HOW SCIENCE AND TECHNOLOGY WORK TOGETHER

SCIENCE: The Process of Discovering how the Natural World Works

WHY DO OBJECTS FALL?

HOW DO CELLS DIVIDE?

WHAT MAKES ELECTRICITY?

TECHNOLOGY: Application of Knowledge to Create Useful Tools & Solutions

TECHNOLOGY ENABLES NEW SCIENTIFIC DISCOVERY

OBSERVING GALAXIES

STUDYING MICROBES

ANALYZING GENOMES

KNOWLEDGE GROWS OVER TIME

ELECTRICITY → LIGHTING, COMPUTERS

BIOLOGY → MEDICINE, AGRICULTURE

TIME-TRAVEL DIARY

MY DIARY – YEAR 1392

October 14, 1392.

Life is hard work! I wake at dawn to feed the chickens and then help father in the fields. We don't have school. So much is different, I wish I could do simple things.

Here are 3 things I cannot do because the tech doesn't exist yet:

To my right, I list them...

1. I CAN'T INSTANTLY MESSAGE MY FRIENDS.
No 'phones' ne! I only see my closest friends at market, and my cousins live far away.

2. I CAN'T TRAVEL FAST.
To visit my grandfather, it takes almost a whole day in a bumpy, slow oxcart. There are no smooth roads, cars, or trains.

3. WHEN THE SUN SETS, IT IS DARK.
We only have small, expensive tallow candles which don't give much light. We have to sleep when it's twilight. No bright lights at the flick of a switch.

HOW SCIENCE & TECHNOLOGY WORK TOGETHER

THE EUREKA CHALLENGE!

ARCHIMEDES' BIG IDEA!

King Hiero's Crown: Pure Gold or Mixed?

Archimedes couldn't weigh it, only find its density! He realized water displacement is the key!

REAL GOLD CROWN	FAKE GOLD MIX CROWN
Less Water Displaced	More Water Displaced

THE EUREKA CHALLENGE:

MEASURING VOLUME

1. FILL THE CUP TO THE BRIM
2. DROP IN A SMALL TOY
3. MEASURE THE SPILLED WATER

THE DISPLACED WATER'S VOLUME IS EQUAL TO THE TOY'S VOLUME!

SCIENCE DISCOVERS, TECHNOLOGY USES!

SCIENCE

(Discoveries & Laws): Asking "Why?".

Examples: Archimedes' Principle, Laws of Gravity.

Science provides the principles!

Technology builds the applications!

TECHNOLOGY

(Applications & Tools): Using knowledge to solve problems.

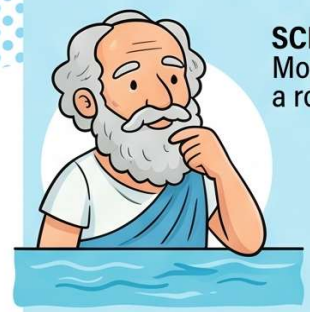
Examples: Ship Design, Submarines, Rocketry.

HOW SCIENCE AND TECHNOLOGY WORK TOGETHER

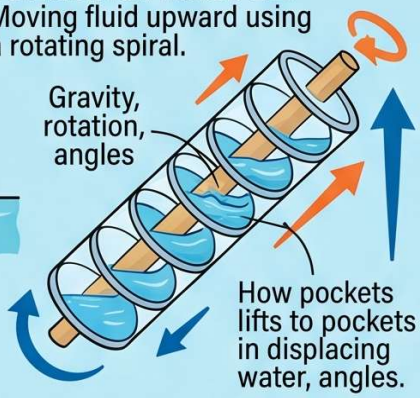
Science understands the principles of nature.
Technology uses these principles to build useful devices.

