

DATE DUE: _____
Instructor: Ms. Terry J. Boroughs
Geology 305

Name: _____

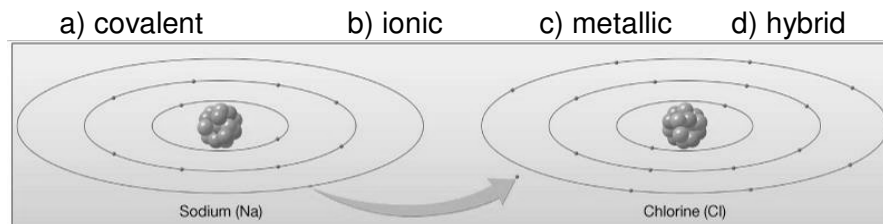
ATOMS, ELEMENTS, AND MINERALS

Instructions: Read each question carefully before selecting the BEST answer. Use GEOLOGIC VOCABULARY where APPLICABLE! Provide concise, but detailed answers to essay and fill-in questions. Use an 882-e scantron for your multiple choice and true/false answers.

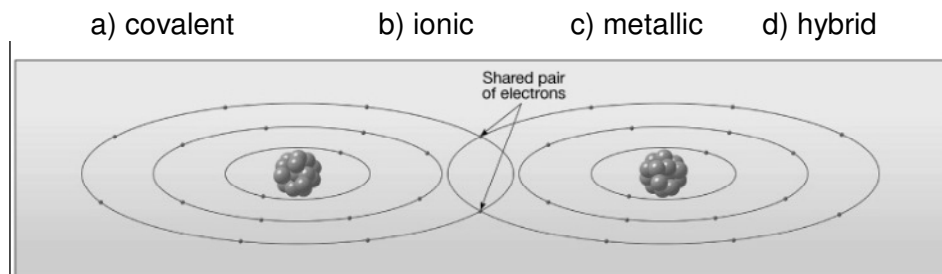
MULTIPLE CHOICE:

- The smallest unit of matter that retains the characteristics of an element is an:
a. Ion b. isotope c. atom d. electron
- Orbiting the central region of an atom are negatively charged
a. Protons b. Electrons c. Neutrons d. Nuclei e. Shells
- A (n) _____ has a positive charge and mass.
a. Neutron b. Electron c. Proton d. Isotope e. Nucleus
- Each element is defined by the number of _____ in the nucleus.
a. Atoms b. Isotopes c. Neutrons d. Protons e. Nuclei.
- 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.
- 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
- Isotopes are atoms with a variable number of:
a. Electrons b. protons c. ions d. neutrons
- 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
- Isotopes of the same element have the same number of:
a. Protons b. Electrons c. Neutrons d. Nuclei e. Ions
- The center portion of an atom is called a(n) _____.
a. Electron b. bond c. nucleus d. orbital e. neutron
- The atomic mass number for carbon-14 is 14, meaning that carbon atoms have _____.
a. 14 protons b. 14 neutrons c. 8 protons and 6 neutrons
d. none of these e. 6 protons and 8 neutrons
- The atomic number of an atom is equal to the number of
a. Protons and electrons
b. Protons d. Electrons and neutrons
c. Protons and neutrons e. Neutrons
- The atomic mass or weight 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
- The atomic number of an atom is based upon the number of:
a. Nucleus b. Electrons c. Neutrons d. protons e. protons and neutrons
- An atom contains particles which have no charge and are called:
a. Protons b. Electrons c. Neutrons d. Nuclei e. Shells
- 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
- An atom that loses or gains electrons is called a(n)
a. isotope. b. proton. c. neutrino. d. neutron. e. ion.

18. True Minerals exhibit all but the following characteristics:
- naturally occurring
 - crystalline solids
 - substances with definite physical properties and definite or nearly definite chemical compositions
 - organic in their composition
 - all of the these are characteristics of minerals
19. Mineraloids contain:
- All of the same characteristics as a mineral
 - Some, but not all of the same characteristics as a mineral
 - None of the same characteristics as a mineral
 - Can contain important industrial and/or economic resources
 - Answers b. and d.
 - Answers a. and d.
20. Minerals are identified in the field most commonly by using their:
- chemical properties
 - molecular structure
 - physical properties
 - social security number
21. The most abundant mineral group in Earth's crust is the _____ group.
- Oxide
 - carbonate
 - sulfide
 - halide
 - silicate
22. Cations are ions that have a _____ net charge.
- positive
 - negative
 - neutral
 - single
23. Anions are ions that have a _____ net charge.
- positive
 - negative
 - neutral
 - single
24. If the atomic number of an element is 6 and its mass number is 14, how many protons are contained in the nucleus?
- 6
 - 7
 - 8
 - 13
 - 14
25. If the atomic number of an element is 6 and its mass number is 14, how many neutrons are contained in the nucleus?
- 6
 - 7
 - 8
 - 13
 - 14
26. What type of chemical bonding is shown in the diagram **below**?



27. What type of chemical bonding is shown in the diagram **below**?



28. 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?
- covalent
 - van der Waals
 - metallic
 - tetrahedral
 - ionic
29. The most unreliable (variable) diagnostic property of minerals such as quartz is
- Hardness
 - Crystal form
 - Color.
 - Specific gravity.
 - Luster.

30. The **shape** of a crystal depends upon many things, but the **most** important factor is:
- Amount of source material available
 - Amount of time available
 - Amount of space available
 - The geometry of the atomic structure
 - None of these influence the overall size of a crystal
31. The **size** of a crystal depends upon many things, but the **most** important factor is:
- Amount of source material available
 - Amount of time available
 - Amount of space available
 - The geometry of the atomic structure
 - None of these influence the overall size of a crystal
32. The silicon atom has a positive charge of 4, and oxygen has a negative charge of 2. Accordingly, the ion group (SiO_4) has a net charge of:
- positive charge of 4
 - positive charge of 2
 - negative charge of 1
 - negative charge of 2
 - negative charge of 4
33. Amphibole minerals are common examples of _____ silicates.
- Framework
 - double chain
 - ring
 - sheet
 - single chain
34. Muscovite Mica minerals are common examples of _____ silicates.
- Framework
 - double chain
 - ring
 - sheet
 - single chain
35. Rocks can contain:
- one or more minerals
 - none of these
 - mineraloids
 - some or all of these
 - native elements
36. The two most abundant **elements** in the Earth's **crust** are:
- iron and magnesium
 - sodium and nitrogen
 - carbon and potassium
 - silicon and oxygen
 - iron and manganese
37. Non-Ferromagnesian silicates are rich in:
- iron and magnesium
 - silicon and sometimes aluminum
 - iron and manganese
 - none of the above
38. Ferromagnesian silicates are rich in:
- iron and magnesium
 - silicon and sometimes aluminum
 - iron and manganese
 - none of the above
39. All silicate minerals contain the elements
- silicon and iron.
 - silicon and sodium.
 - silicon and oxygen.
 - silicon and magnesium.
 - silicon and calcium.
40. The tendency of minerals to break along jagged, irregular surfaces is called:
- streak
 - fracture.
 - cleavage.
 - conchoidal.
 - polyhedral.
41. The tendency of minerals to break along jagged, irregular surfaces is called:
- streak
 - fracture.
 - cleavage.
 - conchoidal.
 - polyhedral.
42. The tendency of minerals to break along smooth, planar surfaces is called:
- streak
 - fracture.
 - cleavage.
 - conchoidal.
 - polyhedral.
43. The hardness of a mineral depends on _____.
- the color of the powdered mineral
 - the way the mineral reflects light
 - the strength of the chemical bonds in the mineral
 - the ratio of silicon to oxygen atoms in the mineral
44. The basic building block of all silicate minerals is the:
- silicon-oxygen tetrahedron
 - silica octahedron
 - oxygen-silicon cube
 - silica tetrahedron
 - answers a. and d.
45. On Mohs hardness scale, which of the following is the softest mineral?
- Talc
 - Calcite
 - Quartz
 - Apatite
 - Feldspar

46. Which of the following minerals has the greatest hardness? In other words, which is the hardest mineral listed?
 a. Calcite b. diamond c. feldspar d. talc e. quartz
47. The shape in which an individual crystal grows is called the mineral's crystal _____.
 a. Cleavage b. density c. habit d. streak
48. The most common mineral in Earth's **crust** is
 a. mica. b. quartz. c. olivine. d. feldspar. e. hornblende.
49. 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
50. The chemical formula for olivine is $(\text{Mg}, \text{Fe})_2\text{SiO}_4$, which means that in addition to silica:
 a. more magnesium than iron occurs in the Earth's crust
 b. magnesium and iron can substitute for one another
 c. all olivine contains both magnesium and iron
 d. magnesium is more common than iron
 e. magnesium is heavier than iron
51. Cation Substitution of certain ions within the atomic structure of minerals is due to similarities, such as:
 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.
52. 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

TRUE = A / FALSE = B:

53. Metallic Luster is due to the extreme sharing of electrons between adjacent atoms, which also increases the materials conductivity of heat and electricity.
54. The basic building block of the silicate minerals is the silica octahedron.
55. Polymorphs are minerals that have the same chemical compositions, but have the different atomic structures and different physical characteristics.
56. Minerals, like all matter, are composed of atoms of various elements.
57. All minerals exhibit cleavage.
58. All atoms with the same number of neutrons are given the same name.
59. A mineral can not be composed entirely of one element.
60. Fracture is mineral breakage along smooth, planar surfaces.
61. Cleavage is mineral breakage along jagged, irregular surfaces.
62. Cation Substitution is a common phenomenon associated with the silicate minerals.
63. Halite exhibits cubic cleavage.
64. All minerals will produce a streak.
65. Metallic is a term used to describe a type of luster.
66. Electrons have no charge.
67. The amphibole minerals exhibit sheet-like cleavage.
68. Crystals generally will develop in an open cavity, where there are no space restrictions.
69. Non-ferromagnesian silicates are dark in color.
70. In the silicon-oxygen tetrahedron there are more oxygen atoms than silicon atoms.
71. Graphite and diamond are polymorphs of carbon.

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:

72. The nucleus of an atom contains neutrons and _____
73. The _____ is the smallest unit of matter that still retains the characteristics of an element.
74. Magnetite has a special physical property: Magnetite exhibits: _____
75. A common type of atomic bonding where two adjacent atoms share electrons is called _____ bonding.
76. When minerals are permitted to grow without space restrictions, they will develop large uniformly-shaped objects and these large (visible) objects are called:
77. The physical property denoting a mineral's tendency to break along rough, jagged surfaces is called _____.
78. A common type of atomic bonding where ions of equal but opposite charge are electrically attracted to each other is called _____ bonding.
79. The physical property denoting a mineral's tendency to break along smooth, planar surfaces is called _____.
80. What physical property denotes the color of a powdered mineral, formed when the mineral is scraped across a porcelain plate?
81. Moh's hardness scale is a relative measure of which physical property of minerals?
82. **All** samples of Calcite (even those that are opaque) have the following special physical property, it will:
83. One of the hardest naturally occurring minerals is _____.
84. Plagioclase Feldspar has the following special physical property, it has:
85. Graphite and diamond are both composed of carbon, but have very different physical characteristics because they represent _____s of carbon.
86. One of the softest naturally occurring minerals is _____.
87. 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:
88. If you discovered a mineral deposit that is white to clear and is non-metallic, how would you determine whether or not the deposit contained halite? What special physical property would you use to test for Halite? (i.e. how would you test for even small quantities of halite?)
89. For **each** of the following pictures, note the number of cleavage **directions (not Surfaces)**.



90. What are some of the differences between cleavage and fracture?
91. Identify five different 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. The atomic structures of minerals influence many different physical characteristics of a mineral. Identify a specific physical property influenced by a mineral's atomic structure and describe how the atomic structure influences that property.

GEOLOGY 305: MINERALS-CLUES

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: _____.

GEOLOGY 305: MINERALS - WORD LIST

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|----------|-----------------|------------|------------------|
| ANION | CRYSTALLIZATION | IONIC | NUCLEUS |
| ATOM | DENSITY | ISOTOPE | POLYMORPH |
| CATION | ELECTRON | LUSTER | PROTON |
| CLEAVAGE | FRACTURE | METALLIC | SPECIFIC GRAVITY |
| COLOR | GLASSY | MINERALOGY | STREAK |
| COVALENT | HABIT | MOHS | TRACE |
| CRYSTAL | ION | NEUTRON | |