

STUDY GUIDE – CHAPTERS 6 & 7**THE EARTH AND SPACE****1. ENVIRONMENTAL IMPACTS OF MINING AND THE TRANSFORMATION OF MINERALS**

- *animal habitat is ruined;*
- *trees and vegetation are removed and therefore can no longer remove CO₂ from the environment*
- *trees and vegetation are removed and therefore can no longer introduce O₂ into the environment*
- *food chains are disturbed as animals' food is taken away*
- *trucks and machinery used in mining add CO₂ to the environment by burning fossil fuels*
- *the rock and soil is dumped back as a series of spoil banks and can contaminate the water*

2. PERMAFROST

1) layer of ground whose temperature has been 0° or less for at least 2 years

SAMPLE PROBLEMS

1) In the Canadian Arctic, houses are sinking into the ground, and runways are cracking. Explain why.

THE UPPER LAYER OF PERMAFROST THAWS IN SUMMER, THREATENING THE STABILITY OF BUILDINGS WITH FOUNDATIONS IN THIS LAYER OF FROZEN GROUND.

2) Is there any vegetation in the Far North of Québec? Explain your answer.

NO, BECAUSE THE GROUND IS PERMANENTLY FROZEN.

3. CONSEQUENCES OF A RISE IN TEMPERATURE IN THE PERMAFROST

2) landslides can occur;

3) trees can fall;

4) building constructed on permafrost can collapse;

5) carbon dioxide and methane gas trapped in the permafrost can be released and contribute to global warming

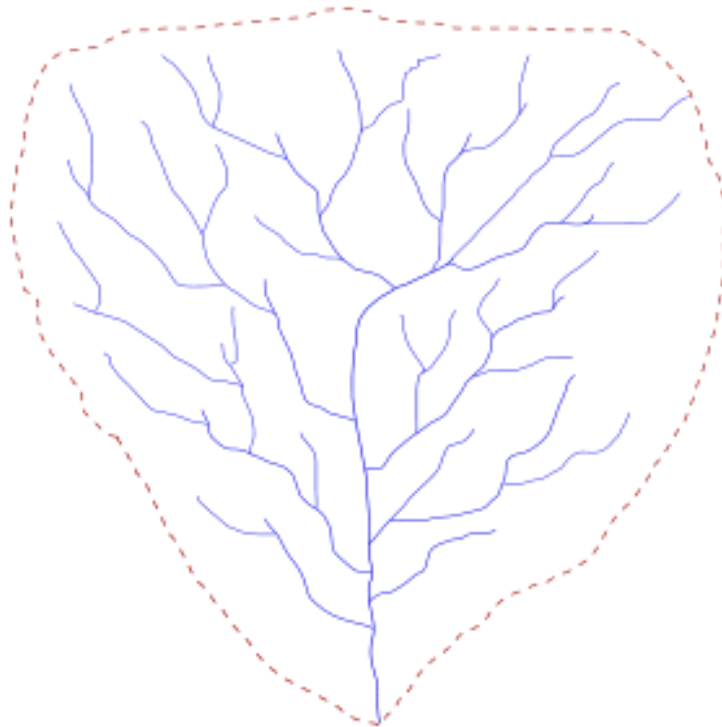
4. CHEMICAL AND BIOLOGICAL REACTIVITY OF A SOIL

Conditions for a soil to be fertile:

- 1) *a sufficient amount of minerals*
- 2) *adequate moisture*
- 3) *an appropriate soil pH(7)*

5. CATCHMENT AREA

- *Territory surrounding a waterway*



- *A watershed is an extent or an area of land where surface water from rain and melting snow or ice converges to a single point, usually the exit of the basin, where the waters join another water body, such as a river, lake, reservoir, estuary, wetland, sea, or ocean.*
- *The watershed includes both the streams and rivers that convey the water as well as the land surfaces from which water drains into those channels, and is separated from adjacent basins by a drainage divide.*
- *The watershed acts as a funnel by collecting all the water within the area covered by the basin and channeling it to a single point. Each watershed is separated topographically from adjacent basins by a geographical barrier such as a ridge, hill or mountain.*

