

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

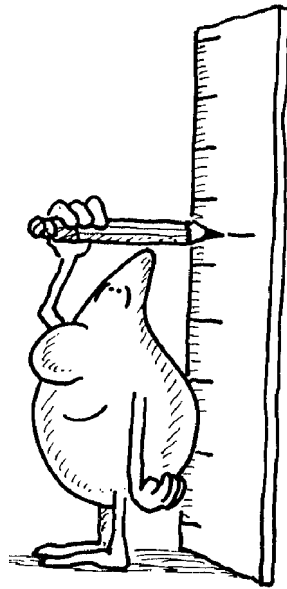
1. Ask students to look at the diagram “World’s water system” in their information sheets to get an idea of how much of the world’s water supply is available to us.
2. Try the following demonstration to show students how water is distributed throughout the hydrologic cycle and how much fresh water is 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.

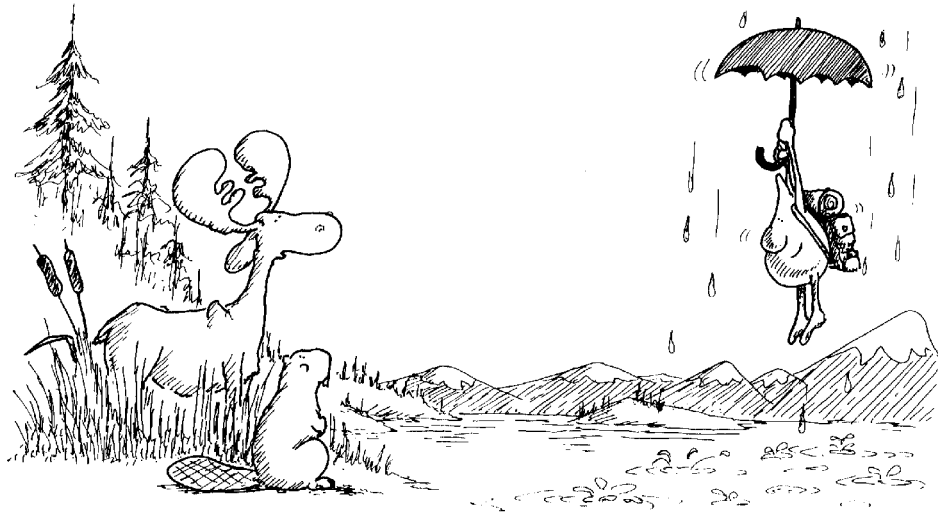


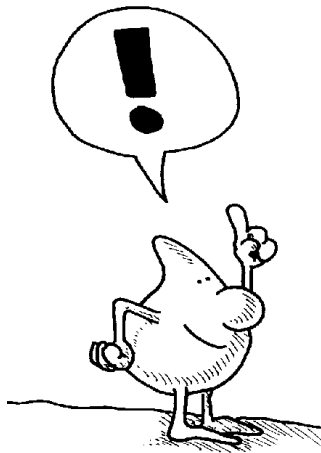
Vocabulary

<i>basin</i>	<i>desertification</i>
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References