THE ARCHIMEDES SCREW

THE SCIENCE (THE PRINCIPLE)



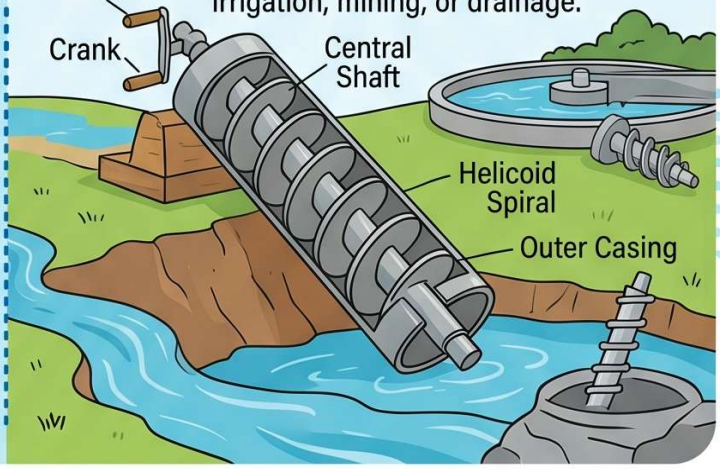
SCIENTIFIC PRINCIPLE:
Moving fluid upward using a rotating spiral.



Key concepts: Gravity, rotation, displacing water, angles.

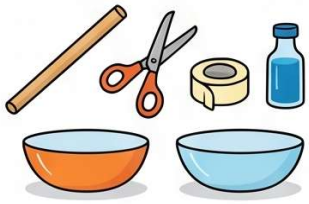
THE TECHNOLOGY (THE DEVICE)

TECHNOLOGICAL APPLICATION:
A device built to raise water for irrigation, mining, or drainage.

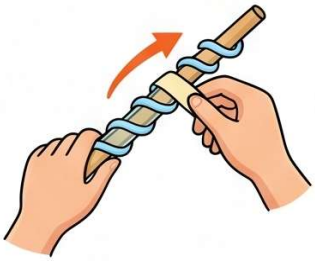


BUILD IT: ARCHIMEDES SCREW

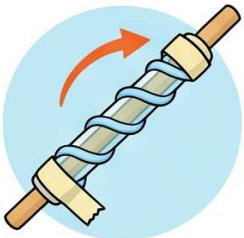
1 MATERIALS:
You'll need a dowel (or stick), clear tubing or a spiral straw, tape, scissors, two bowls (one with water), food coloring (optional).



2 WRAP IT:
Wind the tube tightly around the stick in a spiral. Start at one end.



3 SECURE:
Use strong tape to hold the tubing at both ends.

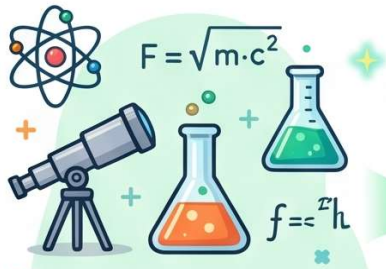


4 TILT & TURN:
Place the lower end in the bowl of colored water. Tilt the screw at an angle. Then, spin the stick/handle!

CAN YOU LIFT THE WATER?

DRAW WHAT HAPPENS!

HOW SCIENCE AND TECHNOLOGY WORK TOGETHER



SCIENCE

SCIENCE DISCOVERS NEW PRINCIPLES & KNOWLEDGE

TECHNOLOGY CREATES TOOLS TO AID SCIENTIFIC DISCOVERY

TECHNOLOGY

GREEK WORD DETECTIVE

The Suffix **"-LOGY"** (*logia*) means **"THE STUDY OF"**

TECHNOLOGY

techne ("craft" or "art") + ***logy*** ("study of")

The study and application of engineering, science, and skills.

BIOLOGY

bios (life) + ***logy***

The study of living organisms.

GEOLOGY

geo (earth) + ***logy***

The study of the Earth's solid material and structures.

PSYCHOLOGY

psyche (mind) + ***logy***

The study of the mind and behavior.