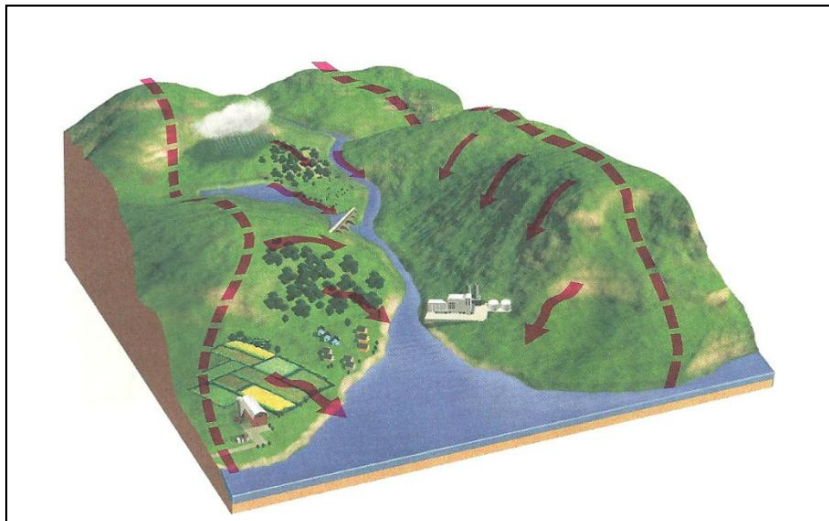
6. IMPACTS OF HUMAN ACTIVITY ON THE WATERWAYS IN A CATCHMENT AREA

- *Watersheds are important elements to consider also in ecology. As water flows over the ground and along rivers it can pick up nutrients, sediment, and pollutants. Like the water, they get transported towards the outlet of the basin, and can affect the ecological processes along the way as well as in the receiving water source.*
- *Modern usage of artificial fertilizers, containing nitrogen, phosphorus, and potassium, has affected the mouths of watersheds. The minerals will be carried by the watershed to the mouth and accumulate there, disturbing the natural mineral balance. This can cause eutrophication where plant growth is accelerated by the additional material.*

SAMPLE PROBLEMS

- 1) Environmental experts divide inland waters among watersheds. How do they define the boundaries of watersheds?

BY IDENTIFYING THEIR NATURAL BOUNDARIES, FORMED BY THE CRESTS OF NEARBY MOUNTAINS, HILLS OR OTHER HIGH GROUND



- 2) Name four factors that affect the flow of water within a watershed.

TOPOGRAPHY, GEOLOGY, CLIMATE, VEGETATION, AND AGRICULTURAL, INDUSTRIAL AND URBAN DEVELOPMENT.

- 3) The illustration below shows a watershed.
- a) Draw the watershed divides and indicate the direction of the water flow with arrows.



- b) What might be the sources of contamination for the body of water?

THE HYDROELECTRIC DAM, INDUSTRY, AGRICULTURE

- c) All the waters of the watershed flow to the same lake. If one of the pollution sources dumps a contaminant in the water, what might be the consequences?

LAKE EUTROPHICATION

7. SALINITY

- *measure of the quantity of salt in a solution*

SAMPLE PROBLEMS

- 1) Where does salt in seas and oceans comes from?

IT COMES FROM THE MINERALS IN THE LITHOSPHERE.

- 2) Which water is denser?

- a) water with three-percent salinity or water with four-percent salinity?

WATER WITH FOUR-PERCENT SALINITY (IT HAS MORE SALT IN IT)

- b) water at 12°C or water at 18°C?

WATER AT 12°C (COLDER WATER IS DENSER)

8. INFLUENCE OF SALINITY ON THE DENSITY OF A SOLUTION

- *Water with higher salinity has a higher density and sinks deeper into the seas and oceans.*
- *Water salinity is responsible for the formation of subsurface currents in seas and oceans.*
- *Colder water has a higher density*
- *Movement of water of different salinity produces ocean currents*

SAMPLE PROBLEMS

1) Explain why sea water is less salty near the poles.

SEAWATER IS LESS SALTY NEAR THE POLES BECAUSE MELTING GLACIERS AND PACK ICE ADD FRESH WATER TO IT.

2) Does sea water sinks deeper into the ocean than fresh water?

YES, BECAUSE IT IS SALTIER AND DENSER THAN FRESH WATER AND THEREFORE SINKS BENEATH FRESH WATER

1) Explain why sea water is less salty near the poles.

