**Chemistry: 10. Fossil fuels, Hydrocarbons and Acid Rain**

***Please remember to photocopy 4 pages onto one sheet by going A3→A4 and using back to back on the photocopier***

**Syllabus**

**OC53** Recall that fossil fuels are sources of hydrocarbons, and that they produce CO2 and H2O when burned

**OC54** List two examples of fossil fuels

**OC55** Describe the role of the combustion of fuels and of SO2 in the production of acid rain, and describe the effects of acid rain

**OC56** Describe the effect of acid rain on limestone and on plants

**OC57** Understand that natural gas is mainly methane

 **Student Notes**

**Hydrocarbons are compounds that contain hydrogen and carbon only**

**One common source of hydrocarbons is fossil fuels**

**Fossil fuels**

First of all let’s look at what a fuel is:

**A fuel is a substance that burns in oxygen to produce heat**

**Fossil fuels are fuels that were formed from the remains of plants and animals that lived millions of years ago**

**Fossil fuels produce carbon dioxide (CO2) and water (H2O) when burned**

**Examples of fossil fuels**

* Peat
* Coal
* Oil
* Natural gas

**Natural gas is mainly methane**

* Methane is a compound. It is composed of carbon and hydrogen.
* The symbol for methane is CH4 (where C is carbon and H is hydrogen).

**Did you know?**

A cow emits as much methane as a car -through its mouth!!

**Acid Rain**



**The role of the combustion of fuels and of sulphur dioxide in the production of acid rain**

* Many fossil fuels contain small amounts of sulphur.
* As the fuel gets burnt the sulphur combines with oxygen to from sulphur dioxide (SO2) which gets released into the air.
* When this gas dissolves in water (e.g. in the sky) it forms sulphuric acid, which is corrosive.
* This is the main culprit in acid rain.

**Acid Rain is rain water with a pH of less than 5.5**

**The effect of acid rain on limestone and on plants**

* Acid rain destroys lakes, kills fish and harms trees.
* It corrodes limestone and iron.

**Ways to reduce effects of acid rain**

1. Install chemical plants to remove sulfur dioxide from emissions in the chimney of power stations.
2. Burn less fossil fuel and use other types of energy such as wind energy, hydroelectric energy, etc.

Can you keep burning this candle forever? Why?/Why not?

**Exam Questions**

1. [2012]
The table gives the % by volume of five gases/ vapours found in our atmosphere.

|  |  |
| --- | --- |
| Formula | % Volume |
| N2 | 78.08 |
| O2 | 20.95 |
| H20 | 0 to 4 |
| Ar | 0.93 |
| CO2 | 0.036 |

1. Which two of these gases/ vapours are produced when a fossil fuel is burned?
2. The amount of water vapour present in the air is the most variable. Suggest a reason for this.
3. [2007 OL]
Fossil fuels are sources of hydrocarbons.
4. Name one element found in all hydrocarbons.
5. Natural gas is mainly composed of one particular hydrocarbon.

What is the name of this gas?

1. [2008][2011 OL][2006 OL]
2. Name the main constituent of natural gas.
3. Name one of the two elements found in methane.
4. Name one gas produced when methane is burned in air.
5. [2008][2011 OL][2009 OL] [2008 OL][2012 OL]
6. Natural gas is a fossil fuel. What is a fossil fuel?
7. Name two fossil fuels.
8. Name two products formed when a fossil fuel is burned in air.
9. [2006]

Fossil fuels are burnt to provide energy to generate electricity.

Give the name or formula of a compound of sulfur formed when a sulphur containing fossil fuel burns in air.

1. [2009]
2. Name a pollutant present in the emissions from a coal burning electricity generating station.
3. Describe its effect on the environment.
4. [2010][2006][2007 OL]

Acid rain is formed when sulphuric acid dissolves in and reacts with water in the atmosphere.

1. What effect has acid rain on limestone?
2. Explain this effect.
3. [2006]

In Ireland 90% of electricity is generated by burning fossil fuels compared to other European countries who have an average of 50% use of fossil fuels and a 30% use of fossil fuels in the USA.

List two disadvantages, excluding acid rain, of this heavy reliance on fossil fuels for the production of electricity.

1. [2006]

Fossil fuels are burnt to provide energy to generate electricity.

Give the name or formula of a compound of sulfur formed when a sulphur containing fossil fuel burns in air.

1. [2009]
2. Name a pollutant present in the emissions from a coal burning electricity generating station.
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4. [2010][2006][2007 OL]

Acid rain is formed when sulphuric acid dissolves in and reacts with water in the atmosphere.

1. What effect has acid rain on limestone?
2. Explain this effect.
3. [2011]

The experiment shown in the diagram was carried out to investigate the products of the combustion of a hydrocarbon wax produced from the fossil fuel oil.

In the experiment the products of the combustion were drawn through the apparatus by the vacuum pump.

A colourless liquid formed at the bottom of the U-tube after a while.

Liquid A was clear and colourless at the start of the experiment and it slowly became milky.

1. What do you think the liquid that formed in the U-tube was?
2. Give a test that could be used to confirm your identification.
3. Identify liquid A and state why it went milky.
4. Name a fossil fuel other than oil.

**Exam Solutions**

1. CO2, H2O
2. Temperature changes/ weather/ evaporation/ rain/ snow/ transpiration/ plants/ respiration/ combustion/ photosynthesis/ specified location…
3. Carbon // hydrogen
4. Methane
5. Methane
6. It is a fuel produced from dead animals and plants
7. Coal, Oil
8. Carbon dioxide / carbon monoxide / water vapour / steam
9. Sulfur dioxide/ SO2
10. Carbon dioxide: global warming/ greenhouse effect.

Sulphur dioxide: acid rain/ kill plants/ kill fish.

Smoke: damage to lungs/ lung disease.

1. Acid rain dissolves/ erodes the limestone.
2. Because the limestone is calcium carbonate and so reacts with the acid in the rain.
3. CO2 production, global warming (greenhouse effect), possibly insecure supplies, acidification of oceans, non renewable, rising fuel (electricity) costs.
4. Sulfur dioxide/ SO2
5. Carbon dioxide: global warming/ greenhouse effect.

Sulphur dioxide: acid rain/ kill plants/ kill fish.

Smoke: damage to lungs/ lung disease.

1. Acid rain dissolves/ erodes the limestone.
2. Because the limestone is calcium carbonate and so reacts with the acid in the rain.
3. Water
4. Anhydrous (white) copper sulphate turns blue / blue cobalt chloride turns pink.
5. Limewater – because it contained carbon dioxide/ CO2
6. Natural gas/ methane/coal/ turf (peat)…