Name: _____

Living With Water: Polar Bears

Section A) The Polar Bear's Arctic Habitat

1. Did you know that unlike any other kind of bear, the polar bear is classified as a marine mammal?

   In Canada, polar bears *(Ursus maritimus)* are most common along the coastal areas and islands of the Arctic, as far south as Newfoundland and Labrador, or even occasionally in the Gulf of the St. Lawrence in years when sea ice travels farther to the south than normal.

   Polar bears are also found in Alaska, Greenland and northern parts of Russia and Norway.

   In the Arctic, polar bears have evolved to spend most of the year away from land, mainly hunting seals from the sea ice.

   Sea ice is made of frozen sea water that forms a thick crust of ice. This crust of ice makes up some of the Earth's North Pole. Multi-year sea ice can be up to four metres thick, and remains frozen all year-round. Thinner areas of annual sea ice melt in the summer.

Name: _____

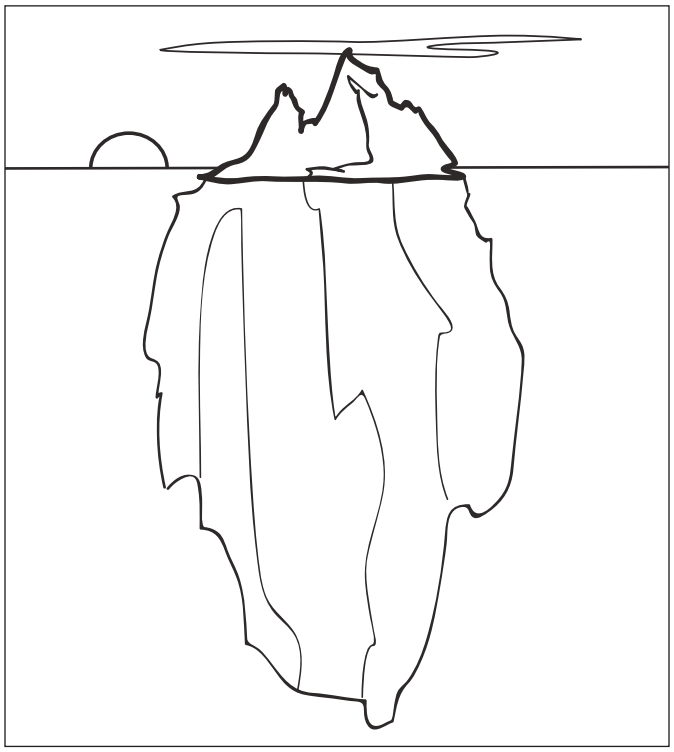
Some sea ice melts and breaks off into large chunks that float away from the shore. These chunks of ice are called floes, and they can range in size from 20 metres to a whopping 10 kilometres – like huge floating islands of ice.

Floe

Open areas of seawater that are surrounded by sea ice are called polynyas.

Polynya

Name: _____



Iceberg

Unlike ice floes that are made up of seawater, icebergs are chunks of freshwater ice that break off from glaciers in the spring or summer and float out into the ocean. Icebergs vary in size – small chunks are called growlers. Bigger chunks are called bergy bits. The tallest iceberg ever recorded in the North Atlantic was 168 metres high, about as tall as a 55-storey building! When you see an iceberg in the water, you're usually only looking at 10 percent of it. The rest is underwater, which is why ships traveling the ocean must steer clear of them to avoid hitting any outcropped edges they can't see.

A glacier is a large body of freshwater ice that stays frozen all year-round. About 10 percent of the planet's surface is made up of glaciers, and most of them are located in the Arctic and the Antarctic. They move very slowly, like rivers of ice, pushed by their own weight and the force of gravity. Glacier ice is the largest reservoir of fresh water on Earth. Much of the ice in Arctic glaciers has been frozen for over 15,000 years!