SEAWATER IS LESS SALTY NEAR THE POLES BECAUSE MELTING GLACIERS AND PACK ICE ADD FRESH WATER TO IT.

2) Does sea water sinks deeper into the ocean than fresh water?

YES, BECAUSE IT IS SALTIER AND DENSER THAN FRESH WATER AND THEREFORE SINKS BENEATH FRESH WATER

3) The differences in seasonal temperatures are not as great in the ocean as on land.

Explain why.

IN THE WINTER, THE OCEAN LOSES SOME OF THE HEAT IT STORED DURING THE SUMMER BECAUSE WATER LOSES HEAT MORE SLOWLY THAN THE GROUND, THE DIFFERENCES IN SEASONAL TEMPERATURES ARE LESS PRONOUNCED AT SEA THAN ON LAND.

a) Name three factors that affect the temperature of ocean waters.

THE SEASONS, LATITUDE AND DEPTH

4) Is seawater more saline at the poles or in the tropics? Explain your answer.

SEAWATER IS MORE SALINE IN THE TROPICS BECAUSE HEAT AND DROUGHT ACCELERATE EVAPORATION AND CONCENTRATE THE SALTS IN THE WATER. NEAR THE POLES, ON THE OTHER HAND, MELTING ICE AND GLACIERS DILUTE SEAWATER AND REDUCE ITS SALT CONTENT.

9. GLACIERS AND ICE FLOES

A) Glaciers- mass of ice on land, formed by compressed snow

B) Ice pack – composed of ice floating on the oceans near the North and South Poles.

10. IMPACTS OF THE MELTING OF GLACIERS AND ICE FLOES

A) increase in sea level

B) disturbance of thermohaline circulation

C) disturbance of certain marine ecosystems that depend on salt water like coral reefs

D) melting pack ice threatens the survival of species that depend on the ice, such as polar bears or ringed seals.

SAMPLE PROBLEMS

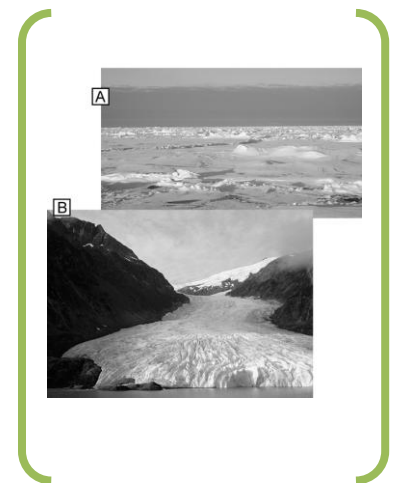
1) The two photos opposite were taken during a trip to the Arctic.

a) Which photo features pack ice?

PHOTO A

b) What distinguishes the glacier from the pack ice?

A GLACIER IS A MASS OF ICE ON LAND, FORMED BY COMPRESSED SNOW, WHILE PACK ICE CONSISTS OF THE ICE FLOATING ON THE OCEANS NEAR THE NORTH AND SOUTH POLES.



11. FACTORS THAT AFFECT THE CIRCULATION OF SURFACE CURRENTS

WINDS

a) ROTATION OF THE EARTH

12. FACTORS THAT AFFECT THE CIRCULATION OF DEEP CURRENTS

A) TEMPERATURE

B) SALINITY

C) DENSITY

SAMPLE PROBLEMS

1. What am I?

- a) I am a wind-driven ocean current

A SURFACE CURRENT

- b) I am an ocean current caused by differences in water density.

A SUBSURFACE CURRENT

- c) I form a huge “conveyor belt” that transports ocean waters around the world.

