

Possible Exam Questions for Other Topics in Chemistry 10

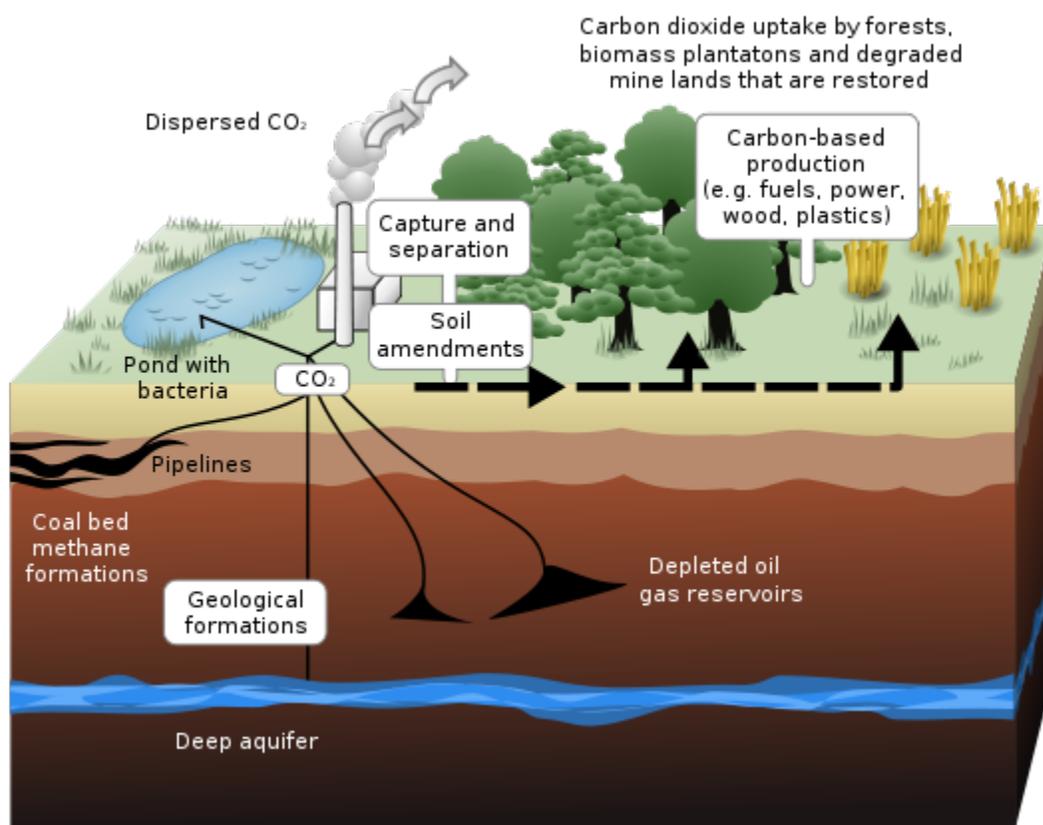
Climate Change (first exam)

1. Convert between the following terms and definitions

Anthracite = the highest rank of coal...harder, glossy black coal used primarily for residential and commercial space heating.

Bituminous coal = a dense sedimentary rock, usually black but sometimes dark brown often with well-defined bands of bright and dull material, used primarily as fuel in steam-electric power generation, with substantial quantities used for heat and power applications in manufacturing.

Carbon capture and storage (CCS), (carbon capture and sequestration) = technology attempting to prevent the release of large quantities of CO₂ into the atmosphere from fossil fuel use in power generation and other industries by capturing CO₂, transporting it and ultimately, pumping it into underground geologic formations to securely store it away from the atmosphere. It is a potential means of mitigating the contribution of fossil fuel emissions to global warming.



Climate = the statistics of temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric particle count and other meteorological elemental measurements in a given region over long periods. Climate can be contrasted to weather, which is the present condition of these elements and their variations over shorter periods.