Name: _____

2. Bear Necessities

During the approximately 200,000 years that they've lived in the Arctic (that's when they are believed to have evolved from grizzly bears), polar bears have adapted to the harsh Arctic climate, freezing cold water and ice. Do some research to learn more about polar bears. Fill in the boxes on the following page with facts about how polar bears have adapted to their environment.

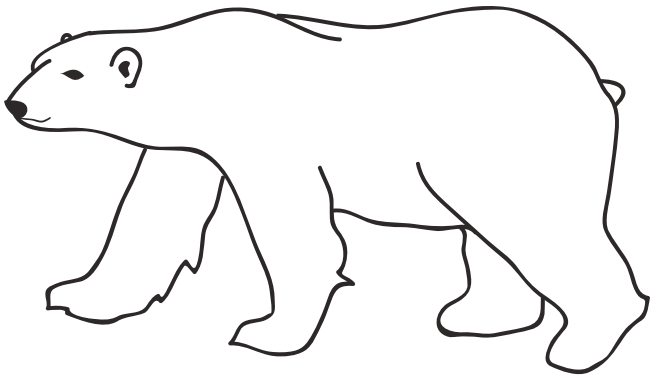
Use encyclopedias or the internet for more information. Check out this link to the ***Hinterland Who's Who*** *website and type in "polar bear" for some cool facts:* **hww.ca**

Name: _____

Fierce Hunter

Fabulous Fur

The Nose Knows



Powerful Paws

Super Swimmer

A Little Extra Padding

Name: _____

3. Polar Bears and Arctic Waters

Based on what you've learned, how do polar bears rely on these water and ice formations to survive?

Sea Ice:

Ice Floes:

Polynyas or open seawater:

Name: _____

Section B) Global Warming In The Arctic

1. *What is global warming?*

   Global warming is an increase in average global temperature. Scientists tracking our climate have noticed that the Earth has been getting progressively warmer in the last 100 years. In fact, overall, the world has warmed by over 0.5°C. This might not sound like much, but it's already having a dramatic effect on weather systems, habitats and water levels all over the world – rising sea levels, as polar ice melts, is a major issue for coastal people and systems.

   Near the North Pole, the average temperature is rising too. In fact, Canada's Arctic is, on average, warming at least twice as fast as anywhere else on the planet. Nearly one million square kilometres of sea ice have already disappeared. As a result of global warming in the Arctic, scientists predict that unless we quickly address the global warming problem, some polar bear populations may become endangered or extinct by 2050. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) lists polar bear populations in Canada as a species of 'Special Concern'. Most experts also believe the summer sea ice that Canadian polar bears rely on will completely vanish by 2050.

2. *Melting ice means less sea ice and fewer ice floes in the Canadian range of the polar bear. How do you think this might affect the hunting habits of the polar bear?*

Name: _____

3. Longer, warmer summers mean that some populations of polar bears stay on shore longer to scavenge for berries, small animals or whatever else they can find to eat. With their sharp noses, polar bears can smell human garbage from far away. What kinds of dangers do you think this poses for polar bears? What about humans?

