POGIL 3.2.1 Energy resources* – *Impacts of a carbon based energy system

Review _____

***Read Chapter 3.2.1f the E-text and then complete this part of the POGIL worksheet.*

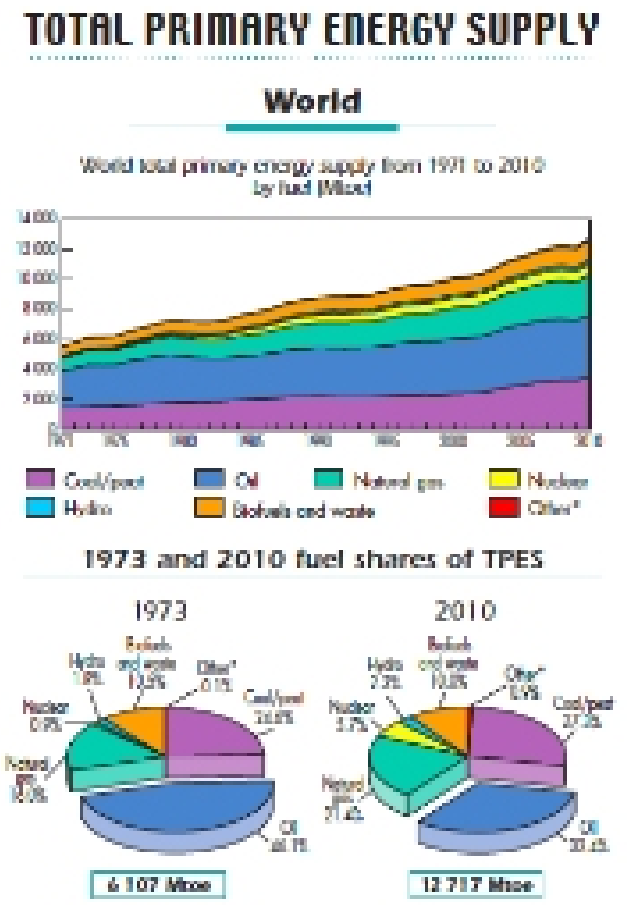
**Please fill out worksheet in a different font or text color (green or blue) so it is easy to distinguish your answer from the questions.

EQ1. How much has global energy supply increased between 1973 and 2010?

From 6107 Mtoe up to 12717 Mtoe: doubled!

EQ2. What percentage of 1973 global supply is served by carbon based fuels?

16% (nat. gas) + 24.6% (Coal/peat) + 10.5% (biofuels)+ 46.1% (oil)=97.2 % from carbon based fuels



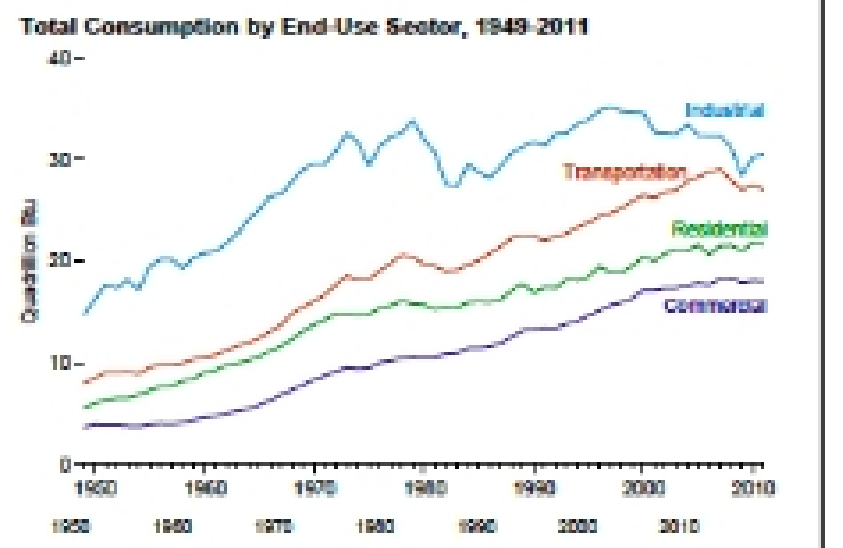
EQ3. What percentage of 2010 global supply is served by carbon based fuels?

