TOPIC 2. WATER — HERE, THERE AND EVERYWHERE

Chapter 2

Purpose

To gain an appreciation of the quantity of water Canada has in its different regions and in relation to other countries of the world.

Subject areas

Math, History, Environmental Studies, Language Arts

Procedure

1. Ask students to look at the diagram "World's water system" in their information sheets to get an idea of how much of the world's water supply is available to us.

2. Try the following demonstration to show students how water is distributed throughout the hydrologic cycle and how much fresh water is available to us:

   - Fill a 75-litre garbage can with water. This represents the world's water supply.
   - Take out 1.65 litres in another container — this represents water frozen in glaciers and polar ice caps.
   - Take out 480 millilitres — this represents the world's underground water supply.
   - Take out 13 millilitres — this represents all the lakes and rivers in the world.
   - Take out 15 drops — this represents the water in the atmosphere.
   - The water left in the garbage can represents the world's water supply in the oceans.

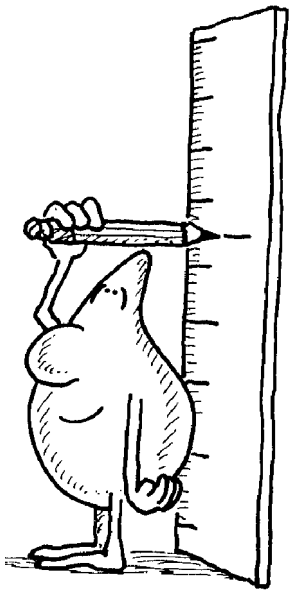
Point out to the students that we have a lot of water in the world, but only a small amount is available as fresh water in lakes, rivers, and groundwater supplies.

3. After they have read the Student Information sheets, ask the students to study the map and note how many of our rivers flow to the north. Point out to them that the majority of the Canadian people live in Canada's south.

4. The learning activities contain examples of math problems and exercises developed from information in the charts and diagrams on lakes and rivers. As an alternative, have students work in teams and use the information provided to develop problems for the other teams.

Option: Tell the students you will select problems for the next math quiz from the problems they develop. Set a time limit or a limit on the number of problems. Encourage students to be creative, but not to make the problems impossible for the other teams.

5. Ask the students to think about different ways officials measure or find out the amount of water in any water body.

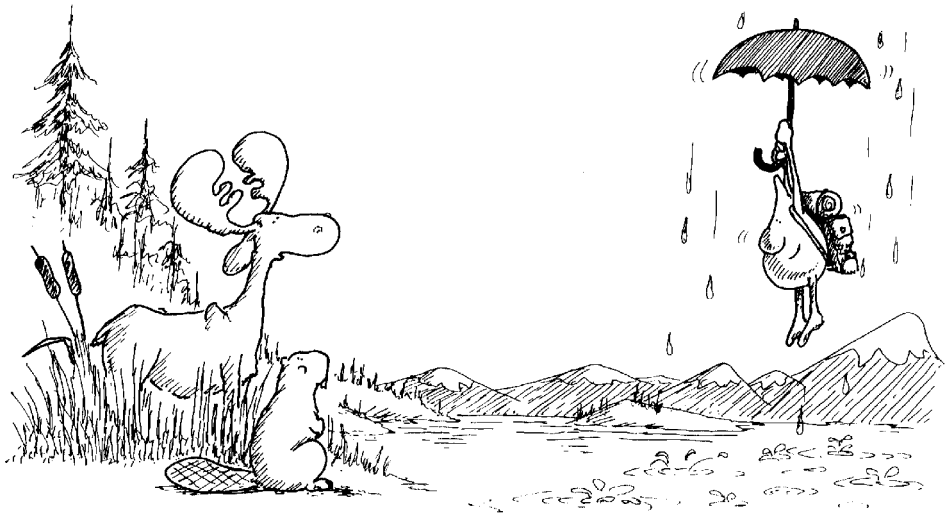


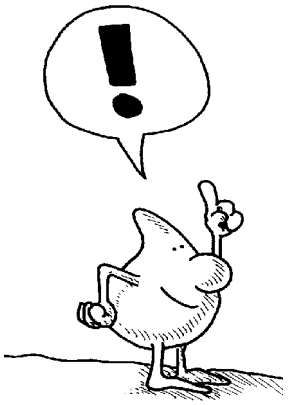
Vocabulary

basin	***desertification***

References

- Freshwater Series A-2: "Water — Here, There and Everywhere"
- *A Primer on Fresh Water*: "Water — In Canada"



