Name:_____ **Midterm Review** **Date:**_____

____ 1. Which statement concerning elements is true?

A) Different elements must have different numbers of isotopes.
B) Different elements must have different numbers of neutrons.
C) All atoms of a given element must have the same mass number.
D) All atoms of a given element must have the same atomic number.

____ 2. Which particles are found in the nucleus of an atom?

A) electrons, only
B) neutrons, only
C) protons and electrons
D) protons and neutrons

____ 3. Which conclusion is based on the "gold foil experiment" and the resulting model of the atom?

A) An atom is mainly empty space, and the nucleus has a positive charge.
B) An atom is mainly empty space, and the nucleus has a negative charge.
C) An atom has hardly any empty space, and the nucleus has a positive charge.
D) An atom has hardly any empty space, and the nucleus has a negative charge.

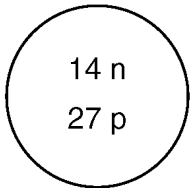
____ 4. Which notation represents an atom of sodium with an atomic number of 11 and a mass number of 24?

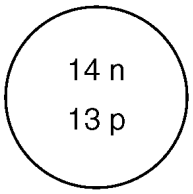
A) $^{24}_{11}\mathrm{Na}$ B) $^{11}_{24}\mathrm{Na}$
C) $^{13}_{11}\mathrm{Na}$ D) $^{35}_{11}\mathrm{Na}$

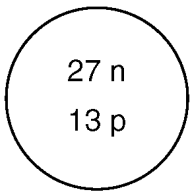
____ 5. What is the mass number of an atom that has six protons, six electrons, and eight neutrons?

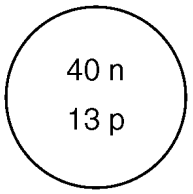
A) 6 B) 12 C) 14 D) 20

____ 6. Which diagram represents the nucleus of an atom of $^{27}_{13}\mathrm{Al}$?

A) 

B) 

C) 

D) 

____ 7. How many electrons are in the outermost principal energy level (shell) of an atom of carbon in the ground state?

A) 6 B) 2 C) 3 D) 4

____ 8. What is the total number of orbitals containing only one electron in an atom of nitrogen in the ground state?

A) 1 B) 2 C) 3 D) 4

____ 9. Which element is malleable and can conduct electricity in the solid phase?

A) iodine B) phosphorus
C) sulfur D) tin

____ 10. Which element is a noble gas?

A) krypton B) chlorine
C) antimony D) manganese

____ 11. The element in Group 14, Period 3 on the Periodic Table is classified as a

A) metal B) noble gas
C) metalloid D) nonmetal

____ 12. Which element has chemical properties that are most similar to those of calcium?

A) Co B) K C) N D) Sr

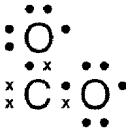
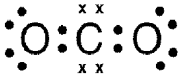
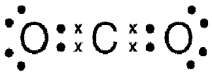
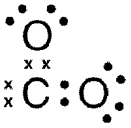
____ 13. Element *X* is a solid that is brittle, lacks luster,and has six valence electrons. In which group on the Periodic Table would element *X* be found?

A) 1 B) 2 C) 15 D) 16

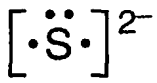
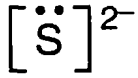
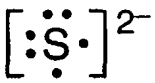
___ 14. In comparison to an atom of $^{19}_{9}\mathrm{F}$ in the ground state, an atom of $^{12}_{6}\mathrm{C}$ in the ground state has

A) three fewer neutrons
B) three fewer valence electrons
C) three more neutrons
D) three more valence electrons

___ 15. Which Lewis electron-dot diagram is correct for CO_2?

A) 
B) 
C) 
D) 

___ 16. Which Lewis electron-dot diagram is correct for a S^{2-} ion?

A) 
B) 
C) 
D) 

___ 17. Which compound forms a green aqueous solution?

A) RbCl B) $CaCl_2$
C) $NiCl_2$ D) $ZnCl_2$

___ 18. Which trends are observed as each of the elements within Group 15 on the Periodic Table is considered in order from top to bottom?

A) Their metallic properties decrease and their atomic radii decrease.
B) Their metallic properties decrease and their atomic radii increase.
C) Their metallic properties increase and their atomic radii decrease.
D) Their metallic properties increase and their atomic radii increase.

