1. The number of electrons in a neutral atom is balanced by the number of ___________.

2. Where do the valence electrons occur?

3. All isotopes of a given element would have the same number of __________, but a different number of ____________. Hence, their atomic ____________ differ.

4. What is the oxidation state of an element?

5. The common oxidation state of oxygen is _____.

6. The common oxidation state of hydrogen is _____.

7. The common oxidation state of calcium is _____.

8. The common oxidation state of sodium is _____.

9. The common oxidation state of magnesium is _____.

10. The common oxidation state of silicon is _____.

11. The common oxidation state of aluminum is _____.

12. The common oxidation state of potassium is _____.

13. The common oxidation state of chlorine is _____.

14. The common oxidation states of iron are ____ and _____.

15. The short hand notation for calcium is _____.

16. The short hand notation for sodium is _____.

17. The short hand notation for potassium is _____.

18. The short hand notation for hydrogen is _____.

19. The short hand notation for magnesium is _____.

20. The short hand notation for iron is _____.

21. The short hand notation for silicon is _____.
22. The short hand notation for aluminum is _____.

23. The short hand notation for oxygen is _____.

24. The short hand notation for chlorine is _____.

25. Which of the following is representative of the formula for plagioclase?
   (A) (Ca,Na)(Al,Si)AlSi₂O₈
   (B) KAlSi₃O₈
   (C) NaCl
   (D) Ca₅(PO₄)(F, Cl, OH)
   (E) CaCO₃

26. Which of the following is representative of the formula for quartz?
   (A) SiO₂
   (B) CaCO₃
   (C) NaCl
   (D) NaAlSi₃O₈
   (E) KAlSi₃O₈

27. Which of the following is representative of the formula for calcite?
   (A) NaCl,
   (B) CaCO₃,
   (C) NaAlSi₃O₈
   (D) (Ca,Na)(Al,Si)AlSi₂O₈
   (E) Ca₅(PO₄)(F, Cl, OH)

28. Which of the following is representative of the formula for K-feldspar?
   (A) NaAlSi₃O₈
   (B) KAlSi₃O₈
   (C) CaMg(CO₃)₂
   (D) (Ca,Na)(Al,Si)AlSi₂O₈
   (E) SiO₂

29. Which of the following is representative of the formula for halite?
   (A) NaCl,
   (B) (Ca,Mg)CO₃,
   (C) NaAlSi₃O₈
   (D) (Ca,Na)(Al,Si)AlSi₂O₈
   (E) FeS₂

30. How many oxygen ions are involved in the formation of the silicon-oxygen tetrahedron?

31. How many silicon ions are involved in the formation of the silicon-oxygen tetrahedron?
32. How would you describe the luster of galena, pyrite, silver, and gold?

33. How would you describe the luster of calcite, K-feldspar, and plagioclase?

34. If a mineral is salty and composed of NaCl, then how many cleavage directions does it exhibit?

35. Gypsum can be scratched with your fingernail. Its hardness is less than ________.

36. What common framework silicate breaks along conchoidal fractures, has no cleavage, and is commonly translucent.

37. A cation carries a _____ charge.

38. An anion carries a _____ charge.

39. What does streak refer to?

40. You would use a magnet to determine what property of a mineral?

41. Fiedrich Mohs is known for developing the Mohs Index of ________________.

42. The hardest mineral is ________.

43. The softest mineral is ________.

44. Which of the following minerals always appears to be darker in color than the other minerals in the list?
   (A) Quartz
   (B) Plagioclase
   (C) K-feldspar
   (D) Calcite
   (E) Biotite

45. Which of the following minerals can occur in a multitude of colors, but always exhibits conchoidal fractures, and is commonly translucent?
   (A) Hornblende
   (B) Pyroxene
   (C) Olivine
   (D) Quartz
   (E) K-feldspar
46. Which of the following minerals display one direction of well developed cleavage?
   (A) Quartz
   (B) Calcite
   (C) Galena
   (D) Biotite
   (E) Pyroxene

47. What kind of a bond is represented in the following illustration?

48. What kind of bond is formed when sodium and chloride combine to form halite?

49. What kind of a bond forms when one or more electrons are shared by two atoms?

50. What kind of a bond is represented in an aggregate of copper atoms?

51. Below is the name of the molecule shown in the following illustration?

52. For the following illustration please fill in the labels.
53. What silicate structure is represented by the following illustration?

