MULTIPLE CHOICE:

1. Each element is defined by the number of
2. Orbiting the central region of an atom are negatively charged
3. A (n) _______ has a positive charge and mass.
4. The atomic mass number of a specific element is determined by the:
   a. number of protons in its nucleus
   b. number of neutrons plus protons in its nucleus
   c. number of neutrons plus electrons in its nucleus
   d. number of electrons in its outermost shell
   e. total number of neutrons orbiting the nucleus
5. The atomic number of an atom is based upon the number of:
   a. Nucleus  b. Electrons  c. Neutrons  d. protons  e. protons and neutrons
6. An atom contains particles which have no charge and are called:
7. The center portion of an atom is called a(n) _______.
   a. Electron  b. bond  c. nucleus  d. orbital  e. neutron
8. The atomic mass number for carbon-14 is 14, meaning that carbon atoms have
   a. 14 protons  b. 14 neutrons  c. 6 protons and 8 neutrons
   d. none of these  e. 8 protons and 6 neutrons
9. The atomic mass of an atom is equal to the number of
   a. Protons and electrons
   b. Protons
   c. Electrons and neutrons
   d. Protons and neutrons
   e. Neutrons
10. The smallest unit of matter that retains the characteristics of an element is an:
    a. Ion  b. isotope  c. atom  d. electron
11. An atom that loses or gains electrons is called a(n)
    a. isotope  b. proton  c. neutrino  d. neutron  e. ion.
12. Solid materials that do not possess an orderly arrangement of atoms are called
    a. glasses  b. minerals  c. amorphous  d. polymorphs  e. answers a. and c.
13. The simple sharing of electrons by adjacent atoms is a type of bonding called:
    a. covalent  b. van der Waals  c. silicate  d. tetrahedral  e. ionic
14. Isotopes are atoms with a variable number of:
    a. Electrons  b. protons  c. ions  d. neutrons
15. Those chemical elements having eight electrons in their outermost electron shell are the:
    a. isotopes  b. native elements  c. carbonates  d. halides  e. noble gases
16. Isotopes of the same element have the same number of:
17. Ionic bonding forms between ions like sodium and chlorine because of:
    a. a weak attractive force between electrically neutral atoms
    b. the attractive force between ions with equal but opposite electrical charges
    c. the sharing of electrons
    d. none of the above
18. Anions are ions that have a ______________ net charge.
   a. positive  b. negative  c. neutral  d. single

19. Cations are ions that have a ______________ net charge.
   a. positive  b. negative  c. neutral  d. single

20. If the atomic number of an element is 6 and its mass number is 13, how many protons are contained in the nucleus?
   a. 6  b. 7  c. 8  d. 13  e. 14

21. If the atomic number of an element is 6 and its mass number is 13, how many neutrons are contained in the nucleus?
   a. 6  b. 7  c. 8  d. 13  e. 14

22. An extreme form of electron sharing occurs in the atomic bonds of certain types of minerals and can affect the luster of these minerals. These bonds involve several atoms, which share several electrons among them. The minerals produced also tend to have dark streaks and are more conductive. What is the name of the type of bonding that produces this extreme electron sharing?
   a. covalent  b. van der Waals  c. metallic  d. tetrahedral  e. ionic

23. What type of chemical bonding is shown in the diagram below?
   a) covalent  b) ionic  c) metallic  d) hybrid

24. What type of chemical bonding is shown in the diagram below?
   a) covalent  b) ionic  c) metallic  d) hybrid

25. True Minerals exhibit the following characteristics except for:
   a. naturally occurring  d. inorganic in their composition
   b. glassy solids  e. all of the these are characteristics of minerals
   c. substances with definite physical properties and definite or nearly definite chemical compositions

26. Minerals are identified most commonly by using their:
   a. chemical properties  c. physical properties
   b. molecular structure  d. social security number

27. The two most abundant elements in the Earth’s crust are:
   a. iron and magnesium  c. carbon and potassium
   b. sodium and nitrogen  d. silicon and oxygen  e. iron and manganese

28. Ferromagnesian silicates are rich in:
   a. iron and magnesium  c. iron and manganese
   b. silicon and sometimes aluminum  d. none of the above