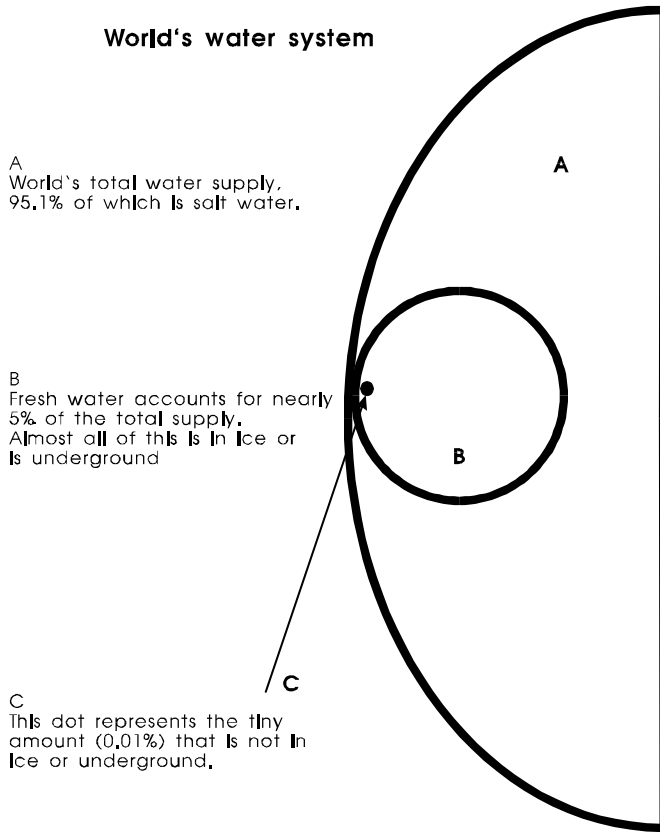


TOPIC 2. WATER — HERE, THERE AND EVERYWHERE

Are you a daydreamer? Do you ever sit in class and let your mind wander, even when you know you should be paying attention? Well, let it wander for awhile just now. Take a look at the globe or the big world map on the wall and imagine that you are looking at the earth from an astronaut's point of view. What colours do you see? You probably see more blue than any other colour.

You could be forgiven for thinking, "So, what's this fuss about water? Looks like a lot of water to me." And, you are right, there is plenty of water. So, what is the problem?

The problem is, we don't get to use most of that water. At present, only 0.01% of all that water can be used by us. The rest is salt water in our oceans or glacial ice (that is ice which has been frozen in glaciers for centuries). To get a good idea of how much 0.01% represents look at the diagram, "World's water system." Not too much is it?



Another problem with the world's water supply is that the water that is available is not always where we would like it to be. If you need examples of this fact, just listen to the news stories of the day:

- Water shortages in Saskatchewan, Alberta, and Manitoba
- Hot, dry summer in California
- Flooding along the Saint John River in New Brunswick
- Drought in Somalia and Ethiopia •Cold, wet summer in Newfoundland
- Flooding in Bangladesh
- **Desertification** in African countries

Just how much water does Canada have?

If you live in parts of Saskatchewan, you won't feel there is enough water; if you live in Vancouver or Newfoundland, you're quite sure there is plenty. The amount of water you have depends on where you live in Canada.

When we consider how much fresh water belongs to Canada, we also have to keep in mind that Canada shares fresh water with another country. Look at the map and you can see how we share the Great Lakes and the St. Lawrence River with the United States. An interesting fact is that the Great Lakes and St. Lawrence River **basin** contain almost one-fifth of the world's fresh surface water. So what we have is two large nations sharing control over 20% of the world's freshwater supply.

World's largest lakes

The following chart lists the largest lakes in the world. From this information you can easily see much of the fresh water Canada has access to — and this chart does not include the fresh water found in the rivers.

Rank (by area)	Area (km^2)	Greatest Depth (m)
1. Caspian Sea	371 000	980
2. Superior	84 500*	405
3. Aral Sea	64 500	68
4. Huron	63 500*	229
5. Victoria	62 940	81
6. Michigan	58 020	281
7. Tanganyika	32 000	1471
8. Baykal	31 500	1620
9. Great Bear	31 400*	431
10. Great Slave	28 400*	614
11. Erie	25 800*	64
12. Winnipeg	24 400*	18
15. Ontario	19 300*	244
23. Athabasca	7 940*	120
25. Reindeer	6 640*	219
31. Winnipegosis	5 360*	12
32. Nettilling	5 530*	NA

*Partly or entirely within Canada

Sources: *Canadian Survey on the Water Balance of Lakes*, published by the Secretariat, Canadian National Committee, International Hydrological Decade, Environment Canada, 1975; and *The World in Figures*, by Victor Showers, Toronto: John Wiley & Sons, 1973.

