Earth Science Regents
Stream Discharge

Name_____

Period_____

INTRODUCTION: Two important factors in the ability of a river to erode (transport sediment) are the largest size sediment particles it can carry, and the total maximum sediment load that it can carry.

The term ***COMPETENCE*** describes the largest sized particle a river can carry, and that is determined by the flow velocity of the river.

The maximum amount of sediment load a river can carry is called the river's ***CAPACITY***
The capacity of a river depends on several variables.

> One of them is the *velocity* of the river. The faster the water is flowing, the more and larger the particles it can pick up and carry.
>
> Equally important, however, is the *amount* of water in a river. It should be obvious to you that, all other things being equal, the more water there is, the more material can be moved.

But it isn't very worthwhile to talk about the "volume" of water in a river…a river with lots of water in it that flows very slowly will have a smaller competence and may have a smaller capacity than a smaller mountain stream that flows very rapidly.

What really matters is how quickly the volume of water moves through the river system - or the volume of water that passes through the river system in certain amount of time.

Hydrologists (geoscientists that study rivers) call the measurement of the volume of water passing a point on the river in a specific amount of time the ***DISCHARGE*** of the river. The data needed to calculate the discharge of a stream is collected at a gauging station, and includes *depth soundings* and *velocity measurements.*

List two metric units of VOLUME: _____ _____

List two units of TIME: _____ _____

List 4 units of DISCHARGE: _____ _____

_____ _____

In this lab, you will determine the discharge of the same stream from data collected in AugustI and data collected in April.

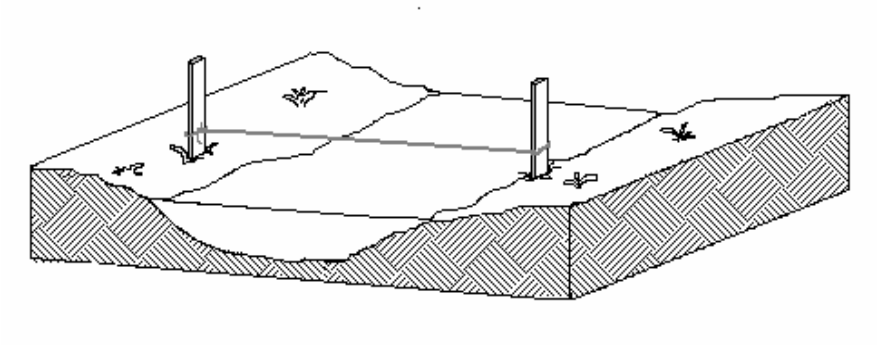
By the end of the lab, you should be able to:

1. Draw the profile of a stream bed, given the depth data from a gauging station
2. Determine the x-sectional area of a stream bed a gauging station.
3. Determine the velocity of a stream
4. Calculate the discharge of a stream
5. Demonstrate your understanding of the term DISCHARGE by explaining what it is, how it is measured, and how it might change over time.

PROCEDURE: Read every word of every sentence carefully before beginning. make sure you understand what you are reading. Then go back over what you've read. Learn from the descriptions and perform the tasks described in *ITALICIZED CAPITAL LETTERS*.

PART 1: THE GAUGING STATION AND X-SECTIONAL PROFILE

FIGURE 1



A gauging station can be established at any convenient point along a river. A simple station can be set up by stretching a string, supported by two stakes, across the stream as shown in Figure 1. The string should be as close to the high water level of the river as possible.

"Soundings", or depth measurements, can be made at regular intervals with a meter stick, as shown in Figure 2. In the example shown here, soundings are being made at 10 cm. intervals. The researcher must be careful to keep the meter stick vertical and measure the depth of the water accurately.

