

Carbon Cycle, Hydrosphere and Energy Types

Carbon Cycle Questions

1. Which of the following is a consequence of the increase in greenhouse gas emissions?

- A) The permafrost will become thicker.
- ☒ B) The surface area of the pack ice (ice floes) will decrease.
- C) The proportion of oxygen in the atmosphere will increase.
- D) The number of extreme weather events on Earth will decrease.

2. In nature, carbon follows a cycle and moves through the Earth's different spheres, namely the atmosphere, the biosphere, the hydrosphere and the lithosphere. Which of the following human activities has the least influence on the carbon cycle?

- A) Intensive tree cutting
- B) Raising dairy cows
- C) Burning fossil fuels
- ☒ D) Operating a nuclear power plant

3. It is said that using wood to build houses helps in the fight against climate change because trees store some of the atmospheric carbon. Through what carbon cycle process do trees store atmospheric carbon?

- ☒ A) Photosynthesis
- B) Cellular respiration
- C) Plant decomposition
- D) Fossil fuel combustion

4. Which of the following does not contribute to the formation of greenhouse gases?

- A) Decomposition of waste in landfills
- B) Burning of fossil fuels
- C) Melting of the permafrost
- ☒ D) Photosynthesis in plants

5. In general, permafrost is ground that...

- ☒ A) Is always frozen
- B) Rarely freezes
- C) Only freezes during winter
- D) Is located mainly in high altitude

6. Which of the following is not a consequence of the warming of the permafrost?

- A) Landslides
- B) Unstable infrastructure (buildings and roads)
- ☒ C) A decrease in the amount of vegetation
- D) The release of greenhouse gases

7. In the last 100 years, the average temperature of our planet has increased. The intensification of the greenhouse effect can explain this increase in temperature.

a) What two human disturbances lead to an increase in greenhouse gases?

- Burning fossil fuels, cars, raising cattle, cutting forests.

b) What are two consequences of the intensification of the greenhouse effect?

- Melting permafrost, sea levels rising,
- infrastructure damage, loss of habitat.

8. Global temperatures have been increasing at a steady rate. Ecologists have been hired to study the impact of increasing temperatures on a region in Northern Quebec. Which graph below correctly shows the consequence of a rise of temperature in the region? Explain your

answer.
Graph A

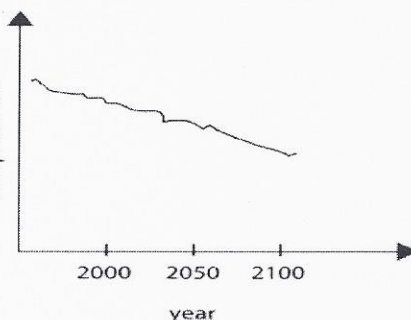
CO₂ and CH₄ emissions
from permafrost

Over time there is an increase in greenhouse gases. This causes permafrost to melt which in turn releases GH gases

2000 2050 2100
year

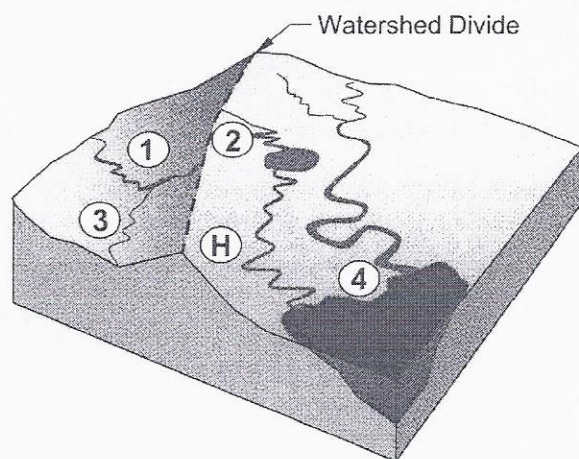
Graph B

CO₂ and CH₄ emissions
from permafrost



Hydrosphere Questions

9. The diagram below shows a house (H) and four nearby farms (1, 2, 3 and 4). A well is located very close to the house.



When the well water was tested, the results showed that it was contaminated with pesticides. Which of the four farms shown (1, 2, 3 or 4) is responsible for contaminating the well water?

