Earth's Resources

Renewable and Nonrenewable Resources

Earth's resources refers to anything we use or extract from the Earth to benefit society, whether it be in the products we make, the energy we generate, or food we grow. List some of Earth's resources:

_____________________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________

We can divide all these resources into two categories:

_____________________________________________________________________________

_____________________________________________________________________________

What makes a resource **renewable**? _____________________________________________

_____________________________________________________________________________

Example 1: _____________________: harnessing its energy does not deplete the source of this energy, so it is a renewable resource.

Example 2: _____________________: they are cultivated each season, but they are replaced by a new crop the next year.

What makes a resource **nonrenewable**? __________________________________________

_____________________________________________________________________________

Example 1: _____________________: gets lowered by overpumping. The water will probably be replenished eventually by infiltration and groundwater flow, but over 100s/1000s of years, which may not be in time to save an agricultural region from failure.

Example 2: _____________________: removal by over-cultivation or accelerated erosion due to the influences of humans. Although soil will eventually be regenerated by the process of weathering of solid rock, this occurs over a long period time- 10s of 1000s of years.
Example 3: ______________________: mined for human consumption (e.g., coal, oil, copper, iron, gold, and phosphates/fertilizer). Once removed from the Earth, they are gone for good. It may take _______________________ years to develop new economic mineral deposits.

**Fossil Fuels**

Both renewable and nonrenewable resources are used for energy consumption. Renewable energy resources include:

______________, _____________, and ________________

However, the majority of our energy production (____% ) comes from nonrenewable resources such as:

______________, _____________, ________________, and ________________.

A fossil fuel refers to any energy resource that forms from ______________________, such as decaying plants and animals. Name four fossil fuels:

1) ______________ 2) ______________ 3) ______________ 4) ______________

The type of fossil fuel that develops depends on the type of organic matter and the changes that the organic matter undergoes after it has been buried in the ground.

**peat and Coal**

Organic matter that accumulates on land comes from trees, shrubs, and grasses. These plants are rich in organic matter that stays solid after burial. If there is a lot of water present, the remains of these plants accumulate to form peat.

Name two environments where peat can form: ______________ and ______________

**Peat** is a biogenic sediment consisting of a loose aggregate of plant remains with a carbon content of about 60%. For this reason, when peat is dried, it burns well and is a good source of energy. This is why peat has been harvested for 1000s of years to provide energy for heating and cooking.

As peat gets buried by sedimentary processes, it starts to convert to coal, which burns far more efficiently than peat. This process of turning peat into coal is called:
There are several ranks of coal quality depending on how high the pressures and temperatures were during the coalification. Rank the types of coal from lowest to highest rank:

1) ___________________________
2) ___________________________
3) ___________________________

Coal occurs in layers called ____________ that are usually sandwiched within sedimentary rocks. Anthracite is more likely to occur within metamorphosed sedimentary rock, such as within a slate. Coal seams are usually no more than a few meters thick, although they may sometimes reach up to 30m thick.

Because peat and coal form from land plants, the oldest coal is limited to the time when plants first began appearing on Earth, which was about 450 million years ago, in the _________________ Period.

The largest peat swamps developed in the northern hemisphere continents during the _________________ and _________________ Periods, 360 to 245 million years ago. Remember, this was during an ice age, but the northern Pangea continents were around the equator at that time, so the climate was wet and hot, as required to form swamps. The fact that the resultant coal can now be found in regions having cold climates is another line of evidence for continental drift.

The second largest peat swamps in geologic history formed during the _________________ period, while the dinosaurs roamed the Earth. Today, peat swamps are forming in places such as the Okefenokee Swamp in Florida.

**Petroleum**

A major source of energy is of course petroleum, also called oil. Oil is found in marine sedimentary rocks, so this immediately tells us that it must form from marine organic material, such as microscopic phytoplankton (a floating plant in the oceans), and marine bacteria.

These organisms get trapped in marine sediments such as clay, which turn into shale during burial and diagenesis. During diagenesis, the organic compounds go through a process called _________________ which causes them to be converted into ____________ and _________________, which are both types of _________________ compounds. They can occur in solid, liquid or gaseous states.
Liquid petroleum removed directly from under the ground is called _________________. It needs to be refined to separate the various petrochemicals that we use in society, such as gasoline.

List other petroleum products derived from hydrocarbons:

______________________  ______________________  ______________________
______________________  ______________________  ______________________

The rocks in which the petroleum forms, such as marine shale, are called _____________.

As it turns out, most oil is not found in the source rocks where it formed. Instead, oil tends to migrate into other rocks, usually because it is squeezed out of the source rocks by high pressures during burial.

The oil migrates upwards where it may form an ________________ at the surface (e.g., La Brea tar pits in Los Angeles), although it usually collects within rocks that have a high porosity (lots of holes called pores).

These rocks that collect the oil are called _____________________.

