscript

69. The small number written after an element's symbol, showing the number of atoms, is called a _____.

A. coefficient

B. exponent

C. subscript

D. superscript

70. The law of conservation of mass states that mass is neither created nor _____ in a chemical reaction.

A. measured

B. destroyed

C. weighed

D. balanced

71. The octet rule states that atoms tend to gain, lose, or share electrons to obtain _____ valence electrons.

A. eight

B. two

C. four

D. zero

72. A horizontal row of elements in the periodic table is called a _____.

A. group

B. period

C. family

D. block

73. The highly reactive metals found in Group 1 are called the _____.

A. noble gases

B. halogens

C. transition metals

D. alkali metals

74. The reactive nonmetals found in Group 17 are called the _____.

A. halogens

B. noble gases

C. alkali metals

D. metalloids

75. An element with properties between those of metals and nonmetals is called a _____.

A. noble gas

B. halogen

C. transition metal

D. metalloid

76. The process of changing one element into another through a nuclear reaction is called _____.

A. ionization

B. sublimation

C. neutralization

D. transmutation

77. The splitting of a heavy nucleus into smaller nuclei is called nuclear _____.

A. fusion

B. decay

C. fission

D. bonding

78. The joining of light nuclei into a heavier nucleus is called nuclear _____.

A. fusion

B. fission

C. decay

D. ionization

79. The kinetic molecular theory describes the particles of an ideal gas as being in constant, _____ motion.

A. circular

B. random

C. fixed

D. slow

80. According to collision theory, a reaction occurs only when particles collide with enough energy and the correct _____.

A. mass

B. color

C. orientation

D. charge

81. The instrument used to measure the heat absorbed or released during a reaction is a _____.

A. barometer

B. thermometer

C. calorimeter

D. manometer

82. An insoluble solid that forms when two solutions are mixed is called a _____.

A. solvent

B. solute

C. filtrate

D. precipitate

83. Each element produces a unique _____ spectrum that can be used to identify it.

A. continuous

B. bright-line

C. infrared

D. sound

84. STP stands for standard temperature and pressure, defined as 0 °C and _____ atmosphere of pressure.

A. 1

B. 0

C. 10

D. 100

85. In a saltwater solution, the salt is the _____ because it is the substance being dissolved.

A. solute

B. solvent

C. precipitate

D. catalyst

Practice Exam 15 – Explained Answer Key

1. D — The nucleus is the dense central region of an atom that holds the protons and neutrons. It contains nearly all of the atom's mass. The electrons occupy the space surrounding it.
2. D — The number of protons defines an element's identity, giving it its atomic number. No two elements share the same proton count. Changing it would change the element.
3. B — An electron carries a negative electrical charge. This negative charge balances the positive protons in a neutral atom. Electrons occupy the region outside the nucleus.

4. C — Isotopes are atoms of the same element with different numbers of neutrons. They share the atomic number but differ in mass. This gives them the same chemistry but different masses.
5. A — Elements in the same group share similar chemical properties because they have the same number of valence electrons. The outer electron arrangement governs reactivity. This is why groups behave alike.
6. D — Metals tend to lose electrons to form positive ions. Their loosely held valence electrons are easily given up. This produces cations.
7. C — Nonmetals tend to gain electrons to form negative ions. Their nearly full outer shells attract additional electrons. This produces anions.
8. B — An ionic bond forms by the transfer of electrons between a metal and a nonmetal. The resulting oppositely charged ions attract each other. This bonding gives ionic compounds high melting points.
9. D — A covalent bond forms when two nonmetal atoms share electrons. The shared pairs hold the atoms together. No ions are formed in covalent bonding.
10. A — One mole of any substance contains 6.02×10^{23} particles, Avogadro's number. This constant links a measurable amount to a particle count. It is the foundation of the mole concept.
11. D — At STP, one mole of any gas occupies 22.4 liters. This molar volume applies to all gases under standard conditions. It connects gas volume directly to moles.
12. D — A balanced equation must have the same number of each type of atom on both sides. This reflects the conservation of mass. Atoms are neither created nor destroyed.
13. B — A reaction that releases heat to its surroundings is exothermic. The products hold less energy than the reactants. The released energy warms the surroundings.
14. C — A catalyst speeds up a reaction without being used up. It lowers the activation energy by providing an easier pathway. The catalyst is recovered unchanged.
15. D — Activation energy is the minimum energy needed to start a reaction. It is the barrier colliding particles must overcome. Catalysts lower this barrier.
16. A — An Arrhenius acid produces hydrogen ions (H^+) in solution. These ions give acids their characteristic properties. This results in a pH below 7.
17. B — An Arrhenius base produces hydroxide ions (OH^-) in solution. These ions give bases their characteristic properties. This results in a pH above 7.
18. C — A solution with a pH of exactly 7 is neutral. Its hydrogen and hydroxide ion concentrations are equal. Pure water is the common example.
19. A — Oxidation is the loss of electrons in a redox reaction. Losing electrons raises the oxidation number. It always occurs with reduction.
20. C — Reduction is the gain of electrons in a redox reaction. Gaining electrons lowers the oxidation number. It always accompanies oxidation.
21. C — Half-life is the time it takes for half of a radioactive sample to decay. It is constant for a given isotope. Each half-life halves the remaining amount.
22. D — An alpha particle is identical to the nucleus of a helium atom. It contains two protons and two neutrons with a +2 charge. Its emission lowers the atomic number by two.
23. B — A substance in the solid state has both a definite shape and a definite volume. Its particles are locked in a fixed arrangement. This rigidity gives solids their form.
24. A — A gas expands to fill its container, having no definite shape or volume. Its particles move freely through the available space. This is a defining property of gases.
25. D — The change from solid to liquid is called melting. Added energy frees the particles to move. It occurs at the melting point.