THERMOHALINE CIRCULATION

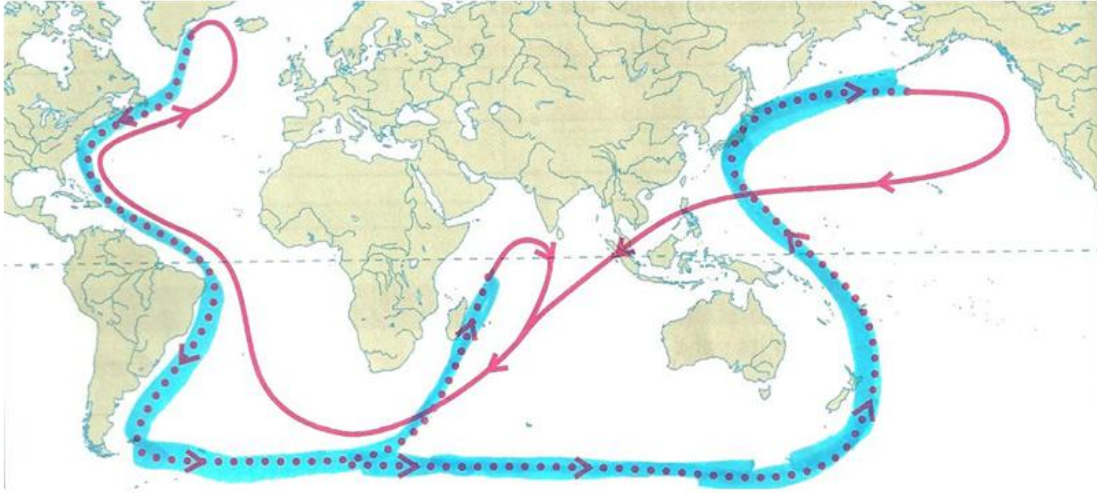
13. THERMOHALINE CIRCULATION

- **Ocean current- movement of seawater in a certain direction**
- **Ocean circulation the combined effect of all the currents that move across the ocean**
- **Termohaline circulation**
 - **huge conveyor belt formed by surface and subsurface currents that move water all around the world**
 - **moves warm water from the equator towards the North and South poles**
 - **moves cold water from the North and South poles towards equator**
 - **transfers heat around the world; regulates the climate on the planet giving warmer temperatures at the poles and colder temperature at the equator**

SAMPLE PROBLEMS

1) Study this map of the world carefully.

- a) *Using arrows draw the termohaline circulation.* Indicate the warm currents in red and the cold currents in blue



- b) Which current is closer to the floor: the red or the blue?

THE BLUE, THE COLD WATER BECAUSE IT HAS COOLED IN THE NORTH AND SUNK TO THE OCEAN FLOOR

Surface ocean currents sink 3 km when they reach the Greenland coast. Why?

WHEN THEY REACH GREENLAND, THE SURFACE WATERS BECOME COLDER AND THEREFORE DENSER WHICH MAKES THEM SINK DEEPER.

- 2) The Gulf Stream is an ocean that crosses Atlantic Ocean. This current carries warm waters from the Florida coast northward to Newfoundland and then branches off eastward to Northern Europe. What effect does the Gulf Stream have on the climate in northwestern Europe?

IT MODERATES THE TEMPERATURE OF NORTHWESTERN EUROPE.

14. TECHNOLOGIES USED TO PRODUCE ELECTRICITY USING THE ENERGY RESOURCES IN THE LITHOSPHERE AND HYDROSPHERE

lithosphere – fossil fuels coal, methane gas, oil result from the transformation of organic residue. These energy sources consist of oil, natural gas and coal.

nuclear energy is the energy stored in the bonds between the particles in the nucleus of an atom. - uranium

geothermal energy the energy that comes from the internal heat of the Earth.

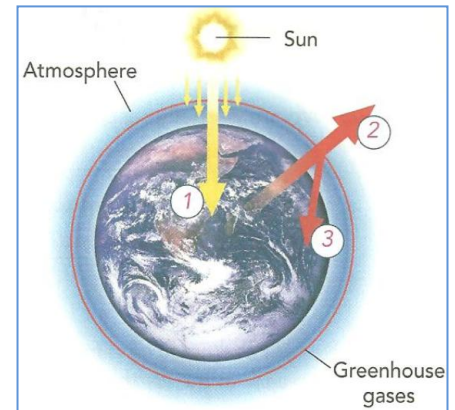
hydrosphere – ocean currents, underwater turbines, hydroelectric dams