_____

_____

_____

_____

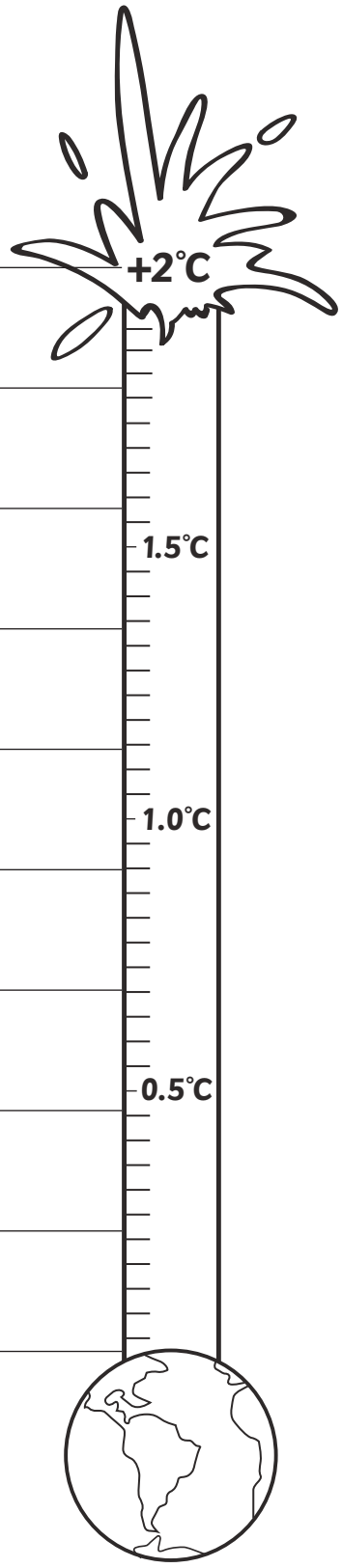
4. Will two degrees make a difference?

   Scientists predict that if the average global temperature rises by even 2°C, it would cause permanent and **catastrophic** damage to the planet.

   Learn how human activities are contributing to global warming ***here***.

Name: _____

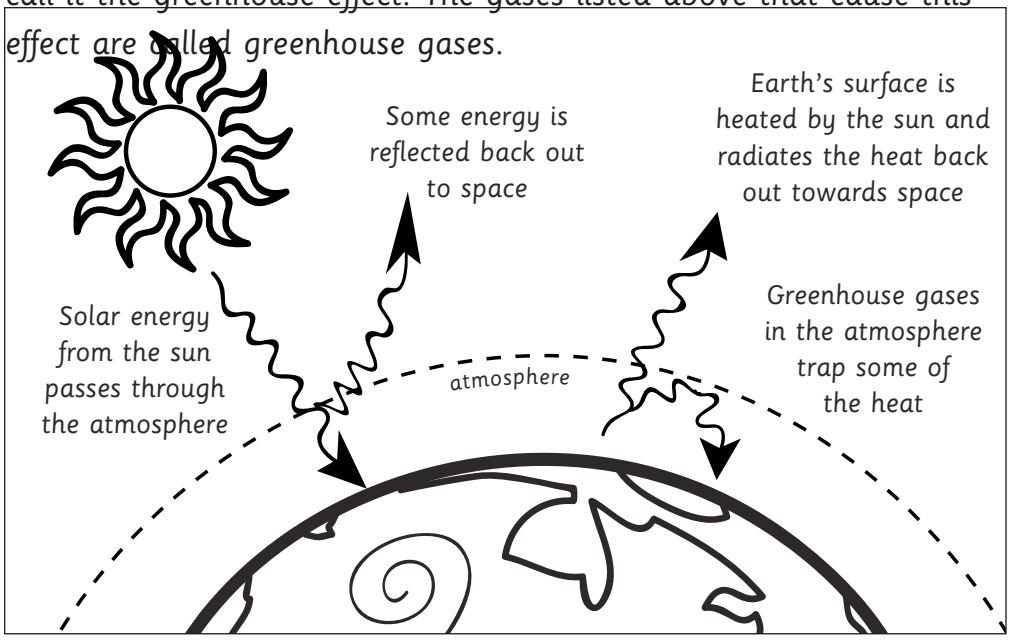
In the text boxes below, write 10 ways that our world will be different if the average global temperature rises by 2° C.



Name: _____

Section C) What's Causing Global Warming and What Can You Do To Help?

Heat-trapping gases in the Earth's atmosphere help maintain the Earth's average temperature of 15°C. These gases include methane, nitrous oxide, water vapour and carbon dioxide. They help warm the Earth by allowing the sun's energy to come into our atmosphere, and preventing some of the heat from escaping into space. This process is similar to the way glass in a greenhouse works, and so we call it the greenhouse effect. The gases listed above that cause this effect are called greenhouse gases.