Here are a few other facts about Canada's water supply:

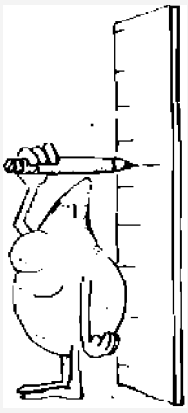
- Canada has about 9% of the world's renewable freshwater supply. (So does China, but more people live in China.)
- Over half of Canada's fresh water drains north, while 90% of Canadians live within 300 kilometres of the U.S. border.
- Canada probably has more lake area than any other country in the world.
- Canada's glaciers contain more water than the Great Lakes.
- The Mackenzie River, over 4000 kilometres long, is Canada's longest river.
- Canada's rivers and lakes contain enough water to flood the country to a depth of more than 2 metres.

How Do You Measure Water Anyway?

How do we know how much water is in any body of water? After all, it's not as if you could measure it with a measuring cup.

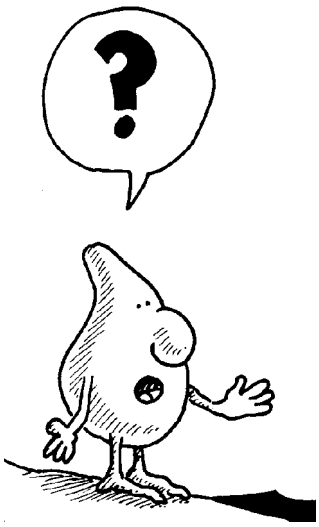
Even as you sit at your desk reading this, people who work for environmental departments are measuring the levels and flow of water in hundreds of identified rivers and lakes across the country.

They approach this task in various ways:



- from a bridge
- by wading in a stream
- by boat
- by cable strung across a river
- through the ice in winter

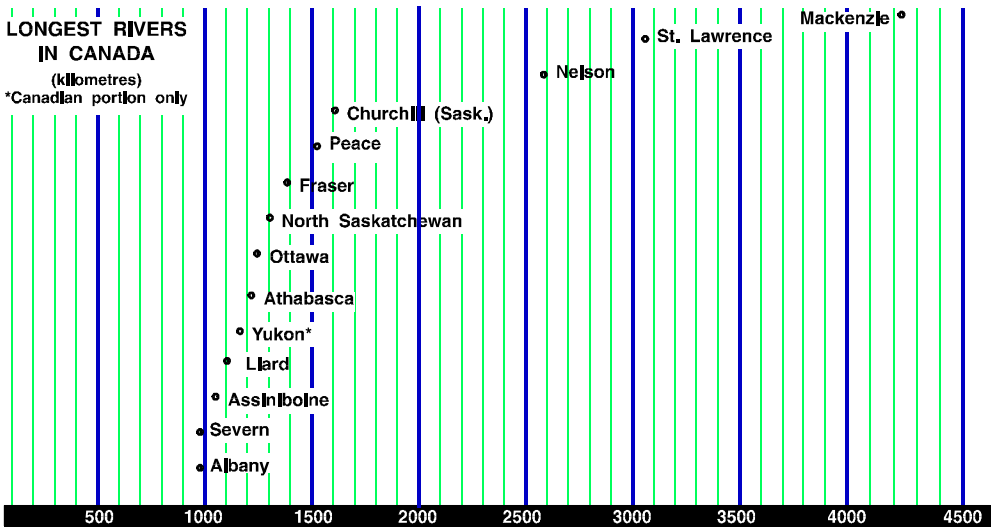
Although some rivers (perhaps including yours) may not be measured, these people can estimate the streamflow based on information they get from the many locations they do measure.