26. D — The change directly from solid to gas is called sublimation. It bypasses the liquid state. Dry ice subliming is a common example.
27. C — Temperature measures the average kinetic energy of the particles in a sample. It reflects how fast the particles move. It governs reaction rates and phase changes.
28. B — Molarity is the concentration unit equal to moles of solute per liter of solution. It expresses how concentrated a solution is. Dividing moles by liters gives molarity.
29. B — A solution holding the maximum dissolved solute at a given temperature is saturated. No more solute will dissolve. It represents the solubility limit.
30. A — For most solids, solubility increases as the solvent's temperature rises. Added energy helps dissolve more solute. Warmer water holds more solid.
31. D — Electronegativity is the measure of an atom's ability to attract bonding electrons. It increases across a period and up a group. Fluorine has the highest value.
32. C — Atomic radius decreases from left to right across a period. The increasing nuclear charge pulls the electrons in more tightly. This shrinks the atom.
33. C — First ionization energy decreases down a group. The outer electrons are farther from the nucleus and more easily removed. Lower elements lose electrons more readily.
34. A — A reaction combining substances into a single product is a synthesis reaction. Simpler substances join into a more complex one. The single product is its signature.
35. B — A reaction breaking a single compound into simpler substances is a decomposition reaction. One reactant yields multiple products. It is the reverse of synthesis.
36. A — The reaction between an acid and a base produces water and a salt. The hydrogen and hydroxide ions form water, leaving the salt. This neutralization moves the solution toward neutral.
37. D — A pure substance made of only one type of atom is an element. It cannot be broken down chemically. Each element has a unique atomic number.
38. B — A pure substance formed when elements chemically combine is a compound. It has a fixed ratio of elements. Its properties differ from those of its elements.
39. D — A combination of substances that are only physically combined is a mixture. The components keep their own properties. Mixtures can be separated physically.
40. A — A mixture with a uniform composition throughout is homogeneous. Its components are evenly distributed. Saltwater is an example.
41. A — A change in which no new substance forms is a physical change. Only the form or state changes. Melting and dissolving are examples.
42. B — A change that produces one or more new substances is a chemical change. The original substances are transformed. Burning and rusting are examples.
43. A — At constant temperature, increasing the pressure on a gas decreases its volume. This follows Boyle's law. Pressure and volume are inversely related.
44. D — At constant pressure, increasing the temperature of a gas increases its volume. This follows Charles's law. Volume and kelvin temperature are directly related.
45. A — Valence electrons, in the outermost energy level, determine how an atom bonds. They are the electrons involved in chemical reactions. The group number often indicates their count.
46. C — Noble gases are unreactive because they have a full outer electron shell. The complete octet gives little tendency to react. This stability explains their inertness.
47. C — Elements such as oxygen and nitrogen exist naturally as diatomic molecules. Two atoms bond together as O_2 or N_2. Several elements share this behavior.
48. A — The simplest whole-number ratio of atoms in a compound is the empirical formula. It may differ from the molecular formula. It is found by reducing the subscripts.