15. IMPACT OF THE USE OF ENERGY RESOURCES IN THE IN THE LITHOSPHERE AND HYDROSPHERE

SPHERE	FORM OF ENERGY	ADVANTAGE	DISADVANTAGE
LITHOSPHERE	FOSSIL FUELS (coal, natural gas, petroleum)	<ul style="list-style-type: none"> - READILY AVAILABLE - CONTAIN A LOT OF ENERGY 	<ul style="list-style-type: none"> - RELEASE CO₂(GLOBAL WARMING) - NON-RENEWABLE
	GEO THERMICS	<ul style="list-style-type: none"> -RENEWABLE - DOES NOT RELEASE GREENHOUSE GASES 	EXPENSIVE
	NUCLEAR ENERGY (uranium)	<ul style="list-style-type: none"> -CONTAINS A LOT OF ENERGY IN A SMALL AMOUNT OF MATTER - DOES NOT RELEASE GREENHOUSE GASES 	<ul style="list-style-type: none"> -DANGEROUS WASTE - RISK OF NUCLEAR ACCIDENTS
HYDROSPHERE	HYDROELECTRIC DAMS	<ul style="list-style-type: none"> -RENEWABLE - DOES NOT RELEASE GREENHOUSE GASES 	<ul style="list-style-type: none"> - FLOODS LARGE AREAS OF LAND - CONTAMINATE THE WATER
	WATER TURBINES	<ul style="list-style-type: none"> -RENEWABLE - DOES NOT RELEASE GREENHOUSE GASES 	<ul style="list-style-type: none"> - EXPENSIVE -not possible everywhere due to geographical conditions
ATMOSPHERE	WIND MILLS (AEOLIAN ENERGY)	<ul style="list-style-type: none"> -RENEWABLE - DOES NOT RELEASE GREENHOUSE GASES 	<ul style="list-style-type: none"> - AFFECTS THE BEAUTY OF LANDSCAPES - UNRELIABLE- IT CANNOT BE PREDICTED WHEN THE WIND WILL BLOW

15) DESCRIBE THE GREENHOUSE EFFECT

- Greenhouse gases have always been present in the atmosphere. The main greenhouse gases are water vapour (H₂O), carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). They help the Earth retain part of the heat it receives from the Sun. Without these gases, the mean temperature on Earth would be -18°C
- In the greenhouse effect, the sun's rays are absorbed by the ground.(1)
- Once heated, the ground emits infrared rays, some of which pass through the atmosphere and are lost in space.(2)
- Greenhouse gases trap some of the infrared rays and send them to Earth, which makes the temperature rise on the Earth's surface. (3)



16) DESCRIBE THE CONSEQUENCES OF A HIGHER CONCENTRATION OF GREENHOUSE GASES

GLOBAL WARMING: Scientists believe that an overall temperature increase of 2°C is a critical point beyond which there will be serious climate disruptions: droughts, melting of glaciers and a rise in sea level, heat waves, floods, disturbances in ecosystems.

SAMPLE PROBLEMS

1. True or false? Explain your answers.

- a) The greenhouse effect is a recent phenomenon, caused by human activity on Earth.

FALSE. GREENHOUSE GASES HAVE ALWAYS BEEN PRESENT IN THE ATMOSPHERE.

- b) By accumulating in the atmosphere, greenhouse gases trap increasing amounts of ultraviolet radiation.

FALSE. THEY TRAP INFRARED RAYS EMITTED BY THE GROUND.

- c) Clearing land intensifies the greenhouse effect because carbon dioxide is released as felled trees decompose.

TRUE. THE CARBON STORED IN FORESTS RETURNS TO THE ATMOSPHERE IN THE FORM OF CO₂ WHEN TREES ARE FELLED.

- d) Photosynthesis in plants plays a major role in stabilizing temperatures on Earth.

TRUE. PLANTS ABSORB CO₂ DURING PHOTOSYNTHESIS, REDUCING THE GREENHOUSE EFFECT.

2. For each of the following greenhouse gases, name a human-caused source of emissions.

a) carbon dioxide (CO₂)

EXAMPLE: THE COMBUSTION OF OIL, NATURAL GAS AND COAL IN CARS OR INDUSTRIAL PROCESSES.

b) methane (CH₄)

EXAMPLES: DIGESTION IN FARM ANIMALS, MANURE STORAGE AND MANAGEMENT, RICE FARMING IN PADDY FIELDS, DECOMPOSING HOUSEHOLD WASTE AND THE DISTRIBUTION OF NATURAL GAS.

c) nitrous oxide (N₂O)

EXAMPLES: CERTAIN CHEMICAL PROCESSES AND APPLYING NITROGEN-RICH FERTILIZER TO FARM CROPS.