TOPIC 2. WATER — HERE, THERE AND EVERYWHERE

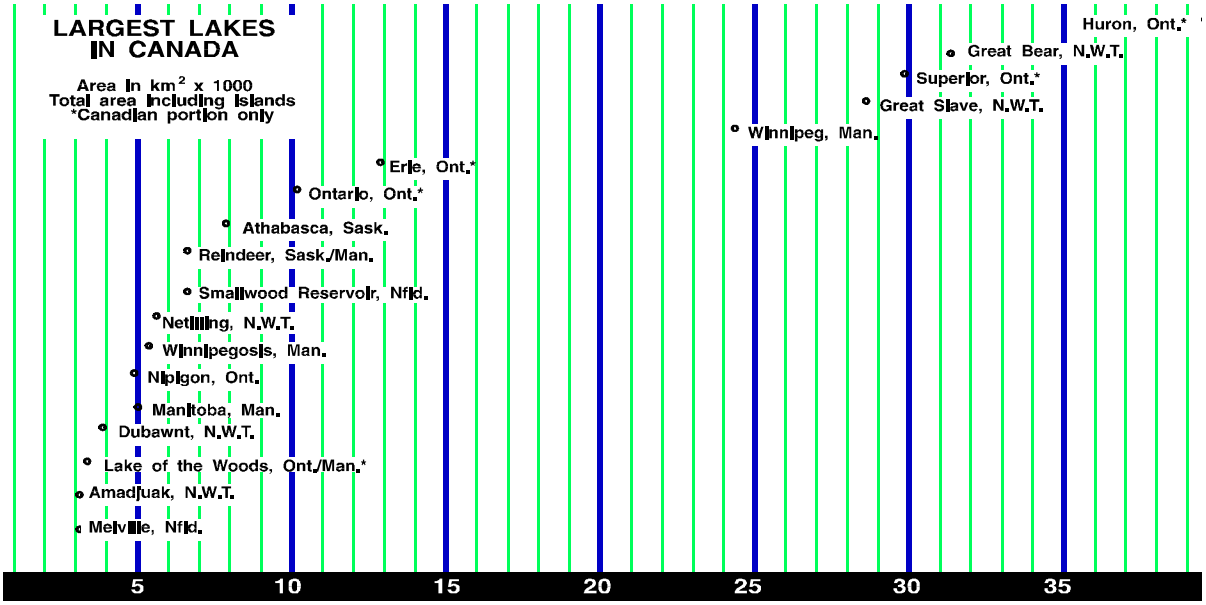
Activity 1 — Math, Interpreting Charts

1. Study the chart, "Longest rivers in Canada." Estimate the approximate lengths of each of the rivers. Compare lengths.



- How much longer is the Mackenzie than the Albany?
- Is the total length of the North Saskatchewan, the Churchill, and the Yukon longer than the Mackenzie? What is the difference?
- What is the total length of all the rivers?
- Why does the Yukon have an asterisk (*) by it?
- How much longer is the St. Lawrence than the Fraser?

2. Look at the chart "Largest lakes in Canada." Make up five problems similar to those about the longest rivers. Give these questions to a partner.



3. Make up a bar graph for one of the above charts to show the same information.

Activity 2 — Math Problem Solving

Use the following math problems as examples and develop problems of your own from the charts provided in Activity 1.

- The St. Lawrence River is approximately 3100 km in length. If you had a boat that travelled 16 km an hour, how long would it take you to travel the length of the St. Lawrence River?
- Suppose you decided to walk the length of the river and you average 6 km an hour walking for 7 hours per day. How many days would this take you?
- If your walking trip began June 15, on what date would you finish?
- Suppose you could drive the whole length of the river by car. Estimate the time it would take if you averaged 100 km/hour.
- The Mackenzie River is approximately 4200 km long. How long would it take you to travel the river by boat? Car? On foot?
- Your problems . . . .

Activity 3 — Environmental Studies

The chart below shows typical river flows in all areas of Canada.

- Check the river(s) in your province or territory. What is the difference between the highest flow and the lowest? Find out when the highest flow usually occurs; the lowest. Why?
- Select one river from each of the other provinces/territories in Canada and find the differences between highest and lowest flows for each. Which river has the greatest difference between high and low flows?
- Make up two questions to ask a friend.