___ 19. Which element forms an ion that is larger than its atom?

A) aluminum B) chlorine
C) magnesium D) sodium

___ 20. The strongest forces of attraction occur between molecules of

A) HCl B) HF C) HBr D) HI

___ 21. Which properties are most common in nonmetals?

A) low ionization energy and low electronegativity
B) low ionization energy and high electronegativity
C) high ionization energy and low electronegativity
D) high ionization energy and high electronegativity

___ 22. Which element is an alkali metal?

A) hydrogen B) calcium
C) sodium D) zinc

___ 23. Which group contains elements composed of diatomic molecules at STP?

A) 11 B) 2 C) 7 D) 17

___ 24. Which trends are observed when the elements in Period 3 on the Periodic Table are considered in order of increasing atomic number?

A) The atomic radius decreases, and the first ionization energy generally increases.
B) The atomic radius decreases, and the first ionization energy generally decreases.
C) The atomic radius increases, and the first ionization energy generally increases.
D) The atomic radius increases, and the first ionization energy generally decreases.

___ 25. A metal, *M,* forms an oxide compound with the general formula M_2O. In which group on the Periodic Table could metal *M* be found?

A) Group 1 B) Group 2
C) Group 16 D) Group 17

___ 26. What is the chemical formula for sodium sulfate?

A) Na_2SO_3 B) Na_2SO_4
C) $NaSO_3$ D) $NaSO_4$

___ 27. What is the chemical formula for copper(II) hydroxide?

A) CuOH B) $CuOH_2$
C) $Cu_2(OH)$ D) $Cu(OH)_2$

28. Two substances, *A* and *Z*, are to be identified. Substance *A* can *not* be broken down by a chemical change. Substance *Z* can be broken down by a chemical change. What can be concluded about these substances?

A) Both substances are elements.
B) Both substances are compounds.
C) Substance *A* is an element and substance *Z* is a compound.
D) Substance *A* is a compound and substance *Z* is an element.

29. A compound is made up of iron and oxygen, only. The ratio of iron ions to oxide ions is 2:3 in this compound. The IUPAC name for this compound is

A) triiron dioxide B) iron(II) oxide
C) iron(III) oxide D) iron trioxide

30. What is the formula of titanium(II) oxide?

A) TiO B) TiO_2
C) Ti_2O D) Ti_2O_3

31. Which is a binary compound?

A) $CaCl_2$ B) KOH
C) $NaNO_3$ D) $MgSO_4$

32. A correct name for N_2O_3 is

A) nitrogen (I) oxide
B) nitrogen (II) oxide
C) nitrogen (III) oxide
D) nitrogen (IV) oxide

33. Which list consists of types of chemical formulas?

A) atoms, ions, molecules
B) metals, nonmetals, metalloids
C) empirical, molecular, structural
D) synthesis, decomposition, neutralization

34. The molecular formula of glucose is $C_6H_{12}O_6$. What is the empirical formula of glucose?

A) CHO B) CH_2O
C) $C_6H_{12}O_6$ D) $C_{12}H_{24}O_{12}$

35. What is the molecular formula of a compound that has a molecular mass of 54 and the empirical formula C_2H_3?

A) C_2H_3 B) C_4H_6
C) C_6H_9 D) C_8H_{12}

36. The gram formula mass of NH_4Cl is

A) 22.4 g/mole B) 28.0 g/mole
C) 53.5 g/mole D) 95.5 g/mole

37. What is the total number of oxygen atoms in the formula $MgSO_4 \cdot 7\ H_2O$? [The • represents seven units of H_2O attached to one unit of $MgSO_4$.]

A) 11 B) 7 C) 5 D) 4

38. A sample of a compound contains 65.4 grams of zinc, 12.0 grams of carbon, and 48.0 grams of oxygen. What is the mole ratio of zinc to carbon to oxygen in this compound?

A) 1:1:2 B) 1:1:3
C) 1:4:6 D) 5:1:4

39. In which compound is the percent composition by mass of chlorine equal to 42%?

A) HClO (gram-formula mass = 52 g/mol)
B) $HClO_2$ (gram-formula mass = 68 g/mol)
C) $HClO_3$ (gram-formula mass = 84 g/mol)
D) $HClO_4$ (gram-formula mass = 100. g/mol)

40. What is the empirical formula of a compound that contains 28% iron, 24% sulfur, and 48% oxygen by mass?

A) $FeSO_3$ B) $FeSO_4$
C) $Fe_2(SO_3)_3$ D) $Fe_2(SO_4)_3$

41. What occurs when an atom of chlorine and an atom of hydrogen become a molecule of hydrogen chloride?

A) A chemical bond is broken and energy is released.
B) A chemical bond is broken and energy is absorbed.
C) A chemical bond is formed and energy is released.
D) A chemical bond is formed and energy is absorbed.