3. Decomposing waste in landfills produces methane (CH₄). In some sites, this gas is collected and burned to transform it into carbon dioxide (CO₂). Does this practice have a positive or negative impact on the environment? Explain your answer.

POSITIVE. METHANE IS A GAS WITH A GREENHOUSE EFFECT 21 TIMES GREATER THAN THAT OF CARBON DIOXIDE.

**16. DESCRIBE TECHNOLOGIES USED TO PRODUCE ELECTRICITY USING THE ENERGY RESOURCES IN THE ATMOSPHERE **

- *Wind energy can be drawn from the wind and converted into electricity.*
- *It is a renewable resource that produces no greenhouse gas.*
- *Wind turbines work in a relatively simple way. The wind spins the blades, which activate an electric generator inside the nacelle.*
- *Wind energy is then transformed into electrical energy, which is distributed to consumers.*

EXTRA PRACTICE

1) *Explain what the concept of “permafrost” represents:*

- A) Layer of ground whose temperature has been 0° or less for at least 2 years.
- B) Layer of ground whose temperature has been -10° or less for at least 2 years.
- C) Layer of ground whose temperature has been 0° or less for at least 1 year.
- D) Soil with a high buffering capacity

2) *Which of the following represent real consequences of a rise in temperature in the permafrost?*

- 6) landslides can occur
- 7) sea level can rise
- 8) trees can fall
- 9) polar bears will be in danger because their habitat will be disrupted
- 10) buildings constructed on permafrost can collapse
- 11) CARBON DIOXIDE AND METHANE GAS TRAPPED IN THE PERMAFROST CAN BE RELEASED AND CONTRIBUTE TO GLOBAL WARMING

- A) 1, 2, 3, 4 and 5
- B) 2, 3, 4 and 6
- C) 1, 3, 4, 5 and 6
- D) 1, 2, 3, 4, 5 and 6

3) Which of the following DOES NOT REPRESENT a correct description of a watershed (catchment area)?

- A) A watershed is an extent or an area of land where surface water from rain and melting snow or ice converges to a single point, usually the exit of the basin, where the waters join another water body, such as a river, lake, reservoir, estuary, wetland, sea, or ocean.
- B) The watershed includes both the streams and rivers that convey the water as well as the land surfaces from which water drains into those channels, and is separated from adjacent basins by a drainage divide.
- C) The watershed acts as a funnel by collecting all the water within the area covered by the basin and channeling it to a single point. Each watershed is separated topographically from adjacent basins by a geographical barrier such as a ridge, hill or mountain.
- D) A watershed is an area of land where water is collected by building dams. The water falls from considerable height onto enormous turbines that generate electricity in their rotational motion.

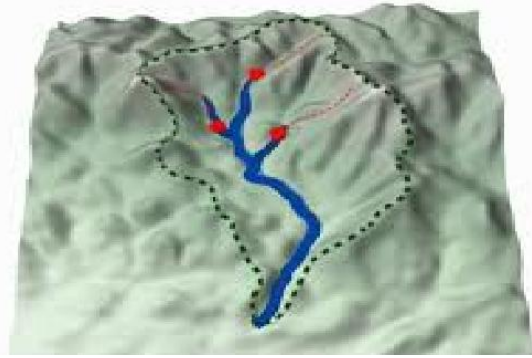
3) At what temperature is water density at its maximum? Choose the correct answer.

- A) 100°C B) 5°C C) 30°C D) 4°C

5. How does the salinity of the sea water influence its density?

- A) Water with higher salinity has a lower density and stays at the surface of the seas and oceans.
- B) Salinity does not influence the density of the sea water.
- C) Water with higher salinity has a higher density and sinks deeper into the seas and oceans.
- D) Water with higher salinity has a higher temperature.

6. The picture below represents an area of land where surface water from rain and melting snow or ice converges to a river. **What is the name given to this form of relief?**



- A) glacier
- B) thermohaline circulation
- C) catchment area**
- D) permafrost

7. *Which of the following samples of water is denser?*

- A) water with three-percent salinity
- B) water with four-percent salinity**
- C) fresh water
- D) the water produced by the melting of ice packs

8. *What distinguishes a glacier from the pack ice?*

- a) Glaciers are formed by a mass of ice on land whereas the pack ice is composed of ice floating on the ocean.**
- b) The pack ice is formed by a mass of ice on land whereas a glacier is composed of floating ice.**
- C) Glaciers are found at the North Pole whereas the pack ice is found at the South Pole.
- D) Glaciers are found at the South Pole whereas the pack ice is found at the North Pole.

