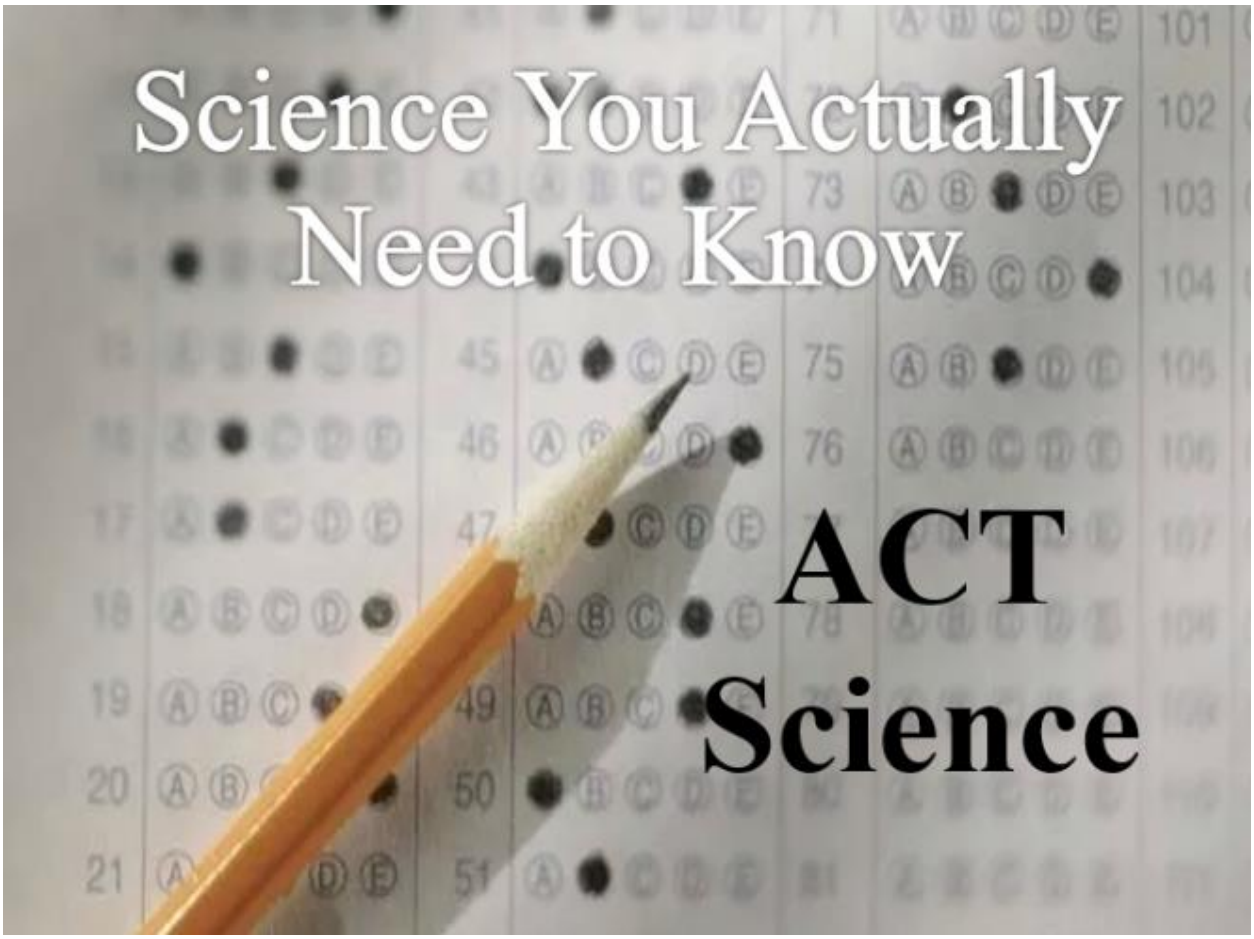

Science You Actually
Need to Know
ACT
Science

There are usually four questions per test that you cannot answer without previous background knowledge.

That's the difference between a 31 and a 36 on the Science section!

We'll break down what you are expected to know for ACT Science.

This is subject matter you have already covered in elementary, junior high, and high school.

You need to reacquaint yourself with the topics so you are ready on test day.

General Science Terminology

These are terms you should know and will see in the passages, as labels in illustrations, and within the questions.

Independent variable: the variable that scientists purposefully change with the intent of measuring how it impacts the dependent variable.

Dependent variable(s): the variable(s) that the scientists are measuring, which is often impacted by the independent variable.

Constants: elements of the experiment that the scientists keep the same.