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



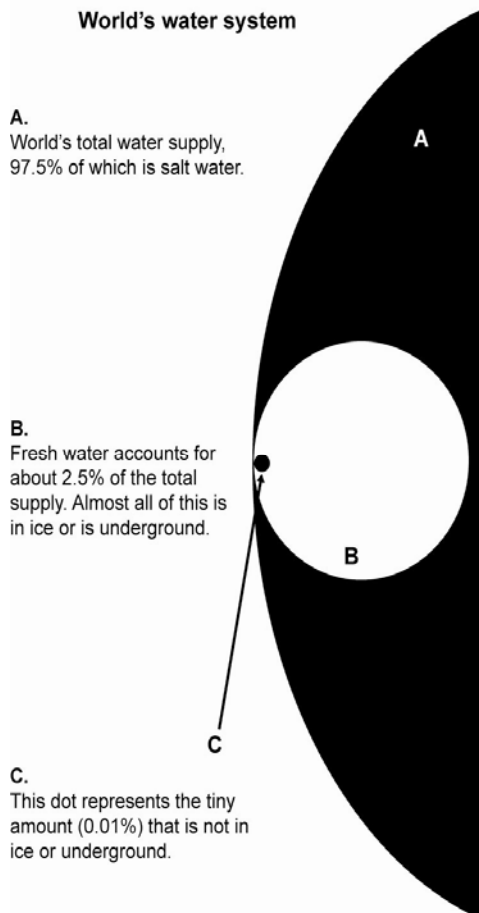


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Are you a daydreamer? Do you ever sit in class and let your mind wander, even when you know you should be paying attention? Well, let it wander for awhile just now. Take a look at the globe or the big world map on the wall and imagine that you are 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 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 world map and you can see how we share the live in 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)	Name	Area (km ²)	Maximum depth (m)
1	Caspian Sea	374 000 – 436 000	946 – 1 025
2	Superior*	82 100 – 83 300	307 – 406
3	Victoria	62 940 – 69 900	80 – 92
4	Huron*	59 500 – 59 800	223 – 229
5	Michigan	57 016 – 58 100	265 – 285
6	Tanganyika	32 000 – 34 000	1 435 – 1 470
7	Baikal	31 500	1 620 – 1 741
8	Great Bear*	30 200 – 31 792	137 – 445
9	Great Slave*	27 000 – 28 570	156 – 614
10	Erie*	25 657 – 25 720	64
11	Winnipeg*	24 387 – 24 600	19 – 28
13	Ontario*	18 760 – 19 480	225 - 273
22	Athabasca*	7 935 – 8 080	60 – 124
29	Winnipegosis*	5 370 – 5 470	12

*Partly or entirely within Canada

Sources: Adapted from Peter H. Gleick. *Water in Crisis*. New York: Oxford University Press, 1993.

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

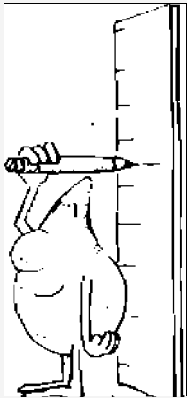
- Canada has about 7% of the world's renewable freshwater supply. (So does China, but more people live in China.)
- Over half of Canada's fresh water drains north, while 85% of Canadians live within 300 kilometres of the U.S. border.
- Canada probably has more lake area than any other country in the 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.



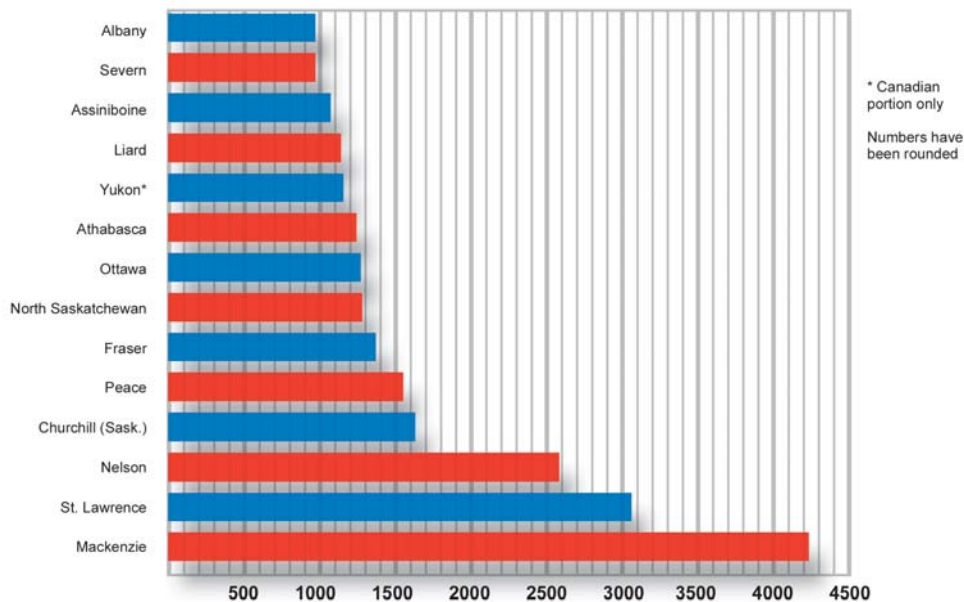
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Chapter 2

