06CIV-18/06 CIV 28 ENVIRONMENTAL STUDIES
(E-Notes)

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Unit-1V ENERGY

Different types of energy are - Electro magnetic radiation, conventional and non-conventional sources, Hydro electrical, Fossil fuel based, Nuclear, solar, Bio mass and Biogas, Hydrogen as an alternative future source of energy**.**

Energy :It is great word, which is defined as the ability or capacity to do work.
We use energy to do work and make all movements. When we eat, our body's trans form the food into energy to do work. When we run or walk or do some work, we ' burn' energy in our bodies. Cars, planes, boats machinery etc. also transform energy into work. Work means moving or lifting something, warming or lifting something, warming or lighting something. There are many sources of energy that help to run the various machines invented by man.

Energy is measured in BLU (British Thermal Unit) or Joule (Named after the English Physicist type of energy). One Joule after the amount of energy required to lift 1 pound (approx 400g) about 9 inches (23cm). It takes 1000 Joules to equal a Btu. It would take 2 million Joules to make a pot of coffee. A price of buttered tarts contains 315 kilo Joules of energy.

a) Jog for 6 min b) Bicycle for 10 min c) walk briskly for 10 min d) sleep for 11/2 hours e) Run a car at 80 km ph for sec s f) light a 60 w bulk for 11/2 hrs. g) Lift a sack of sugar from floor to counter 21,000 tones.

Kinds of energy

a) Kinetic energy: it is the energy of motion
b) Potential energy: It is the energy due to position or energy stored.

Types of energy

Light, chemical. Mechanical, heat, electric, atomic, sound.

All these forms of energy can be broken down either into kinetic or potential energy.

Sources of energy

Energy resources are broadly classifies as primary and secondary .

