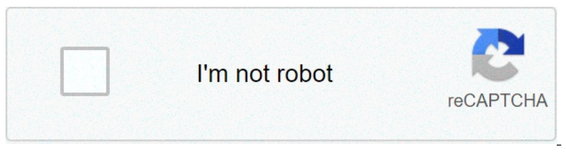

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Essay about global warming pdf

Global warming was once an uncommon term used by a few scientists who were growing concerned over the effects of decades of pollution on long-term weather patterns. Today, the idea of global warming is well known, if not well understood. It is not unusual to hear someone complaining about a hot day or a freak storm and remark, "It's global warming."Well, is it? In this article, we'll learn what global warming is, what causes it, what its current effects are and what the future effects could be. Although there has been a scientific consensus on global warming, some aren't sure it's something we need to worry about. We'll examine some proposed changes in the United States' national policies related to curbing global warming and the criticisms and concerns surrounding them.Global warming is a significant increase in the Earth's climatic temperature over a relatively short period of time as a result of the activities of humans.In specific terms, an increase of 1 or more degrees Celsius in a period of one hundred to two hundred years would be considered global warming. Over the course of a single century, an increase of even 0.4 degrees Celsius would be significant.To understand what this means, let's start by reviewing the difference between weather and climate. Basically, it all boils down to this: Don't use as much of the stuff that creates greenhouse gases. On a local level, you can help by using less energy. The electricity that operates many of the devices in our homes comes from a power plant, and most power plants burn fossil fuels to generate that power. Turn off lights when they're not in use. Take shorter showers to use less hot water. Use a fan instead of an air conditioner on a warm day.Here are some other specific ways you can help decrease greenhouse-gas emissions:Make sure your car is properly tuned up. This allows it to run more efficiently and generated fewer harmful gases.Walk or ride a bike when you can. Driving your car generates more greenhouse gases than almost anything else you do.Turn lights and other appliances off when you're not using them. Even though a light bulb doesn't generate greenhouse gas, the power plant that generates the electricity used by the light bulb probably does.Recycle. Garbage that doesn't get recycled ends up in a landfill, generating methane; plus, recycled goods require less energy to produce than products made from scratch.Plant trees and other plant life where you can. Plants take carbon dioxide out of the air and release oxygen.Don't burn garbage. This releases carbon dioxide and hydrocarbons into the atmosphere.Cars burn fossil fuel, so smaller, more fuel-efficient cars emit less CO 2, particularly hybrid cars. Walk or ride your bike if possible, or car pool on your way to work.To really stem the emission of greenhouse gases, we need to develop non-fossil fuel energy sources. Hydro-electric power, solar power, hydrogen engines and fuel cells could all create big cuts in greenhouse gases if they were to become more common.At the international level, the Kyoto treaty was written to reduce CO2 and other greenhouse gas emissions worldwide. Thirty-five industrialized nations have committed to reducing their output of those gases to varying degrees. Unfortunately, the United States, the world's primary producer of greenhouse gases, did not sign the treaty.For more information on global warming and related topics, check out How Global Warming Works.Here are some interesting links: While a few scientists disagree with the overall scientific consensus that human behavior is contributing to climate change, there's no disagreement over one fact: the Earth's mean surface temperature is rising. While some regions on Earth are experiencing a cooling trend, the overall average temperature has increased about 0.74 degrees Celsius since the 1800s [source: National Climatic Data Center]. Climatologists believe this trend will continue with potentially devastating consequences for us and the environment.So what can be done? Is there a way to reduce or even reverse the warming trend? Or can we only take measures to avoid making it worse?The news isn't all bad. There are some measures humans can take to slow, halt or perhaps even reverse the warming trend. These measures range from changing our behaviors and making some sacrifices to plans that seem to belong in the realm of science fiction.One way to affect global warming is to reduce greenhouse gas emissions. Greenhouse gases are important. Without them, the Earth would lose heat too quickly and life as we know it would be impossible to sustain. Greenhouse gases, which include water vapor and carbon dioxide, absorb heat in the lower atmosphere and reflect it back to the Earth. But according to the Intergovernmental Panel on Climate Change (IPCC), a consortium of more than 2,000 scientists, humans are increasing the greenhouse gas effect through carbon dioxide emissions from burning fossil fuels.Assuming that the IPCC's conclusions are accurate, reducing greenhouse gas emissions and planting trees could help slow and eventually reverse global warming trends. It takes time for the environment to absorb carbon dioxide. Right now, humans are producing carbon dioxide faster than the environment can absorb it. It doesn't help that humans are also clearing large regions of forests for various reasons -- that reduces the carbon-absorbing abilities of the environment, too.But even if we were to convince everyone to stop cutting down trees, start re-foresting the planet, switch to environmentally friendly fuels and energy production methods, and generally try to reduce greenhouse gas emissions, the Earth's temperature could continue to climb. It could take as long as 1,000 years after a complete halt of greenhouse gas emissions for environmental measures like sea level and ocean surface temperature to return to pre-industrial levels [source: NOAA]. In addition, other factors besides greenhouse gas emissions can contribute to global warming.There's no question that if warming continues, it'll cause big problems for us. Sea levels will rise as ice melts at the Arctic circle. Farmers will see reduced yields in crops as the temperature climbs. Certain regions will experience extreme weather events like heat waves more frequently. And it's possible that we'll see bigger hurricanes more often. But if the globe keeps warming even if we cut greenhouse gas emissions, what can we do?The first step might be finding a way to capture carbon from the atmosphere and recycle it ourselves, giving nature a boost. Global warming is an incontrovertible truth, even if climate change deniers persist. One of the most high-profile presidential candidates is actually repeatedly denying global warming (despite the sheer amount of emissions he must burn keeping his hair in check). And it's taken not one, but four studies to finally refute the myth that global warming had somehow "stopped" in the last decade. We're just not particularly willing to accept that the climate is changing — or that it may have something to do with human actions.The science behind global warming — that gas emissions on Earth cause a "blanket" in the atmosphere, enclosing the planet, raising its temperature and altering its climate patterns — is well known. But in the face of overwhelming images and statistics — like the emaciated polar bear that went viral this week, seemingly starved by the breakup of ice in its native Arctic by, you guessed it, warming temperatures — it can seem a bit hopeless.While on a personal level your contribution to lowering global warming is likely to be negligible (unless you happen to be Bill Gates or to own an enormous shipping fleet), there are still small changes to be made that aren't inconvenient and will ensure you're reducing your contribution as much as possible.The differences may be small, but they're worth making — and adding your voice to political causes to make our lives low-emission may have further impacts than you think. (Also, you'll get to feel really smug.)1. Make Your Household Energy EfficientGreenpeace has a host of global warming initiatives that you can do at home — and there's quite a lot you can try to reduce your household's energy consumption. Turning off appliances you're not using; getting energy efficient new appliances; making sure you're not lavishly heating or cooling a house unnecessarily; and insulating your house to eliminate the need for extra heating are all good steps to keep your footprint small.2. Get A Home Energy AuditEven if you just rent your house/apartment/share it with five roommates and somebody's kitten, it can be a good idea to ask your utility company for an energy audit. They're basically designed to show you how much energy all your stuff uses, which ones suck up the most, and how you could make things run more efficiently. You'll feel incredibly grown-up — and probably also a bit horrified when you figure out just how much energy your ancient refrigerator is chewing up per month. (Ask your utility if they have options for green energy in your area, too.)3. Buy Energy Efficient Light BulbsNext time a light blows — or when you next have the money to go on a blow-out shop (sorry for the pun) in the light bulb aisle — replace all the lights in your home with more energy efficient alternatives. They're called compact fluorescent bulbs, and while they'll cost more to purchase than ordinary light bulbs, they'll be far more energy efficient and can last up to 10 times longer. Plus, they'll lower your electricity bills while still producing your required amount of light.4. Eat Less (Or No) Meat And DairyOne of the interesting things about food emissions is that "eating locally" may not actually be the greenest way to be. Some small farms may actually be less energy efficient than big ones further away, and the road or air miles may not cancel out the difference.One element climate scientists do agree on, however, is that the beef industry in particular causes huge amounts of one particular greenhouse gas: methane. Even if you're a committed carnivore, it's good for your health not to overly rely on red meat and dairy in your diet — and good for the planet, too.Just look at the numbers: a staggering 87 percent of the land in America is used just to raise animals for food; it takes 2,500 gallons of water to produce a pound of meat but only 25 gallons to produce a pound of wheat; and the amount of fossil fuels it takes to produce just one hamburger could take a small car 20 miles.5. Travel More SustainablyIf you're going to go around the world, chances are you're going to be reliant on planes — but, unfortunately, they don't have the best reputation as a green mode of transport. The emissions created by air travel will probably be your most significant contribution to greenhouse gases in your lifetime (though, notably, The New York Times calculated that they total only five percent of all warming — another indicator that the individual is only a small part of this problem).If you can limit your air travel, do it — and don't just replace it with a car. Travel via public transport and over short distances wherever possible. If you have to fly, try to go during the daytime; night flights have a higher emission footprint.6. Wash Your Clothes In Cold WaterIf you get the right detergent, washes don't need to be hot — or even close to it. Hot water washes aren't technically required (and can ruin your clothes anyway), and the estimates on the emission benefits of switching to cold are pretty insane. The National Park Service has the statistics: switching to cold water for two loads a week cuts down your emissions by 550 pounds a year. (Obviously, it's also better to line-dry your clothes, rather than using all the energy up again on a dry cycle.)7. Pick Cars Based On Fuel EconomyOwning a car is, pretty obviously, one of the biggest emission-boosters in a person's life. But if you sincerely can't do what you need