



The Nature of Science

Earth Science

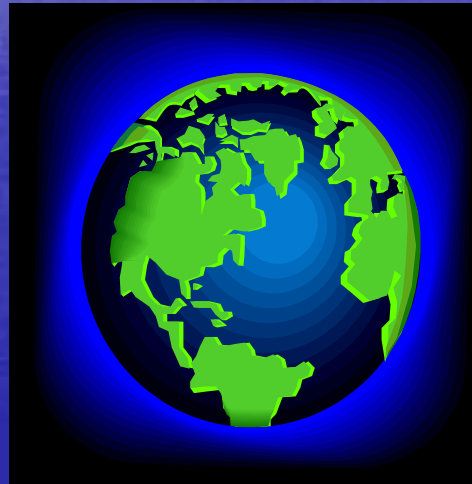
- How does Earth science affect your everyday life?
- You need to learn:
 - How Earth science is a blend of sciences
 - How Earth's four major systems interact
 - What is involved in carrying out scientific experiments
 - Why it is important to communicate scientific methods and results accurately

Four Areas of Earth Science

- **Astronomy**: The study of objects beyond the Earth's atmosphere
- **Meteorology**: The study of the air that surrounds our planet
- **Geology**: The study of the materials that make up Earth and how they change
- **Oceanography**: The study of the Earth's oceans