- A) Farm 1, because it is located upstream.
- ☒ B) Farm 2, because it is located in the same catchment area.
- C) Farm 3, because it is located near the house.
- D) Farm 4, because it is located downstream.

10. What is the role of thermohaline circulation?

- A) It keeps the pH of oceans uniform.
- ☒ B) It transports heat from the equator toward the poles.
- C) It captures atmospheric CO₂
- D) It controls the tidal cycle

11. Which of the statements below correctly identifies the effect of the increase in the melting of pack ice due to climate change?

- ☒ A) Loss of habitat for arctic species
B) Rise in the sea level
C) Flooding of low lying areas
D) Increase in the number of icebergs

12. Which of the following activities has the greatest impact on the flow of water in a catchment area?

- A) Filling up a child's swimming pool with 40 L of water.
B) Treating drinking water for a city in a municipal water treatment plant.
☒ C) Rerouting rivers for the construction of a hydroelectric dam.
D) Repairing a bridge connecting Montreal's South Shore to the Island of Montreal.

13. Which of the following does not affect the flow of water into a catchment area?

- ☒ A) Depth and latitude of the water reservoir
B) Industrial and urban development
C) Shape and slope of the terrain
D) Density and diversity of the vegetation

14. In which situation will water sink most rapidly to the ocean floor?

- ☒ A) When it is cold and very salty
B) When it is warm and very salty
C) When it is cold and not very salty
D) When it is warm and not very salty

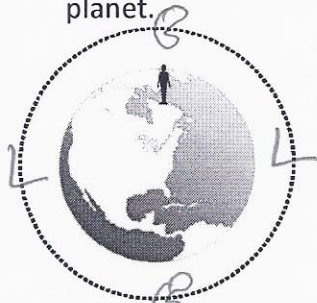
15. Different factors can affect the circulation of surface currents and deep currents in the ocean.

- | | |
|---|------------------------------|
| 1. Temperature differences in the water | 4. The rotation of the Earth |
| 2. Air pressure differences in the atmosphere | 5. The depth of the water |
| 3. Differences in the waters' salinity | |

Which of the factors above only effect surface currents?

- A) 1 and 3 only
☒ B) 2 and 4 only
C) 1, 3 and 5
D) 2, 4 and 5

16. In Ungava Bay in northern Québec, the tidal range can reach more than 17 m. The diagram below shows the Earth along with a dotted circle representing the moon's orbit around the planet.



- Draw the symbol ☾ on the dotted circle to indicate the two (2) points in its orbit where the moon causes high tides in Ungava Bay. The position of this bay is denoted by the symbol: ☐.
- Write the letter L on the Earth to indicate the two (2) points where the tides are low at the same time as the tide is high in Ungava Bay (☐).

17. For each statement state whether it is an example of a surface current or a subsurface current.

- a- these currents are altered by density and salinity *Sub*
- b- these currents are mostly controlled by wind *surf.*
- c- these currents will allow cause you to swim off course in the ocean *surf.*

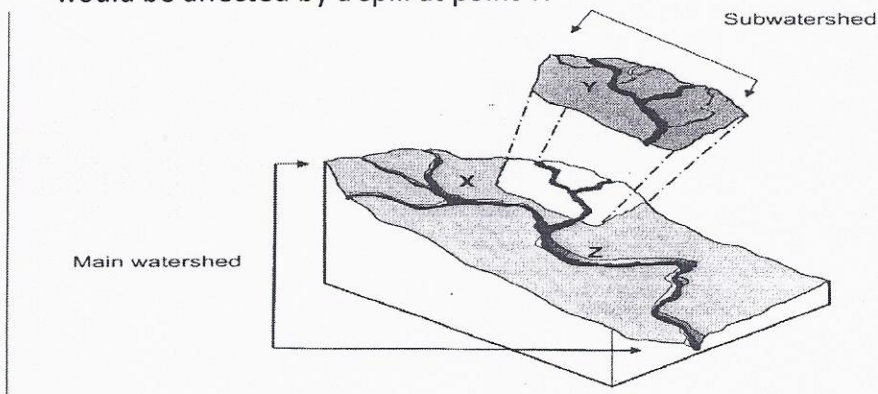
18. The table below lists three human activities that can have an impact on the quality of the water in a drainage basin.