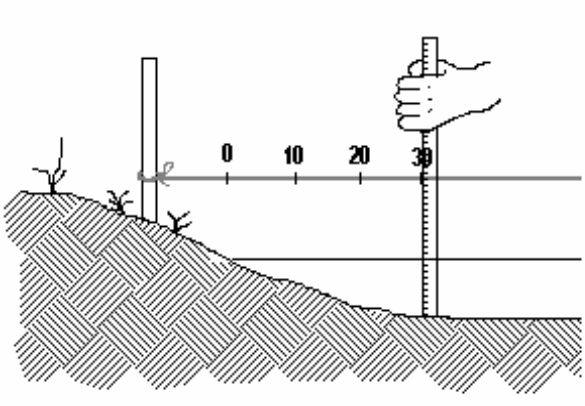


FIGURE 2

The sounding data collected from the stream used in this study are summarized in Tables 1 and 2 below:

TABLE 1

Stream in AUGUST	
Distance from Shore (cm)	Depth (cm)
0	0
10	3
20	7
30	13
40	18
50	18
60	24
70	26
80	24
90	29
100	31
110	26
120	27
130	23
140	20
150	17
160	10
170	0

TABLE 2

Stream in APRIL	
Distance from Shore (cm)	Depth (cm)
0	0
10	3
20	8
30	12
40	12
50	21
60	22
70	25
80	32
90	35
100	39
110	44
120	47
130	44
140	42
150	35
160	29
170	25
180	20
190	15
200	8
210	8
220	0

DRAW A GRAPH OF THE STREAM DEPTH DATA. Since the depth of the stream varies with distance from the shore, the independent variable is:

_____
and should be labeled on the X-axis

LABEL THE DEPENDANT VARIABLE (DEPTH) ON THE Y-AXIS. Your graph will be most useful to you if ***0 is at the top of the y-axis and the depth values increase downward from 0*** (make the depth measurements (-) numbers).

Once your graphs are neatly drawn and labeled, *DETERMINE THE X-SECTIONAL AREA OF THE STREAM IN AUGUST AND AGAIN IN APRIL*. There are several ways to do this, and you should even be able to write a formula to do it. *THINK HARD, BUCKAROOS! AND ENTER YOUR CALCULATED AREAS BELOW.* Remember, no calculation is complete without units. *ATTACH A NEAT COPY OF YOUR CALCULATIONS TO THIS PAGE*

X-SECT. AREA
of August Stream

_____

X-SECT. AREA
of April Stream

_____

PART 2: MEASURING VELOCITY

The velocity of the stream was measured by timing a wooden block as it was carried by the water for distance of 500 cm (5 m). Several measurements were made - the results appear in Table 3 and Table 4.

TABLE 3

STREAM IN AUGUST

TIME for wooden block to travel 500 cm (sec)
43
47
50
39
51
50

TABLE 4

STREAM IN APRIL

TIME for wooden block to travel 500 cm (sec)
23
27
29
24
30
18

USE THE DATA IN TABLES 1 AND 2 TO DETERMINE THE AVERAGE VELOCITY OF THE STREAM AT THE TIME THE MEASUREMENTS WERE MADE, AND ENTER THAT INFORMATION BELOW. (Remember – Velocity is a distance per time, or D/T). ATTACH A NEAT COPY OF YOUR CALCULATIONS TO THIS PAGE

VELOCITY of stream in AUGUST

_____

VELOCITY of stream in APRIL

_____

PART 3: DETERMINING STREAM DISCHARGE

DETERMINE THE DISCHARGE OF THE EACH STREAM BY ***MULTIPLYING THE X-SECTIONAL AREA BY THE VELOCITY,*** *AND ENTER THAT INFORMATION HERE*.
ATTACH A NEAT COPY OF YOUR CALCULATIONS TO THIS PAGE

WRITE A FORMULA FOR THE DISCHARGE OF A RIVER:

_____

DISCHARGE OF Stream in AUGUST

_____

DISCHARGE OF Stream in APRIL

_____

Turn in the following to receive credit for this lab:

1. These pages
2. 2 graphs (August cross section and April cross section)
3. 3 Neat and labeled calculation pages:
    a. Cross Sectional Area of stream in August and April
    b. Velocity of Stream in August and April
    c. Discharge of Stream in August and April