12 YEAR-OLD

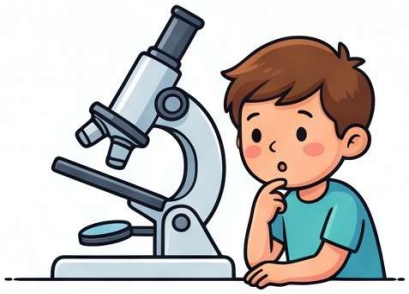
SCIENCE OR TECHNOLOGY?
SORT THESE INTO TWO COLUMNS

HOW SCIENCE AND TECHNOLOGY WORK TOGETHER

SCIENCE:
DISCOVERING KNOWLEDGE
Understanding the natural world through observation & experiments

TECHNOLOGY:
CREATING SOLUTIONS
Using knowledge to design useful tools and solve problems

THE LAW OF GRAVITY

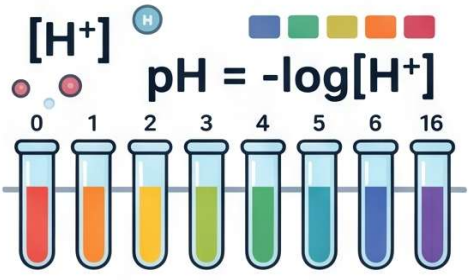


A MICROSCOPE

THE IDEA THAT EARTH ORBITS THE SUN

SCIENCE ENABLES TECHNOLOGY, TECHNOLOGY IMPROVES SCIENCE

A GPS DEVICE



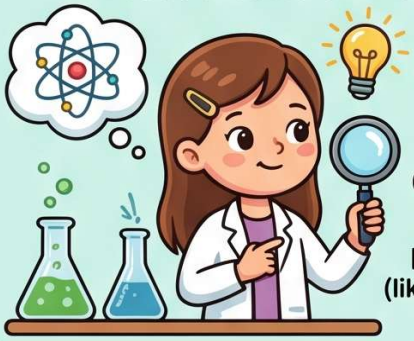
A pH FORMULA

A TELESCOPE

LEARN, EXPLORE, INNOVATE!

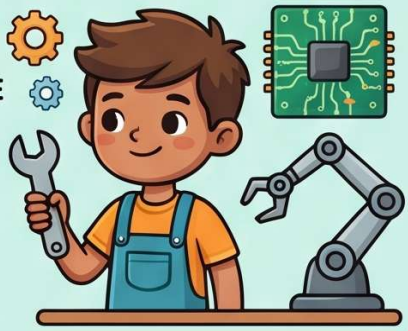
HOW SCIENCE AND TECHNOLOGY WORK TOGETHER:
INVENTION PITCH

SCIENCE:
DISCOVERING THE 'WHY'



- OBSERVES NATURE
- ASKS QUESTIONS
- FINDS PRINCIPLES (like light, growth, forces)

TECHNOLOGY & ENGINEERING:
CREATING SOLUTIONS & TOOLS



- APPLIES KNOWLEDGE
- BUILDS SYSTEMS
- SOLVES PROBLEMS (like lenses, machines, computers)

THE INVENTION PITCH:
SPROUT-BOT

THE PROBLEM:
WILTED PLANTS & CONFUSED GARDENERS

FORGETTING WATER?

NOT ENOUGH SUN?

TOO MANY NUTRIENTS?

THE SCIENCE & TECH BEHIND SPROUT-BOT

SCIENCE:
- **Plant Biology** (Understanding Photosynthesis, Nutrients, Water needs)
- **Soil Science** (Principles of soil moisture)

TECHNOLOGY:
- **Sensors** (Measures Soil Moisture, Ambient Light, Temperature)
- **Microcontroller** (Analyses data)
- **Wireless Link** (To App or Home Base)

SMART ALERTS! (I'm thirsty!)

PERSONALIZED CARE GUIDE (For each plant type)

HISTORY TRACKING

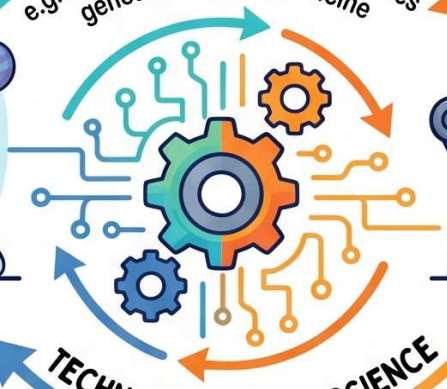
LET'S INNOVATE!