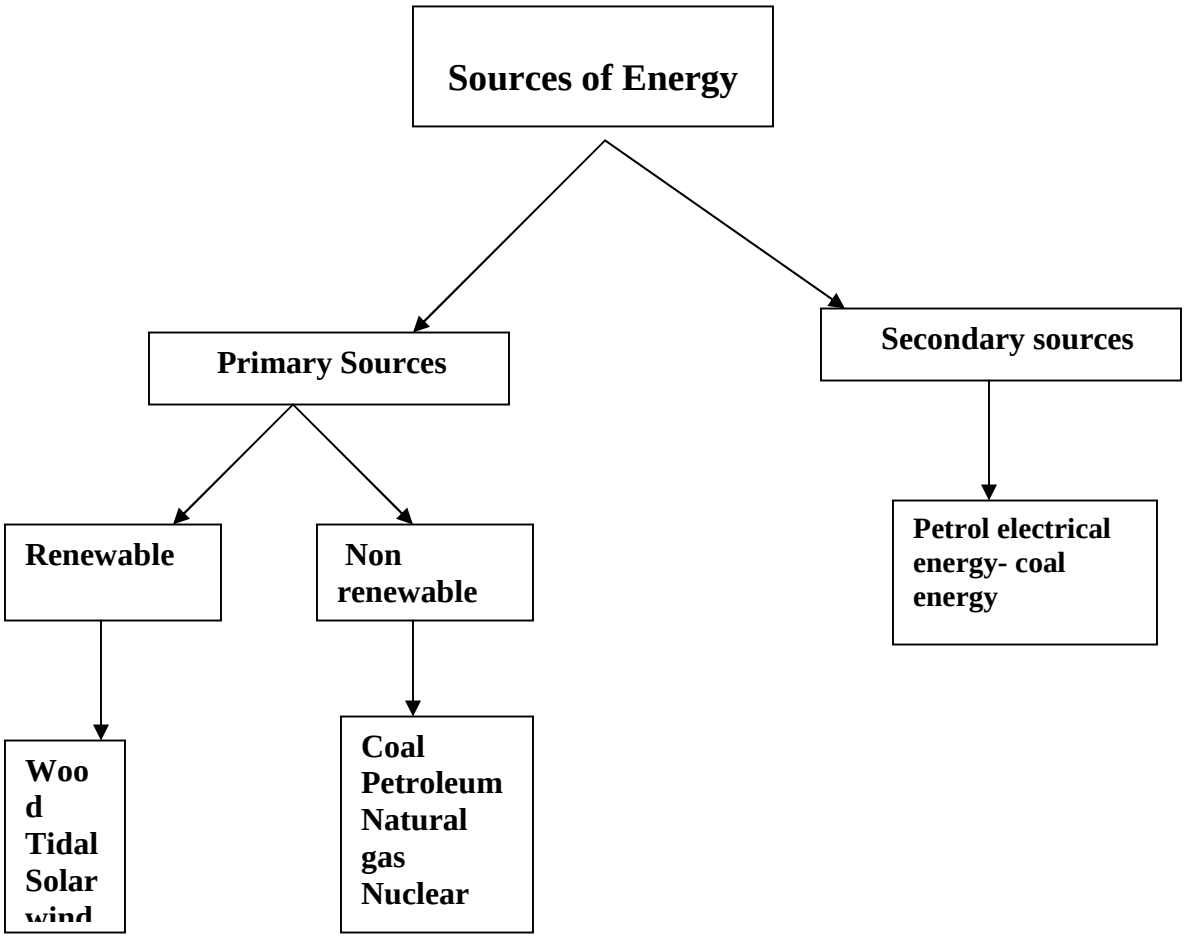


Fig 1 Sources of energy

Primary:

Energy resources are mined or otherwise obtained from the environment.

Ex. a. Fossil fuels: coal, lignite, crude oil, Natural gas etc.
b. Nuclear fuels: Uranium, Thorium, other nuclear used in friction reaction.
c. Hydro energy : It is energy of falling water, used to turn a turbine.
d. Geo thermal: The heat from the underground stream .
e. Solar energy: Electromagnetic radiation from the Sun.
f. Wind energy: The energy from moving air used by wind mills.
g. Tidal energy: The energy associated with the rise and fall of the tidal waters.

Table 1: ***Different Sources of Energy***

Energy Source	Percentage of total energy	Sub total percentage
A) Non- renewable Sources		
Oil	32	
Coal	21	
Natural gas	23	
Nuclear	6	82
B) Renewable Sources		
Bio mass(mainly wood)	11	
Solar, wind, hydro and Geothermal power	7	18
	Total	100

Global energy consumption patterns

Transportation consumes about 24% of the energy, 40% for industry, 30% for domestic and commercial purposes and remaining 6% for other uses including agriculture.
The top 20 richest countries of the world consumes 80 of the natural gas 65% of the oil and 50 of the coal produced every year while these countries have only one fifth of the world's population. One third of the world's population is about two billion people, lack access to adequate energy supplies , they mainly depend on fuel wood, dung, coal, charcoal and kerosene for cooking and heating. U.S.A is the largest energy consumer in the world.

Energy Status of India

India's energy status is not promising. Presently, the country consumes about 100 million tones of coal and 32,5 million tones of oil annually. Official estimate report that 40 billion tones of coal are available but only one half this is recoverable which means it is less than the projected demand of 23 billion tones of coal till the year 2020.

On the other hand the projected demand for hydroelectric power by 2020 is 12 times more than the present installed capacity of nearly 15, 000 MW.

India's oil deposits Is about 400 million tones as against the world oil reserve of 750,000 million tones. Gas reserves of our country is about 100 million cubic meters, as against world's reserves of 63,000 million cubic meters.
Here, one can conclude that the energy Scenario of India is blank.

Renewable and Non- Renewable Energy Sources

a) Renewable or inexhaustible energy sources:

These are the resources that can be generated continuously. These are mostly biomass based which are renewed over relatively short period of time and then available in

unlimited amount in nature. These include *conventional energy sources* like: firewood, petrol plants, plant biomass, animal dung, water energy etc.

Non-conventional energy sources like solar energy, wind energy, tidal energy, geothermal energy and dendro thermal energy etc. These can reproduce themselves in nature and can be harvested continuously through a sustained planning and proper management.

b) Non- renewable or exhaustible energy sources:

These are available in limited amount and develop over a longer period of time. Hence, they cannot be replenished in the quantities they are being consumed in a given period of time.

Non- Conventional energy sources like nuclear energy etc.

Development of modern technological civilizations is chiefly based on the non-renewable sources. These reserves are fast depleting and within a few decades they will get exhausted. The unwise and exploitative use of renewable energy sources have forced these resources in the category of non- renewable energy sources as the rate of production of these sources become much less than the rate of their utilisation.