Activity 1 — Math, Interpreting Charts

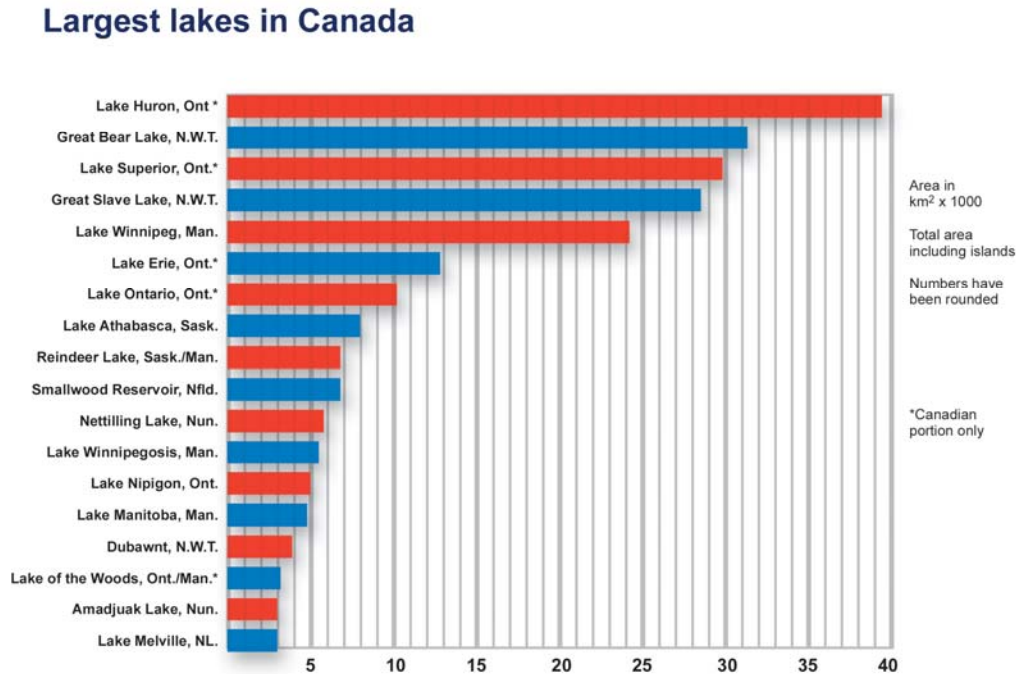
1. Study the chart, “Longest rivers in Canada.” Estimate the approximate lengths of each of the rivers. Compare lengths.

Longest rivers in Canada
(kilometres)



- 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 another type of chart for one of the above graphs 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 graphs 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

(from lowest to highest daily average, m³/s)

Location	River	Annual average	Daily average	
			Highest	Lowest
Prince Edward Island	Dunk River at Wall Road	2.55	84.7	0.212
Saskatchewan	Qu'Appelle River near Lumsden	5.44	436	0
New Brunswick	Lepreau River at Lepreau	7.37	340	0.028
Manitoba	Manigotagan River near Manigotagan	8.93	103	0.065
Ontario	Rideau River at Ottawa	37.2	583	1.48
Newfoundland	Gander River at Big Chute	119	1 170	2.78
Alberta	Athabaska River at Hinton	175	1 200	10.8
Yukon	Yukon River at Whitehorse	243	646	32.6
Saskatchewan	South Saskatchewan River at Saskatoon	254	3 940	14.2
Quebec	Rivière aux Outardes à la Centrale de Chute-aux-Outardes	387	2 830	10.5
New Brunswick	Saint John River below Mactaquac	809	11 100	21.5
Ontario	Ottawa River at Britannia	1 180	5 060	245
Newfoundland	Churchill River above Upper Muskrat Falls	1 740	6 820	253
British Columbia	Fraser River at Hope	2 720	15 200	340
Ontario	Niagara River at Queenston	5 880	9 760	2 440
Ontario	St. Lawrence River at Cornwall	7 350	10 700	4 500
Northwest Territories	Mackenzie River at Norman Wells	8 480	33 300	1 680