42. Which symbol represents a particle that has the same total number of electrons as S^{2-}?

A) O^{2-} B) Si C) Se^{2-} D) Ar

43. Which of these elements has an atom with the most stable outer electron configuration?

A) Ne B) Cl C) Ca D) Na

___ 44. Which substance contains bonds that involved the transfer of electrons from one atom to another?

A) CO_2 B) NH_3 C) KBr D) Cl_2

___ 45. Based on bond type, which compound has the highest melting point?

A) CH_3OH B) C_6H_{14}
C) $CaCl_2$ D) CCl_4

___ 46. What is the total number of pairs of electrons shared in a molecule of N_2?

A) one pair B) two pairs
C) three pairs D) four pairs

___ 47. What occurs when a coordinate covalent bond is formed between nitrogen and hydrogen in the ammonium ion, NH_4^+?

A) Hydrogen provides a pair of electrons to be shared with nitrogen.
B) Nitrogen provides a pair of electrons to be shared with hydrogen.
C) Hydrogen transfers a pair of electrons to nitrogen.
D) Nitrogen transfers a pair of electrons to hydrogen.

___ 48. Which phase change results in the release of energy?

A) $H_2O(s) \rightarrow H_2O(\ell)$
B) $H_2O(s) \rightarrow H_2O(g)$
C) $H_2O(\ell) \rightarrow H_2O(g)$
D) $H_2O(g) \rightarrow H_2O(\ell)$

___ 49. When a quantity of electricity is converted to heat, the heat energy produced is measured in

A) volts B) amperes
C) joules D) degrees

___ 50. The average kinetic energy of water molecules is greatest in which of these samples?

A) 10 g of water at 35°C
B) 10 g of water at 55°C
C) 100 g of water at 25°C
D) 100 g of water at 45°C

___ 51. The temperature of a sample of a substance changes from 10.°C to 20.°C. How many Kelvin does the temperature change?

A) 10. B) 20. C) 283 D) 293

___ 52. According to Reference Table *H*, what is the boiling point of ethanoic acid at 80 kPa?

A) 28°C B) 100°C
C) 111°C D) 125°C

___ 53. A sample of a gas is contained in a closed rigid cylinder. According to kinetic molecular theory, what occurs when the gas inside the cylinder is heated?

A) The number of gas molecules increases.
B) The number of collisions between gas molecules per unit time decreases.
C) The average velocity of the gas molecules increases.
D) The volume of the gas decreases.

___ 54. Under which conditions of temperature and pressure would helium behave most like an ideal gas?

A) 50 K and 20 kPa
B) 50 K and 600 kPa
C) 750 K and 20 kPa
D) 750 K and 600 kPa

___ 55. The data table below gives the temperature and pressure of four different gas samples, each in a 2-liter container.

Temperature and Pressure of Gas Samples

Gas Sample	**Temperature** (K)	**Pressure** (atm)
He	300.	1.20
Ne	300.	1.00
CO_2	200.	1.20
CH_4	300.	1.00

Which two gas samples contain the same total number of particles?

A) CH_4 and CO_2 B) CH_4 and Ne C) He and CO_2 D) He and Ne

___ 56. A sample of helium gas has a volume of 900. milliliters and a pressure of 2.50 atm at 298 K. What is the new pressure when the temperature is changed to 336 K and the volume is decreased to 450. milliliters?

A) 0.177 atm B) 4.43 atm
C) 5.64 atm D) 14.1 atm

___ 57. A gas occupies a volume of 444 mL at 273 K and 79.0 kPa. What is the final kelvin temperature when the volume of the gas is changed to 1880 mL and the pressure is changed to 38.7 kPa?

A) 31.5 K B) 292 K
C) 566 K D) 2360 K

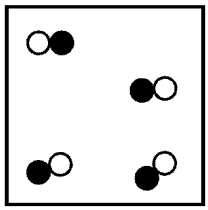
___ 58. If 4.00 moles of oxygen gas, 3.00 moles of hydrogen gas, and 1.00 mole of nitrogen gas are combined in a closed container at standard pressure, what is the partial pressure exerted by the hydrogen gas?