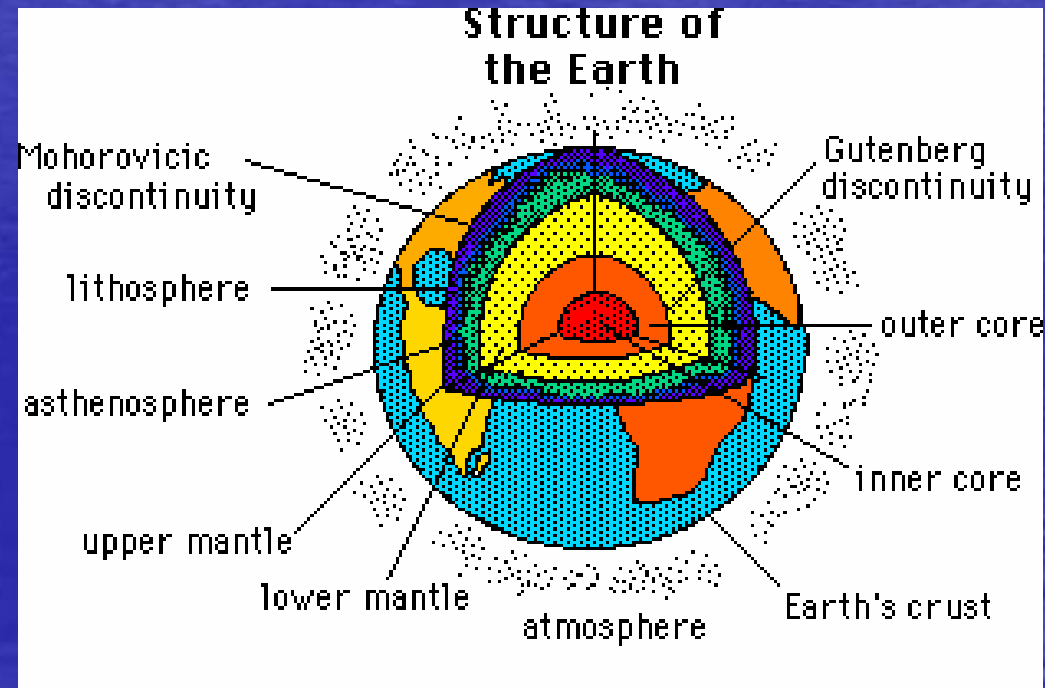
Earth's Systems

- Lithosphere
- Hydrosphere
- Atmosphere
- Biosphere



The Lithosphere

- Rigid outer shell
 - Includes the crust and mantle
 - Rocks and minerals

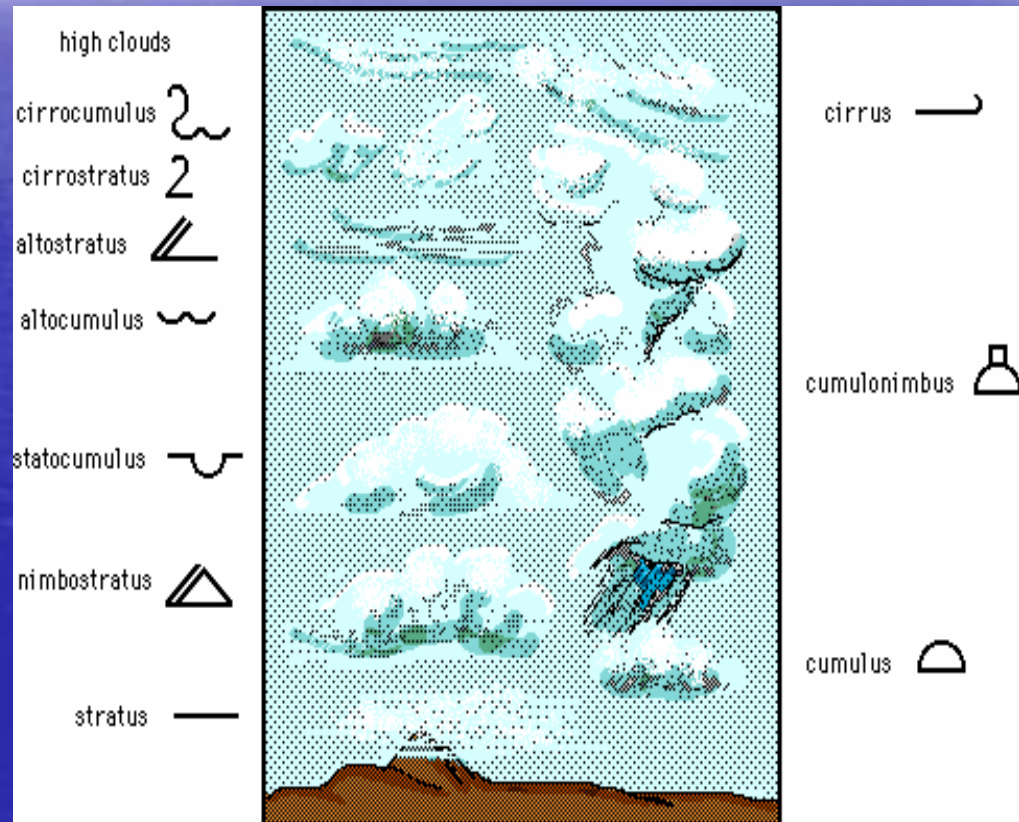


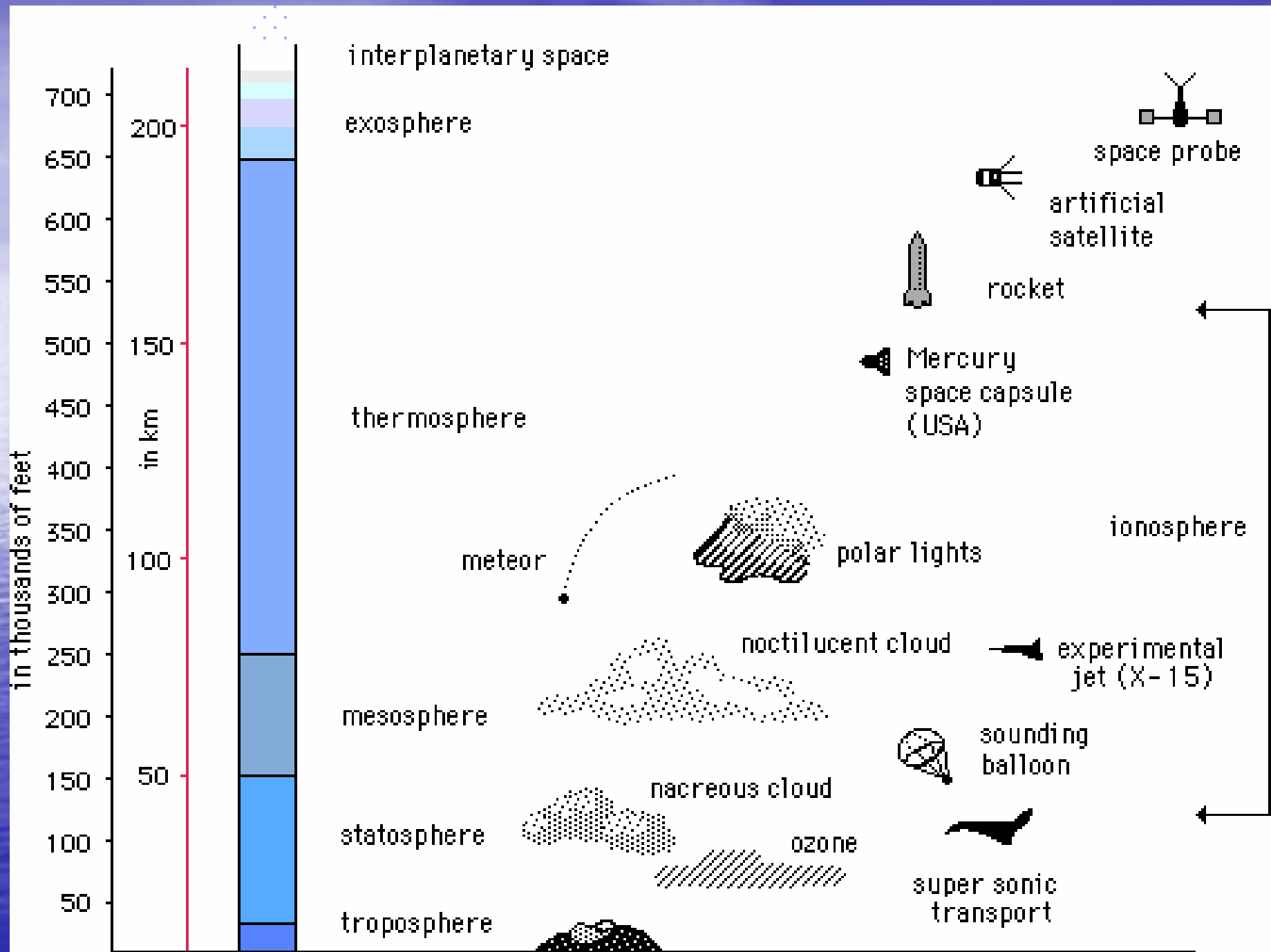
The Hydrosphere

- Oceans, seas, lakes, rivers, glaciers, and atmospheric water
- ~97% salt water

The Atmosphere

- Gases that surrounds Earth
- Clouds, gases, and liquids
- Protects living things
- Maintains temperature
- Contains: 78% N₂, 21% O₂



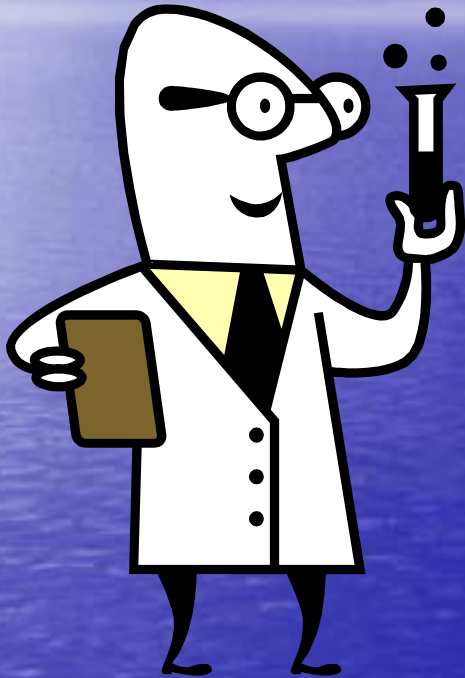


The Biosphere

- Includes all organisms and their environment
- Interactive with all other systems



Methods of Scientists



- The scientific method
- A way to solve problems and learn new things

STEPS OF THE SCIENTIFIC METHOD

- determine the problem
- observe and collect information
- make a hypothesis
- test your hypothesis by designing an experiment and performing the experiment
- analyze your results
- draw conclusions
- go back to above steps and rethink, re-experiment, and re-conclude

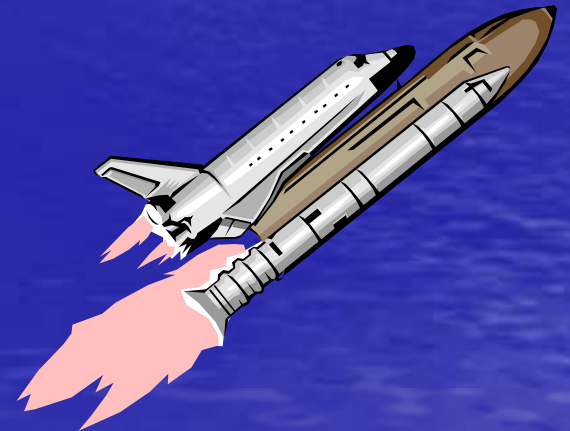
Measurement

- The International System of Measurement
 - Also known as SI
- Length, weight and mass, area and volume, density, time, and temperature
- Scientific notation – expressing numbers as a multiplier and a power of ten



STANDARDS OF MEASUREMENT

- STANDARD: AN EXACT QUANTITY THAT PEOPLE AGREE TO USE FOR COMPARISON
- THIS QUANTITY HAS TO BE THE SAME FOR EVERYONE
- WHY?



UNITS

- EVERY MEASUREMENT MUST HAVE A UNIT OR ELSE IT DOESN'T MAKE SENSE
- EXAMPLES: FEET, INCHES, POUNDS, QUARTS
- INTERNATIONAL SYSTEM OF MEASUREMENT (SI)
 - STANDARD OF MEASUREMENT USED WORLDWIDE
 - SI UNITS: CONTAINS A BASE (METER, LITER, ETC.), IS BASED ON MULTIPLES OF 10, AND CONTAINS A PREFIX (A WORD BEFORE)

PREFIX MEANINGS

- KILO (K) 1000
- DECI (D) .1
- CENTI (C) .01
- MILLI (M) .001
- MICRO (μ) .000001
- NANO (n) .000000001

UNIT EXAMPLES

- KILOMETER = KM
- CENTIMETER = CM
- KILOLITER = KL
- CAN YOU NAME SOME MORE??

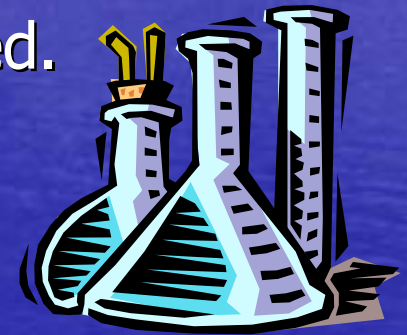


USING SI UNITS

LENGTH	METER	m
MASS	KILOGRAM	kg
TIME	SECOND	s
ELECTRICITY	AMPERE	A
TEMPERATURE	KELVIN	K
AMOUNT OF SUBSTANCE	MOLE	mol
INTENSITY OF LIGHT	CANDELA	cd

