

Climate Change

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Contact Karen with suggestions

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Includes answers

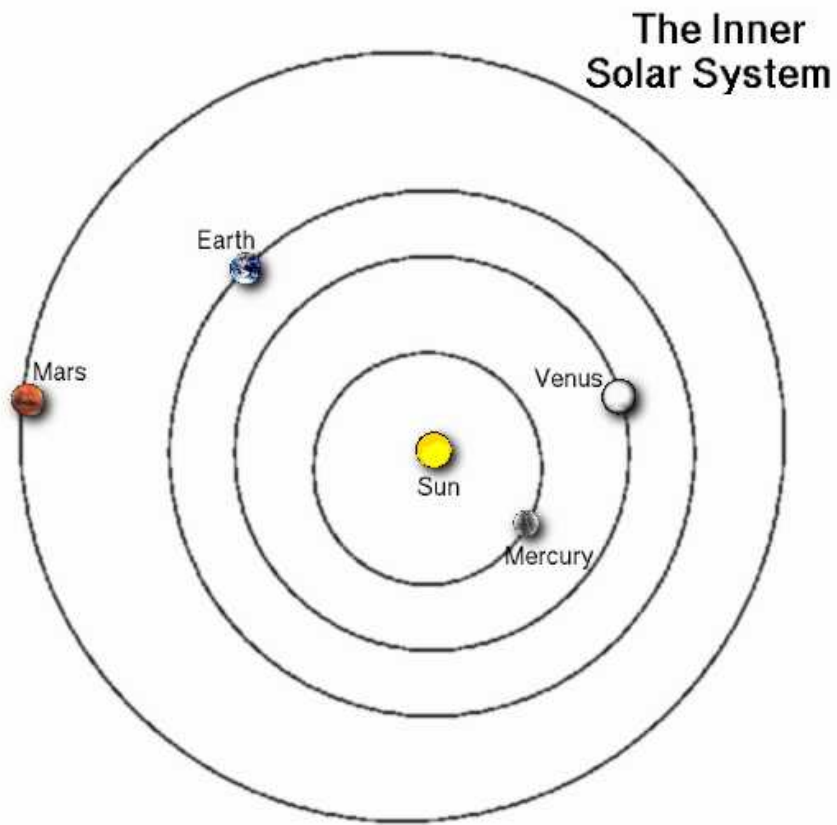
More ideas:

NASA

<http://climate.nasa.gov/kids/bigQuestions/greenhouseEffect/>

European Space Agency

<http://www.esa.int/esaKIDSen/Climatechange.html>

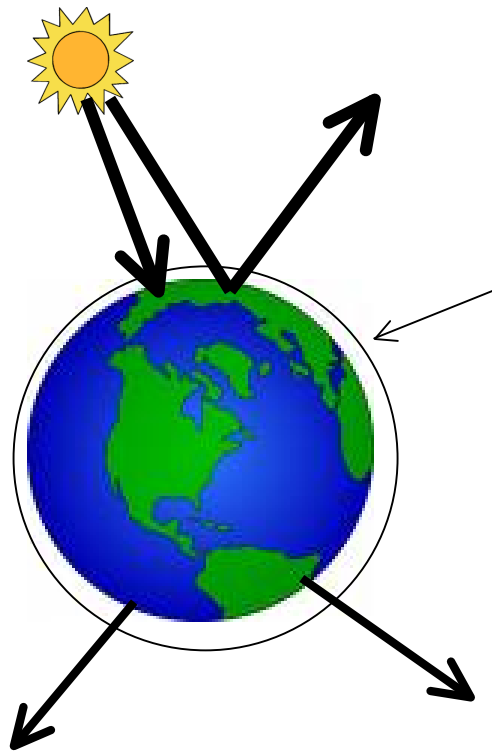


Because of the greenhouse effect, Venus is warmer than Mercury, even though it is further from the sun. Mercury has no atmosphere and no greenhouse effect. Earth is cooler than Venus and Mercury, but warmer than it would be without the greenhouse effect.

The Greenhouse Effect

A greenhouse is a building that holds in the heat. It warms plants and helps them grow. Our atmosphere does the same²⁵ thing. Water vapor and other greenhouse gases naturally in the atmosphere keep the atmosphere about 60°F warmer than it would be otherwise. This is called⁵⁰ the greenhouse effect. Earth would still be warm enough for life without these natural greenhouse gases, but animals and plants would be different, ones that⁷⁵ prefer a cooler climate.

Mercury is a planet with no atmosphere, and no greenhouse effect. Mercury is the closest planet to the sun, and so¹⁰⁰ very hot. Venus is further from the sun than Mercury. It has an atmosphere made of carbon dioxide, and is hot enough to melt lead¹²⁵. The greenhouse effect makes Venus much hotter than Mercury, rather than cooler.¹³⁷



We are changing the atmosphere by adding carbon dioxide and other greenhouse gases. The atmosphere looks thick here, but if the Earth were an apple, the atmosphere would look as thin as the peel.

Some sunlight is absorbed, and some sunlight reflects off the Earth. At night, heat energy is given off. Greenhouse gases trap some of the heat that would otherwise escape. We are adding greenhouse gases to the atmosphere, and now less heat is given off at night.

How the Earth Is Warming

The sun heats Earth, and makes life possible. The atmosphere helps hold in heat at night. Normally, some places on²⁵ Earth get warmer, some get cooler, but average temperature stays the same, and Earth radiates out as much heat as it absorbs from the sun.⁵⁰

Now, though, we are changing the atmosphere. We are adding carbon dioxide and other greenhouse gases. With these extra greenhouse gases, Earth holds in heat⁷⁵ more easily, and is getting warmer. Over the last 100 years, the temperature has gone up more than 1°F. This doesn't sound like much. After¹⁰⁰ all, temperature every day changes by much more than 1°F. Yet this small change in average temperature has begun to change climate zones. In many¹²⁵ places, the old climate zone will become a new, different one.¹³⁶



This Australian bird (Mallee Emuwren) is losing its habitat to drought. The same drought reduced Australian rice production by 98%. Scientists predict worse droughts in the future, in Australia and elsewhere. Droughts in California and Australia started in the late 1990s.

Changing Climate

Temperature increased more than 1°F over the last century, and is expected to go increase much more degrees this century. But more than²⁵ just the temperature is changing. Rainfall patterns have also changed. In the southwestern United States, a drought began in 1999. In the northeast more rain⁵⁰ is falling, and it is falling in bigger storms. Australia has had a long drought, and Australian farms grow less rice. Many people in Asia⁷⁵ depend on Australian rice, and some go hungry.

Plants and animals are on the move because of the changing climate. We know much about birds¹⁰⁰ because many dedicated birders worldwide write down where and when they see birds. Birders are now seeing birds much further from the equator in winter.¹²⁵ Sometimes birds move, but their food does not.¹³³



We burn fossil fuels, releasing carbon dioxide, when we fly or drive.

Fossil Fuels

The most important greenhouse gas is carbon dioxide. The most important source of carbon dioxide is fossil fuels. Fossil fuels were created when²⁵ the Earth was warm and covered with swamps. Dead plants and animals sank to the bottom of swamps and oceans. Over millions of years, these⁵⁰ fossils became coal, oil, and natural gas.

Electricity is made from coal and natural gas, as well as some sources that do not produce greenhouse⁷⁵ gases. Oil fuels our cars and airplanes. We use electricity made from fossil fuels, or fossil fuels directly, to heat our homes, and for cooking¹⁰⁰ and drying clothes.

The most important low-greenhouse gas sources for electricity are nuclear and hydroelectric (water) power. Wind power use is increasing. Solar power is¹²⁵ expected to become important, but not for a few years yet.¹³⁶



This light bulb saves money, even although it costs more, because it only uses one fourth as much electricity.

Reducing Fossil Fuel Use

To address climate change, we need to burn less fossil fuel. Much less! Part of the solution is technology change. For²⁵ example, we can use less coal and natural gas to make electricity, and use more of the low greenhouse gas sources. Another technology change is⁵⁰ to use cars, light bulbs, and televisions and other appliances that use less energy. Some will save money because they use so much less energy.⁷⁵

Another part of the solution is to make personal changes in how we live. We can drive and fly less, turn lights off in empty¹⁰⁰ rooms, and take shorter showers. Greenhouse gases are released when food is grown and transported, so we help when we buy only as much food¹²⁵ as we eat. What ways can you think of to reduce fossil fuel use?¹³⁹

The Greenhouse Effect

1. How does Earth's atmosphere act like a greenhouse?

- A. Both are places where plants and animals grow.
- B. Greenhouses cool off at night and heat up in the day.
- C. They both hold in heat and moisture.
- D. Greenhouses contain water and soil.

2. Compare the "greenhouse effect" on Earth and Venus.

Answer:

How The Earth Is Warming

1. What is the main reason for the recent warming of the Earth?

- A. We are adding warm carbon dioxide to the atmosphere.
- B. The inner core of the earth is radiating more heat.
- C. The Earth's atmosphere holds in more heat because of the added greenhouse gases.

D. The sun is getting warmer.

2. Are we seeing evidence that Earth is warming?

Answer:

Changing Climate

1. A temperature increase of one degree has changed

A. migration of birds

B. agriculture

C. patterns of rainfall

D. all of the above

2. Give examples of changes in Earth's climate.

Fossil Fuels

1. What are fossil fuels?

A. Fuels used to make nuclear power.

B. Coal, oil, and natural gas formed from dead plants and animals.

C. Fuels that release harmful gases.

D. An unlimited source of fuel on Earth.

2. Why has burning fossil fuels caused Earth to warm?

Reducing Fossil Fuel Use

1. Low-greenhouse gas electricity sources _____

A. are less popular than fossil fuels.

B. include water, nuclear, solar and wind.

C. are helping to heat up the Earth.

D. are lower in cost.

2. What are some ways we can reduce fossil fuel use?

Connect your ideas:

Give two examples of how a warming Earth affects people, or other animals and plants.

What are two things you could do to cut your use of fossil fuels?

Answers

The Greenhouse Effect

The side of Mercury facing the sun is warmer than Earth because it is closer to the sun, but that doesn't make it a greenhouse. It doesn't hold in heat well—the side facing away from the sun is very cold. But Venus is warmer than Mercury because its greenhouse gases hold in the heat so well. Earth is colder than Mercury, but Earth's atmosphere acts as a greenhouse. Mercury has no atmosphere and no greenhouse effect.

Here are the data for Venus and Mercury. AU is astronomical unit, with Earth 1 AU from the sun. So Venus is 72% as far from the sun as we are, and Mercury just over half as far as Venus. A really nice demonstration is to put your hand really close to a light bulb (incandescent or infrared, so it's hot) and then twice the distance, and get a sense how much more heat arrives at Venus than Mercury. Venus would be *much* cooler without the greenhouse effect.

Venus 0.723 AU - mean surface temperature $480^{\circ}\text{C} = 900^{\circ}\text{F} = 750\text{K}$

Mercury 0.387 AU Mean surface temperature: day $350^{\circ}\text{C} = 662^{\circ}\text{F} = 623\text{K}$

Mean surface temperature: night $-170^{\circ}\text{C} = -274^{\circ}\text{F} = 103\text{K}$

1 C

2 Both have a greenhouse effect but Venus' atmosphere is mostly carbon dioxide and it is too hot for life.

How The Earth Is Warming

1 C

2 Yes, the temperature has gone up 1°F .

Changing Climate

1 D

2 Rainfall patterns are changing with some areas getting more rain, and some less. Plants and animals have begun to move to climates more appropriate for them.

Fossil Fuels

1 B

2 Burning fossil fuels is the most important source of carbon dioxide, the most important greenhouse gas.

Reducing Fossil Fuel Use

Note: people often list recycling and not using hair spray as answers to climate change. Both are solutions to other problems (and the way hair spray is made was changed decades ago.) Showers are clearly not as important as flying and driving, but they do use a lot of hot water. Also, about 1/5 of California electricity is for pumping water.

1 B

2 We can live with less (behavior change) and we can do the same with better technology.