A) 1.00 atm B) 0.125 atm
C) 3.00 atm D) 0.375 atm

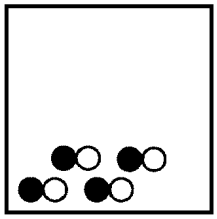
___ 59. Which process is a chemical change?

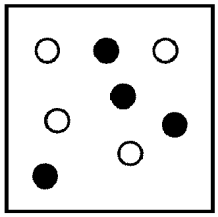
A) melting of ice
B) boiling of water
C) subliming of ice
D) decomposing of water

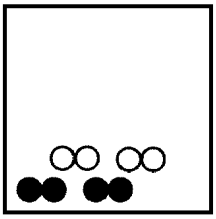
___ 60. Given the particle diagram representing four molecules of a substance:

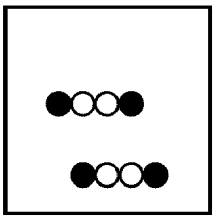


Which particle diagram best represents this same substance after a physical change has taken place?

A) 

B) 

C) 

D) 

___ 61. Which set of procedures and observations indicates a chemical change?

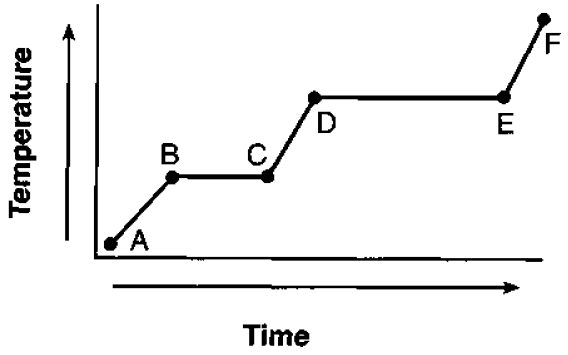
A) Ethanol is added to an empty beaker and the ethanol eventually disappears.

B) A solid is gently heated in a crucible and the solid slowly turns to liquid.

C) Large crystals are crushed with a mortar and pestle and become powder.

D) A cool, shiny metal is added to water in a beaker and rapid bubbling occurs.

___ 62. The graph below represents the uniform heating of a substance, starting below its melting point, when the substance is solid.



Which line segments represent an increase in average kinetic energy?

A) $\overline{AB}$ and $\overline{BC}$ B) $\overline{AB}$ and $\overline{CD}$
C) $\overline{BC}$ and $\overline{DE}$ D) $\overline{DE}$ and $\overline{EF}$

___ 63. The temperature of a sample of water changes from 10.°C to 20.°C when the water absorbs 420 Joules of heat. What is the mass of the sample?

A) 1.0 g B) 10. g
C) 100 g D) 1000 g

___ 64. What amount of heat is required to completely melt a 29.95-gram sample of $H_2O(s)$ at 0°C?

A) 334 J B) 2260 J
C) 1.00×10^3 J D) 1.00×10^4 J

___ 65. In which process does a solid change directly into a vapor?

A) condensation B) sublimation
C) deposition D) solidification

___ 66. When compared to H_2S, H_2O has a higher boiling point because H_2O contains stronger

A) metallic bonds B) covalent bonds
C) ionic bonds D) hydrogen bonds

___ 67. Based on intermolecular forces, which of these substances would have the highest boiling point?

A) He B) O_2 C) CH_4 D) NH_3

___ 68. A mixture of crystals of salt and sugar is added to water and stirred until all solids have dissolved. Which statement best describes the resulting mixture?

A) The mixture is homogeneous and can be separated by filtration.
B) The mixture is homogeneous and cannot be separated by filtration.
C) The mixture is heterogeneous and can be separated by filtration.
D) The mixture is heterogeneous and cannot be separated by filtration.

___ 69. Which must be a mixture of substances?

A) solid
B) liquid
C) gas
D) solution

___ 70. Which statement explains why low temperature and high pressure are required to liquefy chlorine gas?

A) Chlorine molecules have weak covalent bonds.
B) Chlorine molecules have strong covalent bonds.
C) Chlorine molecules have weak intermolecular forces of attraction.
D) Chlorine molecules have strong intermolecular forces of attraction.