SCIENCE + TECHNOLOGY = AMAZING SOLUTIONS

ACT OF 12 YEARS

HOW SCIENCE AND TECHNOLOGY WORK TOGETHER

SCIENCE leads to TECHNOLOGY
e.g. understanding light to fiber optics
genetics leads to medicine



TECHNOLOGY enables SCIENCE
e.g. telescopes see space
e.g. computers analyze data

SCIENCE
(DISCOVERY & KNOWLEDGE)

- Studying the natural world
- understanding how things work
- asking questions

TECHNOLOGY
(INVENTION & TOOLS)

- Applying scientific knowledge to build useful things
- solving problems
- creating inventions

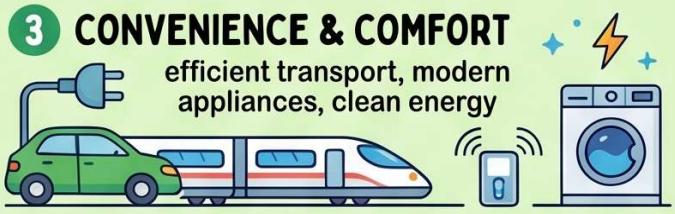
DEBATE: TECHNOLOGY HAS DONE MORE GOOD THAN HARM?

YES - A FORCE FOR GOOD

1. **HEALTH & MEDICINE**
vaccines, treatments, artificial limbs, disease cures

2. **COMMUNICATION**
staying connected, sharing ideas globally

3. **CONVENIENCE & COMFORT**
efficient transport, modern appliances, clean energy

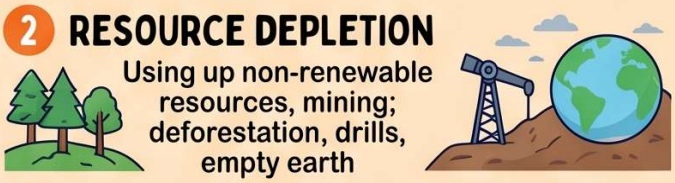


4. **EXPLORATION & DISCOVERY**
learning about the universe, deep oceap ocean

NO - MAJOR CONCERNS

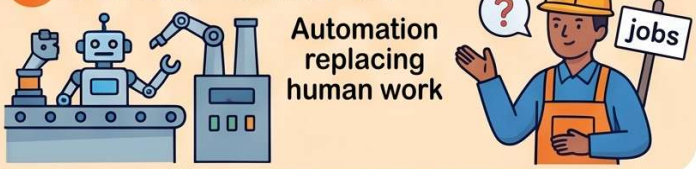
1. **POLLUTION & ENVIRONMENT**
Industrial waste, greenhouse gases, electronic waste

2. **RESOURCE DEPLETION**
Using up non-renewable resources, mining; deforestation, drills, empty earth



3. **ADDICTION & DISTRACTION**
Screen time, social isolation, cyberbullying

4. **JOB DISPLACEMENT**
Automation replacing human work



12 YEAR OLD

HOW SCIENCE & TECHNOLOGY WORK TOGETHER: TOOL MATCH GAME

THE SCIENTISTS & THEIR TOOLS!

1

CHEMIST

Finds out how substances react.

2

BIOLOGIST

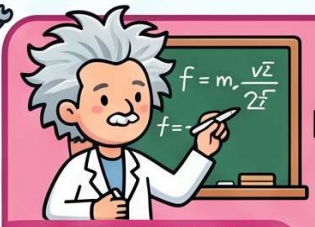
Studies living things like cells and plants.

GEOLOGIST

Examines Earth's rocks and structures.

ASTRONOMER

Explores stars, planets, and space.



PHYSICIST

Studies matter, energy, and forces.