to do via public transport or bike, the Union Of Concerned Scientists, a nonprofit lobbying group concerned with global warming, recommends that you do some basic research under the hood of your next car. Fuel efficiency — the rate at which your car's engine consumes fuel — is not only a key component of its running cost, it's also a big indicator of its environmental footprint. The more efficient it is, the cheaper, and the greener.8. Sign PetitionsNot all "green" ideology is the same. Environmentalists disagree, for instance, on whether nuclear power is the future of clean energy, or whether geoengineering (deliberate fiddling with atmosphere chemical levels to lower global temperature) is a good idea.So before you start signing petitions, don't just seek out anything that says "lowering emissions" willy-nilly; do your research, look at the most recent science, assess the arguments for and against, and put your voice in the place where you really believe it can help. Change.org and your local government website will have lists of the petitions currently going.Images: Abigail Keenan/Unsplash, Giphy The globe is heating up. Both land and oceans are warmer now than they were when record keeping began, in 1880, and temperatures are still ticking upward. This rise in heat is global warming, in a nutshell.Here are the bare numbers, according to the National Oceanic and Atmospheric Administration (NOAA): Between 1880 and 1980, the global annual temperature increased at a rate of 0.13 degrees Fahrenheit (0.07 degrees Celsius) per decade, on average. Since 1981, the rate of increase has sped up, to 0.32 degrees F (0.18 degrees C) per decade. This has led to an overall 3.6 degrees F (2 degrees C) increase in global average temperature today compared to the preindustrial era. In 2019, the average global temperature over land and ocean was 1.75 degrees F (0.95 degrees C) above the 20th-century average. That made 2019 the second hottest year on record, trailing only 2016. This rise in heat is caused by humans. The burning of fossil fuels has released greenhouse gases into the atmosphere, which trap warmth from the sun and drive up surface and air temperatures. How the greenhouse effect plays a roleThe main driver of today's warming is the combustion of fossil fuels. These hydrocarbons heat up the planet via the greenhouse effect, which is caused by the interaction between Earth's atmosphere and incoming radiation from the sun. "The basic physics of the greenhouse effect were figured out more than a hundred years ago by a smart guy using only pencil and paper," Josef Werne, a professor of geology and environmental science at the University of Pittsburgh, told Live Science.That "smart guy" was Svante Arrhenius, a Swedish scientist and eventual Nobel Prize winner. Simply put, solar radiation hits Earth's surface and then bounces back toward the atmosphere as heat. Gases in the atmosphere trap this heat, preventing it from escaping into the void of space (good news for life on the planet). In a paper presented in 1895, Arrhenius figured out that greenhouse gases such as carbon dioxide could trap heat close to the Earth's surface, and that small changes in the amount of those gases could make a big difference in how much heat was trapped.Where the greenhouse gases come fromSince the beginning of the Industrial Revolution, humans have been rapidly changing the balance of gases in the atmosphere. Burning fossil fuels like coal and oil releases water vapor, carbon dioxide (CO2), methane (CH4), ozone and nitrous oxide (N2O), the primary greenhouse gases. Carbon dioxide is the most common greenhouse gas. Between about 800,000 years ago and the beginning of the Industrial Revolution, CO2's presence in the atmosphere amounted to about 280 parts per million (ppm, meaning there were about 208 molecules of CO2 in the air per every million air molecules). As of 2018 (the last year when full data are available), the average CO2 in the atmosphere was 407.4 ppm, according to the National Centers for Environmental Information. That may not sound like much, but according to the Scripps Institution of Oceanography, levels of CO2 haven't been that high since the Pliocene epoch, which occurred between 3 million and 5 million years ago. At that time, the Arctic was ice-free at least part of the year and significantly warmer than it is today, according to 2013 research published in the journal Science. In 2016, CO2 accounted for 81.6% of all U.S. greenhouse gas emissions, according to an analysis from the Environmental Protection Agency (EPA)."We know through high-accuracy instrumental measurements that there is an unprecedented increase in CO2 in the atmosphere. We know that CO2 absorbs infrared radiation [heat] and the global mean temperature is increasing," Keith Peterman, a professor of chemistry at York College of Pennsylvania, and his research partner, Gregory Foy, an associate professor of chemistry at York College of Pennsylvania, told Live Science in a joint email message.CO2 makes its way into the atmosphere through a variety of routes. Burning fossil fuels releases CO2 and is, by far, the biggest U.S. contribution to emissions that warm the globe. According to the 2018 EPA report, U.S. fossil fuel combustion, including electricity generation, released just over 5.8 billion tons (5.3 billion metric tons) of CO2 into the atmosphere in 2016. Other processes — such as nonenergy use of fuels, iron and steel production, cement production, and waste incineration — boost the total annual CO2 release in the U.S. to 7 billion tons (6.5 billion metric tons).Deforestation is also a large contributor to excess CO2 in the atmosphere. In fact, deforestation is the second largest anthropogenic (human-made) source of carbon dioxide, according to research published by Duke University. After trees die, they release the carbon they have stored during photosynthesis. According to the 2010 Global Forest Resources Assessment, deforestation releases nearly a billion tons of carbon into the atmosphere per year.

Globally, methane is the second most common greenhouse gas, but it is the most efficient at trapping heat. The EPA reports that methane is 25 times more efficient at trapping heat than carbon dioxide. In 2016, the gas accounted for about 10% of all U.S. greenhouse gas emissions, according to the EPA. Methane is the second most abundant greenhouse gas and the most persistent. Cattle constitute the largest single source of methane production. (Image credit: Shutterstock)Methane can come from many natural sources, but humans cause a large portion of methane emissions through mining, the use of natural gas, the mass raising of livestock and the use of landfills. Cattle constitute the largest single source of methane in the U.S., according to the EPA, with the animals producing nearly 26% of total methane emissions. There are some hopeful trends in the numbers for U.S. greenhouse gas emissions. According to the 2018 EPA report, these emissions rose 2.4% between 1990 and 2016 but declined by 1.9% between 2015 and 2016.Part of that decline was driven by a warm winter in 2016, which required less heating fuel than usual. But another significant reason for this recent decline is the replacement of coal with natural gas, according to the Center for Climate and Energy Solutions. The U.S. is also transitioning from a manufacturing-based economy to a less carbon-intensive service economy. Fuel-efficient vehicles and energy-efficiency standards for buildings have also improved emissions, according to the EPA.Effects of global warmingGlobal warming doesn't just mean warming, which is why "climate change" has become the favored term among researchers and policymakers. While the globe is becoming hotter on average, this temperature increase can have paradoxical effects, such as more frequent and severe snowstorms. Climate change can and will affect the globe in several big ways: by melting ice, by drying out already-arid areas, by causing weather extremes and by disrupting the delicate balance of the oceans.Melting icePerhaps the most visible effect of climate change so far is the melting of glaciers and sea ice. The ice sheets have been retreating since the end of the last ice age, about 11,700 years ago, but the last century's warming has hastened their demise. A 2016 study found that there is a 99% chance that global warming has caused the recent retreat of glaciers; in fact, the research showed, these rivers of ice retreated 10 to 15 times the distance they would have if the climate had stayed stable. Glacier National Park in Montana had 150 glaciers in the late 1800s. Today, it has 26. The loss of glaciers can cause the loss of human life, when icy dams holding back glacier lakes destabilize and burst or when avalanches caused by unstable ice bury villages.At the North Pole, warming is proceeding twice as quickly as it is at middle latitudes, and the sea ice is showing the strain. Fall and winter ice in the Arctic hit record lows in both 2015 and 2016, meaning the ice expanse did not cover as much of the open sea as previously observed. According to NASA, the 13 smallest values for maximum winter extent of sea ice in the Arctic were all measured in the last 13 years. The ice also forms later in the season and melts more readily in spring. According to the National Snow and Ice Data Center, January sea ice extent has declined 3.15% per decade over the past 40 years. Some scientists think the Arctic Ocean will see ice-free summers within 20 or 30 years.In the Antarctic, the picture has been a little less clear. The Western Antarctic Peninsula is warming faster than anywhere else besides some parts of the Arctic, according to the Antarctic and Southern Ocean Coalition. The peninsula is where the Larsen C ice shelf just broke in July 2017, spawning an iceberg the size of Delaware. Now, scientists say that a quarter of West Antarctica's ice is in danger of collapse and the enormous Thwaites and Pine Island glaciers are flowing five times faster than they did in 1992.The sea ice off Antarctica is extremely variable, though, and some areas have actually hit record highs in recent years. However, those records could bear the fingerprints of climate change, as they may result from land-based ice moving out to sea as the glaciers melt or from warming-related changes to wind. In 2017, though, this pattern of record-high ice abruptly reversed, with the occurrence of a record low. On March 3, 2017, Antarctic sea ice was measured at an extent of 71,000 square miles (184,000 square kilometers) less than the previous low, from 1997. Heating upGlobal warming will change things between the poles, too. Many already-dry areas are expected to get even drier as the world warms. The southwest and central plains of the United States, for example, are expected to experience decades-long "megadroughts" harsher than anything else in human memory."The future of drought in western North America is likely to be worse than anybody has experienced in the history of the United States," Benjamin Cook, a climate scientist at NASA's Goddard Institute for Space Studies in New York City who published research in 2015 projecting these droughts, told Live Science. "These are droughts that are so far beyond our contemporary experience that they are almost impossible to even think about."The study predicted an 85% chance of droughts lasting at least 35 years in the region by 2100. The main driver, the researchers found, is the increasing evaporation of water from hotter and hotter soil. Much of the precipitation that does fall in these arid regions will be lost.Meanwhile, 2014 research found that many areas will likely see less rainfall as the climate warms. Subtropical regions, including the Mediterranean, the Amazon, Central America and Indonesia, will likely be hardest hit, that study found, while South Africa, Mexico, western Australia and California will also dry out.Extreme weatherAnother impact of global warming: extreme weather. Hurricanes and typhoons are expected to become more intense as the planet warms. Hotter oceans evaporate more moisture, which is the engine that drives these storms. The U.N Intergovernmental Panel on Climate Change (IPCC) predicts that even if the world diversifies its energy sources and transitions to a less fossil-fuel-intensive economy (known as the A1B scenario), tropical cyclones are likely to be up to 11% more intense on average. That means more wind and water damage on vulnerable coastlines.Paradoxically, climate change may also cause more frequent extreme snowstorms. According to the National Centers for Environmental Information, extreme snowstorms in the eastern United States have become twice as common as they were in the early 1900s. Here again, this change comes because warming ocean temperatures lead to increased evaporation of moisture into the atmosphere. This moisture powers storms that hit the continental United States.Ocean disruptionSome of the most immediate impacts of global warming are beneath the waves. Oceans act as carbon sinks, which means they absorb dissolved carbon dioxide. That's not a bad thing for the atmosphere, but it isn't great for the marine ecosystem. When carbon dioxide reacts with seawater, the pH of the water declines (that is, it becomes more acidic), a process known as ocean acidification. This increased acidity eats away at the calcium carbonate shells and skeletons that many ocean organisms depend on for survival. These creatures include shellfish, pteropods and corals, according to NOAA.Corals, in particular, are the canary in a coal mine for climate change in the oceans. Marine scientists have observed alarming levels of coral bleaching, events in which coral expel the symbiotic algae that provide the coral with nutrients and give them their vivid colors. Bleaching occurs when corals are stressed, and stressors can include high temperatures. In 2016 and 2017, Australia's Great Barrier Reef experienced back-to-back bleaching events. Coral can survive bleaching, but repeated bleaching events make survival less and less likely.One of the most visible effects of global warming is the prevalence of coral bleaching. (Image credit: Shutterstock)There wasn't a climate hiatusDespite overwhelming scientific consensus about the causes and reality of global warming, the issue is contentious politically. For instance, deniers of climate change have argued that warming slowed between 1998 and 2012, a phenomenon known as the "climate change hiatus."Unfortunately for the planet, the hiatus never happened. Two studies, one published in the journal Science in 2015 and one published in 2017 in the journal Science Advances, reanalyzed the ocean temperature data that showed the warming slowdown and found that it was a mere measurement error. Between the 1950s and 1990s, most measurements of ocean temperature were taken aboard research boats. Water would be pumped into pipes through the engine room, which ended up heating the water slightly. After the 1990s, scientists began using ocean buoy-based systems, which were more accurate, to measure ocean temperatures. The problem came because no one corrected for the change in measurements between boats and buoys. Making those corrections showed that the oceans warmed 0.22 degrees F (0.12 degrees C) on average per decade since 2000, almost twice as fast as earlier estimates of 0.12 degrees F (0.07 degrees C) per decade.Global warming fast factsAccording to NASA:Carbon dioxide levels in the atmosphere are 412 ppm in 2020, their highest levels in 650,000 years.Average global temperature is up 1.9 degrees F (3.4 degrees C) since 1880.The minimum expanse of Arctic summer sea ice has declined 12.85% per decade since satellite measurements began, in 1979.Land ice has declined at the poles by 413 gigatons a year since 2002.Global sea level has risen 7 inches (176 millimeters) in the past century.Additional resources: