GLOBAL WINDS

1. Scales: micro, meso, macro (includes synoptic and global)
    a. Winds involved in redistributing heat
        i. Equator: heat surplus
        ii. Poles: heat deficit
2. Single cell model
    a. Earth not rotating (No Coriolis)
    b. Earth is completely water (no differential heating between land and water
    c. No tilt to the Earth (no seasonal variation)
    d. Single Hadley cell model
    e. Establishes equatorial or tropical; subtropical; mid latitude; sub polar and polar regions
    f. Other areas: ITCZ where trades meet (doldrums0, horse latitudes
3. Three cell model
    a. Hadley (equator to 30 degrees)
        i. Hot moist air rises at equator releasing latent heat that drives the cell and also generates high clouds that produce rain over the tropics
        ii. Air moves poleward and converges becoming heavier and sinking as dry war air
        iii. The area of the descending air produces the world's great deserts
        iv. Upper wind moves from W to E; surface air E to W) (Trade winds)
    b. Ferrel (30 to 60 degrees)
        i. Upper level winds NE to SW; surface winds SW to NE (prevailing westerlies)
        ii. Meets colder polar air – "polar front" does not mix well
        iii. Point of meeting is the "polar front" an area of low pressure
    c. Polar (60 to 90 degrees) preceded by a Polar front an area of low pressure.
        i. Polar front is the place where cool polar air meets warmer air moving poleward
        ii. Cold air sinks at the poles and moves on the surface from NE to SW (polar easterlies)
    d. Pressures
        i. Where air rises, low pressure, where it sinks, high pressure

ii. Semipermanent Highs and Lows
    1. Highs 25 – 35 N latitude.
        a. Bermuda (Azores) High
        b. Pacific high
    2. Lows 40 – 65 degrees
        a. Greenland Icelandic low
        b. Aleutian low
iii. Not so permanent highs and lows
    1. Siberian high (winter)
    2. Canadian high (winter)
    3. SW US low (summer)
    4. Iran Plateau low (summer)
        a. Shifts are cause by the seasonal change of the position of the sun.

e. General circulation and precipitations patterns
    i. Abundant rain where air rises
        1. Tropics (humid air rises)
        2. Polar front
    ii. Low rainfall where air descends
        1. Around 30 degrees
        2. In polar regions where air is cold and dry
        3. Seasonal movement moves areas a bit north and south

f. Winds above 500mb level (1/2 point in atmospheric pressure)
    i. Wind speeds increase (less dense air) as decreases above 500mb speeds increase to the tropopause
    ii. Where strong winds tend to concentrate in narrow streams there are fast flowing rivers of air – the jet stream

g. Tropopause jet streams
    i. Polar and subtropical jets form along the 500mb surface
    ii. May merge or split
    iii. Appear has wavy bands around the world although not always continuous
    iv. Loop north and south redistributing heat
    v. Fastest flowing air is called the jet core
    vi. Jet streams form as a result of horizontal variations in temperature and pressure

h. Formation of the Jet streams
    i. Polar jet forms where the Polar front is.
        1. 500mb surface dips sharply as it goes through front
        2. Temperature on either side of the front very different

3. Sudden change in pressure along the front sets up a steep pressure (contour) gradient that intensifies wind speed and causes the jet stream to form
4. Wind speed that changes with height caused by horizontal temperature changes are called thermal wind. The Jet is a thermal wind
5. Jet blows along the front with the cold air on the left (N Hemisphere) (reverse in S hemisphere)
6. Jets are stronger in winter when the temperature gradient is greater across the front.

ii. Subtropical Jet forms on pole side of Hadley cell and is strongest at about 200mb
    1. Rising warm air moves poleward in the Hadley cell and produces something akin to the polar front, but it doesn't reach the surface.
    2. Additional force is the conservation of angular momentum
        a. Angular moment =mass x velocity x radius (angular momentum = mvr)
        b. As radius decrease velocity increases
        c. As parcel of air moves N from the equator, the radius becomes smaller and hence the parcel will accelerate.

iii. Other jets
    1. Tropical Easterly Jet stream
        a. Forms over SE Asia and India and Africe
        b. Forms at about 15km
        c. Forms on equator side of the upper level sub-tropical high, so winds are eastward (high is anticyclonic (clockwise)
    2. Stratosphere Polar Night Jet Stream
        a. Appears over poles – maximizes on cold polar nights in winter. Blows westerly
        b. In summer slows considerable and blows from the east
    3. Lower level jets (mesosphere)
        a. Low level Jet "Nocturnal Jet Stream"
            i. Appears over Great Plains usually at night because of temperature inversion

ii. This reduces friction with rising air (which would happen with air that is not stable)
iii. N-S running Rockies funnel the air
iv. Great Plains slope upwards to the west, so air is cooler on the western side of the plains.