TYPICAL RIVER FLOWS (m^3/s)
(from lowest to highest daily average)

Location	River	Annual Average	Daily	
			Highest	Lowest
P.E.I.	Dunk River at Wall Road	2.63	84.7	0.212
Sask.	Qu'Apelle River near Lumsden	5.20	436	0
N.B.	Lepreau River at Lepreau	7.37	340	0.028
Man.	Manigotagan River near Manigotagan	8.25	103	0.065
Ont.	Rideau River at Ottawa	38.9	583	1.48
N.S.	St. Mary's River at Stillwater	43.0	974	0.150
Ont.	Saugeen River near Port Elgin	56.5	1 030	5.72
Nfld.	Gander River at Big Chute	117	1 170	2.78
Alta.	Athabasca River at Hinton	173	1 200	10.8
Y.T.	Yukon River at Whitehorse	242	646	32.6
Sask.	South Saskatchewan River at Saskatoon	259	3 940	14.2
Que.	Rivière aux Outardes at Chute-aux-Outardes	385	2 830	10.5
N.B.	Saint John River below Mactaquac	810	11 100	21.5
Ont.	Ottawa River at Britannia (Ottawa)	1290	5 060	334
Nfld.	Churchill River above Upper Muskrat Falls	1740	6 820	253
B.C.	Fraser River at Hope	2710	15 200	340
Ont.	Niagara River at Queenston	6010	9 760	2440
Ont.	St. Lawrence River at Cornwall	7540	10 200	4500
N.W.T.	Mackenzie River at Norman Wells	13200	33 300	3680

Source: Water Survey of Canada, 1989

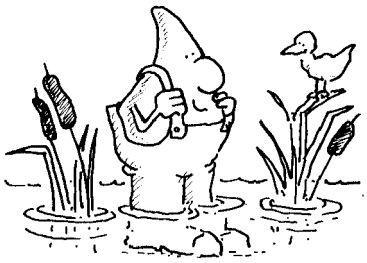
Activity 4 — Math

Estimation

Environment officials do not go and stand in the middle of every stream and pond in Canada. But they can estimate the stream flow based on information they keep from the hundreds of sources they do measure.

Sometimes we need to measure something accurately, other times we can estimate. What are some of the things you have estimated? For example:

- how long it will take you to get somewhere
- how many jelly beans are in a jar
- how much time it will take you to finish this assignment
- how many balls you can sink in twenty-five throws at the basket
- how long it will be before a parent tells you to turn down the music or get off the phone



- Brainstorm: Why do we estimate? Talk about some situations where we ask others to give us an estimate. How does that help us?
- Officials often have to estimate how much of the budget they should set aside for snow removal, for pollution cleanup, for repairs, etc. What do they base the estimates on? Why can they not say exactly how much money to budget?
- Are any of the bills which come into your house estimated bills?
- Estimate is often called a "guesstimate" by some people. That's how lottery numbers are picked out, or long-range weather predictions are made. When have you guesstimated about something?
- What do you think are some of the reasons why Environment Canada estimates water levels and rate of flow instead of measuring exactly?
- Research: Find out more about one of the methods used to measure the amount and flow of water.

Activity 5 — Language Arts

Poets have a way of using words to create pictures or sounds for the readers of poetry. Two of these poetic devices are described below.

Read through these and write a poem (or descriptive paragraph) of your own to talk about water.

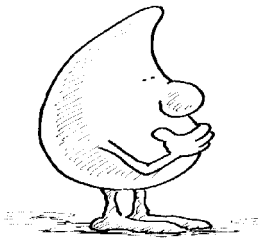
Alliteration — a number of words begin with the same letter, for example, "the rising river roared and rumbled."

- Try to make a tongue twister such as "Sally selling seashells by the seashore."

Onomatopoeia — words make the actual sound of what they are describing, for example, buzz, drone, slurp. Or, in the case of water, "the slow slapping and lapping of waves on the rocks."

- How many sounds can you make that make the sound of water? For example, the sound of water on a tin roof; long slow tides on a beach; the sound of walking through swamps in rubber boots.

Brainstorm with your class and make a list of "water sounds." Use these to help with your descriptive writing. Or, get silly. Make up your own words for water sounds and make a riddle: What colour is a raindrop? Plink!