29. Non-Ferromagnesian silicates are rich in:
   a. iron and magnesium  c. iron and manganese
   b. silicon and sometimes aluminum  d. none of the above
30. All silicate minerals contain the elements
   a. silicon and iron.  c. silicon and oxygen.  e. silicon and calcium.
   b. silicon and sodium.  d. silicon and magnesium.
31. The tendency of minerals to break along jagged, irregular surfaces is called:
   a. streak  b. fracture.  c. cleavage.  d. conchoidal.  e. polyhedral.
32. The tendency of minerals to break along smooth, planar surfaces is called:
   a. streak  b. fracture.  c. cleavage.  d. conchoidal.  e. polyhedral.
33. The most abundant mineral group in Earth's crust is the _______ group.
   a. oxide  b. carbonate  c. sulfide  d. halide  e. silicate
34. The hardness of a mineral depends on
   a. the color of the powdered mineral  
   b. the way the mineral reflects light
   c. the strength of the chemical bonds in the mineral
   d. the ratio of silicon to oxygen atoms in the mineral
35. The basic building block of all silicate minerals is the:
   a. silicon-oxygen tetrahedron  c. oxygen-silicon cube  d. silica tetrahedron
   b. silica octahedron  e. answers a. and d.
36. Which of the following minerals has the smallest hardness? In other words, which is the softest mineral listed?
   a. Calcite  b. diamond  c. feldspar  d. talc  e. quartz
37. On Mohs hardness scale, which of the following is the hardest mineral?
38. The shape in which an individual crystal grows is called the mineral's crystal ________.
   a. Cleavage  b. density  c. habit  d. streak
39. Calcite and dolomite are:
   a. important energy resources
   b. common rock-forming carbonate minerals
   c. oxide minerals of great value
   d. ferromagnesian silicates possessing a distinctive sheet structure
   e. minerals used in the manufacture of pencil leads
40. The chemical formula for olivine is (Mg, Fe)\text{\textsubscript{2}}SiO\text{\textsubscript{4}}, which means that in addition to silica:
   a. more magnesium than iron occurs in the Earth's crust
   b. all olivine contains both magnesium and iron
   c. magnesium and iron can substitute for one another
   d. magnesium is more common than iron
   e. magnesium is heavier than iron
41. Cation Substitution of certain ions within the atomic structure of minerals is due to similarities in
   a. atomic size  b. atomic charge  c. number of protons  d. number of neutrons
   e. answers a. and b.  f. answers b. and c.  g. answers c. and d.
42. The two most abundant elements in the Earth's core are:
   a. iron and magnesium  c. iron and nickel
   b. sodium and nitrogen  d. silicon and oxygen  e. iron and manganese
43. The most common mineral in Earth's crust is
   a. mica.  b. quartz.  c. olivine.  d. feldspar.  e. hornblende.
44. The size of a crystal depends upon many things, but the most important factor is:
   a. Amount of source material available
   b. Amount of time available
   c. Amount of space available
   d. None of these influence the overall size of a crystal
45. The most unreliable (variable) diagnostic property of minerals such as quartz is
46. The silicon atom has a positive charge of 4, and oxygen has a negative charge of 2.
   Accordingly, the ion group \((\text{SiO}_4)\) has a net charge of:
   a. positive charge of 4
   b. positive charge of 2
   c. negative charge of 1
   d. negative charge of 2
   e. negative charge of 4

47. Pyroxene minerals are common examples of ________ silicates.
   a. Framework
   b. double chain
   c. ring
   d. sheet
   e. single chain

48. Amphibole minerals are common examples of ________ silicates.
   a. Framework
   b. double chain
   c. ring
   d. sheet
   e. single chain

49. Rocks can contain:
   a. one or more minerals
   b. none of these
   c. mineraloids
   d. some or all of these
   e. native elements

TRUE = A / FALSE = B:
50. A mineral can be composed entirely of one element.
51. Minerals, like all matter, are composed of atoms of various elements.
52. Some minerals exhibit cleavage.
53. Neutrons have a negative charge.
54. All atoms with the same number of protons are given the same name.
55. All minerals will produce a streak.
56. Metallic is a term used to describe a type of luster.
57. Fracture is mineral breakage along smooth, planar surfaces.
58. Cleavage is mineral breakage along jagged, irregular surfaces.
59. Cation Substitution is a common phenomenon associated with the silicate minerals.
60. Quartz exhibits rhombohedral cleavage.
61. Olivine minerals exhibit sheet-like cleavage.
62. Crystals generally will develop in an open cavity, where there are no space restrictions.
63. Ferromagnesian silicates are light in color.
64. In the silicon-oxygen tetrahedron there are more silicon atoms than oxygen atoms.
65. Graphite and diamond are polymorphs of carbon.
66. Metallic Luster is due to the extreme sharing of electrons between adjacent atoms, which also
   increases the materials conductivity of heat and electricity.
67. The basic building block of the silicate minerals is the silica octahedron.
68. Polymorphs are minerals that have the same chemical compositions, but have the different
   atomic structures and different physical characteristics.

Place your answers to the following questions on the answer sheet provided by your
instructor. Use the appropriate word, phrase, or short essay to answer the following
questions.

Fill-ins, essays:
69. When minerals are permitted to form without space restrictions, they will develop large:
70. The nucleus of an atom contains neutrons and __________
71. The _________ is the smallest unit of matter that still retains the characteristics of an element.
72. A common type of atomic bonding where ions of equal but opposite charge are electrically
   attracted to each other is called _______________bonding.
73. A common type of atomic bonding where two adjacent atoms share electrons is called _______ bonding.

74. The physical property denoting a mineral's tendency to break along irregular, jagged surfaces is called:

75. What physical property denotes the color of a powdered mineral, formed when the mineral is scraped across a porcelain plate?

76. Halite has a special physical property, it is (or it has): ____________________________

77. Moh's hardness scale is a relative measure of which physical property of minerals?

78. All samples of Calcite have the following special physical property, it will:

79. One of the hardest naturally occurring minerals is ____________.

80. Plagioclase Feldspar has the following special physical property, it has:

81. Graphite and diamond are both composed of carbon, but have very different physical characteristics because they represent __________________s of carbon.

82. The physical property denoting a mineral's tendency to break along planar, smooth surfaces is called ____.

83. One of the softest naturally occurring minerals is ____________.

84. Natural glasses exhibit many of the same characteristics as minerals, but do not satisfy all of the five criteria that a mineral does. One of the criteria that a natural glass does not exhibit is:

85. If you discovered a mineral deposit that is dark gray to black, how would you determine whether or not the deposit contained Magnetite? What special physical property would you use to test for Magnetite?

86. Does this picture depict cleavage or crystal growth? (pick one)

87. Do these pictures depict cleavage or fracture? (pick one)

88. For each of the following pictures, note the number of cleavage directions (not Surfaces).
89. Identify three of the five different criteria for a substance to be considered a true mineral.
90. Identify four different silicate mineral groups or families.
91. Identify five different non-silicate mineral groups or families.
92. A. What is Cation Substitution? B. What two elements are most commonly involved in cation substitution? C. What group of silicates are more likely to exhibit cation substitution?
93. Identify the various parts of typical atom on the figure below.

![Diagram of an atom with parts labeled A, B, and C.]

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**ACROSS**

4. _______ or the growth of a solid with a characteristic internal structure is the way minerals form.
7. This scale measures the relative hardness of minerals, based upon the ability of a mineral to scratch another.
10. Describes the way in which minerals break along irregular surfaces.
12. _______ are atoms that have gained or lost an electron.
13. Solid materials that do not have an orderly arrangement of matter are amorphous or _______.
17. This type of atomic bond is formed by electrical attraction between ions of opposite charge.
19. A _______ makes up part of the nucleus of an atom and is positively charged.
21. _______ surround the nucleus in a moving cloud, have virtually no mass, and are negatively charged.
23. A crystal's _______ is the shape in which individual crystals or aggregates of crystals grow.
24. Negative ions are called _______.
25. This type of bond is characteristic of cation packing and the sharing of freely mobile and dispersed electrons.

**DOWN**

1. This is the study or science of minerals.
2. _______ is the color of the powder produced when a mineral is scraped across a tile of unglazed porcelain.
3. Graphite and diamond are _______ s composed of carbon.
4. _______ is the breaking of minerals along planar surfaces defined by the crystal structure of a mineral.
5. _______ is the weight of a mineral in air divided by the weight of an equal volume of pure water at 4 °C.
6. This mineral property is determined by the way a surface of a mineral reflects light.
8. This part of an atom contains protons and neutrons.
9. _______ is a measure of a material's mass per unit volume or grams/cubic cm.
11. This mineral property is the least reliable.
14. _______ represent the smallest unit of matter that combines in chemical reactions.
15. These type of elements are often found in minerals as impurities.
16. A _______ has a specific geometric shape and often form slowly, in open spaces.
17. An atom that has a constant number of protons but may have different numbers of neutrons is an _______.
18. _______ bonding forms in compounds made of elements that share electrons.
20. A _______ makes up part of the nucleus of an atom and is uncharged.
22. A positively charged ion is called a: _______.

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**GEOLOGY 305: MINERALS - WORD LIST**

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