

Climate Change: Background Concepts Needed

What do students need in order to understand the causes and consequences of climate change? What will it take to motivate a student to change their behavior? How is climate change connected to other global life threatening scenarios?

- 1) background information in physics, chemistry, earth science, biology, and human history
- 2) current events in physical world, world politics, populations, and economies
- 3) personal actions - how can this help? impact on community and culture
- 4) community actions - communal will, culture, laws, enforcement, communications,
- 5) interactions, relationships, causes, consequences, and results of world events - global system science - how each event adds to the mix

Major global threats to all life on earth that are human caused:

- Climate Change (aka Global Warming)
- Ocean Acidification
- Ocean Current Changes due to Arctic Ice Cap melting (Is "Day after Tomorrow" possible?).
- Collapse of ocean food web due to overfishing and waste toxicities (pesticides, fertilizers, plastics)
- Ozone Hole and increased UV light penetration due to halogen chemistry

List of Concepts Connected to Climate Change

Physics/Astronomy

Light Energy - light from the sun, heat loss from the earth, electromagnetic waves

Sun Energy - output, cycles, nuclear chemistry, UV and Visible light, solar wind

Energy and Heat - basic physics, potential energy, kinetic energy, heat energy, Joules, production of electricity at power plants, energy use in buildings, conservation of energy (and water and minerals), insulation, thermal blankets, green construction

Energy Balance on Earth - Input = Output, UV and VIS in and IR out, albedo, tipping points, out of balance

Modeling - Input-Output scenarios, do we trust the climate modelers?

Alternative Energy Sources - wind (sun), tides (sun and moon), gravity (water flowing downhill), geothermal, photovoltaic (sun), nuclear (degradation, fusion)

Climate Change Evidence - changes in radiation/heat balance (note: several video and slide shows on web: see slideshare.com, youtube.com, climate.nasa.gov and many other sites)

Universe - longer time frame and larger size than our Solar System

Solar System - why is the 3rd rock from the sun perfect for life? what are the key elements to form a life sustaining planet?

Chemistry

Acids and bases, solutions, chemical reactions, bonds, polymers, chlorine properties, chemical degradation, toxicity, smog chemistry, ocean water chemistry

Gas Laws - pressure, volume, number of molecules, temperature interactions, La Chatlier's Principal

Earth science

Climate Change Evidence - ocean temperature increase, ocean acidification, glacier melts, extremes in weather patterns, rising oceans, rise in atmospheric CO₂.

Geologic Time - physical evolution of the Earth, Natural Disasters, and Major Extinction Events

Circulation of Water and Air - global currents, movement of energy and heat, thermal blankets

Climate - long term averages, large movements of air and water masses, reasons for the seasons

Weather - local conditions change on a daily basis and depends on location and general climate

Connections between global threats - Space Ship Earth, additive impacts, global system science

Fossil Fuels - reservoirs, chemistry, mining and distribution, economies, energy uses, chemical uses

Biogeochemical Cycles - water, carbon, nitrogen

Geography - both land and ocean plates, movement of humans over time,

Global System Sciences - Natural Resources, movement of air and water, global carbon cycle, human history and current populations, geography, modeling

Oceans Are The Largest Reservoir Of Human Waste Streams - erosion, watersheds, pesticides, fertilizers, plastics, human waste, dead zones, Plastic Vortex in every ocean, coral reef degeneration

Biology

Gaia Hypothesis - microbes and small organisms working in mass to control the atmospheric composition

Climate Change Evidence - collapse of ocean food web

Climate Change Impacts - changes in agricultural practices and food/fiber production, shifting migrations, loss of habitat, species evolution

Social Science

Human Population - history, size, locations, impact on environment, current trends, use/overuse of natural resources, past collapses of civilizations (good reference: Jared Smith's "Collapse")

Human Story - social evolution, causes of wars, influence of technology, meaning of community, collapse of past cultures, industrial revolution, age of information, (good reference: Jared Smith's "Guns, Germs, and Steel" and "Collapse")

Politics: local, state, national and world - how do we work together to agree on acceptable common behaviors, how do we keep a world society together, International Laws,

World Economy - poverty creates environmental disasters, greed creates environmental disasters, World Bank, United Nations, responses to large scale natural disasters, dependence on fossil fuels, distribution of natural resources, distribution of waste, supply and demand,

Consumerism - basic life needs, global distribution of goods and services, what if we continue with the economic growth model for business as usual (web animation Story of Stuff, National Geographic's Human Footprint video, Food Inc. video,)

Ethics, Morals, Behavior, Common Good - how to build a community in agreement that is sustainable?

Psychology/Sociology/Philosophy - how do each of us make decisions?
Know the process and dynamics of teamwork and community.

Marketing - how do we do the PR to change human culture on large scales?

Sustainability - what does it look like? how do we get there? Plan B 4.0!

Plan B 4.0 - Is this a practical solution? Is this the best plan? Who is going to continue this work? What is our next step? Is there still time?