49. C — The sum of the atomic masses of all atoms in a formula is the gram-formula mass. Each element's mass is multiplied by its subscript and totaled. This value converts between mass and moles.
50. B — A substance that conducts electricity when dissolved in water is an electrolyte. It produces mobile ions in solution. Salts and strong acids are examples.
51. C — Complete combustion of a hydrocarbon produces carbon dioxide and water. The fuel reacts fully with oxygen. These are the standard combustion products.
52. C — At equilibrium, the forward and reverse reaction rates are equal. Concentrations stay constant while both reactions continue. It is reached in a closed system.
53. D — Grinding a solid into powder increases the reaction rate by increasing its surface area. More exposed surface allows more collisions. Greater surface area speeds the reaction.
54. C — Increasing the concentration of a reactant generally increases the reaction rate. More particles collide more frequently. This produces a faster reaction.
55. B — A reaction that absorbs energy from its surroundings is endothermic. The products hold more energy than the reactants. The absorbed energy cools the surroundings.
56. C — An organic compound containing only carbon and hydrogen is a hydrocarbon. Methane and propane are examples. Other elements would make it a different class.
57. A — A hydrocarbon with only single carbon-carbon bonds is an alkane. It holds the maximum number of hydrogen atoms. The "-ane" ending identifies it.
58. B — Compounds with the same molecular formula but different structures are isomers. The different arrangements give different properties. One formula can represent several substances.
59. D — An ion with a positive charge is a cation. It forms when an atom loses electrons. Metals commonly form cations.
60. A — An ion with a negative charge is an anion. It forms when an atom gains electrons. Nonmetals commonly form anions.
61. A — The amount of mass per unit volume of a substance is its density. It is found by dividing mass by volume. This intensive property helps identify substances.
62. B — Water dissolves many ionic compounds because its molecules are polar. The partial charges attract and surround the ions. This is how polar solvents dissolve ionic solids.
63. B — "Like dissolves like" means polar solvents tend to dissolve polar solutes. Matching polarities allow strong interactions. Nonpolar substances dissolve better in nonpolar solvents.
64. D — Adding salt to water lowers its freezing point. The dissolved particles interfere with ice formation. This freezing-point depression is a colligative property.
65. B — Adding a nonvolatile solute to water raises the boiling point of the solution. The solute lowers the vapor pressure, requiring more heat to boil. This boiling-point elevation is a colligative property.
66. B — Metals conduct electricity well because of their mobile, delocalized electrons. These free electrons carry the electric current. This is the basis of metallic conductivity.
67. C — In an exothermic reaction, the products have less energy than the reactants. The difference is released to the surroundings. This drop in energy is why heat is given off.
68. A — The number written in front of a formula in an equation is a coefficient. It counts whole molecules or formula units. Coefficients are adjusted to balance the equation.
69. C — The small number written after an element's symbol is a subscript. It shows the number of atoms of that element. Changing a subscript changes the substance.
70. B — The law of conservation of mass states that mass is neither created nor destroyed in a reaction. The mass of products equals the mass of reactants. This is why equations must be balanced.

71. A — The octet rule states that atoms tend to gain, lose, or share electrons to obtain eight valence electrons. This stable configuration drives bonding. A full outer shell lowers an atom's energy.
72. B — A horizontal row of elements in the periodic table is a period. The period number equals the number of occupied energy levels. Properties change gradually across a period.
73. D — The highly reactive metals in Group 1 are the alkali metals. They have one valence electron and form +1 ions. Their single outer electron is easily lost.
74. A — The reactive nonmetals in Group 17 are the halogens. They have seven valence electrons and form −1 ions. They readily gain an electron to complete their octet.
75. D — An element with properties between metals and nonmetals is a metalloid. Silicon is a common example. Metalloids border the metal-nonmetal staircase.
76. D — Changing one element into another through a nuclear reaction is transmutation. It alters the number of protons. This does not occur in ordinary chemical reactions.
77. C — The splitting of a heavy nucleus into smaller nuclei is nuclear fission. It releases large amounts of energy. Fission powers nuclear reactors.
78. A — The joining of light nuclei into a heavier nucleus is nuclear fusion. It releases even more energy than fission. Fusion powers the Sun and stars.
79. B — The kinetic molecular theory describes ideal gas particles as being in constant, random motion. They move freely with negligible attraction. Their collisions are treated as elastic.
80. C — According to collision theory, a reaction occurs only when particles collide with enough energy and the correct orientation. Not every collision is effective. Both conditions must be met.
81. C — The instrument used to measure the heat absorbed or released in a reaction is a calorimeter. It captures the energy change. This makes it the key tool in calorimetry.
82. D — An insoluble solid that forms when two solutions are mixed is a precipitate. It separates out because it cannot stay dissolved. Its formation signals a reaction.
83. B — Each element produces a unique bright-line spectrum that can identify it. The lines come from electrons emitting specific energies as they drop between levels. This serves as a fingerprint for the element.
84. A — STP is defined as 0 °C and 1 atmosphere of pressure. Gas volumes are often compared at these standard conditions. One mole of gas occupies 22.4 L at STP.
85. A — In a saltwater solution, the salt is the solute because it is the substance being dissolved. The water is the solvent. The solute is usually present in the smaller amount.