

ESSENTIALS

Atoms & Molecules

1. I can explain what matter is.
2. I can identify and distinguish between a proton, neutron, and electron in location, size, and charge.
3. I can explain how elements are different from each other and what the atomic number means.
4. I can calculate the atomic mass of an atom.
5. I can explain what molecules are and how they are formed.
6. I can differentiate between physical changes and chemical changes.
7. I can explain the Law of Conservation of Mass.

Electrons

8. I can discuss orbitals and suborbitals.
9. I can discuss valence shells.
10. I can compare energy levels of different orbitals.
11. I can use Lewis dot diagrams to draw molecules.
12. I can name ions and discuss how they are formed.
13. I can use electronegativity to identify polarity in a bond.

Periodic Table

14. I can explain and differentiate between electronegativity, electron affinity, and ionization energy.
15. I can explain the trends in electronegativity, electron affinity, ionization energy, and atomic radii.
16. I can compare elements in similar periods and rows by related properties.
17. I can use the periodic table to find the number of valence electrons in each orbital.

Moles & Stoichiometry

18. I can calculate the molecular weight of a molecule.
19. I can convert from grams to moles and moles to grams.
20. I can calculate the formula mass.
21. I can find the percent composition of each element in a molecule.
22. I can balance a chemical reaction.
23. I can identify a limiting reagent.
24. I can calculate the percent yield
25. I can calculate molarity and explain what it is.

BONDING

Molecular Geometry

26. I can describe the shapes of basic molecules given the molecular formula.
27. I can use the molecular geometry to determine the polarity of a molecule.
28. I can describe the general shapes of complex molecules

Inter/Intramolecular Bonding

29. I can explain the difference between an intermolecular bond and an intramolecular bond.
30. I can explain the different types of intramolecular bonds.
31. I can explain what happens if atoms share more than two electrons.

32. I can describe resonance structures.
33. I can explain why resonance structures are more stable than non-resonance structures.
34. I can explain why noble gases do not bond.
35. I can explain how the differences in intramolecular bonds create different properties.
36. I can describe how hydrogen bonds build strong compounds.
37. I can identify the different types of intermolecular bonds and differentiate based on strength.
38. I can explain physical properties of matter in terms of inter and intramolecular bonding.

Solids, Liquids, Gases

39. I can explain how hydrogen bonding causes differences in states of matter from other compounds without it.
40. I can explain why some molecules are solids at room temperature and why others are liquids or gases.
41. I can discuss the difference between amorphous and crystalline solids.
42. I can describe a phase change diagram in terms of pressure and temperature.
43. I can explain what happens during phase changes in terms of bonding and energy.
44. I can identify the three colligative properties (boiling point elevation, freezing point depression, vapor pressure lowering) and explain why they are affected by adding particles.

Ideal Gases

45. I can describe the properties of any ideal gas.
46. I can explain Charles' Law in words and manipulate the equation.
47. I can use and explain Avogadro's Law.
48. I can use and explain Boyle's Law.
49. I can manipulate the ideal gas law to find the 4th variable when given the other three.

REACTIONS

Acid & Base Chemistry

50. I can identify an acid and base using the Arrhenius and Bronsted-Lowry definitions.
51. I can identify common acids and bases in my home.
52. I can identify strong acids and strong bases.
53. I can describe what conjugate acids and bases are and how to identify them.
54. I can explain how the difference in pH relates to the change in $[H^+]$.
55. I can calculate the pH and pOH of a solution using $[H^+]$ and $[OH^-]$.
56. I can use titration to determine the initial concentration of an unknown acid.
57. I can identify acids and bases using pH paper and indicator solutions.

Oxidation/Reduction Chemistry

58. I can calculate the oxidation state of an atom within a molecule.
59. I can identify oxidation and reduction in a reaction.
60. I can identify the oxidizing agent and the reducing agent.
61. I can write the half reactions for both oxidation and reduction.
62. I can use reduction potentials to calculate the electromotive force.
63. I can explain the Law of Conservation of Charge.

Electrochemistry

64. I can identify the differences between an electrolytic and galvanic cell.
65. I can create both an electrolytic cell and galvanic cell.
66. I can explain what electrolytes are.
67. I can explain what reduction potential is and use it to determine the spontaneity of a reaction.
68. I can calculate the EMF of a reaction.

PHYSICAL CHEMISTRY

Kinetics

69. I can explain what a rate and a rate constant are.
70. I can identify the differences between zero-order, first-order, and second-order reactions.
71. I can identify the factors affecting the reaction rate.
72. I can explain the role of a catalyst in a reaction.
73. I can calculate the rate of each reactant using a rate table.

Thermodynamics

74. I can discuss the three laws of thermodynamics.
75. I can explain enthalpy and use Hess's Law to calculate the enthalpy of a reaction.
76. I can measure and explain entropy.
77. I can identify endothermic and exothermic reactions.
78. I can calculate the Gibbs Free Energy and determine the spontaneity of a reaction.
79. I can combine thermodynamics with redox reactions to determine spontaneity.
80. I can write and read a potential energy diagram.

Equilibrium

81. I can explain what equilibrium is and write an equilibrium expression based on a reaction.
82. I can use an equilibrium expression to calculate K_{eq} .
83. I can use Le Chatelier's Principle to determine the direction of a reaction.
84. I can solve for the reaction quotient, Q , and use it to determine the direction of the reaction.
85. I can use the solubility rules to determine whether a molecule will dissolve or not.
86. I can determine K_{sp} by using solubility rules and concentrations of products.