Direct relationship: a relationship in which the dependent variable increases as the independent variable increases.

Indirect relationship: a relationship in which the dependent variable decreases as the independent variable increases, or vice versa.

According to ACT,

"The content of the Science Test includes **biology, chemistry, physics, and the Earth/space sciences** (for example, geology, astronomy, and meteorology)."

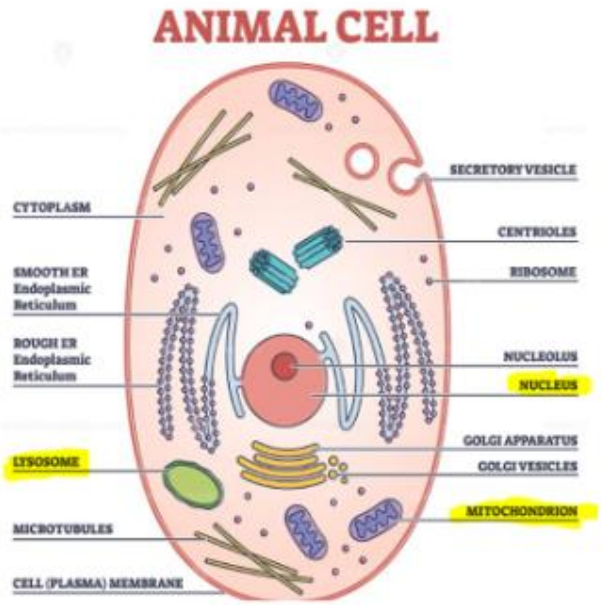
Biology
- Cell Biology
- DNA, RNA, and Ribosomes
- Natural Selection
- Greenhouse Gases
- Photosynthesis and Respiration
- Taxonomic Rank
- Genetics

Chemistry
- Basic Molecule Structure
- Freezing/Boiling Point of Water in Celsius
- pH Scale
- Molar Mass Concepts
- How Charges Interact
- Phase Changes

Physics
- Gravity
- Density Formula
- Density Rules
- Kinetic vs Potential Energy
- Velocity and Acceleration

Math
- Basic Math Skills

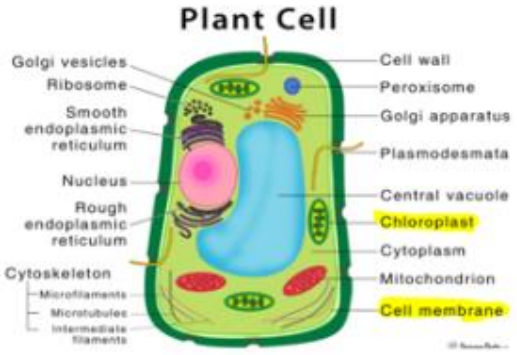
BIOLOGY



Cell Biology

You need to know certain cell organelles (parts of cells), their functions, and whether they are found in animal or plant cells.

- **Lysosomes** hold enzymes. Lysosomes digest food or break down the cell when it dies.
- **Mitochondria** are organelles that act like a digestive system, which takes in nutrients, breaks them down, and creates energy-rich molecules (ATP) for the cell.
- **Cell nucleus** acts as the brain of the cell. It contains the cell's DNA, or the genetic information, from which proteins are made. It also helps control eating, movement, and reproduction.



Chloroplasts only exist in plant cells and assist in the process of photosynthesis, converting light into energy (which only plants do, not animals).
The **cell membrane** holds all of the pieces of the cell and serves as the barrier between the cell and other cells.

DNA, RNA, Ribosomes, and Protein Synthesis

DNA contains the genetic information and is the blueprint for making proteins (protein synthesis).

DNA, RNA, Ribosomes, and protein are all involved in the production of proteins.

Messenger RNA (known as mRNA) makes a copy of DNA of a specific gene. This process is known as **transcription** and happens in the nucleus.

Ribosomes use mRNA to make protein of the same amino acid sequence as the original DNA. The process of producing protein from the mRNA is referred to as **translation**.

Natural Selection

Natural selection is **the process through which populations of living organisms adapt and change**.

Both natural selection and evolution occur as a response to the long term changes in the environment. All species undergo both natural selection and evolution and work on **genetic traits in populations rather than individuals**.

Greenhouse Gases

Greenhouse gases include 6 main gases: **carbon dioxide CO_2, methane CH_4, nitrous oxide N_2O, ozone O_3, water vapor H_2O, and chlorofluorocarbons CFCs.** They trap some of the Earth's outgoing energy, thus retaining and increasing heat in the atmosphere. This is called the greenhouse effect.

