

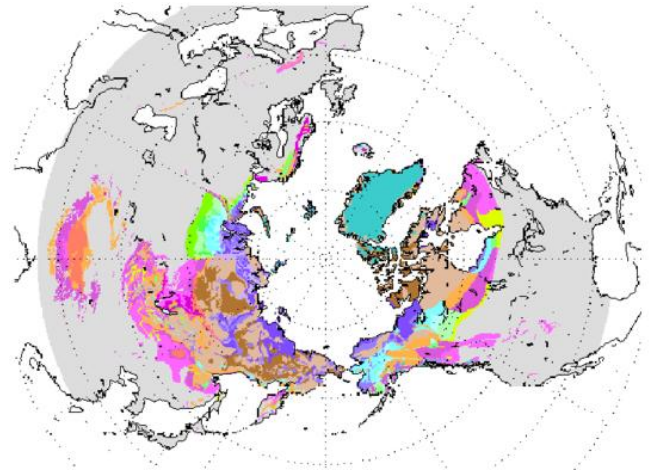


Permafrost

1. What is permafrost?

2. Large parts of northeastern Russia and almost 50% of Canada's land can be frozen up to a depth of 0.5 km.

Where else is this permafrost found?



3. What can happen to the top part (active layer) of permafrost during summer?

4. a) How could climate change lead to large amounts of methane being produced?

b) What's wrong with releasing methane into the atmosphere?

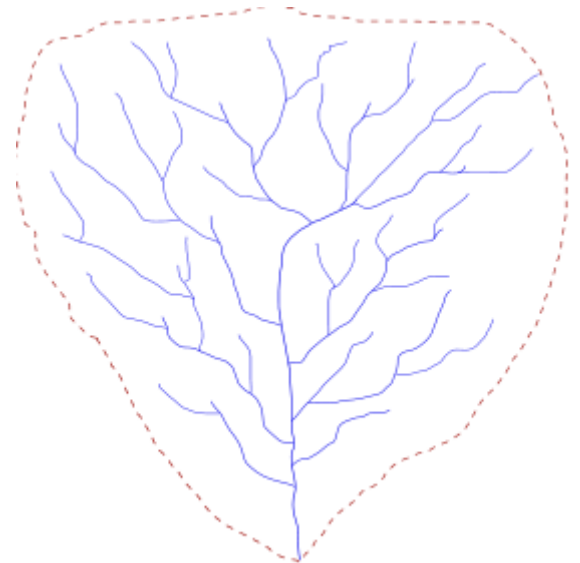
WATERSHEDS= Catchment Areas

1. A catchment area or drainage basin or watershed? an area of land where all inland waters from rain and snow drain into the same lake, river or sea.

2. Explain how the following factors can affect how water flows within a watershed:

a) Topography:

b) Geology:



c) Climate:

d) Vegetation:

e) Development:

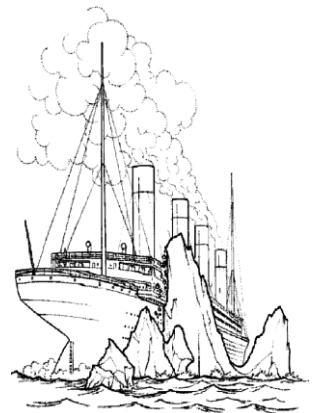
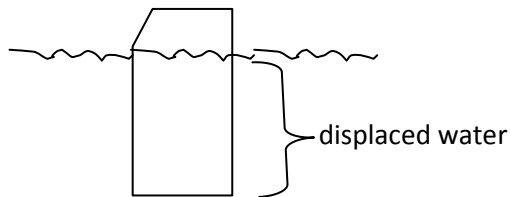
3. How does catchment (the amount of water actually absorbed by land) affect towns, cities and the economy?

Glaciers

1. How do they form?

2. a) How are they related to icebergs?

b) Prove that over 90% of an iceberg is submerged. The density of ice is 0.917 g/cm^3 . Use the idea that the buoyant force is the product of g and the **mass of water displaced** by a floating object. The buoyant force balances the weight of the floating object. Assume 1.00 g/cm^3 for water's density. (STE diversion)



$$m_{\text{displaced water}} * g = m_{\text{iceberg}} * g$$

$$m_{\text{displaced water}} = m_{\text{iceberg}}$$

$$V_{\text{displaced water}} * d_{\text{water}} = V_{\text{iceberg}} * d_{\text{iceberg}}$$

$$\frac{V_{dw}}{V_{ice}} = \frac{d_{ice}}{d_{dw}} = \frac{0.917}{1.00} = 0.917 = 91.7\%$$

3. When does sea level rise?

EXERCISES

1. Why do parts of British Columbia have permafrost even though its northern boundaries are south of the Arctic Circle?

The mountain peaks of Northern BC

2. a) How is methane released from permafrost?
In a warmer climate, microorganisms become active again and break down organic material in the absence of oxygen. (otherwise you would get carbon dioxide)
b) What actually produces it?
Microorganisms
c) What do the microorganisms act as? Think of trophic levels.
decomposers

3. a) What is the active layer of permafrost?

It's the top layer which is the only one that defrosts in the summer and supports life.

b) Is it possible for the active layer not to exist in certain areas?

Yes. There's no active layer where it's too cold.



4. Is a sandy area less likely to be flooded? Why or why not?
Yes. Water seeps down very easily and does not accumulate on the surface and does not runoff to rivers or increase their volume.

5. a) How do storm drains help during heavy rainfall?
They prevent water from accumulating on the streets.
b) What can act as a natural storm drain?
If there are rocky depressions in a landscape, the water can escape.



c) How does deforestation affect the amount of water that ends up in a river?

Trees help absorb water. Without them, more water and soil is lost from the land.

6. What is the difference between a glacier and an iceberg?

A glacier is a large persistent body of ice that forms with the accumulation of snow. It's found on land. An iceberg which floats in the sea forms by breaking off a glacier or ice shelf.

7. If sea water has a density of 1.027 g/cm^3 , what percentage of an iceberg will be submerged if ice's density = 0.917 g/cm^3 .

$$m_{\text{displaced water}} * g = m_{\text{iceberg}} * g$$

$$m_{\text{displaced water}} = m_{\text{iceberg}}$$

$$V_{\text{displaced water}} * d_{\text{water}} = V_{\text{iceberg}} * d_{\text{iceberg}}$$

$$\frac{V_{dw}}{V_{ice}} = \frac{d_{ice}}{d_{dw}} = \frac{0.917}{1.027} = 0.893 = 89.3\%$$

8. What can cause ice sheets to leave land? What will subsequently happen to sea level?
Climate change. Sea level will rise.
9. a) What happens to the volume of water if an already submerged ice cube melts?
Nothing.
- b) In what way does this not contradict the answer from #8?

The ice experiment is equivalent to what happens to sea levels when icebergs melt: nothing. But the sea level rises when ice moves off the land and ends up in the sea. That's like placing an ice cube in a full glass of water. It will cause the water to overflow before melting.