UNITS OF VOLUME

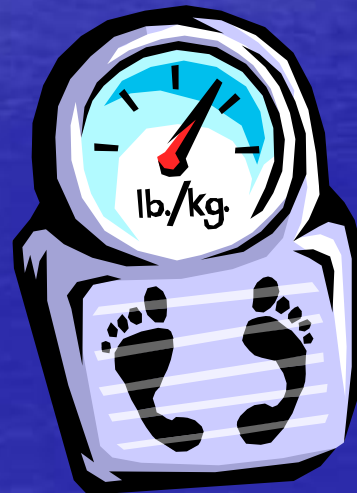
- VOLUME: Amount of space occupied by an object
- units: cm^3 , m^3 , liters
- volume is a derived unit. It can be calculated.
- Most common unit is the liter
- 1 liter = 1 dm^3 = about a quart
- 1 mL = 1 cm^3



- TO CONVERT USE THE SAME RULES AS LENGTH
- Volume can be measured using a Graduated Cylinder

MASS

- MASS IS THE AMOUNT OF MATTER IN AN OBJECT
- UNITS = KILOGRAM (1 kg = 1000g)
- MASS IS MEASURED WITH A BALANCE



DENSITY

- DENSITY IS MASS PER UNIT VOLUME OF MATERIAL
- DENSITY IS CALCULATED BY : $D = M/V$
- DENSITY CAN BE CALCULATED IF YOU KNOW 2 OUT OF 3 VARIABLES
- EVERY SUBSTANCE HAS ITS OWN DENSITY

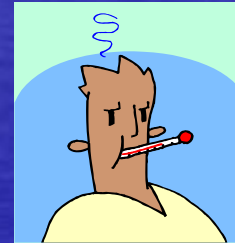


TIME & TEMPERATURE



- TIME UNITS = SECOND
- TEMPERATURE UNITS = KELVIN
- TEMPERATURE IS USUALLY MEASURED IN °C OR °F

0 °C = WATER FREEZES
100 °C = WATER BOILS
32 °F = WATER FREEZES
212 °F = WATER BOILS



- ABSOLUTE ZERO = 0 K = COLDEST KNOWN TEMPERATURE (0K = -273 °C)

EXAMPLE

- MASS = 10 GRAMS
- VOLUME = 2 CM³
- DENSITY = ?