21.4%+10%+27.3%+32.4%=91.1% from carbon based fuels

EQ4. Which non-carbon energy sources have increased in use globally between 1973 and 2010? What percentage of the total primary energy supply does each of these sources provide as of 2010?

hydro increased from 1.8% to 2.3%, Nuclear increased from .9% to 5.7%, and other (solar/wind etc) increased from .1% to .9%

The graphs below refer to the United States



EQ5. The United States has until recently been the largest consumer of power in the world. What sector increased in consumption the most between 1950 and 2010?

Transportation

IQ6. Why do you think consumption leveled off a bit since 2007-2008?

Prices of fuels

IQ7. Which of these sectors directly use petroleum (that you know with good confidence)?

Transportation. Directly use gasoline in cars.

AQ8. While thinking about your answer to Q7, look at the bar graph to the right. What do you think is the difference between primary consumption and total consumption?

Primary is the direct use of the fuel for this sector, total includes the indirect use of petroleum in that sector (such as using oil to generate electricity that is used in that sector)

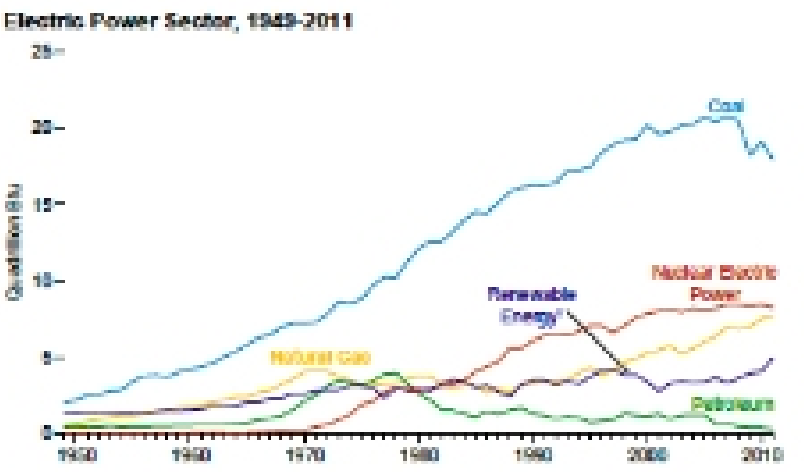
EQ9. Between 1950 and 2010, which sector of power generation increased the most?
Coal!

EQ10. Between 1950 and 2010, which sector of power generation declined?

petroleum

IQ11. What percentage of electic power generation in the US utilizes carbon based fuels?
42%+25%+1%=68%

The graph below refers to the United States

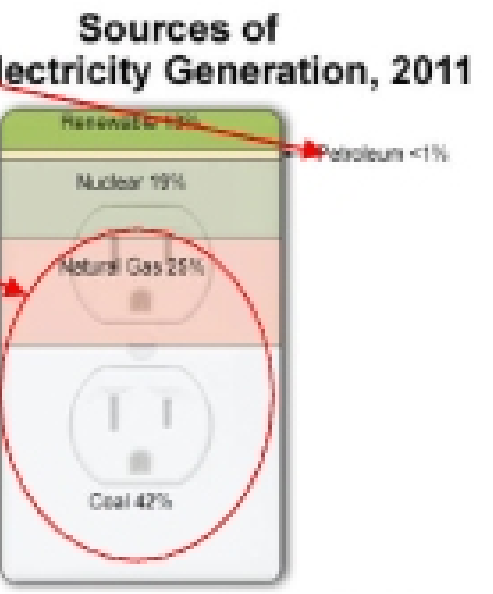


AQ12. Think back to the carbon cycle. We use combustion to release energy from carbon based fuels. What is the simple chemical equation for combustion? (Give your answer in words or a chemical forumla.)

Fossil fuel +oxygen(plus a spark to ignite)=carbon dioxide+energy+water

IQ13. As carbon dioxide increases in the atmosphere, does the capacity of the atmosphere to hold heat increase or decrease?

Increases!



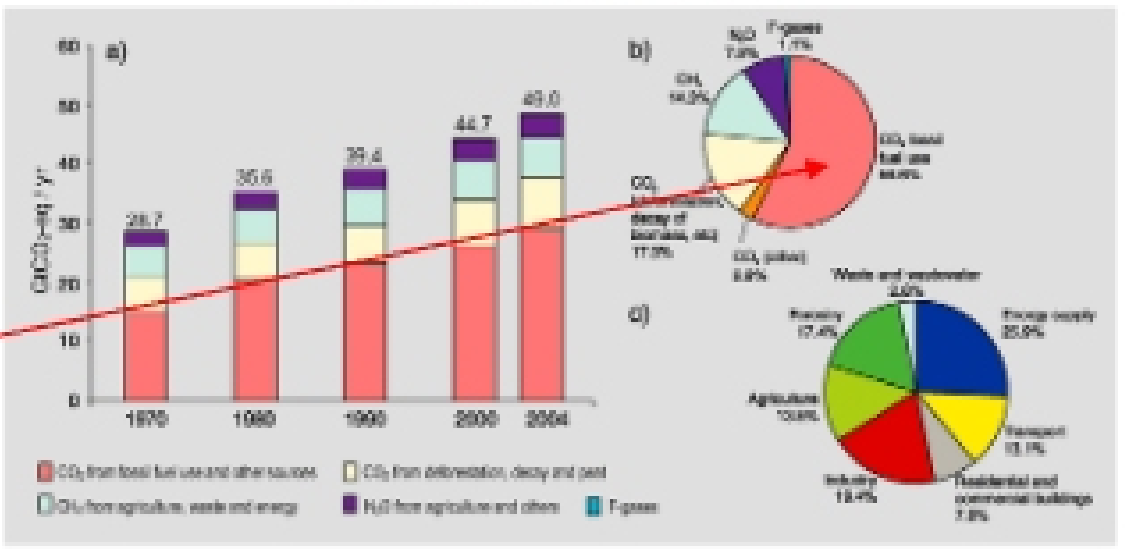
EQ14. How much have emissions of green house gasses (GHG) increased between 1970 and 2004?

From 28.7 $GTCO_2$ eq/yr up to 49 $GTCO_2$ eq/yr

EQ15. What percentage of GHG emissions are due to fuel use?
56.6%

EQ16. What percentage of GHG emissions are <u>not</u> due to fuel use?

1.1+7.9+14.3+17.3+2.8=43.4%



(a) Global annual emissions of anthropogenic GHGs from 1970 to 2004.(b) Share of different anthropogenic GHGs in total emissions in 2004 in terms of CO2-eq. (c) Share of different sectors in total anthropogenic GHG emissions in 2004 in terms of CO2-eq. (Forestry includes deforestation.) IPCC image

EQ17. Add up the percentages of GHG from the following sources: energy supply, transport, residential and commercial buildings and industry as shown in graphic "c". What is your answer? 66.7 %
Is your answer higher or lower than the CO2 emissions from fossil fuel use in graphic "b"? Hypothesize what other types of emissions could come from the energy supply, transport, residential and commercial buildings, and industry sectors.
Higher. Other types of emissions could come from the mining of the

AQ18. Based on your understanding of the nitrogen cycle, what sectors are the sources of N_2O in the graphic labeled "c"?
Mainly Agriculture and Some Industry

AQ19. Based on your understanding of the carbon cycle, from what stock of carbon is CO_2 released during deforestation?
From the soil and from the trees(if they are burned)

AQ20. Consider what you have learned about the use of carbon based fuels and carbon in the atmosphere. In a few gramatically correct sentences, describe the relationship between our choice of energy supply and climate change.
This one is up to you, but should include a discussion of the following:

Fossil fuels→greenhouse gases→atmosphere→increase heat holding capacity of the atmosphere→ holds more energy→atmosphere warms→changes to climate.

EAD THIS: Impacts beyond climate change – ***Our carbon fuels come from oil and gas wells, tar sand, and coal seams. Extraction from each of these sources has consequences. You will be provided with case studies on oil, tar sand operations, coal bed methane, and coal extraction processes. Depending on the level of disturbance, leaks and contamination impacts to ecosystem services and biodiversity will vary between case studies.***

Case Study: BP oil spill- Macanudo well, Gulf of Mexico
Watch BBC Documentary on the BP Oil Spill (59 min) *http://www.youtube.com/watch?v=Z2UMMfDTiJM* ***and then answer the following questions.***

EQ21. In addition to crude oil, what else was released from the Macanudo well?

From E-text: **"released an estimated 200 million gallons of crude oil and 500 million tons of methane and other gases into the deep water of the Gulf".**

EQ22. What are the impacts of exposure to crude oil (to animals, fish, and people)?
From E-text: