



Chapter 1



Exploration: Entering the World of Secondary Science



Science is the key to understanding the world
and creating a better future.



Observe



Think



Experiment



Explore



Discover



SCIENCE AS EXPLORATION & MODELS

Science asks not only WHAT we know, but HOW we know it.

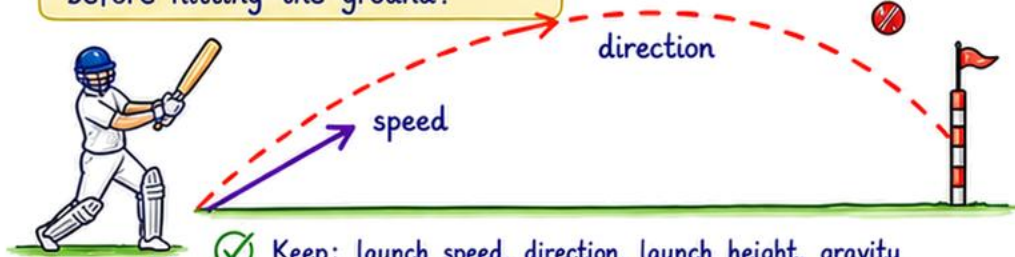
DEEP EXPLORATION

- Curiosity and observation begin the journey.
- Observations → measurements → patterns → symbols/equations.
- Models represent complex systems.
- Ideas are tested, revised and sometimes discarded.



CRICKET-SHOT MODEL

Will the ball cross the boundary before hitting the ground?

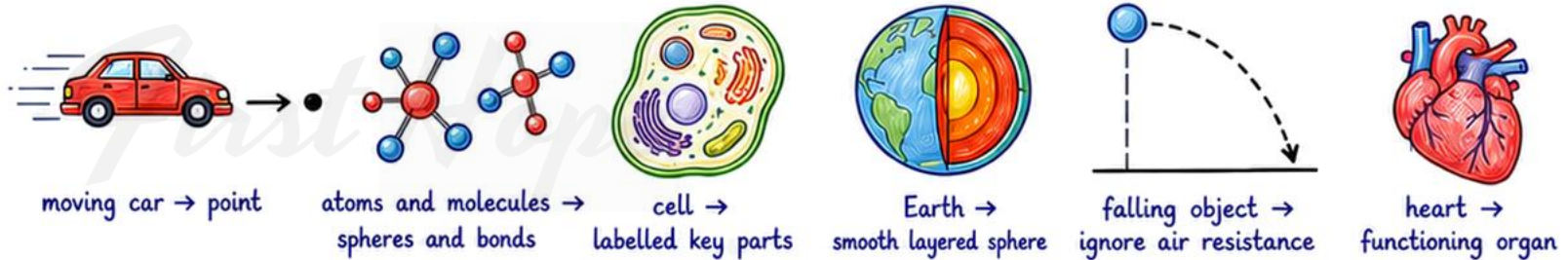


- ✓ Keep: launch speed, direction, launch height, gravity
- ✗ Ignore in ideal flight: mass, bat brand, ball colour, grass, air resistance, spin, seam stitching

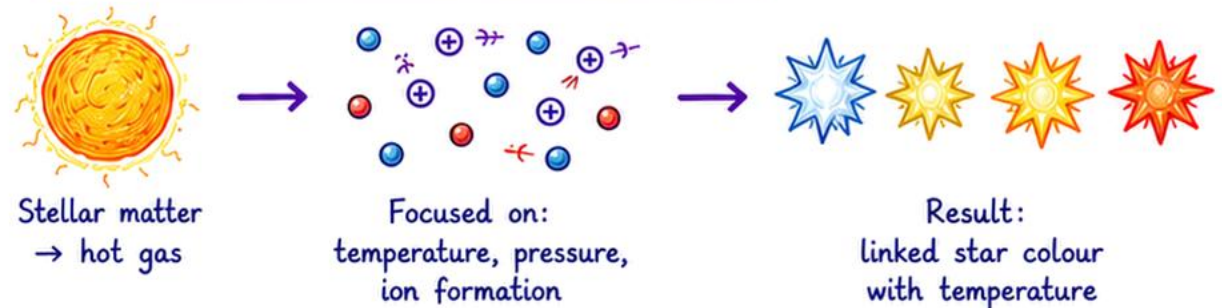
SCIENTIFIC MODELS

A model is a simplified representation of a real system.