- $D = M/V$

- $D = 10 \text{ g}/2\text{cm}^3$

$$D = 5 \text{ g/cm}^3$$

Communication

- Lab reports
- Graphing
- Models
- Theories and Laws



GRAPHS

TYPES OF GRAPHS

```
graph TD; A[TYPES OF GRAPHS] --> B[LINE GRAPHS  
shows trends  
continuous change]; A --> C[BAR GRAPHS  
shows info collected  
by counting]; A --> D[PIE GRAPHS  
shows how a fixed quantity  
is broken down into parts];
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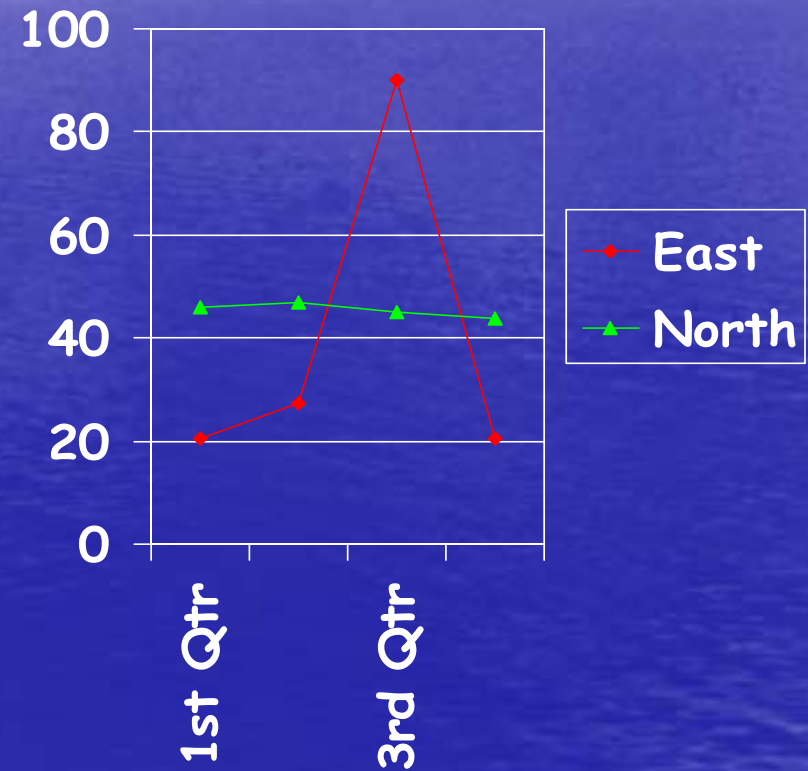
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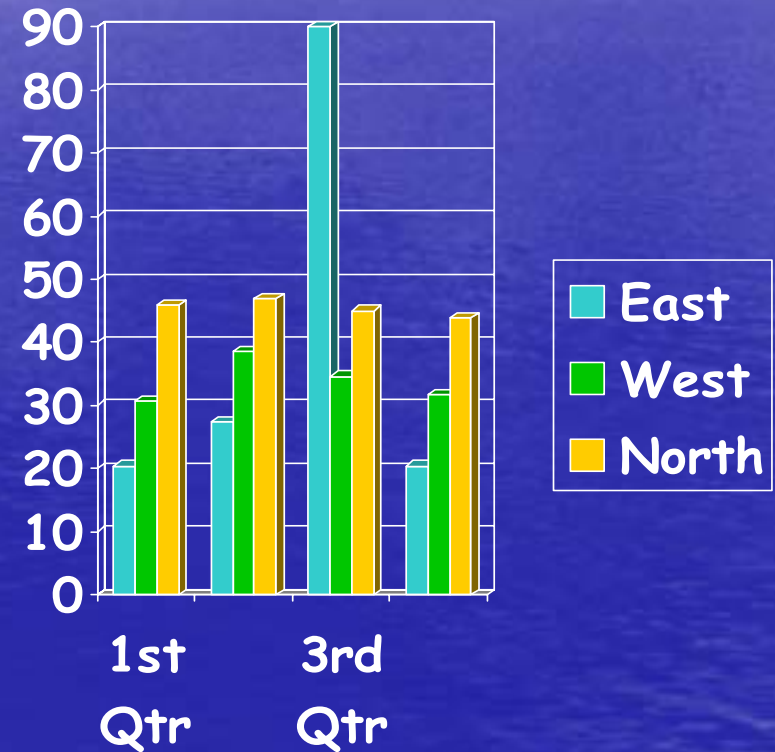
Line graphs

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
East	20.4	27.4	90	20.4
West	30.6	38.6	34.6	31.6
North	45.9	46.9	45	43.9



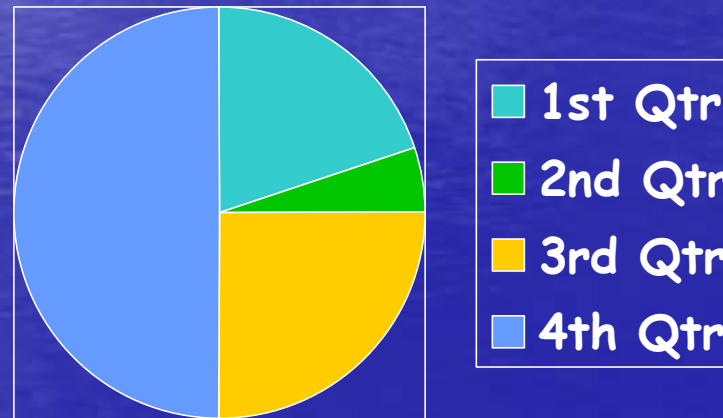
Bar graphs

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
East	20.4	27.4	90	20.4
West	30.6	38.6	34.6	31.6
North	45.9	46.9	45	43.9



Pie graphs

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
East	20	5	25	50
West	30.6	38.6	34.6	31.6
North	45.9	46.9	45	43.9



EAST