9) One of the following statements IS NOT a direct consequence of the melting of glaciers and pack ice. *Which one is it?*

- a) Threatens the survival of species that depend on ice, such as polar bears or ringed seals.
- B) Increase in sea level.
- C) Disturbance of the thermohaline circulation.
- D) Global warming as a result of the increase in methane gas emissions.**

10) *What is the role of the thermohaline circulation?*

- A) **Transfers heat around the world; regulates the climate on the planet giving warmer temperatures at the poles and colder temperature at the equator.**
- B) Maintains the balance of the soil pH in different ecosystems.
- C) Acts as a funnel by collecting all the water within an area covered by it, channeling it to a single point.
- D) Increases the sea level by melting the pack ice.

11) *Which of the following energy resources IS NOT found in the lithosphere?*

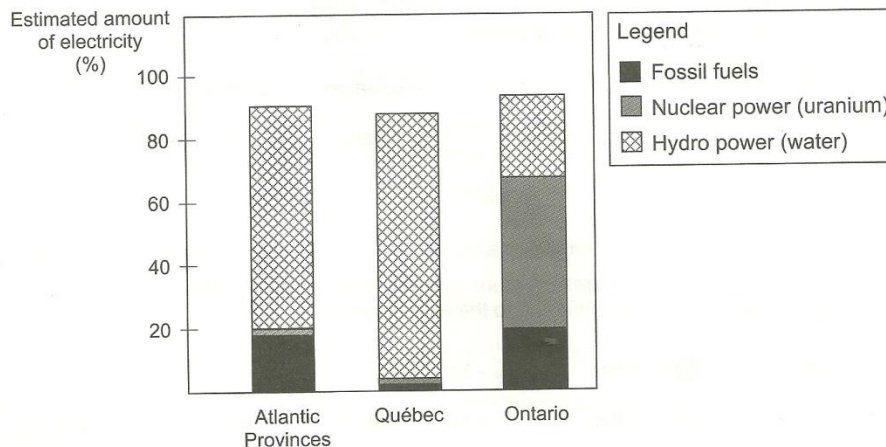
- A) Fossil fuels
- B) Uranium
- C) Geothermal energy
- D) **Electric dams**

12) *What is the process by which the ground retains some of the heat received from the Sun called?*

- A) **Absorption.**
- B) Global warming.
- C) Reflection.
- D) Greenhouse effect.

13) The following graph shows different sources of electricity in three major regions of Canada.

Graph 1 – Proportion of Electricity Produced From Different Sources in Three Major Regions in Canada



Adapted from Statistics Canada (May 2011), *Report on Energy Supply and Demand in Canada — 2009 Preliminary*, Catalogue no.57-003-X, pp. 110-111

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

- A) Air pollution caused by electricity is greater in Ontario than in Quebec, since Ontario has more thermal power plants.
- B) Electricity production has little impact on the environment in these regions, since they mainly use hydro power.
- 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.

14) Oceanic circulation involves two types of ocean currents; surface currents and deep currents. The following table lists 4 factors that influence oceanic circulation.

FACTORS AFFECTING OCEANIC CIRCULATION

1. Rotation of the Earth
2. Differences in the water temperature
3. Differences in the water salinity
4. Prevailing winds

Which of the two factors in particular influence DEEP CURRENTS?

- A) 1 and 2
- B) 1 and 4
- C) 2 and 3
- D) 3 and 4

15) *Which of the following energy resources is found in the atmosphere?*

- A) Geothermal energy.
- B) Electric dams.
- C) Fossil fuels.
- D) Wind energy.

