Atmosphere - Meteorology

Layers

interplanetary space

Exosphere

occasional molecules
gradually escape
into space

500 km

Thermosphere

fewer molecules
large T changes

80 km

Mesosphere

cold
few molecules
meteors burn here

50 km

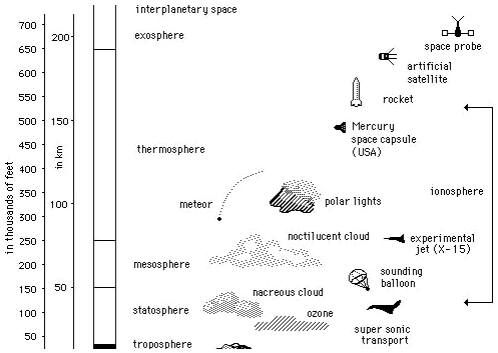
Stratosphere

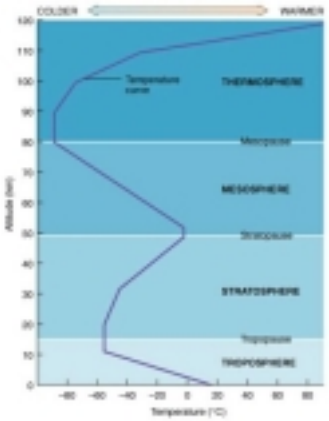
ozone layer
24% of atmosphere

10 km

Troposphere

life forms
weather
75% of atmosphere





Atmosphere Evolution

Universe: H 92% He 7%
Outer planets ~ same
Inner planets
more heavy elements
lighter gasses escaped

Atmosphere I

rich in H compounds
CH_4 NH_3 H_2O H_2S

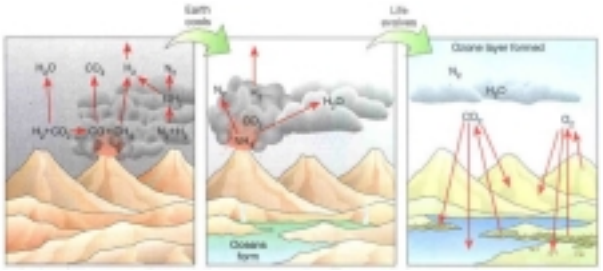
Atmosphere II

cooled
N_2 CO_2 H_2O

Atmosphere III

oceans absorb CO_2
plants produce O_2

Composition

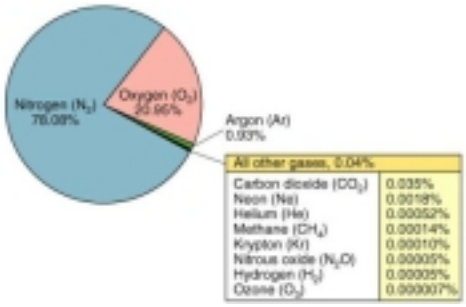


24-02

N_2 78%

O_2 21%

Ar 1%



Greenhouse Effect

in **Troposphere**

CO_2 H_2O passes

to visible light

but blocks IR

similar to

greenhouse glass

traps heat

could melt polar caps

(in last Ice Age

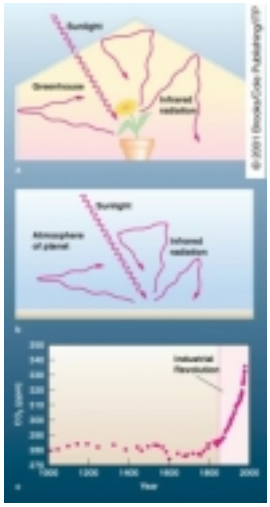
sea 120 m lower)