Electromagnetic Radiation

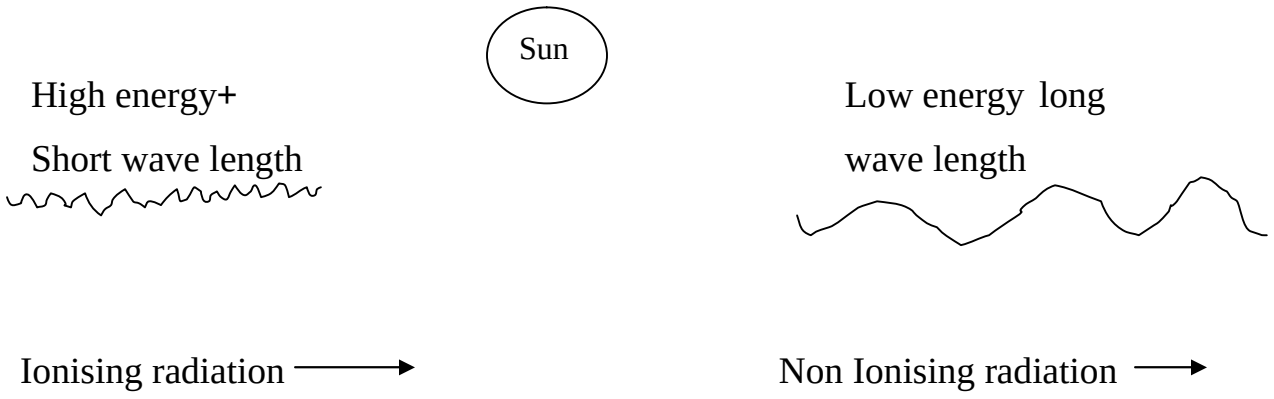
An electromagnetic radiation is energy in the form of a wave due to changing electric and magnetic fields. There are different forms of electro magnetic radiation, each with a different wavelengths (i.e. Distance between successive peaks or troughs in the wave) and energy content. Such radiation travels through space at the speed of light, which is about 3,00 000 kilometers/ sec.

Cosmic rays, gamma rays, x-rays and ultra violet radiation are known as *Ionizing radiation* because they have energy to knock electrons from atoms and change them to positively charged ions. The resulting highly reactive electrons and ions can disrupt living cells, interfere with body processes and cause many types of sickness, including various cancers.

The other forms of electromagnetic radiation do not contain enough energy to form ions and are known as Non- ionizing radiation.

The visible light that can be detected by our eyes is a form of non- ionizing radiation that occupies only a small portion of full range or spectrum of different types of electro magnetic radiation.

Fig.2 given the details of Electromagnetic Spectrum.



Cosmic Rays	Gamma rays	X-ray rays	Far U V waves	Near UV waves		Near infra red waves	Far infra red waves	Micro waves	TV waves	Radio waves

Wave length (meters)

HYDRO ELECTRICAL ENERGY

Electricity produces from waterpower is known as hydroelectric energy. The potential energy of falling water captured and converted to mechanical energy by water wheel powered the start of industrial revolution. Wherever head or change in elevation could be found, river and stream were dammed and mills were built.

a. **Large Scale Hydro power**: in this case a high dam is built across a large river to create a reservoir, water is allowed to flow to through huge pipes laid along the steep hill slopes (falling) at controlled rates, thus spinning turbines (prime movers) and in turn generators producing electricity.

b. **Small hydropower**: In this case a low dam with no reservoir (or only a small one) is built across a small stream and the water used to spin turbine to produce electricity.

c. **Pumped Storage hydropower:** In this case the surplus electricity conventional power plant is used to lift water from a lake or tail race to another reservoir at a higher elevator, water in the upper reservoir is released to spin the turbine for generating electricity.

In 2001, hydro power supplied about 7% of the world's total commercial energy, 20% of the world's electricity. It supplies 99% of the electricity in Norway, 75% in New Zealand and 50% in developing countries and 25% in China.

In India the generation of hydro electricity has been emphasized right from the beginning of the First Five Year plan. By the end of Fourth plan, India was able to generate 6.9 thousand MW of hydro electricity, contributing 42% of the total power generation capacity. But due to increase in demand, by the end of Eighth plan it fell down to 25% only. The hydropower potential of India is estimated to be 4×10^{11} k w –hours. Till now we have utilized only a little move than 11% of this potential.

Because of increasing concern about the harmful environment and social consequences of large dams, there have been growing pressure on the world bank and other development agencies to stop funding new large scale hydro power projects.

According to a study by world commission on Dams, hydropower in tropical countries is a major emitter of green house gases. This occurs because reservoirs that power the dams can

trap rotting vegetation, which can emit green house gases such as Carbon dioxide and Methane.

Small-scale hydropower projects eliminate most of the harmful environmental effects of large-scale projects. However their power output can vary with seasonal changes in the stream flow.