Photosynthesis and Respiration

Photosynthesis is the process where plants capture sunlight to make food for themselves. $CO_2 + H_2O$ + Sunlight = Glucose and O_2

Respiration is basically the opposite of photosynthesis. Respiration is when cells break down molecules into a type of energy they can use.

Glucose and oxygen are converted into carbon dioxide, water, and ATP (a chemical that provides energy to cells).

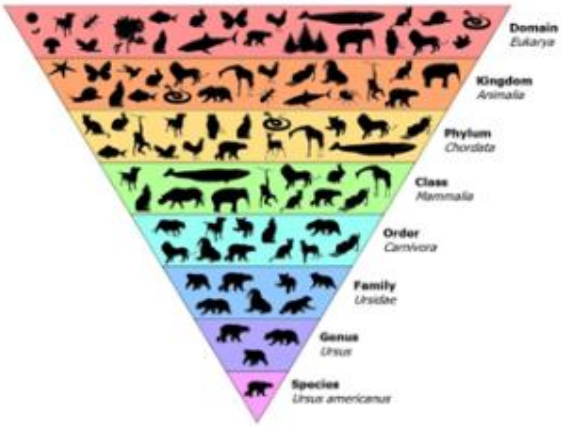
Taxonomic Rank

Taxonomic rank is the eight levels that organisms are classified in.

Taxonomy is the science of naming and classifying all organisms. It allows scientists to see how organisms are related and what characteristics they share.

Domain
Kingdom
Phylum
Class
Order
Family
Genus
Species

Taxonomic Ranking System



If two species are in the same family, they are also in the same order, class, phylum, and kingdom.

Genetics

The key genetic term to know is "allele". **Alleles are pairs of genes responsible for particular traits.** Allele pairs can be made up of two dominant genes, two recessive genes, or a dominant and recessive gene.

Dominant genes are usually expressed as capital letters and recessive genes are expressed as lower-case letters.

So an allele pair shown as "Tt" would have one dominant and one recessive allele.

Chemistry

Basic Molecule Structure

ACT Science expects you to know the basic molecular structure of **sugar, fat, protein, and nucleic acids**.

The basic **sugar** molecule structure is $\mathbf{C_6H_{12}O_6}$  Know this structure

You only need to know that **fats** are made up of C (Carbon), H (Hydrogen), and O (Oxygen), and to differentiate fats from sugar, **fats have nearly twice the number of H as C and a very small number of O**.

A fat molecule structure looks like this: $\mathbf{C_{55}H_{98}O_6}$

Proteins are composed of amino acids and all proteins contain C, H, O and N (Nitrogen).

Nucleic acids, like DNA and RNA are biomolecules. Theses are different from sugar, fats, and proteins because they are made up of P (Phosphorus)

Phase Changes

Below freezing point, a material will be in solid form, just above freezing point a material will be in liquid form, above boiling point, liquid becomes gas (is vaporized).

Gases are generally less dense than liquids, and liquids are generally less dense than solids.

Physics

Gravity

You need to know that **gravity** is a downward force that acts on objects, and other forces (such as a spring or pulley) can counteract gravity. This will come up in passages that show experiments using springs or pulleys.

Density Formula

Density = mass/volume

Density is the degree of compactness of a substance.

Freezing/Boiling Point of Water in Celsius
Water freezes at 0 degrees Celsius and boils at 100 degrees Celsius**.** Memorize those temperatures.

pH Scale
All you need to know is that a **pH** of below 7 is acidic, above 7 is basic, and at 7 is considered neutral.

A pH scale is a measure of how acidic or basic a substance is. It is typically approximated as the concentration of hydrogen ions.

Molar Mass Concepts
The only **molar mass** concept you need to know is that the mass of a molecule is the sum of the mass of its atoms.

How Charges Interact
Atoms are composed of three types of particles: **protons, electrons, and neutrons**. Protons are positively charged, electrons are negatively charged, and neutrons have no charge.
Like charges repel each other while opposite charges attract each other.

Kinetic vs Potential Energy

Energy is the ability to do work. **Kinetic energy** is energy that results from an object's motion. Examples are airplanes flying, skiers going downhill, and a car driving along a road. If an object isn't moving, it has no kinetic energy.

Potential energy is energy that results from an object's position or arrangement. Examples include a stretched rubber band, someone sitting at the top of a slide, and a charged battery.

When a stationary object begins to move, its potential energy is converted to kinetic energy.

Velocity and Acceleration

Velocity is speed in a given direction.

Acceleration is the rate of change in velocity per unit of time.

Understand that Force equals Mass multiplied by Acceleration (F=MA).