Examples: ___________________ and _____________________.

It is also common that oil migrating upwards towards the surface encounters a very low permeability unit such as a shale layer that traps the oil underground. This sealing layer is called a ________________ and we say it has formed a _____________________.

This is what geologists attempt to locate when looking for oil.

Today, more than ____% of all the world's oil reserves are in the _____________________. We are constantly looking for new oil reserves, hoping that somewhere out there an oil field of huge proportions awaits discovery, but most of the gigantic oil reserves have probably already been discovered.

**Tar Sands and Oil Shales**

Oil that is so viscous that it cannot flow easily is called _______.

Tar may collect in the pores of sandstones to form a ________________, which can be processed to produce energy.
If burial temperatures and pressures during diagenesis were not high enough to allow maturation, sediments may contain a wax-like substance called _____________ instead of oil or natural gas.

This is usually found in shale, which we then call an ______________, which can be mined and heated for energy production, although this is an expensive and environmentally unfriendly process.

Where can we find about two-thirds of all the world's oil shales?

1. ______________
2. ______________
3. ______________

Unless we turn our focus on harnessing alternative energy sources, we may have to overlook environmental concerns and rely on the most abundant reserve we have to meet future energy needs using fossil fuels.

What is our most abundant type of hydrocarbon reserve? _____________

**Alternative Energy Sources**

The Earth's energy is derived from three primary sources:

• ______________
• ______________
• ______________

This amounts to a flow of energy across Earth's surface of about 174,000 trillion watts. The needs of all people on the planet amount to about 10 trillion watts. So we're not about to run out of energy.

We need to learn to use these alternative energy resources instead of relying upon nonrenewable fossil fuels. List the alternative energy sources:

_____________________  ___________________  ___________________
_____________________  ___________________  ___________________
_____________________  ___________________  ___________________
As long as the Sun, Earth and Moon maintain their orbits, and the interior of the Earth is generating radioactive heat, all of these energy resources are essentially renewable.

**Solar, Wind and Water Power**

Solar energy is derived by directly using the energy of the Sun. Solar energy is used for heating purposes, such as supporting greenhouses, and can be used for generating electricity using ______________________, like you see on the roofs of houses.

Photovoltaic technology is expensive and inefficient, however, so it is unlikely to become a major source of energy production for society’s needs.

**Wind energy** is harnessed using ________________, which have long been used as a source of small amounts of energy, such as in the earliest grain mills. Today, wind energy can only be harnessed in locations where there is a constant source of wind.

Even where such winds exist, we would still only be able to generate about _____% of our energy needs, so wind power is unlikely to become globally significant.

The three forms of energy that can be harnessed from moving water are:

___________________  _________________  ____________________

Wave energy from the oceans offers great potential, but we have not yet perfected a mechanism of harnessing that energy.

Where is a good location to build a tidal power station? _______________________

There are two high tides a day, so if a tidal dam traps the water at high tide, it can be released at low tide to drive a turbine and generate electricity.

What type of tidal ranges are necessary to make tidal power generation efficient?

___________________________

Is tidal power likely to meet the energy needs of society?  YES  or  NO

What is currently our greatest source of water-generated power? _______________________

This source of power necessitates the construction of dams across rivers. Water flowing through turbines in the dam generates electricity.

Where in Idaho is hydroelectric power a main source of electricity? _________________

Is hydroelectric power likely to meet the energy needs of society?  YES  or  NO
**Geothermal Power**

Energy derived from Earth's internal heat constitutes geothermal energy. Many countries use geothermal energy to heat houses, produce hot water, and generate electricity.

Examples: ________________________________

Steam from underground reservoirs of hot water (hydrothermal reservoirs) is used to power turbines and generate electricity.

**Nuclear Power**

Changing the atoms of an element into different types of atoms by the loss or gain of subatomic particles is a nuclear reaction. Controlled reactions can be used to harness nuclear energy.

The two types of nuclear reactions are:

1. Splitting a large atom into smaller atoms: _________________, or
2. Combining two smaller atoms to form a larger atom: ________________.

A naturally occurring type of a fission reaction is ____________________________

What type of nuclear reactions are produced in nuclear power plants?

FISSION or FUSION

These power plants utilize the radioactive element U-235 and causes it to collide with a neutron. This produces lighter element atoms, heat, and additional neutrons which in turn collide with more atoms, producing a type of reaction called a chain reaction.

We utilize the heat produced in these reactions to generate steam, which is used to power turbines and generate electricity. About _____% of the world's energy is produced in this way. It is far more efficient than fossil fuels. For example, 1 gram (a few grains) of U-235 produces the same amount of energy as _______ barrels of oil!

This is why nuclear energy is essentially an inexhaustible resource and may be our main source of electricity in the future- we need so little to generate so much power.

**FINAL QUESTION:**

What's the downside of using nuclear fission for energy production?

______________________________