Following are the advantages of and disadvantages of using large-scale hydropower plants to generate electricity

Advantages	Disadvantages
* Moderate to high net energy.	* High construction cost
* High efficiency (80%)	* High environmental impact
* Low cost electricity	* High carbon dioxide emission from biomass decay in shallow tropical reservoirs.
* Long life span	* Floods natural areas.
* No carbon dioxide emission during operation	* Coverts land habitat to lake habitat.
* May provide flood control below dam.	* Danger of collapse
* Provides water for year-round Irrigation.	* Uproots People.
* Reservoir is useful for fishing and recreation.	* Decreases fish harvest Below dam. • Decreases flow of natural Fertilizer (stilt) to land Below dam.

According to the United Nations, only about 13% of the World's exploitable potential for hydropower has been developed. Much its un trapped potential is in South Asia, (China), South America and parts of Russia.

FOSSILS FUELS

Fossils fuels (oil, coal, natural gas) are energy rich substances that have formed from the remains of organisms that lived 200 to 500 million years ago. During the stage of the Earth's evolution, large amount of dead organic matter had collected. Over million of years, this matter was buried under layers of sediment and converted by heat and pressure into coal, oil and natural gas.

Chemically, fossil fuels largely consist of hydrocarbons, which are compounds of hydrogen and carbon. Some fossils fuel also contains smaller quantities of other compounds. After the accumulating sediments exerted increasing heat and pressure for millions of years on the ancient organisms hydrocarbons were formed. Most common among them are petroleum, coal and natural gas. However Geologists have identified other types of hydrocarbon rich deposits, which can serve as fuels. Such deposits are: oil shale, tar sands and gas hydrates. However, they are not widely used due to the fact that they are very costly to extract and refine.

Majority of fossil fuels are being used in transportation, industries heating and generation of electricity.
Crude petroleum is refined into gasoline; diesel and jet fuel that power the world's transportation system.
Coal is mostly used in the generation of electricity (thermal power). Natural gas is used for commercial and domestic purposes like heating, air conditioning and as fuels for stoves and for other heating appliances.

Once we discovered the fossil fuel we began consuming them at an increasing rate. From 1859 to 1969, total oil production was227 billion barrels (1 barrel=159 lts). 50% of this total was extracted during the first 100 years, while the next 50% was extracted in next 10 years.

Today, fossil fuels are considered to be non-renewable for the reason that their consumption rate is far in excess of the rate of their formation.

Coal : about 250 to 350 million years ago coal was formed on earth in hot, damped regions. Almost 27350 billion metric tones of known coal deposits occur on our planet. Out of which about 56% are located in Russia, 28% in USA and Canada. India has about 5% of world's coal reserve and that too not of vary good quality in term of heat capacity. West Bengal, Jharkhand, Orissa, Andhra Pradesh, Madya Pradesh and Maharastra are the major coal producing states of India.

Mainly, there are three types of coal:

a. Anthracite or hard coal (90% carbon content)
b. Bituminous or soft coal (85% carbon content)
c. Lignite or brown coal (70% carbon content)

The present annual extraction rate of coal is about 3000 million metric tones, at this rate coal reserves may lasts for about 200 hundred years and if its use is increased by 2% per year then it will last for another 65 years.

Petroleum: Convenience of petroleum or mineral oil and its greater energy content as compared to coal on weight basis has made it the lifeline of global economy. Petroleum is cleaner fuel when compared to wood or coal as it burns completely and leaves no residue. Petroleum is unevenly distributed like any other mineral. There are 13 countries in the world having 67% of the petroleum reserves which together form the OPEC (Organisation of petroleum exporting countries). Six regions in the world are rich in petroleum – USA, Mexico, Russia and West Asian countries. Saudi Arabia oil producing has one fourth of the world oil reserves. The total oil reserves of our planet is about 356.2 billion metric tones out of this annually we are exporting about 28% million metric tones. Hence the exisisting reserves would last for about 40 – 50 years. About 40% of the total energy consumed in the entire world is now contributed by oil.

The oil bearing potential of India is estimated to be above one million square kilometers is about one third of the total geographic area. Northern plains in the Ganga-Brahmaputra valley, the coastal strips together with their off-shore continental shelf (Bobay Hihgh), the plains of Gujarat, the Thar Desert and the area around Andaman and Nicobar Islands.

Natural gas: Natural gas mainly consists of Methane (CH_4) along with other inflammable gases like Ethane and propane. Natural gas is least polluting due to its low Sulphur content and hence is clearest source of energy. It is used both for domestic and industrial purposes. Natural gas is used as a fuel in thermal plants for generating electricity as a source of hydrogen gas in fertilizing industry and as a source of carbon in tyre industry.