- Focuses on details relevant to a question.
- Uses assumptions and deliberately ignores some details.
- Makes a complex system simple enough to reason about.
- Add more detail when greater accuracy is needed.



MEGHNAD SAHA'S STAR MODEL



GOOD MODEL = simple enough to use + detailed enough to answer the question

THE LANGUAGE OF SCIENCE

PRECISE SCIENTIFIC LANGUAGE

Everyday words force, work, cell and reaction have specific scientific meanings.

Shared terms, symbols and units let scientists describe observations, compare results and build ideas unambiguously.

mass
m

velocity
v

force
F

electric current
I

Each quantity has a defined unit.

MATHEMATICS = A LANGUAGE

An equation is a compact statement of how quantities relate - not only a calculation tool.

Understand
situation



identify
relevant
quantities



use a
relationship



interpret
and
check

Uses: motion (distance, time, velocity); reaction rates; population growth; energy changes.

Understand first; do not merely memorise equations.

WHY c?

c comes from Latin celeritas, meaning speed.
speed of light = exactly 299,792,458 m/s



STANDARD SI UNITS

Consistent measurements allow comparison, fairness in trade, and fewer conversion errors.

Kilogram means the same everywhere.



UNIT MIX-UP

Fuel required: 22,300 kg

Mistake: density in lb/L used as kg/L

Result: about 15,000 L short

Emergency gliding landing; no casualties.



lb/L $\neq$ kg/L

LAWS, THEORIES, PRINCIPLES & PREDICTIONS

LAW

- Describes a regular pattern observed in nature.
- Expressed in words or mathematical relationships.

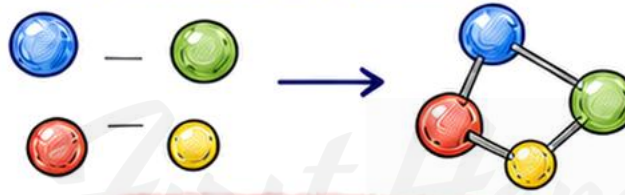
Example: Newton's laws of motion - the jerk when a bus stops suddenly.



THEORY

- Evidence-based explanation of why patterns occur.
- Built through careful testing and critical examination.

Example: Atomic theory explains how molecules are formed.

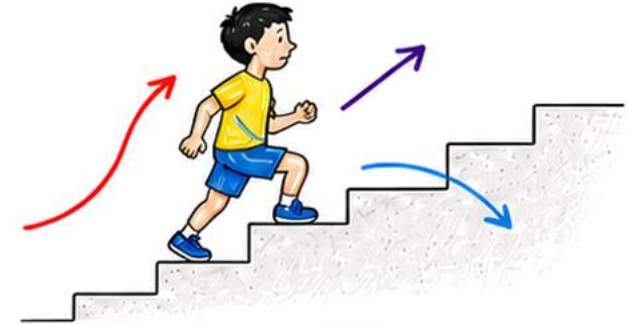


THEORY $\neq$ GUESS

PRINCIPLE

- Broad idea used to make sense of a situation.

Example: Conservation of energy while climbing stairs.



SCIENTIFIC PREDICTION

A reasoned expectation based on evidence - not a guess.
Established laws, theories and models help anticipate new conditions.

football travel



amount of CO₂ produced



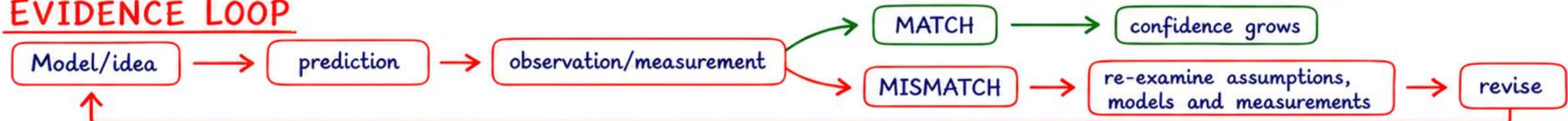
softness of baked bread



breathing while running



EVIDENCE LOOP



No scientific theory is final or beyond question; new evidence can reveal limits.

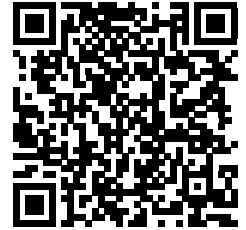


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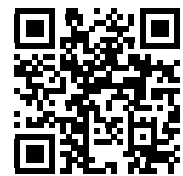


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