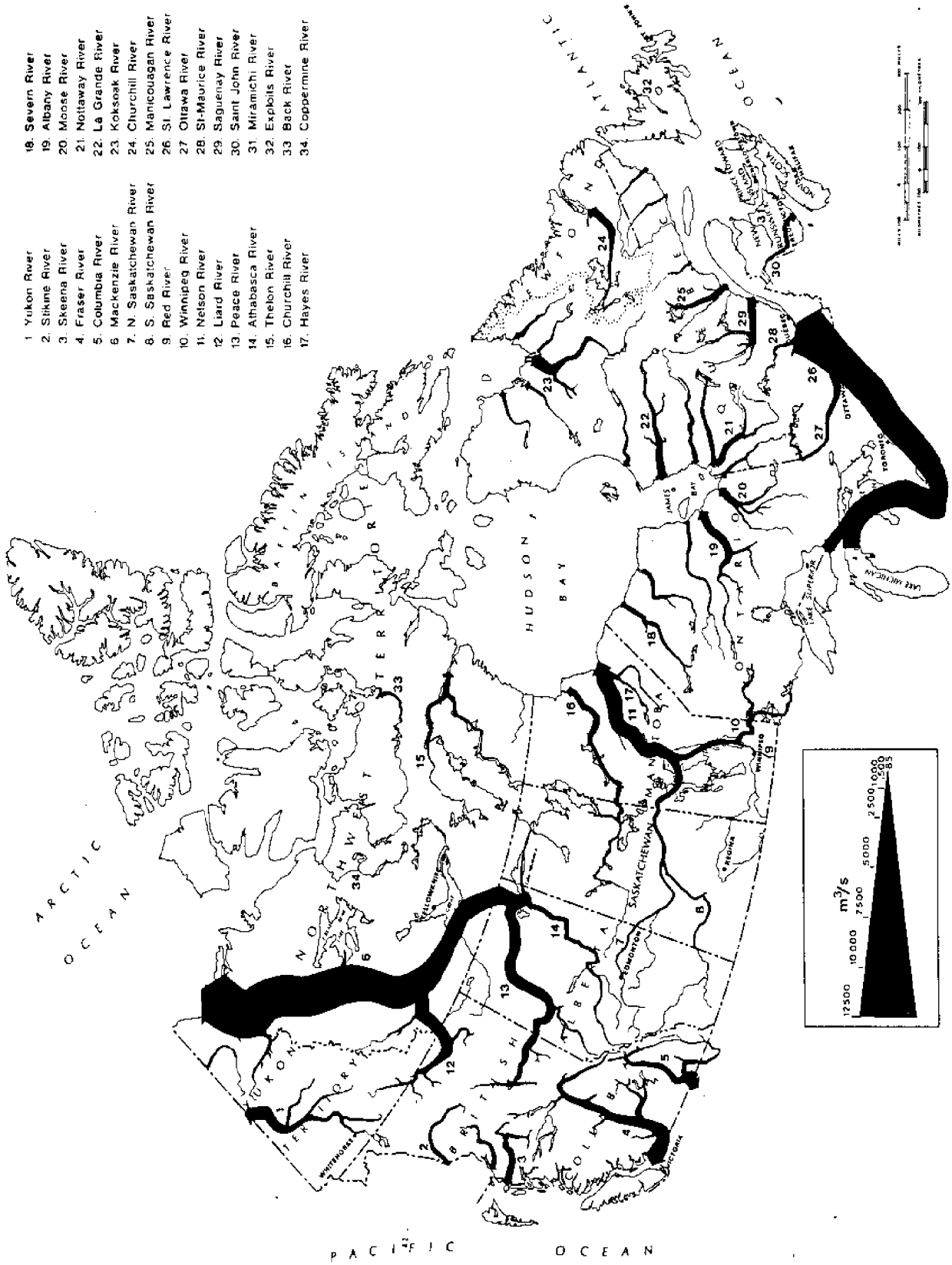


Activity 6 — History and Map Study

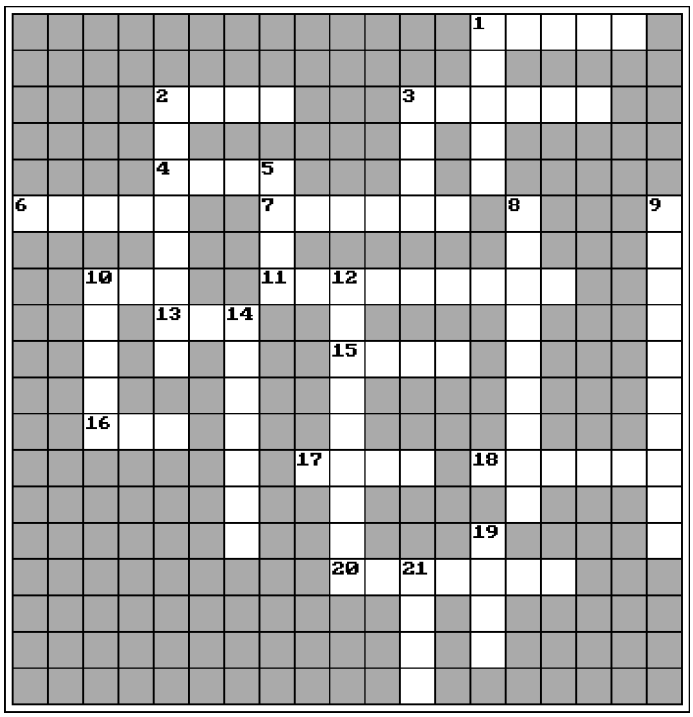
When the early explorers first came to Canada, they came to the east coast and gradually moved inland, mostly in search of furs. As you know, there were no roads or cars then, so they had to move by water whenever they could, using the vast network of lakes and rivers.