The total natural gas reserves of the world is about 600 000 billion meters, out of this Russia has 34%, Middle East 18%, North America 17%, Africa and Europe 9% each and Asia 6%. Annual production of natural gas is about 1250 billion cubic meters and hence it is expected to last for about 50-100 years. In India gas reserves are found in Tripura, Jaisalmer, off shore areas of Bombay and Krishna-Godavari Delta.

Environmental effects of Using Fossil Fuels:

a. **Acid rain:** When fossil fuels are buried, Sulphur, Nitrogen and Carbon combine with oxygen to form compounds known as oxide. These oxides when released into the atmosphere, they react with water form and result in the formation of Sulhuric acid, Nitric acid and Carbonic acid. These acids can harm biological quality of forests, soils, lakes and streams.

b. Ash particles: Ash particles are the un burnt fuel particles. However with strict imposition of Government regulations, perubben are provided to trap these particles. Petro and natural gas generate less ash particles than coal, diesel or gasoline.

c. Global warming: Carbon dioxide is a major by product of fossil combustion and this gas is known as green hour gas. Green hour gas absorbs solar heat reflected off the earth's surface and retains this heat, keeping the Earth warm and habitate for living organisams. Rapid industrialization between 19^{th} and 20^{th} centuries, however has resulted in increasing fossils fuel emissions, raining the percentage of carbon dioxide by about 28%. This drastic increase has led to global warming that could cause environmental problems, including disrupted weather patterns and polar ice cap melting.

Metal hydra rides, charcoal powders, graphite nanofibers and glass microspheres containing hydrogen will not explode or burn of a vehicle's tank is ruptured in an accident. Such tanks would be much safer than current gasoline tanks.

Advantages and Disadvantages of various fossil fuels

a. Conventional oil

Advantages	Disadvantages
* Amply supply for 40-90years	* Need to find substitute within 50 years
* Low cost (with huge substitute)	* Artificially low price encourages waste and dis courages search for alternative
* High net energy yield	* Air pollution when burnt
* Easily transported within and between countries	* Released carbon dioxide when when burnt
* Low land use	* Moderate water pollution
* Technology is well developed	
* Efficient distribution system	

Heavy oils from oil shale and Tar sand

Advantages	Disadvantages
* Moderate existing supplies	* High costs
* Large potential supplies	* Low net energy yield
* Easily transport within and between countries	* Large amount of water needed to process
* Efficient distribution system in place	* Severe land disruption
* Technology is well developed	* Water pollution from mining residues
	* Air pollution when burnt
	* Carbon dioxide emissions when burnt

c. Conventional Natural gas

Advantages	Disadvantages
* Ample supplies (125 years)	* Non renewable resources
* High net energy yield	* Releases carbon dioxide when burnt
* Low cost (with huge subsidies)	* Methane (a green house gas) can leak from pipelines
* Less air pollution than other fossil fuels	* Shipped across ocean as highly explosive LNG
* Moderate environmental import	* Sometimes burnt off and wasted at wells because of low prices
* Easily transported by pipelines	* Requires pipelines
* Low land use	

* Food fuel for fuel cells and gas turbines

d. Coal

Advantages	Disadvantage
* Ample supplies (225-900years)	* Very high environmental impact
* High net energy yield	* Several land disturbance air pollution and water pollution
* Low cost (with huge substitutes)	* High land use (including mining)
* Mining and combustion technology well developed	* Severe threat to human health
* Air pollution can be reduced with developed	* High carbon dioxide emissions when burnt
	* Releases radio active particles and mercury into air.

NUCLEAR ENERGY

Nuclear energy is non- renewable source of energy, which is released during fission(disintegration) or fusion (union) of selected radioactive materials. Nuclear power appears to be the only hope for large scale energy requirements when fossil fuels are exhausted. The reserves of nuclear fuels is about ten times more than fossil fuels and its major advantage is that even small quantities can produce enormous amounts of energy. For

example, a ton of uranium –235 can produce an energy equivalent 3 million tones of coal or 12 million barrels of oil.
Nuclear energy has been successfully used in the generation of electricity in spaceships, marine vessels, chemical and food-processing industry.

Nuclear fission: Nuclear fission reaction are based on the fission of U_{235} nuclei by thermal neutrons

92 U_{235}

The energy from these nuclear reactions is used to heat water in the reactor and generates steam to drive a stream turbine.
High temperature gas-cooled reactors and Fast Breeder reactors convert non fissionable Pu $_{239}$ and U_{233}

Nuclear fusion It is based on deurterium-deuterium and deuterium-tritum reaction

The deuterium-deuterium re actions promise an unlimited source of energy will take several more years due to the technical problem. Nuclear fusion is also known as thermo nuclear reaction.