Source: Water Survey of Canada, 1999

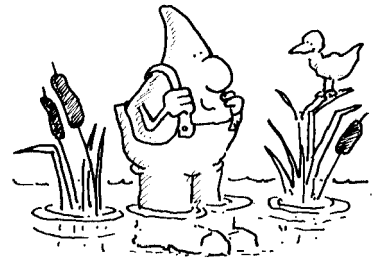
Activity 4 — Math

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.

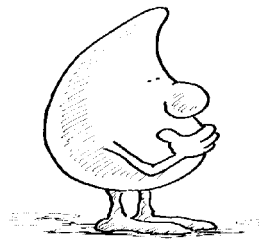
Alliteration — a number of words begin with the same letter, for example, “the rising river roared and rumbled.”

- 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!



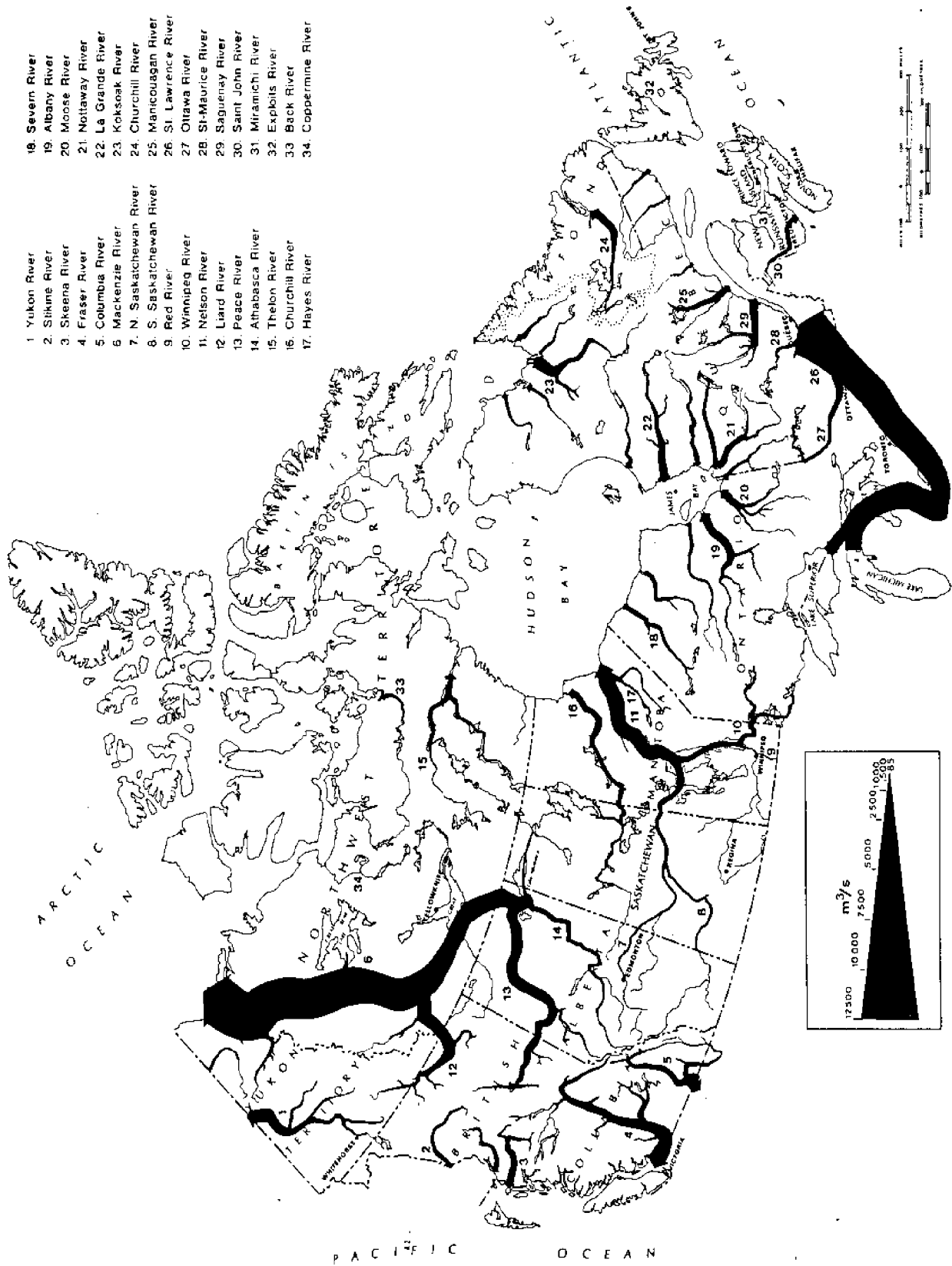
Activity 6 — History and Map Study

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.

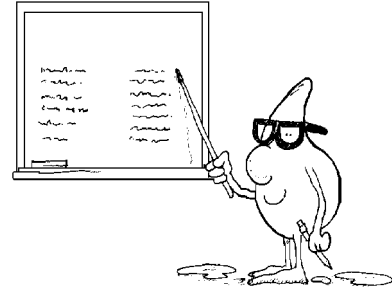
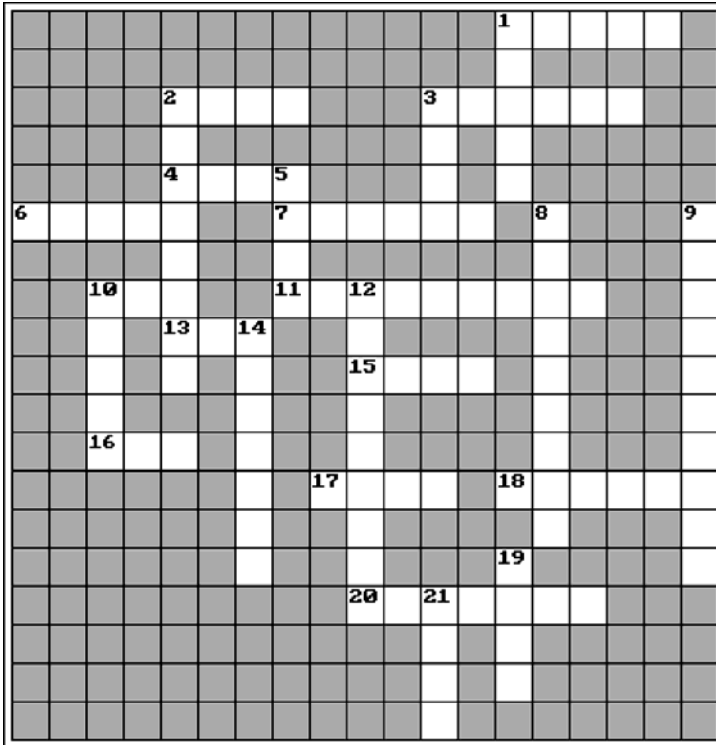
- | | |
|--------------------------|------------------------|
| 1 Yukon River | 18. Severn River |
| 2. Stikine River | 19. Albany River |
| 3. Skeena River | 20. Moose River |
| 4. Fraser River | 21. Nottaway River |
| 5. Columbia River | 22. La Grande River |
| 6. Mackenzie River | 23. Koksoak River |
| 7. N. Saskatchewan River | 24. Churchill River |
| 8. S. Saskatchewan River | 25. Manicouagan River |
| 9. Red River | 26. St. Lawrence River |
| 10. Winnipeg River | 27. Ottawa River |
| 11. Nelson River | 28. St-Maurice River |
| 12. Liard River | 29. Saguenay River |
| 13. Peace River | 30. Saint John River |
| 14. Athabasca River | 31. Miramichi River |
| 15. Thelon River | 32. Exploits River |
| 16. Churchill River | 33. Back River |
| 17. Hayes River | 34. Coppermine River |



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. H₂O 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 pollute water, we _____ it for our use. (Rhymes with oil.)
2. H₂O 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 82% 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 7% 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.

