

## Chapter 16: Running Water Study Guide

### Terms to Remember and Define:

- **Alluvial fan:** accumulate along mountainous fronts; deposited where a mountain stream experiences a sudden decrease in slope (hence velocity)
- **Alluvium:** the general term for (unconsolidated) sediment deposited by streams
- **Antecedent stream:** stream existed before the ridge was formed; a type of water gap formation
- **Bar:** common term for sand and gravel deposits in a stream channel
- **Base level:** the lowest point to which a stream can erode (two general types of base level--ultimate & local)
- **Bed Load:** coarser particles moved by rolling and sliding along the stream bed
- Braided stream
- **Capacity:** maximum load a stream can transport; increasing discharge increases the capacity of stream
- **Competence:** indicates the maximum particle size a stream can transport; determined by the stream's velocity; greater velocities can carry larger particles in suspension and as bed load
- **Cut bank:** the area of active erosion on the outside of a meander.
- **Delta:** forms when a sediment-charged stream enters the relatively still waters of a lake, inland sea, or ocean and dumps its sediment load.
- **Dendritic Pattern:** characterized by a branching pattern, characteristic of most streams and rivers.
- **Discharge:** the measure of how much water the stream is carrying in a particular area, measured in cubic ft/m per second; it is the cross-sectional area of the channel (width x average depth) multiplied by the average velocity ( $Q=A \times V$ )
- **Dissolved load:** dissolved chemical substances such as  $\text{HCO}_3^-$ ,  $\text{Ca}^{2+}$ ,  $\text{Cl}^-$ ,  $\text{Mg}^{2+}$ ,  $\text{S}(\text{O}_4)^{2-}$
- **Distributary:** a section of a stream that leaves the main flow.
- **Divide:** an imaginary line that separates the drainage of two streams, often found along a ridge.
- **Drainage Basin:** the land area that contributes water to a stream. Every stream drains into this area of land.
- **Flood:** most common and destructive geologic hazard; stream is unable to accommodate dramatic increase in discharge and the water overflows banks onto flood plain--result from naturally occurring and human-induced factors.
- **Floodplain:** the flat, low-lying portion of a stream valley subject to periodic inundation.
- **Graded Stream:** has correct slope and other channel characteristics necessary to maintain velocity required to transport material supplied to it (graded stream on average is neither eroding nor depositing material). A change in one characteristic will cause stream to modify its channel to offset the effect.
- **Gradient:** overall slope of the stream
- Headward erosion
- **Hydrologic cycle:** the cyclical movement of water through the various reservoirs; it is powered by the sun and the main processes are evaporation, precipitation, and runoff.
- Incised meander
- **Infiltration:** infiltration capacity is controlled by: intensity and duration of rainfall, prior wetted condition of the soil (if its already wet before rainfall, any additional rainfall will not really be absorbed and become runoff), soil texture (the more porous the soil--the more infiltration that can occur), slope of the land (steeper the slope----->greater the amount of run off), nature of the vegetative cover
- **Laminar Flow:** characteristic of slow-moving streams; streamlines in roughly parallel paths
- **Local Base Level:** resistant rock layers, lakes, dams, etc.; the level of a lake, resistant rock layer, or any other base level that stands above sea level.
- **Meander:** a loop like bend in the course of a stream
- **Mouth:** where the stream empties into large body of water
- **Natural Levee:** an elevated landform composed of alluvium that parallels some streams and acts to confine their waters, except during floodstage
- **Oxbow Lake:** a curved lake that is created when a stream cuts off a meander
- **Point bar:** a crescent shaped accumulation of sand and gravel deposited on the inside of a meander
- **Radial pattern:** where streams flow away in all directions from a central high point such as a volcano
- **Rectangular pattern:** characterized by straight segments of streams taking on perpendicular directions in areas of joints; develops on highly jointed bedrock

- **Rills:** the tiny channels developed by sheet flow that carry water to streams
- **Runoff:** water that does not infiltrate into the ground after originating as rain and melting snow. Run off begins as sheet flow, which develops into tiny channels called rills
- **Saltation:** transportation of sediment through a series of leaps or bounces.
- **Sheet flow:** what run off begins as
- **Stream piracy:** the diversion of the drainage of one stream into another; may result from headward erosion.
- **Superposed stream:** stream lets down upon a preexisting structure; development of a superposed stream: the river establishes its course on relatively uniform strata that cover a structural feature below. As the stream erodes downward, it encounters and cuts through the resistant rock units creating water gaps. By this process the river is superimposed on the ridges (e.g., Bighorn River)
- **Suspended load:** finer particles carried in suspension
- **Terrace:** (marks former flood plains) form when stream downcuts through previously deposited alluvium; downcutting stream carves new, lower floodplain, leaving behind older floodplain as a terrace; with significant downcutting, multiple terraces can result.
- **Trellis pattern:** tributaries trending in parallel valleys of steeply folded terrain; develops in areas of alternating weak and resistant bedrock
- **Turbulent flow:** characteristic of faster-moving streams; streamlines erratic w/ swirling motion; may exhibit whirlpools and eddies
- **Ultimate base level:** sea level; the lowest level to which stream erosion could lower the land.
- **Water gap:** a notch where a river cuts through a ridge that lies in its path. Two possible methods of formation: antecedent stream; superposed stream.
- **Waterfall:** a precipitous drop in a stream channel that causes water to fall to a lower level