Environmental impact : Nuclear fission power reactor generate large quantities of radio active fission waste products, which may remain dangerous for thousand of years. In addition these are no safe disposal methods.

SOLAR ENERGY

The solar energy originates from the thermonuclear fusion reaction taking place in the Sun. It is one of the potential non-conventional energy source. The earth continuously receives energy from the Sun, part of which is absorbed while the remaining is emitted back into space. Out of the solar radiations reaching the earth 92% consists radiations in the range of 315 to 1400 mm. 45% of this is in the visible range and emits radiations in the infra-red region (2u to 40u). The heat equivalent of the solar radiation reaching the earth is estimated to be about 2,68x 10 Joules per year.

Solar energy being non- polluting and non-deplets is considered as renewable energy and thus fills into the principle of sustainability. But only 0,25 to 0.5 % of the solar energy reaching the earth is utilized for photosynthesis.
Utilisation of solar energy is to gain popularity among the masses due to expensive nature.

In India, solar photovoltaic systems are being installed by Department of Non- Conventional energy resources for lighting , running of TV sets, water pumping etc. In India, there has been steady rise in demand for solar photovoltaic system.
Solar cells are used to convert the impinging solar radiation directly of this
method is that no mechanical movement of parts is need. The reliability of the operation is extraordinarily high. Even under severe space conditions a maintenance free life span of ten or more years has been achieved. Only disadvantage is that, its cost is very high.

For a solar power station with a capacity of 1000 Mw, a land of surface of about 12 km^2 is required.

Advantages of solar energy

1. Solar energy is free and it is available locally in abundance.
2. Solar energy is pollution free.
3. Systems are easy to install, generate and maintain.
4. System can be specifically designed according to individual requirements.
5. Supply of hot water is instant and un interrupted
6. Recurring fuel costs are zero
7. Heating 100 liters of water to 60o c by solar system results in an energy saving of 1200-1500 units (kilowatts hours) of electricity per year.

BIOMASS

Biomass is the term used to describe the organic matter produced by photo synthesis that exists on the Earth's surface. The source of all energy in biomass is the Sun, the biomass acting as a kind of chemical energy store.
Traditionally the extraction of energy from biomass is split into three distinct categories:

Solid biomass: The use of trees, crop residues animal and human waste, house hold or industrial residues for direct combustion to provide heat.

Biogas: it is obtained an aerobically (without air) digesting the organic material to produce ethane. Animal waste and municipal waste are two common feed stocks for anaerobic digestion.

Liquid bio-fuels: They are obtained by subjecting organic materials to one of the various chemical or physical processes to produce a usable, combustible liquid fuel. Bio fuels such as vegetable oils or ethanol are often processed from industrial or commercial residues such as biogas or from energy crops rown specially for this purposes.

Biomass use in the development world

More than two billion people in the developing world use biomass for the majority of their household energy needs. Biomass is also used widely used for non-domestic appliances. Biomass is available in varying quantities through out the developing world. In recent decades, with the threat of global deforestation much focus has been given to the efficient use of biomass.

Biomass resources: They are renewable energy recourses **.** Natural Biomass resources vary in type and content depending upon the geographical location. World's biomass producing areas are classifieds into three distinctive regions.

a. Temperate regions: Produce wood, crop residues like straw, vegetable leaves, human and animal waste.
b. Arid and Semi arid regions: Produce very little excess vegetation for fuel. People living in these areas are often the most affected by desertification and have differently in finding sufficient wood fuel.
c. Humid tropical regions: Produce abundant wood supplies, crop produces, animal and human wastes, commercial industrial agro and food processing residues. Many of the world's poorer countries are found in these regions and hence there is a high incidence of domestic biomass use.

Tropical areas are currently the most seriously affected by deforestation, logging and land clearance for agriculture**.**

Activities including Commercial utilization of Biomass- Biomass can be used for a variety of commercial tobacco curing praising direct heat for brick burning, for lime burning and cement kilns.
In India, sugar mills are rapidly turning to bagasse, the leftover of cane after it is crushed and its juice extracted to generate electricity. This is mainly done to clean up the environment, cut down power cost and additional revenue. According to current estimates, about 3500 MW of power can be generated from bagasse in the existing 430 sugar mills of the country. Around 270 MW of power has already been commissioned and more are under construction.
The advantages of biomass is that it can be locally sourced.

