

SAMPLE LESSON PLANS

Brian Poelker (retired) – Midwest Central Middle School
Measuring Stream Gradient of the Illinois River

Introduction:

The gradient is the slope of the stream. A steeper slope causes the water to flow faster. This increases the load of the stream, the amount of material that river can hold in suspension. As the river flattens out the gradient decreases and the load carried by the stream settles to the bottom. Rivers with a higher gradient that erode the banks are called degrading streams. Rivers with a flatter gradient the accumulate silt in the riverbed are called aggrading streams. The data table provides the elevation and distance of various points of the Illinois River from Grafton, IL, where it flows into the Mississippi Rivers, before the Illinois River was changed for barge traffic. To calculate the gradient, divide the difference in elevation of the two locations by the distance between the same locations.

$$\text{Gradient} = \frac{\text{Vertical Distance (m)}}{\text{Horizontal Distance (km)}}$$

<u>Town</u>	<u>Distance from Grafton, IL</u>		<u>Elevation of River</u>	
Marseilles	245mi	394km	470ft	143.3m
Ottawa	240mi	386km	445ft	135.6m
Starved Rock	230mi	370km	430ft	131.0m
Hennepin	210mi	337km	430ft	131.0m
Peoria	168mi	270km	425ft	129.5m
Havana	122mi	196km	422ft	128.6m
Beardstown	90mi	145km	420ft	128.0m
Meredosia	72mi	116km	410ft	125.0m
Hardin	20mi	32km	400ft	121.9m
Grafton	0mi	0km	390ft	118.9m

Source: USGS: <http://il.water.usgs.gov/proj/lirb/illus/elev.html>

1. Create a line graph using the data above.
2. Calculate the gradient from Marseilles to Grafton. (On the back of the page, show your work, and explain in a short paragraph, how you solved the problem).
3. Calculate the gradient from Marseilles to Starved Rock. Show your work on the back.
4. Calculate the gradient from Starved Rock to Havana.

5. Calculate the gradient from Beardstown to Grafton.
6. Why is it more important to know the gradient for individual sections of the river than for the whole river?
7. The Mackinaw River flows into the Illinois River south of Pekin, Illinois. The Mackinaw River has a gradient of 0.63m/km. This makes it a degrading stream. What effect would the Mackinaw River have on the Illinois River?
8. The Illinois River has been changed by the building of several Lock and Dam additions for barge transportation. The river is now a system of pools that are raised and lowered by the Lock and Dam System. The five main pools are Marseilles, Starved Rock, Peoria, LaGrange, and Alton. How do the dams affect the speed of the water flow and siltation in the river?

Measuring Stream Gradient of the Illinois River: Answer Sheet

Introduction:

The gradient is the slope of the stream. A steeper slope causes the water to flow faster. This increases the load of the stream, the amount of material that river can hold in suspension. As the river flattens out the gradient decreases and the load carried by the stream settles to the bottom. Rivers with a higher gradient that erode the banks are called degrading streams. Rivers with a flatter gradient the accumulate silt in the riverbed are called aggrading streams. The data table provides the elevation and distance of various points of the Illinois River from Grafton, IL, where it flows into the Mississippi Rivers, before the Illinois River was changed for barge traffic. To calculate the gradient, divide the difference in elevation of the two locations by the distance between the same locations.

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1. Create a line graph using the data above.
2. Calculate the gradient from Marseilles to Grafton. (On the back of the page, show your work, and explain in a short paragraph, how you solved the problem).

$$24.4\text{m}/394\text{km} = 0.06\text{m}/\text{km}$$

3. Calculate the gradient from Marseilles to Starved Rock. Show your work on the back.

$$12.3\text{m}/15\text{km} = 0.82\text{m}/\text{km}$$

4. Calculate the gradient from Starved Rock to Havana.

$$2.4\text{m}/108\text{km} = 0.02\text{m}/\text{km}$$

5. Calculate the gradient from Beardstown to Grafton.

$$9.1\text{m}/145\text{km} = 0.06\text{m}/\text{km}$$

6. Why is it more important to know the gradient for individual sections of the river than the whole river?

Building projects and environmental assessments take place at the local level not the entire length of the river. For projects near Marseilles the gradient is much different than for projects near Peoria.

7. The Mackinaw River flows into the Illinois River south of Pekin, Illinois. The Mackinaw River has a gradient of 0.63m/km. This makes it a degrading stream. What effect would the Mackinaw River have on the Illinois River?

The gradient of the Illinois River near Pekin is 0.02m/km. The flat stream is aggrading. The Mackinaw River with the steeper gradient carries silt to the Illinois River. Silt carried by the Mackinaw is deposited in the Illinois River and forces the river to flow more to the west. This creates a shallow curve in the river that must be dredged for barge navigation.

8. The Illinois River has been changed by the building of several Lock and Dam additions for barge transportation. The river is now a system of pools that are raised and lowered by the Lock and Dam System. The five main pools are Marseilles, Starved Rock, Peoria, LaGrange, and Alton. How do the dams affect the speed of the water flow and siltation in the river?

The river is slowed and silt accumulates in the river bottom.