#### Concepts to know:

1. What is the hydrologic cycle? Describe the three different ways (e.g., infiltration, evaporation, runoff, and precipitation) by which water is transferred from one reservoir (e.g., oceans, glaciers, groundwater, etc.) to another.
  1. The cyclical movement of water through the various reservoirs (powered by the sun)
  2. Water is transferred from one reservoir to another in many ways:
    1. Evaporation
    2. Transpiration (what plants do)
    3. Precipitation
    4. Ground infiltration
    5. Surface Runoff
2. *Streams are vital geologic agents that perform four special functions. What are those functions?*
  1. Carry most of the water that go from land to sea
  2. Transport billions of tons of sediment to the oceans each year
  3. Carry small amounts of soluble salt ions to the sea
  4. Shape the surface of the earth
3. *How does laminar stream flow differ from turbulent flow? What may cause laminar flow in a stream to change to turbulent flow?*
  1. Laminar flow
    1. characteristic of slow-moving streams
    2. streamlines in roughly parallel paths
  2. Turbulent flow
    1. Characteristic of faster-moving streams
    2. Streamlines erratic with swirling motion
    3. May exhibit whirlpools and eddies
    4. Sediment transport may take the shape of dunes rather than small transports; high angle cross bedding and so on.
4. *Describe how a stream's discharge, channel cross sectional area, velocity, channel roughness, and gradient changes when going from the stream's head to its mouth.*
  1. Stream's Discharge: if the cross sectional area and velocity are low, the stream's discharge will be low as well

; if the cross sectional area is larger and the velocity is faster, then the stream's discharge will increase accordingly.

1. Discharge is typically lowest at the headwaters and increases as it approaches the mouth of the stream.
  2. Channel Cross Sectional Area (would increase since it is a factor of channel size and flow velocity, which increase from the headwaters to the mouth)
  3. Velocity: tends to increase as it moves from the headwaters to the mouth
  4. Channel Roughness: highest at the headwaters, lowest at the mouth
  5. Gradient: the stream gradient typically decreases downstream; head is where the stream originates--where the stream gradient tends to be steepest and the gradient decreases as it approaches the mouth (where the stream eventually feeds into a larger body of water).
    1. DRAW A PIC OF FIG 16.10
5. **What is the base level of a stream and what does it represent? How does ultimate base level differ from local base level? Give some examples of local base levels.**
1. Base level is the lowest point to which a stream can erode.
  2. Ultimate base level would be sea level, local or temporary base level are resistant rock layers, lakes, dams, & waterfalls, etc.-->Niagara falls is an example of local base level.
6. **How does a stream respond to uplift of the land (erosion or deposition)? How does a stream respond to global sea level rise (erosion or deposition)? check on this in the book.**
1. In a graded stream, a stream will deepen its channel if land is uplifted or sea-level drops in order to achieve new base level. (erosion)
  2. Stream will widen and deepen its channel to accommodate increased discharge
  3. Stream will deposit sediment if discharge decreases or sea level rises.
7. **What are the three principal ways by which a stream transports material? What is saltation?**
1. **Dissolved Load (in solution)**: most of the dissolved load is brought to a stream by groundwater and is dispersed throughout the flow; the velocity of streamflow has essentially no effect on a stream's ability to carry its dissolved load; material in the solution goes wherever the stream goes.
  2. **Suspended Load (in suspension)**: most streams carry the largest part of their load in suspension. Usually only very fine sand, silt, and clay particles are carried this way, but during flood stage, larger particles can also be transported in suspension. The type and amount of material carried in suspension are controlled by two factors: the flow velocity and the settling velocity of each sediment grain. The slower the settling velocity and higher the flow velocity, the longer a sediment particle will stay in suspension, and the farther it will be carried downstream.
  3. **Bed Load (by sliding, skipping, or rolling along the bottom)**: coarse material, including coarse sands, gravels, and even boulders typically move along the bed of a channel as a bed load.
  4. **Saltation**: sediment that appears to jump or skip along the stream bed. This occurs as particles are propelled upward by collisions or lifted by the current and then carried downstream a short distance until gravity pulls them back to the bed of the stream.
8. **How does the stream capacity differ from its competence? What major factor affects the capacity and competence of a stream?**
1. Stream capacity is the maximum load of solid particles a stream can transport per unit time, while competence is the measure of the stream's ability to transport particles based on size rather than quantity.
  2. Capacity factors: the greater the discharge, the greater the stream's capacity for hauling sediment.
  3. Competence factors: flow velocity is key: swift streams have greater competencies than slow streams, regardless of channel size.
9. **What causes a stream to deposit its sediment load?**
1. Deposition occurs whenever a stream slows, causing a reduction in competence. Particles are deposited when flow velocity is less than the settling velocity; as a stream's flow velocity decreases, sediment begins to settle, largest particles first. Sorting: a mechanism by which solid particles of various sizes are separated. Alluvium is the general term for sediment deposited by streams. Many different depositional features are composed of alluvium.
10. **Sketch a meandering stream channel with several bends. Include a dashed line in the channel showing the trace of maximum water velocity. At each bend, indicate where the channel wall is undergoing erosion and**