

General Science & How We Learn

Science: It's like being a detective! You look around, ask questions, and test your ideas to figure out how the world works.

Definition: Science

The way we systematically learn about nature.

Scientific Method (The Detective Steps):

1. See something weird: You notice your toy car rolls faster on the wooden floor than on the carpet.
2. Guess why (Hypothesis): "I guess the carpet slows the car down because it's rougher."
3. Test it (Experiment): You race the car on the wood, then on the carpet, timing it both times.
4. Conclusion: You check your times. If the carpet time is slower, your guess was probably right!

Variables: These are the things you change or watch in your test.

Independent Variable: The thing you change (the type of floor: wood vs. carpet).

Dependent Variable: The thing that changes because of you (the time it takes to roll).

Measurements (SI Units): We need ways to measure things so everyone agrees.

Mass: How much "stuff" is in something (measured in kilograms). Example: A big textbook has more mass than a pencil.

Length: How long something is (measured in meters). Example: The length of your desk.

Temperature: How hot or cold something is (measured in Kelvin or Celsius).

Physics Fun (Movement and Energy)

Physics is about movement, pushes, and pulls!

Vectors vs. Scalars:

Scalar: Just a number. Example: You ran 5 kilometers.

Vector: Number + Direction. Example: You ran 5 kilometers North.

Newton's Laws (Why things move):

1. Inertia: Everything resists change. If you are riding a bike fast and suddenly stop pedaling, you keep moving forward until something stops you (like the air or friction).

2. Force ($F = ma$): To make something heavier (more mass, m) speed up (accelerate, a), you need a bigger push (Force, F).

Formula: Second Law

$$F=ma$$

3. Action-Reaction: For every push, there is an equal push back. If you jump off a skateboard, you push the skateboard backward, and it pushes you forward!

Work and Energy:

Work: You only do work if your push actually moves something. If you push a heavy door handle but it's locked and doesn't move, you didn't do work.

Energy: The ability to do work.

Potential Energy: Stored energy. Example: Water held behind a dam has lots of stored energy because of its height.

Kinetic Energy: Energy of movement. Example: The water rushing through the dam gates has kinetic energy that turns a turbine.

Heat and Gases:

Heat Transfer:

Heat moves from hot things to cold things.

Conduction: Touching something hot (like touching a warm mug).

Convection: Heat moving through liquids or air (like the warm air rising from a heater).

Gases: Gas particles are like hyperactive kids running around a giant room-they are far apart and move randomly.

Phase Changes: Heating a solid (ice) makes the particles vibrate more until they break free and become liquid (water). Heating liquid makes them move even faster until they escape as gas (steam).

Chemistry Corner (What Stuff Is Made Of)

Chemistry studies matter and how it changes.

Matter: Anything with mass that takes up space. It's either a Pure Substance (like pure sugar) or a Mixture (like sugar dissolved in water).

Atoms: The tiny building blocks of everything.

The center (Nucleus) has positive Protons and neutral Neutrons.

Negative Electrons orbit the nucleus.

The number of protons (Z) decides what element it is.

Chemical Bonds: How atoms stick together.

Covalent: They share electrons. Example: Two hydrogen atoms share electrons to make an H₂ molecule.

Ionic: One atom gives an electron to another. Example: Sodium (Na) gives an electron to Chlorine (Cl) to make salt (NaCl).

Chemical Reactions: When one type of matter turns into another.

Law of Conservation of Mass: If you burn a log, the wood disappears, but if you weigh the smoke, ash, and gases produced, it will weigh the same as the original log!

The Mole: A huge group of atoms, like saying "a dozen" means 12 things. We use the mole to count atoms because they are so tiny.

Acids vs. Bases: Acids taste sour and release [H] ions (like vinegar). Bases taste bitter and release OH ions (like baking soda solution).

Earth Science

Earth Structure: Earth has layers: the solid Crust on top, the thick Mantle underneath, and the hot Core in the middle.

Plate Tectonics: The crust is made of giant moving pieces called plates. When they bump, we get mountains; when they slide, we get earthquakes.

Atmosphere: The air around Earth. It keeps us warm and protects us from too much sun. The Ozone Layer is a special part of the atmosphere that blocks harmful UV rays.

Remember: The ozone layer protects us from UV rays that can cause skin cancer.

Biology Basics (Life)

Biology is the study of living things.

Cells: They are the smallest living parts of you, a plant, or an animal.

Plant cells have a rigid outer wall and Chloroplasts to catch sunlight.

Animal cells don't have these outer parts.

The Nucleus is the cell's control center, holding the instructions.

Photosynthesis: How plants eat! They use sunlight, water, and air (CO₂) to make sugar (food) and release the oxygen we breathe.

Formula: Photosynthesis



Ecology: How living things interact.

Producers (plants) make their own food.

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Consumers (animals) eat other things.

Decomposers (like fungi) break down dead things to recycle nutrients.

Genetics: How traits are passed down. If you have brown eyes and blue eyes, your brown eye trait is Dominant if you end up with brown eyes