The Greenhouse Effect. Adapted from the Government of Canada.

When humans burn fossil fuels like oil, natural gas and coal, we release large amounts of carbon dioxide into the atmosphere. This increases the greenhouse effect, trapping more heat in our atmosphere, which is causing a rise in the average global temperature, or global warming.

Name: _____

This change in temperature causes more extreme weather, rising sea levels, changes to climate patterns, droughts and floods.

1. Name five ways that we use fossil fuels, like oil, gas and coal everyday.

   i) _____

   ii) _____

   iii) _____

   iv) _____

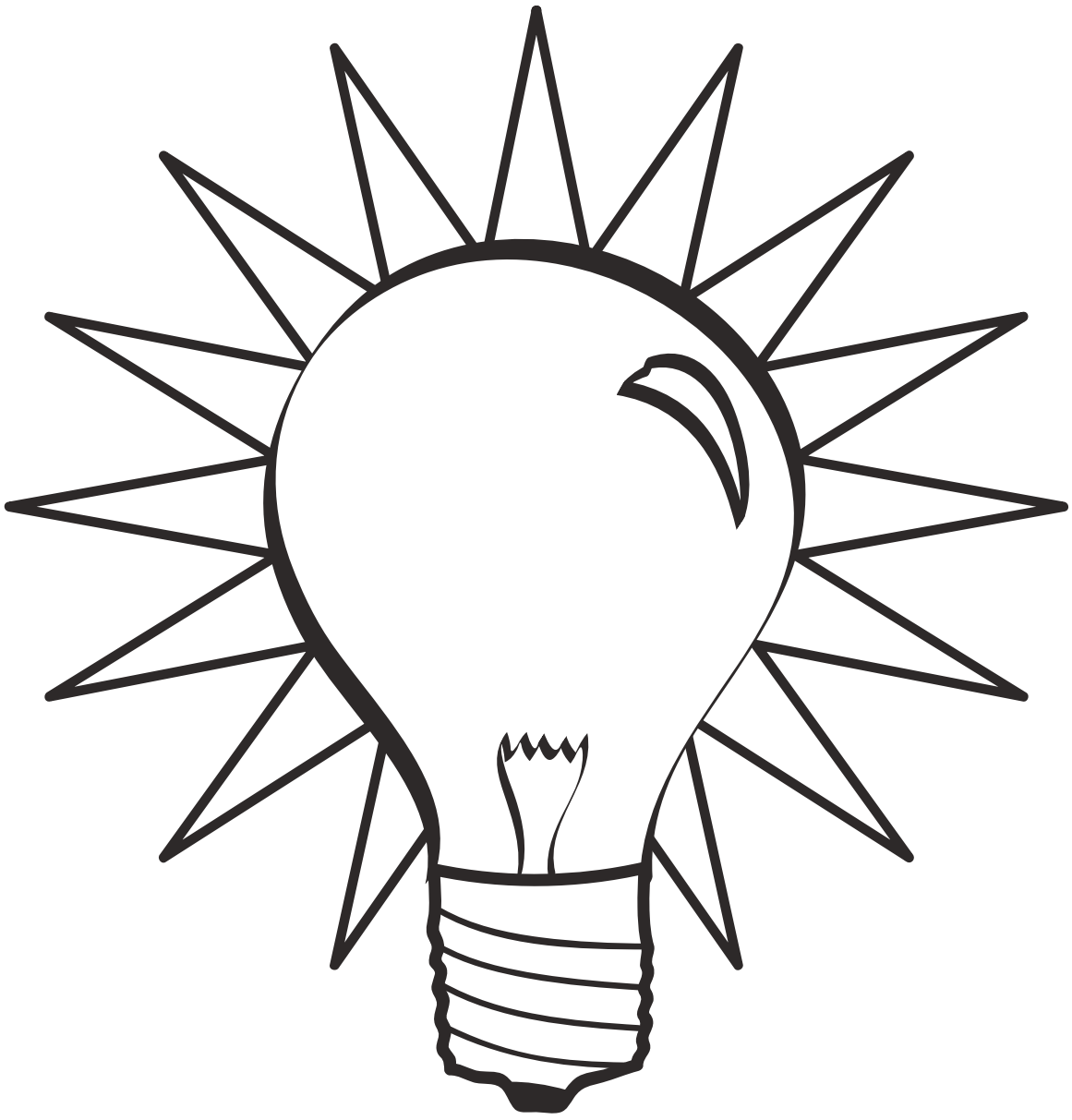
   v) _____

2. Using less energy in your home and at your school can help reduce the burning of fossil fuels and therefore reduce the buildup of greenhouse gases, particularly carbon dioxide, in the atmosphere. Colour in the light bulb on the following page, and write five ways that you can use less energy at home. Post the light bulb somewhere at home, like on the fridge, where it will remind you and your family to save energy.

3. In the next light bulb, write five ways you can use less energy at school. Post your light bulb somewhere in your classroom or school to remind you and your classmates about these energy-saving tips.

Name: _____

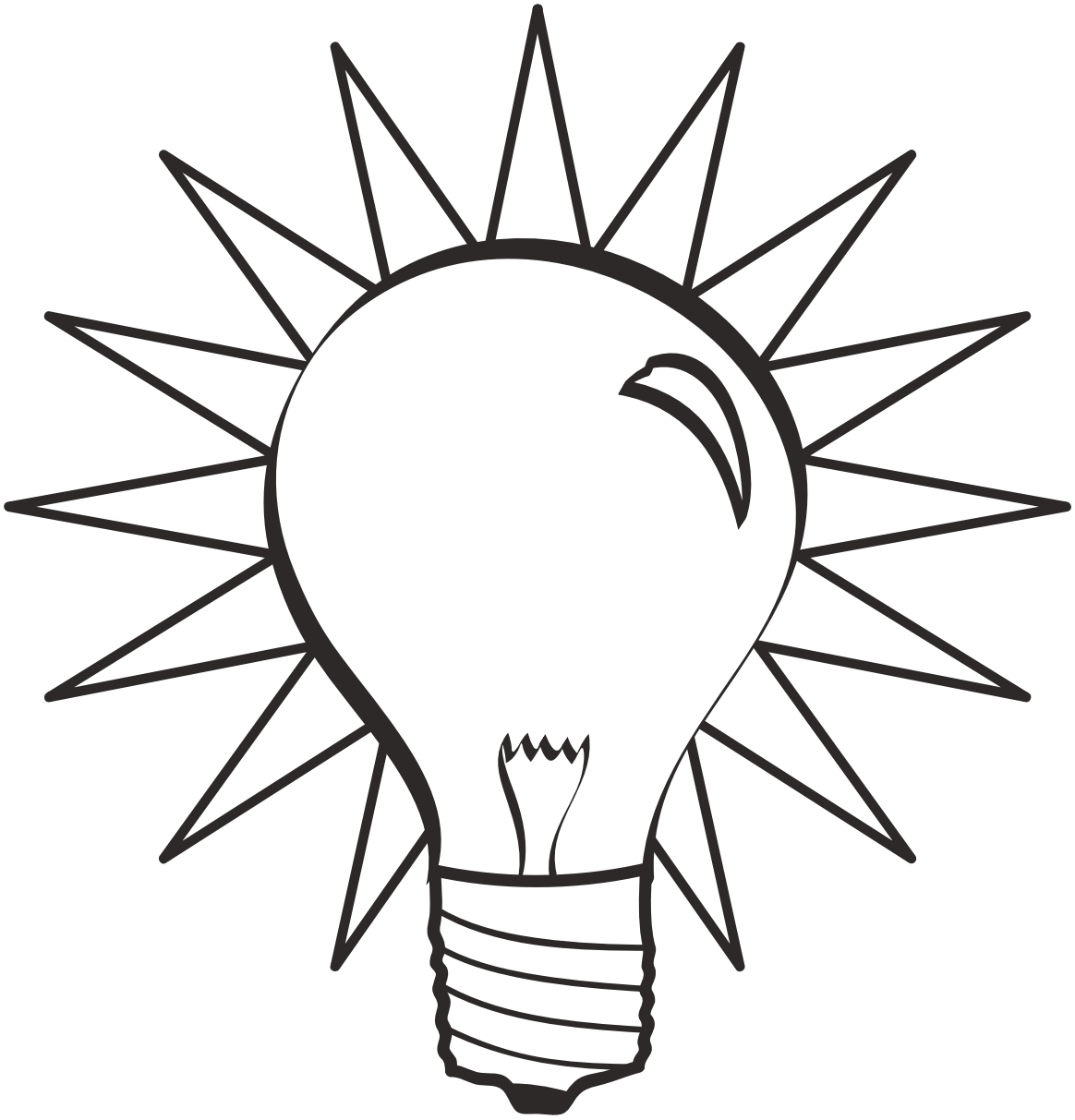
Five Bright Ideas For Saving Energy At Home!



Help Fight Global Warming!

Name: _____

Five Bright Ideas For Saving Energy At School!



Take Action Against Global Warming!

Name: _____

Section D) Go With The Floe! Game

A fun way to test what you've learned about polar bears and their Arctic habitat! Play with one or more classmates. You'll need one die, a penny, and paperclip or some other small item to use as a game piece.

Instructions:

- *Cut out the game cards on the following pages, shuffle them, and place them facedown in a pile within reach of all players.*
- *Each player places their game piece at the Start position on the game board.*
- *To determine who goes first, each player will roll the die. The player who rolls the highest number will start. The next to go will be the player to the left.*
- *The first player rolls the die and moves their game piece forward the number of spaces indicated on the die.*
- *The player to the right then picks a card from the top of the pile and reads the question or instruction on the card to the first player. The first player must then answer the question correctly to stay on that floe or follow the instruction on the card.*
- *If a question is answered incorrectly, the player must roll the die again, and move backward the number of spaces indicated on the die.*
- *Players take turns rolling and answering questions or following instructions until someone reaches the finish. Whoever reaches the finish first is the winner.*
- *You can always make up more questions! Using your research, try to come up with three more questions for the game. The more questions there are, the more fun and surprising it will be.*

Name: _____

Hours of waiting have paid off! You catch a juicy seal for dinner. **Advance two spaces.**	*Due to warming temperatures, you're too hot! Cool off in the icy water.* **Miss a turn.**
You had two healthy cubs this year! **Advance two spaces.**	*Your sharp nose smells a seal 10 km ahead of you.* **Advance three spaces.**
While scavenging for food, you stumbled into a town and scared the locals. **Run back to the start!**	*Use your powerful paws to* **swim ahead three spaces.**

Name: _____

You've been swimming all day but can't find an ice floe! **Go back four spaces.**	**Q:** What do polar bears like to eat best? **A:** Seals
A school down south is using less energy. Enjoy a nice cold day! **Move ahead one space.**	**Q:** What's an ice floe? **A:** A chunk of sea ice or frozen seawater floating in the ocean.
Q: Why do polar bears have such wide feet? **A:** Their feet are wide to distribute their weight across the ice, like snowshoes. Also, they act like paddles for swimming.	**Q:** About what percentage of the Earth's surface is made up of glaciers? **A:** About 10 percent

Name: _____

Q: What are areas of open water surrounded by ice called? **A:** Polynyas	**Q:** What's one way that polar bears have adapted to be such great swimmers? **A:** Long necks, partially webbed feet, blubber that helps them float, wide paws for paddling.
Q: By how many degrees has the Earth warmed in the last century? **A:** 0.5°C	**Q:** How do polar bears depend on sea ice in their habitat? **A:** They travel offshore on the sea ice for most of the year, hunting seals.
Q: Name a greenhouse gas that is causing global warming. **A:** Carbon dioxide, methane, nitrous oxide or water vapour	**Q:** Name three fossil fuels. **A:** Oil, natural gas and coal.

Name: _____

Q: *How is global warming affecting the polar bear's habitat?* **A:** *Rising global temperatures are melting the polar ice. With less sea ice polar bears have smaller hunting areas and must swim further between areas of sea ice. With less food, they have more difficulty storing enough energy to get them through the summer.*	**Q:** *How is polar bear fur specially adapted for cold climates?* **A:** *The hair shaft is hollow to trap warm air; the underfur helps insulate the bear.*

Name: _____


GO WITH THE FLOE
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X

Answers: Living With Water: Polar Bears

Section A) The Polar Bear's Arctic Habitat

2.

Fierce Hunter

Razor-sharp claws. Large canine teeth for tearing, cheek teeth that have jagged, grinding surfaces for chewing meat. When a seal comes up for air, the bear can kill it and flip it out of the water with one flick of its paw.

The Nose Knows

The polar bear's nose is so powerful it can smell a seal from many kilometres away. When they swim, their nostrils close to help them hold their breath, which they can do for over two minutes. Their nose is one area where loss of heat can occur due to lack of thick fur cover so they may cover it with a paw during extreme weather.

Super Swimmer

With its partially webbed feet, the polar bear is an excellent swimmer that has been spotted up to 160 km from any ice floes or coastlines. They have a nictitating membrane (second, clear eyelid) that covers their eyes while swimming. They can see under water up to 4.6 metres away. They also have longer necks than any other bear, an adaptation to help them swim better by making them more streamlined. They can dive to 4.5 metres.

Fabulous Fur

Polar bear fur appears to be white, but the outer hairs or guard hair are actually made up of clear, colourless, hollow tubes of air that trap heat to help insulate the bear. The dense short fur that touches the skin is called the underfur. Underfur helps insulate the animal overall – keeps heat in and cold out. The skin under the fur is actually black, which helps to further warm them by absorbing sunlight. In fact, because of these adaptations to the cold, polar bears are more likely to overheat, than to get too cold. The white appearance of their fur is also a great camouflage for hunting seals.

Powerful Paws

A polar bear's feet are huge and wide, like snowshoes. They spread weight out so a 400 kg bear can walk safely on ice that wouldn't hold a human. Even the bottoms of their feet are covered in fur, which keeps the paws warm, and muffles sound so they can sneak up on their prey. Small bumps and dimples on the soles of their feet act like suction cups that keep them from slipping. Their paws are tipped with razor-sharp claws.

A Little Extra Padding

A 5-10 cm layer of blubber helps insulate polar bears from the cold, and helps them float in the water. Blubber also acts as a nutritional reserve when food can't be found.

Answers: Living With Water: Polar Bears

(continued)

3. Sea Ice: Open

   - Polar bears hunt for seals on the sea ice for most of the year. Most stay on shore only during the summer months when most of the sea ice has melted.
   - They depend on the sea ice to find enough food to survive. With less sea ice because of global warming, they lose hunting grounds, have less to eat and lose weight.
   - As the sea ice thins and melts due to global warming, polar bears can become endangered, and possibly extinct.

   Ice Floes: Open

   - Polar bears swim between ice floes in search of seals.
   - If there aren't enough ice floes, or they are too far apart, some polar bears may drown especially in rough seas, while trying to swim between them.
   - Polar bears often travel many hundreds of kilometers to stay on the sea ice, in search of seals. Once the ice floes start to drift in the spring, bears must follow them. Any bears stranded on land have to wait until the fall to get back on the sea ice.

   Polynyas: Open

   - A polar bear will scan polynyas for seals in the water.