Biomass **energy and environment:** Concern for the environment was one of the major inspiration for early research and development work on improved stoves. Initially, one environment concern dominated the improved stove work, saving trees. Today, this is considerably downplayed. At the same time, other environmental issues have become dominant.
Large scale combustion of biomass is only environmentally feasible if carried out on a sustainable basis. For obvious continual large-scale exploitation of biomass resources without care for its replacement and regeneration will cause environmental damage and also Jeopardize the fuel source itself.

Benefits of Biomass energy:

***** Renewable or recyclable energy source (Stored solar energy)
* Less waste directed to landfills.
* Decrease reliance on imported energy sources.
* Potential rural development and job creation.
* can generate renewable electricity when the Sun is not shining and the wind is not blowing.

BIOGAS

Biogas is obtained by an aerobically (without air) digesting organic material to produce a combustible gas known as methane. Animal waste and municipal waste are two common feed stocks for an aerobic digestion.
At present biogas technology provides an alternative source of energy in rural India for cooking. It is particularly useful for village households that have their own cattle. Through a simple process cattle dung is used to provide the gas. The residual dung is used as manure.
India has world's largest cattle population – 400 million, thus offering tremendous potential for biogas plants. Biogas production has the capacity to provide us with about half of our energy needs either burned for electricity production or piped into current gas lines for use. It just has to be done and made a priority. Though about 3.71 million biogas plants in India up to March 2003 are successfully in operation but still it is utilizing only 31% of the total estimated potential of 12 million plants. The pay back period of the biogas plant is only 2 to 3 years. Rather in the case of community and industrial Biogas plants is even less. Therefore biogas electrification at Community Panchayat level is required to be implemented. A sixty cubic feet approx 2 m^3 biogas plant can serve the needs of one average family.

The charge fro the biogas generation consists f dung and waste in the form of slurry. The fermentation is carried out between 35 to 50^0C. About 160 liters of gas is produced per kg of cow dung and heating value of the gas is 490 kilocalories on 160 liters basis.

The average composition of biogas is methane 55%. Hydrogen 7.4%, Crbon dioxide 39%, Nitrogen 2.6%, Waster- traces. The average gross calorific value of the gas is 5300 kilo cals /cubic meters.

Hydrogen as an alternative future source of energy

Plants and animals that lived ages ago have returned to haunt us with a vengeance. Their incinerated remains pollute both land and sea and clog the air we breathe. Life from the past now threatens life of the present.

As the environmental destruction associated with man's whole sale consumption of fossil fuels has become globally recognized a corresponding need has grown for an alternate energy source.

Easy to produce and non-polluting hydrogen could be the ideal for the future. As a gas, hydrogen could be piped to homes and businesses for heating and cooking purposes or converted into electricity by fuel cells. As a cryogenic liquid, hydrogen electricity by fuel cells. As a cryogenic liquid, hydrogen could launch rocket or fly aircraft or locked as a solid in metal hydride storage canisters, hydrogen solid could propel ground transportation and all this could be provided with virtually no impact on the environment.

Hydrogen is a colorless, odorless gas that accounts for the 75% of the entire Unverse's, mass. Hydrogen is found on Earth only in combination with other elements such as oxygen, carbon and nitrogen. To use hydrogen, it must be separated from these elements.

Hydrogen can be made from molecules called hydro carbons by applying heat, a process known as referring hydrogen. This process makes hydrogen from natural gas. An electric current can also be used to separate water into its compound of oxygen and hydrogen is a process known as electrolysis. Some algae and bacteria using sunlight as their energy source give off hydrogen under contain conditions.

Hydrogen as a fuel is high in energy, yet a machine that burn pure hydrogen produces almost zero pollution. NASA has used liquid hydrogen since 1970's to propel rockets and now the space shuttle into orbit. Hydrogen fuel cells power the shuttle's electric systems, producing a clean by –product pure water, which the crew drink.

The bad news about hydrogen is that although hydrogen is all around us it is chemically locked up in water and organic compounds such as methane and gasoline. The good news is that we can produce it from something we have in plenty ie. water. Water can be split by electrolysis (electricity) or high temperature (thermolysis) into hydrogen and oxygen. The major problem is that if takes high to produce hydrogen. There are other ways to produce hydrogen.

One is reforming , in which high temperature and chemical process are used to separate hydrogen from carbon atoms in organic chemicals (hydro carbons) found in conventional carbon-containing fuels such as gas, gasoline or methanol. Gasification of coal or biomass can also produce it.

