

ES476/G576 Hydrology Mid-Term Study Guide – Winter 2008 (updated Feb. 11, 2008)

**Key Terms and Concepts**

*Introductory Notes*

hydrology  
spatial scale  
temporal scale  
mass  
energy  
flux  
mass transfer functions  
    evaporation  
    condensation  
    precipitation  
    runoff  
    infiltration  
    transpiration  
deterministic vs. stochastic  
processes  
hydrologic cycle (sketch it)  
convection  
advection  
groundwater  
surface water  
global water storage  
residence time  
compartments  
    oceans  
    groundwater  
    lakes  
    glaciers  
    ice caps  
transpiration  
evapotranspiration  
runoff  
infiltration  
vegetative interception  
ice sheets  
oceans  
springs  
soil moisture  
atmospheric moisture  
fresh water storage

*Global Water Budget Figures*

-Sketch hydro cycle in detail  
-understand global precip.  
distribution

-know the basic distribution of  
water resources  
-why is there high runoff in  
PNW?

*Water Chemistry*

atoms  
isotopes  
oxygen isotopes  
carbon isotopes  
ion  
cation  
anion  
complex ion  
dissolved ions in water  
molecules  
compounds  
mixtures  
atomic forces  
bonding forces  
octet rule  
stable-8 configuration  
valence shell  
electron shells  
lewis dot model  
atomic no.  
atomic mass  
no. protons  
no. neutrons  
no. electrons  
ionic bonding  
metallic bonding  
covalent bonding  
dot-model reactions  
aqueous solutions  
solute  
solvent  
saline solution  
salinity  
sheath of hydration  
dissolution  
concentration  
mass percent  
parts per thousand  
parts per million  
parts per billion

molarity  
mole  
avagadros no.  
molality  
density  
hydrogen bonds  
polar covalent bonds  
viscosity  
weight density

*Hydro - Physics Overview*

Know how to define and  
quantify the following...  
mass  
length  
time  
    temperature  
force  
angle (degrees and radians)  
area  
volume  
velocity  
acceleration  
discharge  
pressure  
force  
energy/work  
power  
momentum  
mass density  
weight density  
viscosity  
  
other physics concepts to  
consider:  
  
heat  
heat flow  
heat capacity  
volume expansion/contraction  
density-driven rise / fall  
"hot air balloon model"  
heat transfer  
    conduction  
    convection  
    radiation

phases  
     solid  
     liquid  
     gas  
 states / phase changes  
     condensation  
     evaporation  
     melting  
     insert worksheets  
     delete worksheets  
 column widths  
 data sorting  
 date format  
 worksheets/workbooks  
 physical properties of water  
     liquid / fluid  
     heat capacity  
     polar molecule  
     solvent  
     covalent bonds  
     density-viscosity-temp

## Hydrometeorology

meteorology  
 weather  
 climate  
 temperature  
 humidity  
 precipitation  
 cloudiness  
 air pressure  
 water vapor  
     heat capacity  
     latent heat  
 particulate matter  
 dust  
 condensating nuclei  
 altitude vs. temp variation  
 altitude vs. press. variation  
 Earth-Sun Relation  
 rotational axis  
 north pole  
 south pole  
 equator  
 axial tilt (23.5 deg.)  
 insolation  
 water vapor  
 precipitation  
 solid, liquid, gas

freezing  
 (consider these in terms of heat  
 loss and heat gain)

conservation of:  
     mass  
     energy  
 newton's 2nd law  
 heat energy  
 evaporation  
 condensation  
 freezing  
 sublimation  
 humidity  
 specific humidity  
 relative humidity  
 vapor saturation  
 saturation capacity  
 temperature vs. humidity  
 temperature vs. air volume  
 hot air balloon model  
 dew point  
 dew  
 fog  
 clouds  
 rain  
 condensating nuclei  
 cloud droplets  
 adiabatic heating  
 stable vs. unstable air  
 rising air mass  
 sinking air mass  
 forceful lifting  
 convergent lifting  
 orographic lifting  
 frontal wedging  
 air pressure  
 force / unit area = pressure  
 altitude vs. air pressure  
 millibar  
 pounds per sq. inch  
 barometer