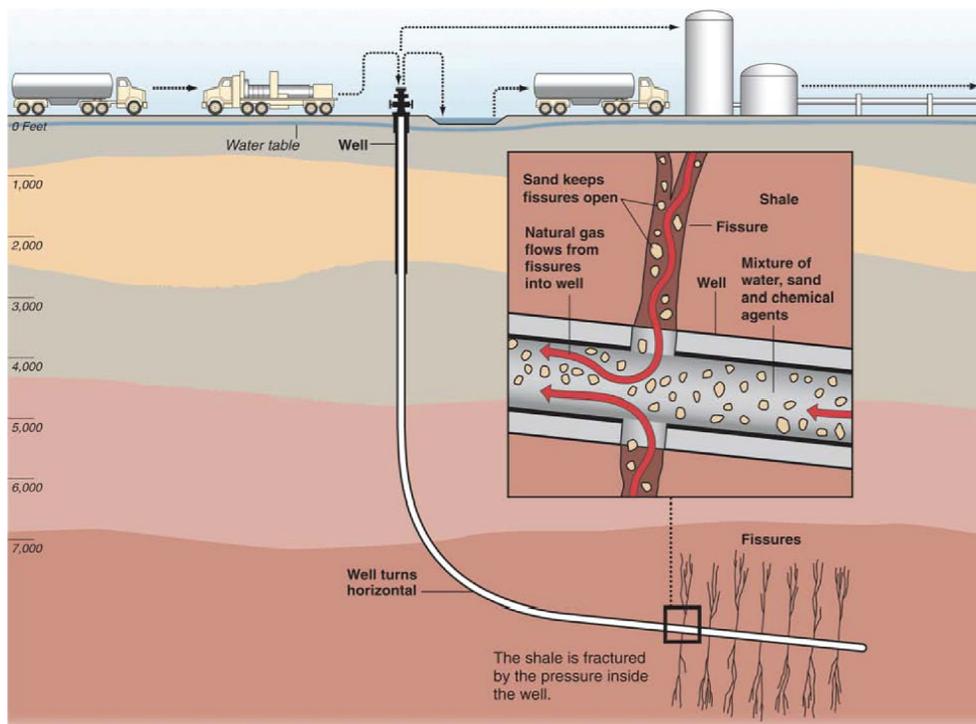
Global-warming potential (GWP) = a relative measure of how much heat a greenhouse gas traps in the atmosphere. It compares the amount of heat trapped by a certain mass of the gas in question to the amount of heat trapped by a similar mass of carbon dioxide. A GWP is calculated over a specific time interval, commonly 20, 100 or 500 years. GWP is expressed as a factor of carbon dioxide (whose GWP is standardized to 1). For example, the 20 year GWP of methane is 72, which means that if the same mass of methane and carbon dioxide were introduced into the atmosphere, that methane will trap 72 times more heat than the carbon dioxide over the next 20 years.

Greenhouse effect = a process by which thermal radiation from a planetary surface is absorbed by atmospheric greenhouse gases, and is re-radiated in all directions. Since part of this re-radiation is back towards the surface and the lower atmosphere, it results in an elevation of the average surface temperature above what it would be in the absence of the gases.

Greenhouse gas (sometimes abbreviated **GHG**) = a gas in an atmosphere that absorbs and emits radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. The primary greenhouse gases in the Earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide, and ozone.

Heavy crude oil or extra heavy crude oil = any type of crude oil which does not flow easily. It is referred to as "heavy" because its density is higher than that of light crude oil.

Hydraulic fracturing = the propagation of fractures in a rock layer caused by the presence of a pressurized fluid. Some hydraulic fractures form naturally, as in the case of veins or dikes, and are a means by which gas and petroleum from source rocks may migrate to reservoir rocks. **Induced hydraulic fracturing** or **hydrofracking**, commonly known as **fracking**, is a technique used to release petroleum, natural gas, or other substances for extraction. This type of fracturing creates fractures from a wellbore drilled into reservoir rock formations.



Light crude oil = liquid petroleum that has a low density and flows freely at room temperature due to the presence of a high proportion of low molecular mass hydrocarbons

Lignite (brown coal) = the lowest rank of coal and used almost exclusively as fuel for electric power generation.

Oil sands, tar sands (bituminous sands) = a type of unconventional petroleum deposit. The oil sands are loose sand or partially consolidated sandstone containing naturally occurring mixtures of sand, clay, and water, saturated with a dense and extremely viscous form of petroleum technically referred to as bitumen.

Peat = partially decayed vegetation...a precursor of coal.

Petroleum or crude oil = a naturally occurring flammable liquid consisting of a complex mixture of hydrocarbons and other liquid organic compounds, that are found in geologic formations beneath the Earth's surface. A fossil fuel, it is formed when large quantities of dead organisms, usually zooplankton and algae, are buried underneath sedimentary rock and undergo intense heat and pressure.

