Matter: anything that has mass and occupies space.

element:- a substance that cannot be broken down to other substance by chemical means.

compound: a substance consisting of 2 or more diff elements combined in a fixed ratio.

CHEMISTRY FOR LIFE

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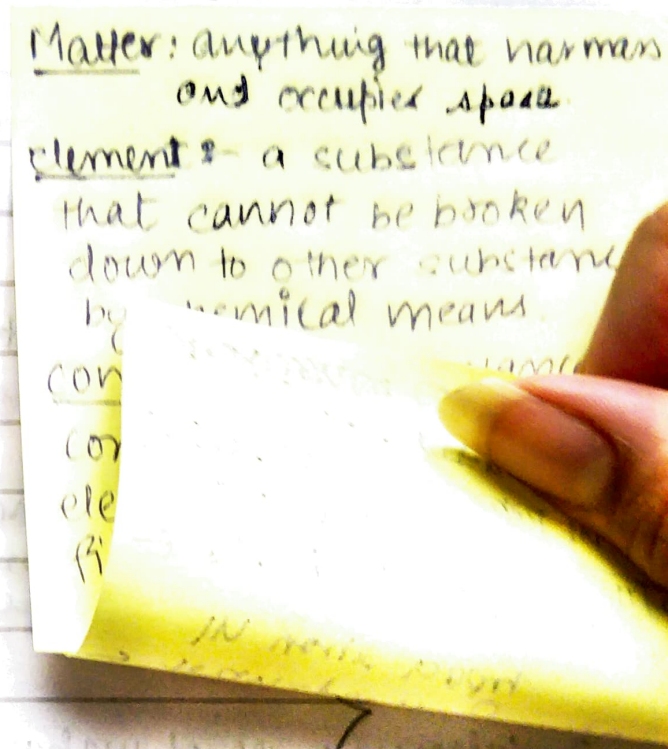


→ Elements present in human body

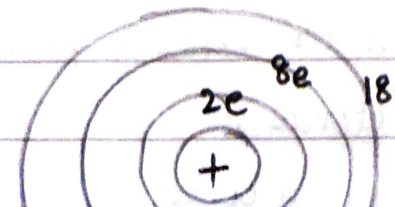
96.3% {
- oxygen
- carbon
- hydrogen
- Nitrogen

3.7 {
- Calcium
- Phasphorous
- Potassium
- Sulphur
- Sodium
- Chlorine
- Magnesium

- trace element: present < 0.01% of mass
  eg- Boron, Iron, Iodine, zinc, Cu, C

→ Elements properties:

- subatomic particles : ~~Nucleons~~ neutrons, electrons, ~~protons~~
  (electrically neutral), (single negative charge), (single +ve charge



trace element: IRON

→ 0.004%.
→ used in energy processing
→ transporting oxygen in your body
→ ONLY element needed by all forms of life.

IODINE: only needed in ~VERTEBRATES~ deficiency causes goitre.

nents properties:

subatomic particles : ~~nucleons~~ neutrons, electrons, protons

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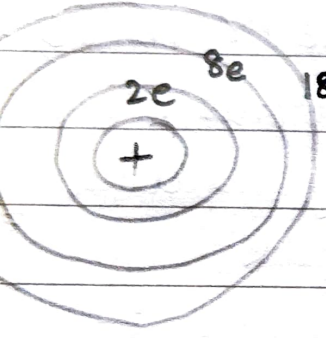

atomic No = ~~p~~ No. of protons

Mass No. = protons + neutrons

Isotopes : same no. of protons, different no. of neutron

- radioactive isotopes : ~~nucleus~~ nucleus decays spontaneously, giving off particles and energy.
  - damages cellular molecules and thus poses serious problem to organisms.

Radioactive isotopes: DANGERS

- uncontrolled exposure is LETHAL
- particles thrown off can damage, molecules, DNA
- RADON: 2nd lead of lung cancer in America
- THYROID CANCER ETC!!
- ALZHEIMER'S DISEASE!