EXTENDED ANSWERS

1) *Name the form of energy described in each statement.*

- A) It is produced by atomic fission. **NUCLEAR ENERGY**
 B) It is the result of the decomposition of prehistoric plants and animals. **FOSSIL FUELS**
 C) It is derived from the internal heat of the Earth. **GEOTHERMAL ENERGY**
 D) It emits more greenhouse gases than any other form of energy. **FOSSIL FUELS**

2) A mining company was examining iron ore deposits in northern Quebec. The company used satellites to find mineral deposits and to determine the location and size of these deposits. It was determined that the ore had a high enough concentration of iron that was economically worth mining, by means of an open-pit mine (illustration on the right). **Name 2 environmental impacts of mining for iron ore.**

- **animal habitat is ruined;**
- **trees and vegetation are removed and therefore can no longer remove CO₂ from the environment**
- **trees and vegetation are removed and therefore can no longer introduce O₂ into the environment**
- **food chains are disturbed as animals' food is taken away**
- **trucks and machinery used in mining add CO₂ to the environment by burning fossil fuels**
- **the rock and soil is dumped back as a series of spoil banks and can contaminate the water**

3) Cruise ships regularly offer tours along the shores of Greenland. Tourists can observe the spectacular blocks of ice that break off from the coast and float into the sea.

A) **What are these blocks of ice called?**

Icebergs; packs ice

B) A few fragments of ice melt in the seawater. This water does not stay near the coast; it moves about. **What factors will affect its movement?**

Deep currents: Temperature; salinity; surface currents: wind; rotation of the earth

C) **Will the meltwater eventually arrive at the equator? Explain your answer.**

Yes; because of the ocean circulation(thermohaline circulation)

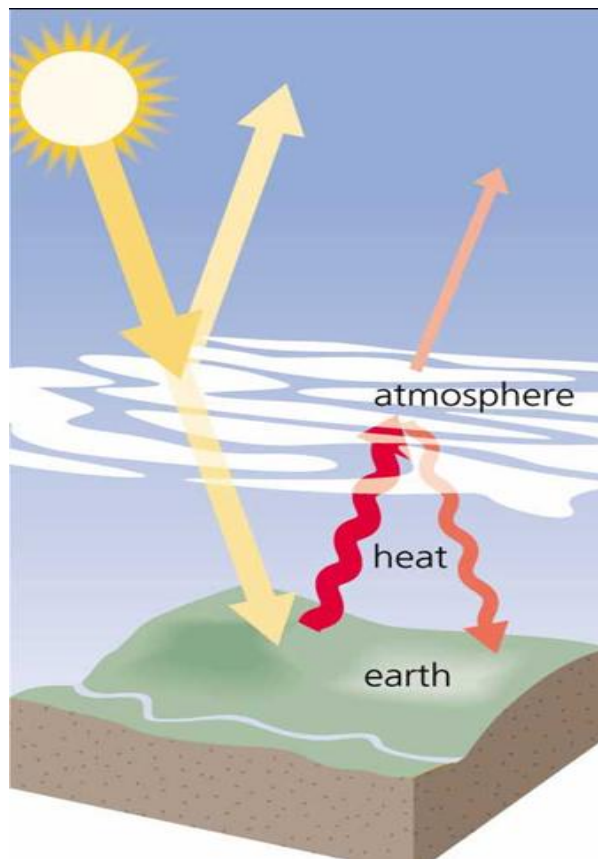
D) In certain places, the Greenland glaciers are melting at twice their previous rate. **Which climatic phenomenon explains this acceleration?**

Global warming; greenhouse effect; climate change

4. **Describe the greenhouse effect**

1. **Solar radiation passes through the atmosphere as visible light.**

2. The land absorbs the radiant energy and transforms it into heat energy.
3. The energy is reradiated back into the outer space in the form of infrared radiation.
4. The layer of greenhouse gases in the atmosphere traps some of the infrared rays, allowing a suitable temperature for life on the planet (infrared radiation is absorbed by greenhouse gases and then reradiated back into the atmosphere).
5. The greenhouse effect is a natural phenomenon that helps the earth to retain some of the heat it receives from the sun.
6. There is a current increase in the greenhouse effect due to the increase of the greenhouse gasses emitted in the atmosphere as a result of burning fossil fuels since the Industrial Revolution.



5. Name two advantages and two disadvantages of wind power.

Advantages: **RENEWABLE, DOES NOT RELEASE GREENHOUSE GASES**

Disadvantages **UNPREDICTABLE , RUINS THE BEAUTY OF LANDSCAPES**