Atmosphere, Ionoshpere & Radio Propagation Cheat Sheet

by azten via cheatography.com/18500/cs/1775/

Atmosphere

gaseus envelope around a celestial body

Composition of Earth's Atmosphere

Nitrogen = 78%
Oxygen = 21%
Argon = .9%
Carbon Bomboxide = .036%

Layers of Earth's Atmosphere

Troposphere -> Stratosphere -> Mesosphere -> Ozone Layer of Doom -> Thermosphere

Heterosphere

Higher region of the atmosphere which constituents are no longer mixed by turbelence

Homosphere

Lower-middle atmosphere which features homogenous mixture of atmospheric gases

CREATION OF THE SOLAR SYSTEM

Nebula Theory

Instellar cloud of gas collapsing under its own gravity. Explains all major features of the solar system and its exceptions

Solar Nebular Hypothesis

Rotating cloud of gas that contracts and flattens into a thin disc (leads to formation of planets) of gas and dust and the forming sun in the center.

Types of Planets

Joviaan: Large, have a lot of solids in their discs. Icy, rocky, metal core.	Terrestrial: Opposite of Jovian. (rocky metal core)

Space Debris

Comets: icy nucleus evaporated and sent to space by solar wind pressure

Meteoroids: dust debris in space

Asteroids: rocky bodies of mass diameters less that 1km

SUN BASICS

Layers of the Sun

Core:

Radiative Layer: no electrons to trap photons (transparent)

Convective Layer: non ionized gases capture photons (opaque)

Photosphere: density decrease

Chromoshpere: can't see due to low density

Transition Zone

Corona

Hydrostatic Equilibrium

Pressure balances the gravitational pull the center of the "SPHERICAL" body

Suns spots

Magnetic phenomena which occurs in the photosphere. Occurs in pairs each member with opposite polarity.

Solar Prominence

Large bright gas features inside the sunspots. Horse shoe shape

Nuclear Fusion

H + H -> 2H + neutrino + positron

2H + H -> 3He + gamma ray

3He + 3He -> He + H + H + ENERGY

Ionoshpere

Region of thermosphere where the Sun's UV radiation ionizes oxygen molecule to a positive ion and free electron.

Layers of the Ionosphere

D Layer (night change)	60-90km
E Layer (night change)	90-140km
F1 Layer	140-200km
F2 Layer	200-500km

Virtual Height

Height from which the radio waves appear to reflect.

Critical Angle

Angle a radio wave must be transmitted at to ensure reflection back to earth

Critical Frequency/Plasma Frequency

Highest frequency that at which radio wave transmitted straight up will get reflected back.

Reasons for D E & F Layers

Solar Decomposition: depends on the UV absorption of the atmosphere

Physics of Recombinatorial factorization: depends on the density of atoms

Atmospheric composition: types of atoms at different heights

Differential Energy Absorption

dI = (sigma)(n)(I)(dS)

sigma = energy abosrption per unit volume

n = particle densitometer

I = intensity from the sun

dS = length of the layer

Ionization Rate

q = (sigma)(p)(n)(I)

p = number of particles

Ionograms

Plot of virtual height of the ionosphere vs the frequency

Produced by ionosondes, transmitting vertically up into atmosphere

MAGNETOSPHERE

Plasma Sheet

Slab-like particle population centered at the mid plane of the magneto tail. Divides into north and south lobes

Magnetopause Current

Divides the earths magnetic field and plasma from solar wind. Induced current as a result of magnetic field deflection

Types of Particle Motion

Gyration: gyration of charge particles along geo magnetic field lines

Bounce: charged particles trapped in magnetic mirrors trapped in north and south

Drift: charged particles experience gradient and curvature drifts to the west for protons and east for electrons

Magnetic Mirror

Charged particles move in helical orbits at their cyclotron

Electromagnetic Wave

Radiation with electric and magnetic components oscillating at same frequency. Used to transmit information by wave motion.

Radio Waves

features air waves moving across the atmosphere. reflects off of clouds or layers of ionosphere.

Types of Radio Wave Propagation

Attenuation

Reflection

Refraction

Diffraction

Types of Radio Waves

Ground wave: follows the curvature of the earth on the surface as a result of earths electrical characteristics. (Direct and Reflected)

Sky wave: gets reflected by the ionoshpere

Space wave: shoots through to space

Amplutide Modulation

Amplitude of carrier wave is made to vary with the incoming signal.

Frequency modulation

Frequency of the carrier wave is made to vary with incoming signal

SEMICONDUCTORS

Types of Semiconductor Atoms

Group III	B & Al
Group IV	Carbon & Silicon
Group V	Nitrogen & Phosphorus

Intrinstic Semiconductors

Features 2 Group IV atoms in convalent bonds. Constant concentration of electron-hole pairs active at room temperature as a result of thermal energy. Ohmic relationship.

Extrinsic Semiconductors

N-Type	P-Type
Atom with 5 valence electrons	Atom 3 valence electrons
Majority carrier electron	Majority carrier holes

Diodes

Combine P and N type semiconductors in a lattice.

Rectification

Converting AC to DC. Remember half-wave and full wave rectification

BACKGROUND PHYSICS

Radiance

Power passing through unit area in unit solid angle about the normal to the area.

Irradiance

Power passing through the unit area.

Scattering

Photons get deflected from incident direction by intermediary particles without energy loss.

Types of Scattering

Rayleigh: photons collide elastically with the atmospheric molecules.

Mie

Non selective

Rayleigh Scattering

Why does the sky look blue?

> light scatters in all directions at an intensity of $(1+\cos^{(2)}(x))^{*\text{lamba}}{}_{-4}$

Aerosols

Atmospheric mixture strong enough to lift up particles into the atmosphere

Types of Aerosols

Natural	Anthropogenic
Sea salts	Pollution
Volcanoes	

Radiative Transfer Equation

-absorptivity + emittance - scattering out + scattering in