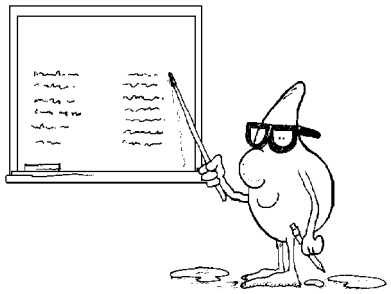
Study the map on the next page closely. Trace the route one of these explorers could have taken to get from Halifax to Vancouver 400 years ago.

Research: Find three rivers which were named after early explorers. Give a brief biography of one of these explorers.


1 Yukon River
2. Stikine River
3. Skeena River
4. Fraser River
5. Columbia River
6 Mackenzie River
7. N. Saskatchewan River
8. S. Saskatchewan River
9. Red River
10. Winnipeg River
11. Nelson River
12 Liard River
13. Peace River
14. Athabasca River
15. Thelon River
16. Churchill River
17. Hayes River
18. Severn River
19. Albany River
20. Moose River
21. Nottaway River
22. La Grande River
23. Koksoak River
24. Churchill River
25. Manicouagan River
26. St. Lawrence River
27 Ottawa River
28. St-Maurice River
29. Saguenay River
30. Saint John River
31. Miramichi River
32. Exploits River
33 Back River
34. Coppermine River
ARCTIC OCEAN
HUDSON BAY
PACIFIC OCEAN
m³/s
12500
10000
7500
5000
2500
1000
500
Annual Large River Flow In Canada

TEST 1
Crossword Puzzle





Across

1. Water turns to __ at 100°C.
2. People like to camp and __.
3. When we don't get ___ water, we experience droughts.
4. You should not allow the tap to __ — it wastes water.
6. Without this, a person would die in about three days.
7. H_2O means that water contains one atom of ___ and two atoms of (2 down).
10. According to the ___ bang theory, water has been on earth over four billion years.
11. Water can be used over and over. It is a __ resource.
13. Cook an _ in water for breakfast.
15. We should __ our water supply to find out if it is safe to drink.
16. The antonym of wet is __.
17. You can catch fish using a rod and __.
18. Clean water should be the concern of all _.
20. Water can dissolve many substances. It is a good _.

Down

1. If we pollute water, we ____ it for our use. (Rhymes with oil.)
2. H_2O means that water contains one atom of (7 across) and two atoms of __.
3. One of the Great Lakes is Lake __.
5. We should not _____ hazardous household products down the drain.
8. All __ of water contain hydrogen and oxygen.
9. The blanket of air around the earth is called the __.
10. This is 83% water.
12. Water can dissolve __ as food for plants and animals.
14. Let's not take water for __.
19. ___ from the sun makes our lakes warm for swimming.
21. Repair a __ promptly — don't waste water.

Fill in Blanks

1. _____% of the blood in your body is water.
2. The scientific symbol for water is _____.
3. Water has been around since the earth was formed over ____ billion years ago.
4. Another name for the water cycle is the _____ cycle.
5. Water vapour enters the atmosphere by _____ from bodies of water and by _____ from plants.
6. Clouds are formed when water droplets come together as _____.
7. Rain, snow, hail, and sleet are all forms of _____.
8. _____% of the world's total water supply is fresh water.

True or False

T F 1. Water is two parts oxygen and one part hydrogen.

T F 2. More than one-half of the world's animal and plant species live in water.

T F 3. Without water, every single living thing on earth could not survive.

T F 4. There is less water on earth today than when the earth was formed.

T F 5. Canada's largest river is the St. Lawrence.

T F 6. Canada has approximately 9% of the world's freshwater supply.

T F 7. Most of Canada's rivers drain north.

T F 8. Water makes up 95% of your body.

T F 9. Water turns to ice at 100°C.

T F 10. Canada's glaciers contain more water than do the Great Lakes.