A

MICROSCOPE

A.

Zooms in on tiny things.

B

TELESCOPE

B.

Looks deep into space.

C

BEAKERS & FLASKS

Contains and mixes chemicals.

D

MULTIMETER

Measures electrical properties and signals.

E

ROCK HAMMER & COMPASS

Chips and analyzes rocks and terrain.

Match the Scientist (number) with the Tool (letter)!
Answers will show how they depend on technology.

HOW SCIENCE AND TECHNOLOGY WORK TOGETHER

MYSTERY CROWN MATH

THE CROWN MYSTERY!

Which Crown is FAKE?

Both are the SAME SIZE!

But one is lighter...

UNDERSTANDING THE SCIENCE

PURE GOLD IS DENSER (HEIGHTER) THAN SILVER.

For the SAME SIZE, GOLD weighs MORE than SILVER. This is DENSITY!

TECHNOLOGY IN ACTION

Technology provides the TOOLS to measure and test!

SOLVING THE MYSTERY

The fake crown will weigh less, revealing it is less dense than pure gold.

The LIGHTER Crown Crown (B) is FAKE!

Because silver is LESS DENSE than gold, a silver or alloy crown of the same size is lighter.

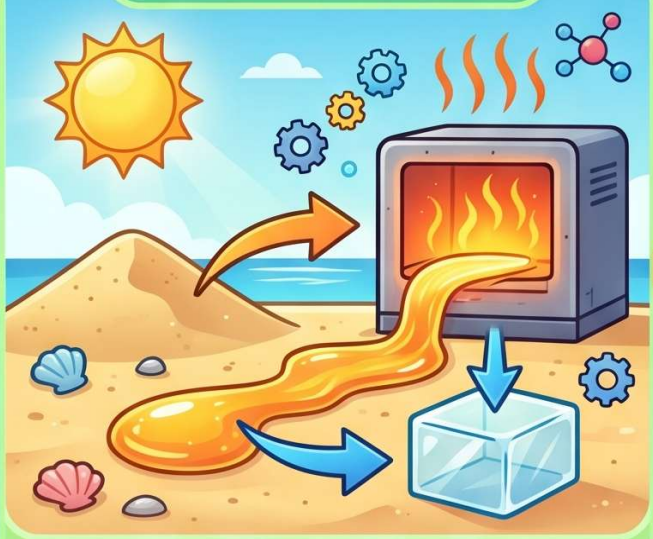
SCIENCE (Concepts) + TECHNOLOGY (Methods) = AMAZING DISCOVERIES!

12 YEAR OLD

HOW SCIENCE & TECHNOLOGY WORK TOGETHER

FROM SAND TO STARS

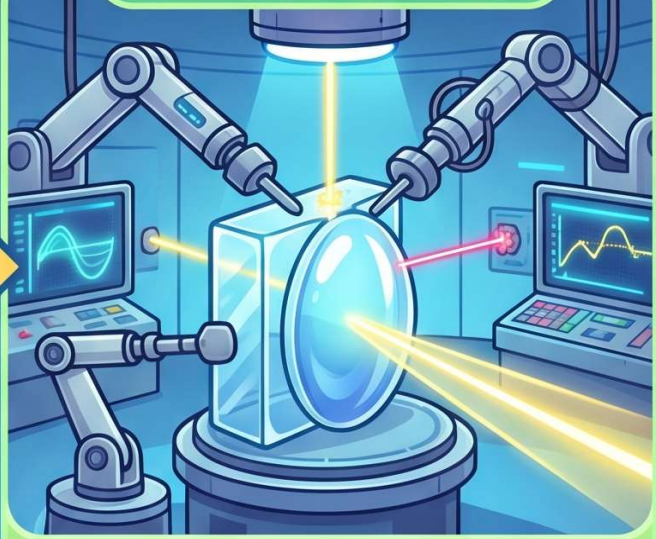
1. MAKING GLASS



1. MAKING GLASS

SCIENCE identifies the properties of sand. **TECHNOLOGY** uses heat and tools to create clear **GLASS.**