Human activities	
1	Fertilizing farmland
2	Using jet skis and motor boats
3	Planting vegetation along the bank of a river or stream

Choose 2 of the 3 human activities and explain their positive or negative impact on the rivers and streams of a drainage basin.

- Fertilizing: fertilizer negatively affects rivers + lakes
- Jetskis - release pollutants + harm aquatic life
- Vegetation - provides natural barriers against pollutants

19. Using the following diagram, complete the table below by writing YES or NO to indicate whether points Y and Z would be affected by a spill at point X and whether points X and Z would be affected by a spill at point Y.



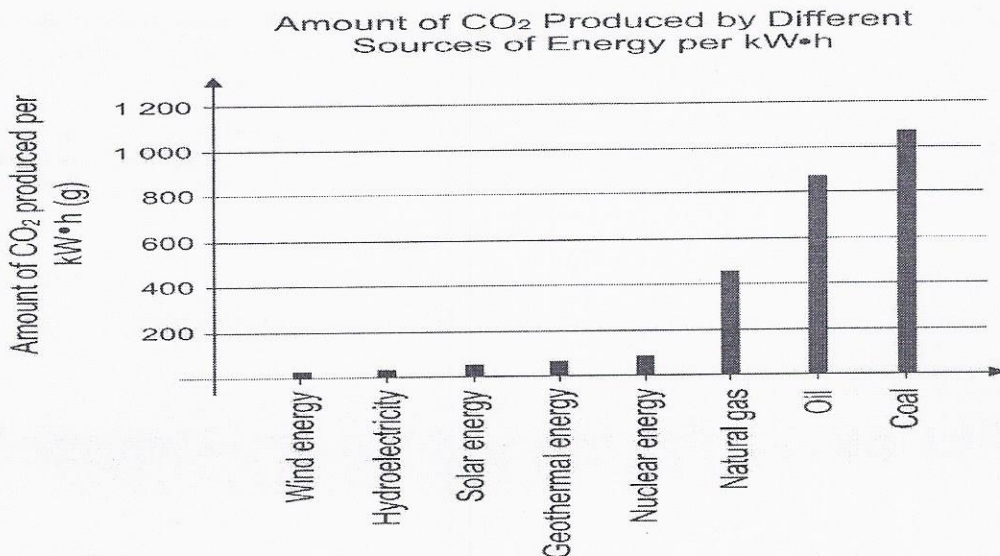
Location of the spill	Impact		
	At point X	At point Y	At point Z
X	YES	No	Yes
Y	No	YES	Yes

Explain your reasoning.

Water flows downstream

Energy Types Questions

20. The use of energy sources generates greenhouse gas emissions. The graph below shows the amount of greenhouse gas, CO₂, produced by different sources of energy per kilowatt-hour.



According to this graph, which of the following statements is true?

- ☒ A) Coal produces less greenhouse gas than all the other fossil fuels combined.
☐ B) Only renewable energy sources produce less than 200 g of CO₂ per kilowatt-hour.
☐ C) Each energy source from the lithosphere produces more than 400 g of CO₂ per kilowatt-hour.
☐ D) Solar energy produces less greenhouse gas than the main energy source from the atmosphere.

21. Which of the following choices provides accurate information about one of the types of power plants listed?

	Type of power plant	Renewable or non-renewable energy	Quantity of greenhouse gases produced
A	Geothermal	Non-renewable	Large amounts
<input checked="" type="radio"/> B	Hydroelectric	Renewable	Little or none at all
C	Nuclear	Renewable	Large amounts
D	Tidal	Non-renewable	Little or none at all

22. Different types of electric power plants are listed in the table below.

Types of Power Plants
Wind, Geothermal, Hydroelectric and Tidal

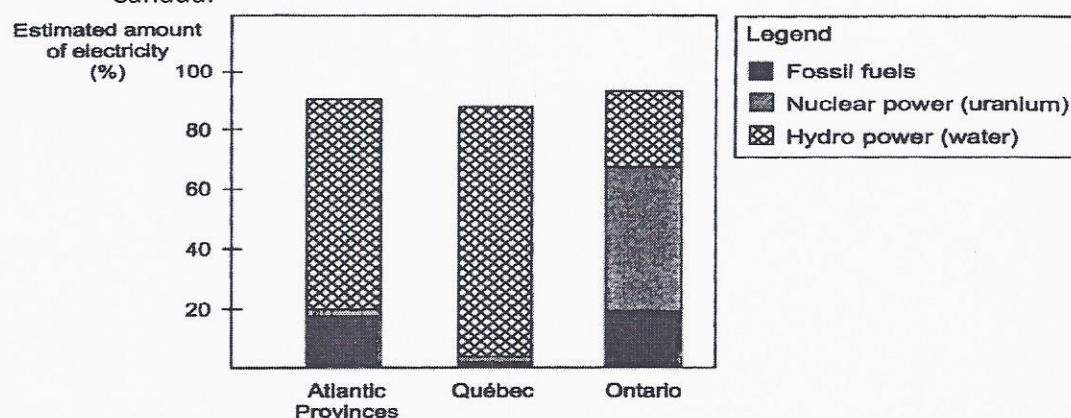
Which statement is true about all these types of power plants?

- ☒ A) They produce few air pollutants.
☐ B) They can be set up anywhere in Canada.
☐ C) They all use water as the primary source of energy.
☐ D) They use non-renewable resources.

23. Listed below are different facilities that use energy resources as well as negative consequences that may result from operating these facilities. Which choice correctly matches each facility with its consequence?

	Facilities	Negative consequences
A)	Coal-fired power plant	Noise produced
B)	Nuclear power plant	Greenhouse gas emissions
C)	Wind turbines	Greenhouse gas emissions
D)	Water turbines	Can negatively affect the migration patterns of aquatic species

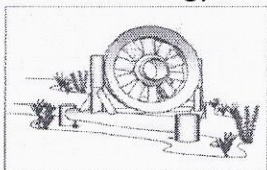
24. The following graph shows different sources of electricity in three major regions in Canada. Graph 1 -Proportion of Electricity Produced From Different Sources in Three Major Regions in Canada.



Given the information in this graph and your knowledge of energy resources, which conclusion is TRUE?

- A) Electricity production has little impact on the environment in these three regions, since they all mainly use hydro power
- B) Air pollution caused by electricity production is greater in Ontario than in Quebec, since Ontario has more thermal power plants.**
- C) Greenhouse gas emissions related to electricity production are greater in Ontario than in the Atlantic Provinces, since Ontario has more nuclear power plants.
- D) Electricity production has a major impact on the environment in the three regions, since they use no renewable energy.

25. There are plans to put underwater turbines in the Gulf of the St. Lawrence. This technology uses the energy of deep currents to produce electricity.



- a) Is the source located in the lithosphere, hydrosphere or atmosphere? *hydro*
 b) Give two advantages of producing electricity with underwater turbines rather than wind turbines.

- less noise - no visual pollution
- currents are predictable - do not take up land

- c) Indicate a possible negative consequence of using the underwater turbines.

May endanger aquatic life - difficult to set up
Change migration patterns

26. The inhabitants of a remote island would like to replace gasoline-powered generators with devices that use renewable energy. The table below indicates certain characteristics of the island.

Population	583 inhabitants
Area	250 km ²
Climate	Summer: humid and sunny Winter: cold and sunny
Environment	Wildlife: seals, fish, aquatic birds Vegetation: diversified
Topography	Coasts: sandy beaches and small waves Igneous rock and volcanic activity constantly monitored
Economic activities	Tourism, sailing, deep sea fishing, excursions

Fill in the table below.

Method of Producing Electrical Energy	Location of the Resource	Justification for Method Chosen Based on the Characteristics of this Island
1) Solar panels	<input checked="" type="checkbox"/> Atmosphere	<i>Sunny on the island</i>
2) Wind turbine	<input type="checkbox"/> Biosphere	<i>since they can sail there is wind</i>
3) Wave	<input checked="" type="checkbox"/> Hydrosphere	<i>waves can drive turbines</i>
4) geothermal	<input checked="" type="checkbox"/> Lithosphere	<i>Volcanoes = thermal source</i>