Section B) Global Warming In The Arctic

2. Open

   - Less hunting ground means less access to seals for food. Polar bears lose weight or starve.
   - Longer distances between ice floes mean polar bears must swim more. If they are too far away, bears get stranded and drown.
   - If sea ice melts too quickly and the floes drift too far too fast, polar bears can get stranded on land where they have to scavenge for food. They may even start visiting human communities to find garbage, which is dangerous for both the bears and humans.

Answers: Living With Water: Polar Bears

(continued)

3. Open:
    - When polar bears get too close to communities, it could increase the number of bear attacks on humans.
    - Hungry polar bears might/could attack humans for food.
    - This means that polar bears may have to be removed from communities, or shot if they pose a danger to humans.
    - Polar bears can also be contaminated by garbage because it is unhealthy for them.
4. Open:
    - Ice caps, glaciers and sea ice melt, raise water levels that can cause floods, particularly in coastal and low-lying areas.
    - Disruption of ocean currents can also cause droughts in forests and wetlands.
    - Heat waves can kill people.
    - Increased smog causes breathing problems, especially for people with respiratory illnesses.
    - Small islands and coastal communities could be submerged by rising sea levels.
    - Could cause extinction of over a million terrestrial species in the next fifty years.
    - Warmer ocean temperatures threaten coral reefs, and other marine species and habitats.
    - If fish in the ocean are affected, it would impact fisheries and those who rely on it for their livelihood. This would also affect humans who rely on fish as a food source.
    - In Canada, Arctic communities and species are already being affected by melting ice caps and the melting of Arctic permafrost.
    - Forests, and all forest-dwelling species could die out.
    - As fresh water levels decline, we lose small streams and wetlands. This results in poorer quality water and reduced amounts of water for drinking and clean hydroelectric power.
    - As temperatures increase, southern species are driven further north, shifting species ranges and upsetting the ecological balance.

- More extreme weather events (e.g. storms, hurricanes, tornadoes, etc.) and associated economic costs.
- Spread of disease-carrying organisms (e.g. mosquitoes and rodents).
- Change in amount and type of precipitation would affect the world's freshwater supply and would have an impact on agriculture.

Section C) What's Causing Global Warming and What Can You Do To Help?

1. Open, possible answers include:
   - To drive cars, buses.
   - To power planes, trucks, ships and trains.
   - To provide energy to heat and cool homes, schools, workplaces.
   - To provide energy for lights.
   - To provide energy for cooking and cooling our food.
   - To provide energy for electronic devices such TVs and computers.
   - To provide energy to heat water.
   - To power machines to manufacture products in factories.
2. Open, possible answers include:
   - Turn off the lights when you leave a room.
   - Run the dishwasher only when it's full.
   - Wash your clothes only when there is a full load and in cold water.
   - Hang your wet clothes to dry instead of using the dryer when possible.
   - Keep your showers short and switch to a low-flow showerhead.
   - Don't leave the refrigerator or freezer door open.
   - Don't leave computers or other electronics running when you're not using them.
   - Unplug phone, game, MP3 rechargers when you're not using them.
   - Unplug appliances when you're not using them or if they are not frequently used.
   - Turn down the heat in the winter and wear a sweater.
   - Turn off the heat during the days when nobody is home.

- Turn down the air conditioner in the summer or avoid using it if possible and use a fan instead.
- Install a programmable thermostat at home.
- Plug any drafts around windows and doors, and improve insulation around the home so heat isn't wasted in the winter.
- Change lights to energy efficient fluorescent bulbs.
- When buying new appliances, consider ones that are the most energy efficient.

3. Open, possible answers include:
   - Turn off the lights when nobody is using the classroom.
   - All electrical appliances, like computers, should be turned off when not in use.
   - Change lights to energy efficient fluorescent bulbs.
   - If a thermostat is present in the classroom, turn down the heat.
   - Do an energy audit of the school and devise a strategy to decrease and even eliminate energy waste.
   - Start an energy conservation campaign to inform and educate other students and teachers so they can begin saving energy, too.
   - Encourage teachers to have some of your classes outside in the summer.