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- the backbone of life is carbon (C) and is the most apt one
  - no one has similar properties (to form bonds)
  - AND is lighter than carbon

- molecular composition of life – 80% water
  – 20% dry → 50% proteins
  → 15% carbohydrates.
  → 10% lipids and fats
  → 15% nucleic acid

formation of these molecules depend on the chemical properties of these elements

- Valency: no. of unpaired electrons in the outer ~~shell~~ orbital of a shell
  - gives an opportunity for the elements to combine with another elements.
- Electronegativity: tendency for an atom of an elements to attract shared electrons when forming a chemical bond.

→ Different types of bonds:-

1) Covalent bond: ~~the~~ mutal sharing of one or more pairs of electrons ~~by~~ b/w two atoms.
   → C – C (single bond). Energy required to break = 80 Kcal/mol
   → C = C (more energy is required to break this bond)
   → C ≡ C (most energy is required to break this bond)

→ characteristics of covalent bond
   1) very strong
   2) stable (unless something is attacking and breaking them)

The elements that make up 98% of living organism

	Valency
→ Hydrogen	1
→ carbon	4
→ Nitrogen	3
→ oxygen	2
→ Phosphorus	3, 5
→ Sulphur	2, 4, 6

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similar properties (to form bonds)
hter than Carbon

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ELECTRONEGATIVITY

→ "The attraction of a particular element for the electrons of a covalent bond."

→ the stronger EN → more pulling of e^-

→ if an element is bonded to more EN element, the e^- of the bond are not shared equally.

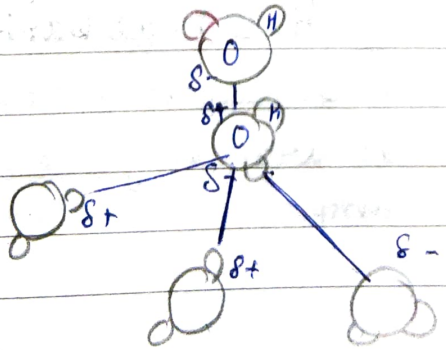
↓

POLAR COVALENT BOND

- **molecule**: consists of two or more atoms held together by covalent bonds.
  → the sharing of e^- in covalent bonds, is not always equal

- ionic bond:
  - transfer of electrons from one atom to another atom to form bond.
  - the atoms forms ions (ie. it should be in ionic form)
  - strong bond unless disturbed.
  - eg. if one drop of water is added to NaCl, the ionic bond breaks.

- water and phospholipids:
  - water can be found in three states → solid, liquid, gas
  - water is the only solvent present in all three phases which interchange.
  - Polar covalent bonds in water molecules result in H-bonding.



Characteristics of H-bond

- they break and form with great frequency.
- each H-bond only lasts for a few trillionths of a second.
- new molecules r const. formed.

- Cohesive and adhesive properties of water.
  - water molecules stay very close due to H-bonding
  - arrangement of molecules is always changing
  - At a given moment, 1 molecule linked to many.
  - this linkages make water more structured.
  - cohesion: hydrogen bonds hold the substance together. (stick together)
  - adhesion :- the clinging of one substance to another
    Adhesion of water to cell walls by hydrogen bond helps counter the downward pull of gravity

cohesion is stronger for water is stronger than most liquids

s similar to surface ension

the thinness of a plant's ein enhances the adhesion f water to its cell walls, elping to counter the ownward pull of gravity

~ Water transportation in plants ~

Evaporation from leaves pulls water upwards from the roots through water conducting cells.

cohesion due to hydrogen bond b/w water molecules helps hold together the coloumn of water within cell.

Cohesion in Trees :-

- transportation of water and nutrients from roots to thier leaves.
- the evaporation of water from the leaves exerts a pulling force on water within the veins the leaves.

- moderation of temperature by water :-
  - moderated air temp by absorbing heat.
  - water is an effective heat bank because it can absorb or release a relatively large amount of heat with only a slight change in its own temp.

DEFINATIONS :-

Thermal energy : energy associa with the random movement of atoms and molecules.

Heat : transfer of thermal energy from warmer to cooler body of matter is defined as heat.

temperature : measure of intensity of HEAT. The avg. speed of molecules in a body of matter.

How can water do that ?