Photovoltaic systems (PV system) = systems that use solar panels to convert sunlight into electricity.

Thermal power plant = a power plant in which water is heated and turned into steam, which expands and spins a steam turbine which drives an electrical generator. After it passes through the turbine, the steam is cooled, condensed back to a liquid, and recycled to where it was heated.

Unconventional oil = According to the EIA definition, conventional crude oil and natural gas production refers to oil and gas “produced by a well drilled into a geologic formation in which the reservoir and fluid characteristics permit the oil and natural gas to readily flow to the wellbore”. By converse unconventional hydrocarbon production doesn't meet these criteria, either because geological formations present a very low level of porosity and permeability, or because the fluids have a density approaching or even exceeding that of water, so that they cannot be produced, transported, and refined by conventional methods.

Weather = the present condition of temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric particle count and other meteorological elemental measurements and their variations over shorter periods.

2. Describe how petroleum, natural gas, and coal are formed.
3. Explain how hydraulic fracturing (fracking) allows oil companies to extract greater quantities of natural gas.
4. Describe the difference between climate and weather.
5. Describe the factors that determine Earth's energy balance, and describe the factors that could affect this balance.
6. Describe the factors that could change Earth's energy balance and increase Earth's temperature.
7. Explain why we should care about climate change.
8. Describe how the greenhouse effect traps energy radiated from the Earth's surface.
9. List the four most important greenhouse gases.
10. Explain how greenhouse gases trap infrared radiation that would otherwise escape.

11. Explain how global warming potential (GWP) describes the relative effects of greenhouse gases on global warming, and list the relative GWPs of carbon dioxide, methane, nitrous oxide, CFC-12, and HCFC-22.
 12. Describe the atmospheric concentration trends for the greenhouse gases of carbon dioxide, methane, nitrous oxide, and CFCs.
 13. Describe the role of humans in the increased concentration of CO₂ in the atmosphere.
 14. List at least four biogenic sources and four non-biogenic sources of methane in the atmosphere.
 15. Describe the role of humans in the release of N₂O into the atmosphere.
 16. Describe the projected impacts of climate change.
 17. Describe the International Energy Agency (IEA) and describe their objectives.
 18. Describe the 2 °C Scenario (2DS), and describe how, according to the IEA's ETS 2012 document, we are doing in our attempts to meet the 2DS goals.
 19. Describe how carbon capture and storage (CCS) can decrease the amount of CO₂ released into the atmosphere.
 20. Describe the recent heat and temperature changes in the ocean.
 21. Describe the ocean's effect on CO₂ in the atmosphere, describe the changes in pH and carbonate ion concentration associated with the solution of CO₂ in the ocean, and explain why these changes can be significant.
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Acid Rain (second exam)

1. Define acid rain.

Acid rain = a rain or any other form of precipitation that is unusually acidic, meaning that it possesses elevated levels of hydrogen ions (low pH). It can have harmful effects on plants, aquatic animals, and infrastructure. Acid rain is caused by emissions of sulfur dioxide and nitrogen oxides, which react with the water molecules in the atmosphere to produce acids.

2. Explain why increased carbon dioxide concentrations in the air lead to increased concentrations of CO_2 in the water.
3. Explain why increased CO_2 concentration in water leads to decreased pH.
4. Describe the three forms of acid deposition that lead to acids moving from the atmosphere to the surface of the Earth.
5. Explain why sulfuric acid and nitric acid have a greater effect on the pH of rain and snow than other acids such as carbonic acid, formic acid, and acetic acid.
6. List the most important anthropomorphic and natural sources of sulfur dioxide, SO_2 .
7. Explain how the sulfur dioxide released in a coal-fired power plant in the U.S. can decrease the pH of a lake in Canada.
8. Explain why the pH of rainfall in 1999 was lower in the Northeastern U.S. than in the Western U.S.
9. List the most important anthropomorphic and natural sources of nitrogen oxides.
10. Describe how nitrogen oxides form HNO_3 in the atmosphere.
11. Describe the impact on acid rain on Freshwater ecosystems, forests, agriculture, human health, and buildings and property.
12. Describe the ways that the effects of acid rain can be mitigated.