![Silicate Structure Image]

54. List below a mineral that exemplifies the silicate structure shown in question 53.

55. What silicate structure is represented by the following illustration?

![Silicate Structure Image]

56. List below a mineral that exemplifies the silicate structure shown in question 55.

57. What silicate structure is represented by the following illustration?

![Silicate Structure Image]

58. List below a mineral that exemplifies the silicate structure shown in question 57.

59. Which of the following minerals belong to the sulfide group?
   (A) Pyrite (FeS₂)
   (B) Halite (NaCl)
   (C) Calcite (CaCO₃)
   (D) Apatite (Ca₅(PO₄)(F, Cl, OH))
   (E) Gypsum (CaSO₄·2H₂O)

60. Which of the following minerals belong to the oxide group?
   (A) Pyrite (FeS₂)
   (B) Hematite (Fe₂O₃)
   (C) Calcite (CaCO₃)
   (D) Apatite (Ca₅(PO₄)(F, Cl, OH))
61. Which of the following minerals belong to the halide group?
   (A) Pyrite (FeS₂)
   (B) Halite (NaCl)
   (C) Calcite (CaCO₃)
   (D) Apatite (Ca₅(PO₄)(F, Cl, OH))
   (E) Gypsum (CaSO₄.2H₂O)

62. Which of the following minerals belong to the carbonate group?
   (A) Pyrite (FeS₂)
   (B) Halite (NaCl)
   (C) Calcite (CaCO₃)
   (D) Apatite (Ca₅(PO₄)(F, Cl, OH))
   (E) Gypsum (CaSO₄.2H₂O)

63. Which of the following minerals belong to the phosphate group?
   (A) Pyrite (FeS₂)
   (B) Halite (NaCl)
   (C) Calcite (CaCO₃)
   (D) Apatite (Ca₅(PO₄)(F, Cl, OH))
   (E) Gypsum (CaSO₄.2H₂O)

64. Which of the following minerals are built from the independent silicate structure?
   (A) Olivine ((Mg, Fe)₂SiO₄)
   (B) Pyroxene ((Mg, Fe)Si₂O₆)
   (C) Amphibole (NaCa₂(Mg, Fe, Al)₃(Si, Al)₉O₂₀(OH)₂)
   (D) Biotite (K(Mg, Fe)₃(AlSi₃O₁₀)(OH)₂)
   (E) Quartz (SiO₂)

65. Which of the following minerals are built from the single chain silicate structure?
   (A) Olivine ((Mg, Fe)₂SiO₄)
   (B) Pyroxene ((Mg, Fe)Si₂O₆)
   (C) Amphibole (NaCa₂(Mg, Fe, Al)₃(Si, Al)₉O₂₀(OH)₂)
   (D) Biotite (K(Mg, Fe)₃(AlSi₃O₁₀)(OH)₂)
   (E) Quartz (SiO₂)

66. Which of the following minerals are built from the double chain silicate structure?
   (A) Olivine ((Mg, Fe)₂SiO₄)
   (B) Pyroxene ((Mg, Fe)Si₂O₆)
   (C) Amphibole (NaCa₂(Mg, Fe, Al)₃(Si, Al)₉O₂₀(OH)₂)
   (D) Biotite (K(Mg, Fe)₃(AlSi₃O₁₀)(OH)₂)
   (E) Quartz (SiO₂)
67. Which of the following minerals are built from the sheet silicate structure?
   (A) Olivine ((Mg, Fe)₂SiO₄)
   (B) Pyroxene ((Mg, Fe)Si₂O₆)
   (C) Amphibole (NaCa₂(Mg, Fe, Al)₃(Si, Al)₉O₂₂(OH)₂)
   (D) Biotite (K(Mg, Fe)₃(AlSi₃O₁₀)(OH)₂)
   (E) Quartz (SiO₂)

68. Which of the following minerals are built from the framework silicate structure?
   (A) Olivine ((Mg, Fe)₂SiO₄)
   (B) Pyroxene ((Mg, Fe)Si₂O₆)
   (C) Amphibole (NaCa₂(Mg, Fe, Al)₃(Si, Al)₉O₂₂(OH)₂)
   (D) Biotite (K(Mg, Fe)₃(AlSi₃O₁₀)(OH)₂)
   (E) Quartz (SiO₂)
Answers

1. protons
2. In the outermost electron shell.
3. protons, neutrons, weights
4. The oxidation state of an element is the charge that it would have if it were an ion
5. -2
6. +1
7. +2
8. +1
9. +2
10. +4
11. +3
12. +1
13. -1
14. +2, +3
15. Ca
16. Na
17. K
18. H
19. Mg
20. Fe
21. Si
22. Al
23. O
24. Cl
25. (a)
26. (a)
27. (b)
28. (b)
29. (a)
30. 4
31. 1
32. metallic
33. nonmetallic
34. 3
35. 2.5
36. quartz
37. positive
38. negative
39. Streak is the color of powder derived from a mineral that has been dragged across a porcelain plate.
40. It's magnetic property
41. Hardness
42. diamond
43. talc
44. biotite
45. quartz
46. biotite
47. Van der Waals
48. ionic
49. covalent
50. metallic
51. silicon-oxygen tetrahedron
52. 
   (A) silicon
   (B) oxygen
53. sheet
54. biotite or muscovite
55. single chain
56. pyroxene
57. double chain
58. amphibole or hornblende
59. (A) pyrite
60. (B) hematite
61. (B) halite
62. (C) calcite
63. (D) apatite
64. (A) olivine
65. (B) pyroxene
66. (C) amphibole
67. (D) biotite
68. (E) quartz