raise ocean level

by 50 m

5 m floods most of

South Florida



06-07

Sea level depends on Temperature

99% of fresh water

in Polar Caps

heated water expands

difficult to predict

Plate Movement

land height

Melting snow

removes weight

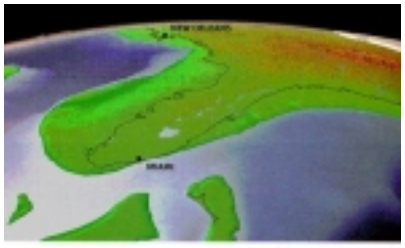
land rises

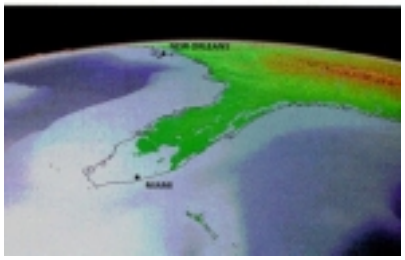
Alaska

Sinking Land

pump oil/water

Erosion





STRATOSPHERE 11-50 km

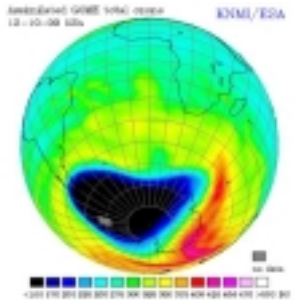
Ozone Layer O_3

concentration 10 ppm

25-30 km

profound influence on life

absorbs Sun's UV radiation
2100Å < λ < 2900Å
UV causes skin cancer
destroys genetic material
raises T in stratosphere

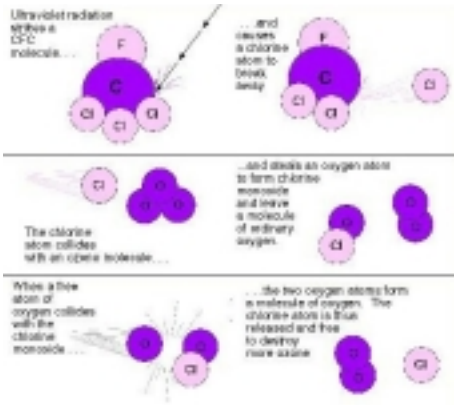


Ozone Hole - depletion
Southern Hemisphere

CFC's
ChloroFluoroCarbons - Freons
$CFCL_3$ CF_2Cl_2
refrigerants, aerosol cans
with UV ⇒ free Cl
reacts to remove O_3

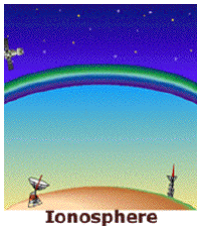
$$CFCL_3 + UV \rightarrow CFCL_2 + Cl$$

$$Cl + O_3 \rightarrow ClO + O_2$$



CFC's now banned/reduced
new refrigerants
auto AC before ~1993
should be replaced

IONOSPHERE ~50 km - 1000's km
UV, X-ray, Cosmic Rays interact
create electrons, + ions
charged layer - scatters radio waves
transmission beyond horizon

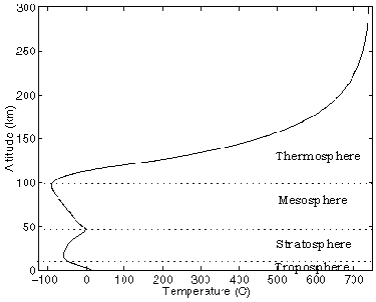


play

THERMOSPHERE
85 km - 500 km
low gas density
absorbs UV
upper T ⇒ 1300°C
not hot to touch

EXOSPHERE
above 500 km
H, not H_2

Magnetosphere
electrons and + ions

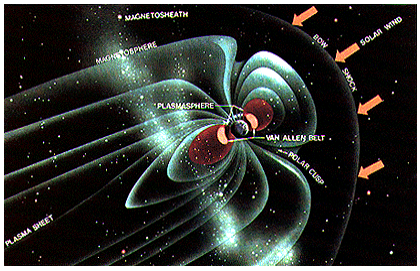


curved by Earth's magnetic field

Van Allen Belts

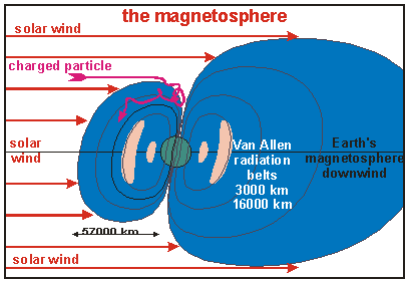
high E protons, electrons trapped in magnetic field

discovered by 1st American satellite



Aurora

solar wind bent to poles excites atoms



WIND - mostly horizontal air motion named for direction blows **from**

Windward direction from which wind blows moist side

Leeward direction in which wind goes dry side

Energy Source - Sun

cool air

weighs more - high P

warm air

weighs less - low P

winds go from high P to low P

Coastal Winds

heat capacity

salt water 0.9 c/g°C

minerals 0.2 c/g°C

Daytime Sun warms land ocean stays cool

Sea Breeze ocean to land

Nighttime land cools more

Land Breeze land to ocean