## Introduction to Surface Water and Watersheds

drainage basin  
 watershed  
 drainage divide  
 interfluvium

drainage network  
 channel network  
 channel tributaries  
 infiltration  
 runoff  
 channelized flow  
 overland flow  
  
 groundwater-surface water  
 discharge  
 drainage area  
 cross-sectional area  
 flow velocity  
 channel width  
 channel depth  
 volume/time  
 continuity equation  
 stream lengths  
 drainage density  
 stream magnitude  
 stream ordering  
 1<sup>st</sup> order, 2<sup>nd</sup> order, etc.  
 peak discharge  
 peak annual flow  
 peak monthly flow  
 rational runoff equation  
 rational runoff coefficient  
 rainfall intensity  
 flood recurrence interval  
 flood magnitude  
 flood frequency  
 flood frequency curve  
 flood hydrograph – what is it?  
 Seasonal flood climatology

## MS Excel Applications

Cell equations  
 cell algebra  
 chart functions  
     scatter  
     frequency histogram  
 math / stat functions  
     average  
     standard deviation  
     sum  
     count  
     max  
     min  
     median

copy / paste  
paste special  
print formatting  
    print area  
    page margins  
    landscape/portrait  
Cell formatting  
    borders / lines  
    fonts  
    number format  
    alignment  
    word wrap

GO BACK OVER THE SLIDE  
SHOWS ON THE CLASS  
WEB SITE; MAKE SURE  
YOU UNDERSTAND THE  
PRINCIPLES ILLUSTRATED  
IN THE SLIDE IMAGES

## **Big Concept Ideas / Essay Question Possibilities**

Can you sketch and discuss the hydrologic cycle?

What are the primary atmospheric processes that trigger precipitation events? Can you list, describe, and sketch the mechanisms?

What types of meteorological conditions lead to flooding in the Pacific Northwest? What about largest flood events in the U.S. as a whole?

Can you list the equations and discuss the difference between energy, force, pressure, and work?

Can you summarize the physical and chemical properties of water?

Why is water a good solvent? Sketch the water molecule.

How are density and buoyancy related to heat in the system?

Can you discuss the global distribution of water in reference to ocean, rivers, lakes, atmosphere, glaciers, etc.

## **Lab Skills to Focus On for Mid-Term**

Can you perform simple and complex unit conversions?

Do you understand dimensional analysis and unit algebra?

Do you know how to manage positive and negative exponents with respect to unit algebra?

Can you perform the following quantitative skills:

- plotting a graph

- re-arranging equations

- solving for unknown variables in an equation

- manipulating exponents and bases

- convert between metric and english systems of measurement

- calculate the equation for a line from a graph

- calculate the slope of a line

- write an equation if given a description of a quantitative problem

- convert between degrees and radians when dealing with angular measurement

- convert between mass and volume using density

Do you know how to use MS Excel as an analytical tool with respect to hydrologic data (data input, graphing, calculating, sorting, etc.... all the tricks we learned in lab)

Can you perform the following quantitative skills from the applied problems labs:

determine volumes of water in a reservoir  
calculating rates of discharge, evaporation and input into a hydrologic system  
converting between various measures of area, length, volume, and discharge  
determine the total input and withdrawal from a simple hydrologic system (calculating water budgets)  
determine the discharge of runoff using weir techniques  
calculate the volume of lake water using the frustrum of a cone  
solve the input-output conservation equation

Can you perform the following quantitative skills from the contouring exercises

draw contour lines on rainfall data (isohyets)?

- identify contour intervals and interpolate between data points
- Can you use the planimeter and cross-section paper to determine areas?
- Determine average precipitation using the arithmetic, Thiessen, and isohyetal methods?
- Can you work with map scales?

Can you calculate solute concentrations in ppm, ppb? ppt?

Can you perform the following skills as related to the Cascade Ice lab:

- calculate ice volumes and areas in glaciers from raw data
- identify glacial ice on a topographic map
- read a topographic map
- plot and interpret graphs using Excel
- enter and manipulate data in MS Excel

Can you perform the basic water budget calculations associated with the Mono Lake Exercise