

Skills List for Physical Science (Basic and Chemistry)

Proficiency will be based on the level of mastery of the following skills:

I. Basic

1. Convert **metric** units (including temperature).
2. Convert standard numbers to **scientific notation** and scientific notation to standard.
3. Calculate the **volume** of an irregular shaped object, then the **density** using the formula $D=m/V$.
4. Analyze and design **line graphs**.

II. Chemistry

5. Describe the contributions of Democritus, Dalton, Thomson, Rutherford, and Bohr to atomic theory and structure.
6. Sketch and label the following atomic models: Billiard Ball, Plum Pudding, Solar System, Bohr Model.
7. Understand that the most current model is the Electron Cloud Model.
8. Identify the 3 **subatomic particles** of an atom and describe their location, charge, and significance.
9. Calculate the number of p^+ , n^0 , e^- in an atom. Calculate the atomic mass and the atomic number.
10. Classify elements on the Periodic Table as **metal**, **metalloids**, and **nonmetals**.
11. Determine the **group/family** and **period** of specific elements.
12. Identify the symbol and name of the 46 assigned elements.
13. Assign a **nuclear symbol** to a specific atom and give it an **isotope name** based on provided info.
14. Sketch a **Bohr Model** from provided information about the atom.
15. Understand that the number of valence e^- determines the group/family and the number of energy levels determines the period.
16. Identify an atom based on its provided Bohr model. Identify the atom's location on the **Periodic Table** based on the Bohr Model.
17. Draw the **Electron Dot Diagram** for elements 1-20.
18. Compare/contrast and **ionic** and **covalent** bonds.
19. Identify **chemical compounds** as ionic or covalent.
20. State the **Octet Rule** in its entirety. Understand the role that the Octet Rule plays in developing ionic compounds.
21. Further classify an ionic compound as "simple binary", "w/transition metal", or "w/polyatomic ion".
22. Further classify a covalent compound as "polar" or "nonpolar".
23. Understand the important role of **oxidation numbers** in writing chemical formulas.
24. Name **compounds** based on their formulas and write **formulas** based on their name.
25. Count the atoms of a chemical compound.
26. **Balance** chemical equations.
27. Identify the type of chemical reaction: synthesis, decomposition, single displacement, double displacement, combustion, and neutralization.
28. Write **chemical equations** in words.

Skills List for Physical Science (Physics)

1. Interpret all motion as relative to a selected reference point.
2. Identify distance and displacement as a scalar-vector pair.
3. Describe motion qualitatively and quantitatively in terms of an object's change of position, distance traveled, and displacement.
4. Compare speed and velocity as a scalar-vector pair.
5. Explain that velocity is a relationship between displacement and time: $v = \Delta d / \Delta t$
6. Apply concepts of average speed and average velocity to solve conceptual and quantitative problems.
5. Explain acceleration as a relationship between velocity and time: $a = \Delta v / \Delta t$
6. Using graphical analysis, solve for displacement, time, and average velocity.
7. Using graphical analysis, solve for velocity, time, and average acceleration.
8. Compare thermal energy, heat, and temperature.
9. Compare conduction, convection, and radiation as methods of energy transfer.
10. Exemplify the relationship between kinetic energy, potential energy, and heat to illustrate that total energy is conserved in mechanical systems such as a pendulum, roller coaster, cars/balls on ramps, etc.
11. Relate types of friction in a system to the transformation of mechanical energy to heat.
12. Explain scenarios in which work is done, identifying the force, displacement, and energy transfer - work requires energy; when work is done on an object, the result is an increase in its energy and is accompanied by a decrease in energy somewhere else.
13. Compare scenarios in which work is done and conceptually explain the differences in magnitude of work done using the relationship $W = F\Delta d$
14. Infer the work and power relationship: $P = W / \Delta t = Fv$
15. Identify the basic characteristics of a longitudinal (compression) wave: amplitude, rarefaction, and compression.
16. Explain the relationship among velocity, frequency, and wavelength and use it to solve wave problems: $v = \lambda f$
17. Exemplify wave energy as related to its amplitude and independent of velocity, frequency or wavelength.
18. Compare compression (longitudinal) and transverse waves in terms of particle motion relative to wave direction.
19. Identify interactions between charged objects - opposite charges attract and like charges repel.
20. Compare the three methods of charging objects: conduction, friction, and induction
21. Compare series and parallel circuits.
22. Explain how the flow of electricity through series and parallel circuits is affected by voltage and resistance.
23. Explain using a cause-and-effect model how changes in composition, length, temperature, and diameter of a wire would affect the current in a circuit.