- the specific heat of water = 1 Cal per gram per °C
- water has higher specific heat wrt most substance
- ∵ of high specific heat, it's temp will not change easily (temp will change less when it absorbs or loses heat)
- water's specific heat ∼ hydrolbonding.
  - heat absorbed to break H-bond
  - heat released when H-bond forms.
  - A calorie of heat causes a relatively small change in the temp of water because much of the heat is used to disrupt H-bond before the water molecules can begin moving faster.
  - when the temp of water drops lightly, many H-bond form, releasing a considerable amount of energy in the form of heat.

a- what is the relevance of water's high specific heat to life on earth

- oceans and seas : • coastal area have milder climate

they absorb a huge amount of heat from sun and their temp only rises a few temp. but later, heat is released

- it also stabilizes ocean temperature for marine life.
- because water covers most of earth's surface, it keeps temp fluctuations on land and in water within limits that permit life.

- floating of ice on liquid water :-
  - water is a few substance that is less dense than as a liquid.

what would happen if ice didn't float on water?

- ice forms a thick "coat". if it wouldn't float, then eventually ponds, oceans, etc would freze solid.

This "blanket" of ice prevents water from freezing which allows other aquatic life forms to survive

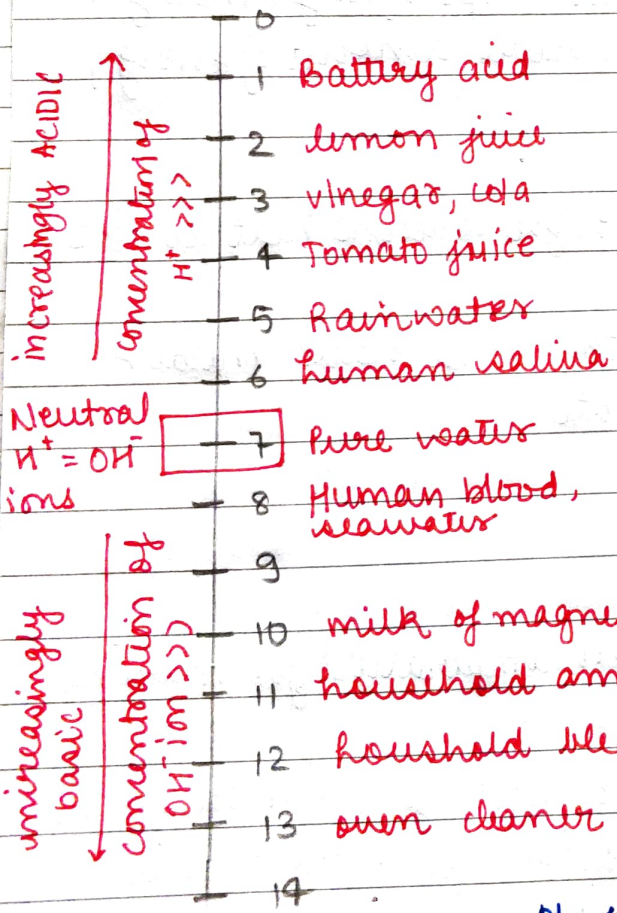
- why?

in ice each molecule is hydrogen-bonded to 4 neighbours in a 3-D crystal.

because the crystal is spacious, ice has fewer molecules than an equal volume of liquid water

- Water: the solvent for life
  - water is a good solvent
  - make reactions take place in an organism. For almost all of them, water is the solvent

→ The chemistry of life is sensitive to acidic and basic conditions



- Acid: a substance that donates H^+ ions to solutions.
- Base: a substance that donates $OH^\ominus$ ions to solution
- pH (potential of hydrogen) is used to measure how acidic or basic is a solution.
  - each unit represents a 10-fold change in the concentration of H^+ or $OH^\ominus$ ion
- the pH of human blood = 7.4
- pH < 7.0 or pH > 7.8 ⇒ DEATH

- How is pH maintained?

biological fluids contain buffers, substances that minimize the change in pH. they accept $H^\oplus$ when it is in excess and donating $H^\oplus$ when it is depleted

→ Effects of rising atmospheric CO_2 on Coral reef ecosystem.

- CO_2 → main product of fossile fuel combustion
- 25% of CO_2 is absorbed by oceans
- ocean acidification: CO_2 in water, lower the pH
- calcification: procers in which coral animals combine calcium and carbonate ions to form thier calcium carbonate skeletons.
- as seawater acidifies, the extra $H^+ + CO_3^{2-}$ (carbonate ions) → HCO_3^- (bicarbonate ion)

this reaction reduces the carbonate ion conc available to corals.