2. SHAPING A LENS



2. SHAPING A LENS

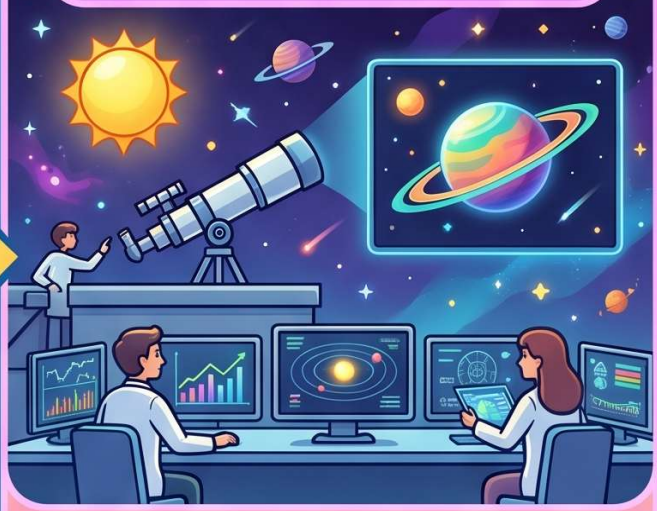
Precision machines (**TECHNOLOGY**) shape the glass using optical principles (**SCIENCE**) to create a **LENS.**

3. BUILDING A TELESCOPE

3. BUILDING A TELESCOPE

Many lenses and components are assembled (**TECHNOLOGY**) based on complex designs (**SCIENCE**) to build a powerful **TELESCOPE.**

4. DISCOVERING A PLANET



4. DISCOVERING A PLANET

The advanced **TELESCOPE** (Technology) explores deep space, allowing astronomers to observe and discover new **PLANETS** (Science).

EXPLORE THE UNIVERSE!

Technology in Science

Chapter 1 • Activity & Game Worksheet • Ages 11-12

Name: _____ Date: _____

Quick recap - key words

• **Technology** = the scientific study of 'craft' (Greek: *techne* + *logy*) - any invention that helps humans control or adapt to their environment.

• **Engineering** = the branch of technology that uses science and math to design and build machines and structures.

• Science shapes technology, and technology shapes science - they need each other!

Activities, Questions & Games

1. Time-Travel Diary

Write a 1-day diary entry as a kid living in 1392. Name 3 things you CAN'T do because the technology doesn't exist yet.

2. Eureka Challenge

Fill a cup to the brim, drop in a small toy, and measure the water that spills. Explain how this is the SAME trick Archimedes used to test the king's crown.

3. Build It: Archimedes Screw

Tape a spiral of straw or tubing around a stick, tilt it in a bowl of water, and turn it. Can you lift the water? Draw what happens in the box.

4. Greek Word Detective

Technology = *techne* ('craft') + *logy* ('study of'). Find 3 other words ending in '-logy' and write what each one studies.

5. Science or Technology?

Sort these into two columns - a microscope, the law of gravity, a GPS device, the idea that Earth orbits the Sun, a telescope, a pH formula.

SCIENCE (ideas/facts about nature)	**TECHNOLOGY** (tools/inventions)

6. Invention Pitch

Invent a brand-new tool that combines science + engineering to solve one everyday problem. Give it a name and draw it.

7. Debate

'Technology has done more good than harm.' Write one strong reason for YES and one for NO (hint: remember the chapter's example of pollution).

8. Tool Match Game

Draw a line to match each scientist with the tool they would use.

Chemist	Microscope
Biologist	Camera + computer
Geologist	Digital pH meter
Astronomer	Rock hammer + GPS
Physicist	Radio telescope + rover

9. Mystery Crown Math

Pure gold is heavier than silver for the same size. If two crowns are the same size but one weighs less, which one is fake - and why?

10. From Sand to Stars

In 4 quick drawings, show the chain: glass -> lens -> telescope -> discovering a new planet. Add one caption per box.