Water Puzzle

Find the water-related words in this puzzle. Learn how to spell all the words and look up the definition for each.

air	groundwater	recycle	use
basin	hydrologic	river	vapour
condensation	ice	saturate	vital
disperse	percolate	snow	
dry	pour	tap	
evaporation	precipitation	transpiration	

M O T A N R T C P O U R

V I T Y O V C O U N S I

N N R V I I I N D O E A

I D U A T T G D E I E G

A O O P A A O E S T T R

R V P H T L L N E A A O

S B A S I N O S R R L U

A E V A P O R A T I O N

T S P T I E D T I P C D

U N A U C N Y I C S R W

R O R Y E O H O E N E A

A W C E R X H N G A P T

T L A C P R E V I R A E

E E S R E P S I D T T R

Match the Meanings

1.	evaporation	( )	method by which water reaches groundwater
2.	condensation	( )	full of water
3.	precipitation	( )	method by which plants send water into atmosphere
4.	transpiration	( )	water molecules form clouds
5.	saturated	( )	sun's energy turns water to vapour
6.	percolate	( )	water falls to earth

TEST 1
Crossword Puzzle

													1 S	T	E	A	M	
													P					
				2 H	I	K	E				3 E	N	O	U	G	H		
				Y							R		I					
				4 D	R	I	5 P				I		L					
6 W	A	T	E	R			7 O	X	Y	G	E	N		8 M				9 A
				O			U							O				T
		10 B	I	G			11 R	E	12 N	E	W	A	B	L	E			M
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		16 D	R	Y		N			I					L				H
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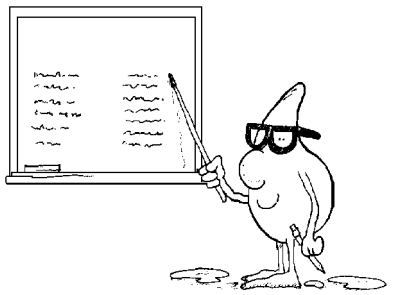


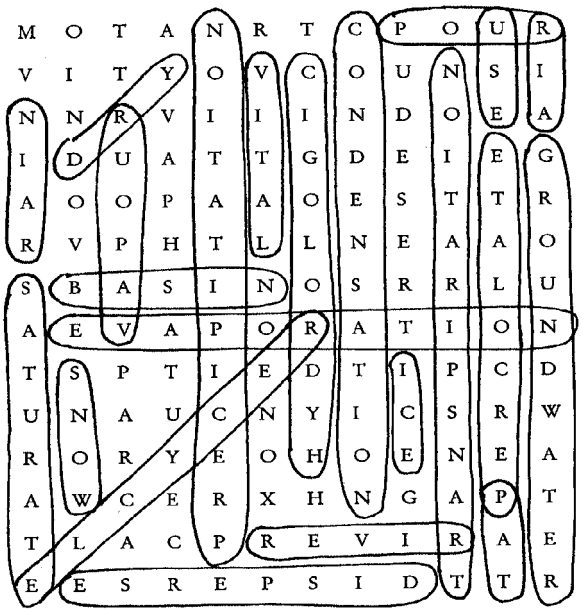
Fill in Blanks

1. 83% of the blood in your body is water.
2. The scientific symbol for water is H_2O.
3. Water has been around since the earth was formed over four billion years ago.
4. Another name for the water cycle is the hydrologic cycle.
5. Water vapour enters the atmosphere by evaporation from bodies of water and by transpiration from plants.
6. Clouds are formed when water droplets come together as condensation.
7. Rain, snow, hail, and sleet are all forms of precipitation.
8. Nearly 5% of the world's total water supply is fresh water.

True or False

1. False. Water is two parts hydrogen and one part oxygen.
2. True. More than one-half of the world's animal and plant species live in water.
3. True. Without water, every single living thing on earth could not survive.
4. False. There is the same amount of water on earth today as when the earth was formed.
5. False. Canada's largest river is the Mackenzie.
6. True. Canada has approximately 9% of the world's freshwater supply.
7. True. Most of Canada's rivers drain north.
8. False. Water makes up approximately 67% of your body.
9. False. Water turns to vapour at 100°C.
10. True. Canada's glaciers contain more water than do the Great Lakes.

Water Puzzle



Match the Meanings

1. evaporation	(6)	method by which water reaches groundwater
2. condensation	(5)	full of water
3. precipitation	(4)	method by which plants send water into atmosphere
4. transpiration	(2)	water molecules form clouds
5. saturated	(1)	sun's energy turns water to vapour
6. percolate	(3)	water falls to earth