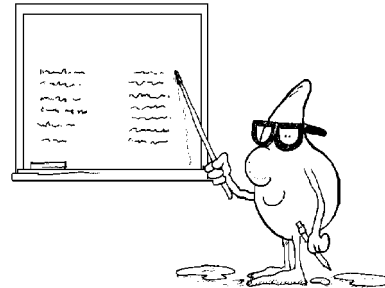
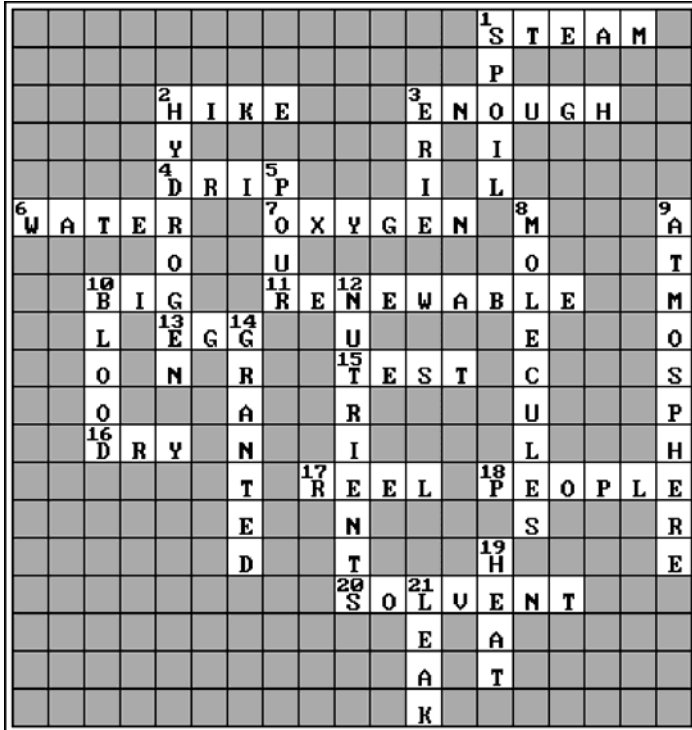
air	groundwater	rain	transpiration
basin	hydrologic	recycle	use
condensation	ice	river	vapour
disperse	percolate	saturate	vital
dry	pour	snow	
evaporation	precipitation	tap	

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



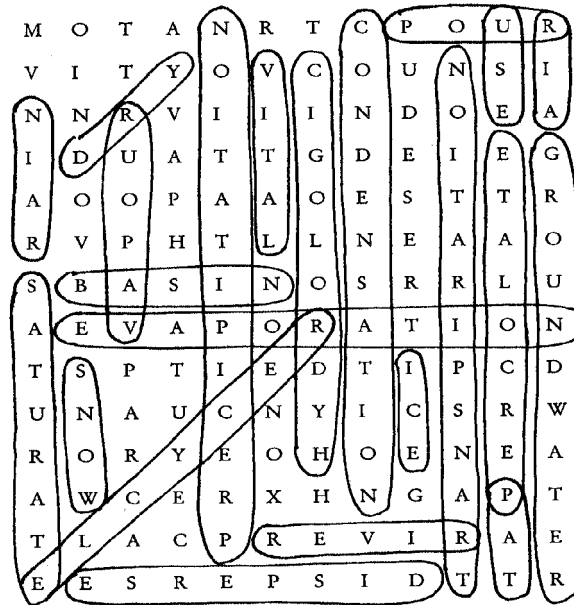
Fill in Blanks

1. **82%** of the blood in your body is water.
2. The scientific symbol for water is **H₂O**.
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. **Around 2%** 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 7% 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 |