Hydrogen can be stored in compressed gas tanks or in the liquid form (liquid hydrogen).In 2002 scientist were also able to trap hydrogen gas in a frame work of water molecules called castrate hydrates.

Advantages and disadvantages of hydrogen

Advantages

* Can be produced from water.
* Low environmental impact.
* No carbon dioxide emissions if produced from water.
* Good substance for oil.
* Competitive price if environmental and social costs are included in cost comparisons.
* Easier to store than electricity.
* Safer than gasoline an natural gasoline.
*High efficiency 65-95% in full cells.

Disadvantages

* Not found in nature.
* Energy is needed to produce fuel
* Negative net energy.
* Carbon dioxide emission if produced from carbon containing compounds.
* Non- renewable if generates by fossil fuels or nuclear power.
* High costs.
* Short driving range for current fuel cells cars.
* No fuel distribution system in place
* Excessive hydrogen leaks may deplete ozone.

UNIT VII ACID RAIN

The term was first coined by ROBERT ANGUS SMITH in the year 1852.

What is Acid Rain?

Acid rain is a form of air pollution in which airborne acids produced by electric utility plants and other sources fall to Earth in distant regions. The major contributors, called PRECURSORS to the acid are the common air pollutants, like Sulphur dioxide and Nitrogen oxides

Through a variety of chemical reactions the gases form Sulphuric acid and Nitric acid, which are the two acids responsible for the acid rain.

How is acid produced?

Nitric oxide can react with oxygen O_2 to form nitrogen dioxide which can be broken down again by Sunlight(h_v)to give Nitric oxide and an oxygen radical (O).

$2NO + O_2 = 2N_2NO_2 + h_v = NO+O$

The oxygen radical then enables the formation of Ozone (O_3)

$O+O_2= O_3$

The presence of ozone causes the formation of more nitrogen dioxide by its reaction with nitric oxide. $NO+O_3= NO_2+O_2$

Or, the oxygen radical reacts with water to give the hydroxyl radical (OH)

$O+H_2O = 2OH.$

This radical then reacts with nitric oxide to give nitrous acid (HNO_2) and nitrogen dioxide to give nitric acid (HNO_3). It also combines with Sulphur dioxide to produce Sulphuric acid

$HO+NH= HNO_2$

$NH_2+HO= HNO_3SO_2+2HO = H_2SO_4$

Where does the 'precursors' come from?

While Nitric oxide and Sulphur dioxide are produced biogenic ally (in nature), there are major anthropogenic (man made) sources of both these polluting gases. Sometimes, natural production of the gases is much higher than human production, but these natural emissions tend to be spread over large area, dispersing their effects, while the man – made emissions are concentrated around the source of their production.

Biogenic Sources (Or Natural Sources)

Volcanic eruptions and decay of organic matter produce significant amounts of Sulphur dioxide. Nitrogen oxides are also generated by push fires as well as by microbial process (in Soil) and lightning discharges.

Anthropogenic Sources (or man made sources)

Nitrogen oxides are produced mainly from the burning of fossil fuels such as Diesel and petrol in automobiles and from power stations burning coal.

Sulphur dioxide is formed primarily in the burning of (Sulphur containing) Coal, fossil fuels and in metal smelters.

How are acids deposited?

•Acid pollutants are deposited on the ground either in wet form through rain, fog or snow. As dry matter, such as gases or particulates, falling directly from the atmosphere to the ground.
•The term acid deposition describes all these possibilities and therefore – generally preferred to “acid rain”.
•Environmental problems from dry deposition tend to occur closer to the source of the pollution. Wet deposition can occur upto hundreds of kilometer away in a different region or country, because microscopic aerosol droplets can be carried in clouds.

How can we reduce acid rain?

•The most effective way to reduce the incidence of acid deposition is to reduce the emission of its causes – The “PRECURSORS”, nitrogen oxides and Sulphur dioxide.
•Nitrogen oxide reduction.
The main method of lowering the levels of nitrogen oxides is by a process known as “Catalytic reduction”. Catalytic reduction is used in Industry & in motor vehicles.

Example

In a motor vehicles the Catalytic converter will convert much of the nitric oxide from the engine gases to the nitrogen and oxygen. Nitrogen is not there in the actual fuels or power stations. It is introduced from the air when combustion occurs. Using less air in combustion can reduce emissions of nitrogen oxides.
Temperature also has an effect on emission. Lower the temperature of combustion, lower will be the production of nitrogen oxides.
Temperatures can be lowered by using processes such as two stage combustion and flue gas recirculation water injection or by modifying the design of the burner.

Sulphur dioxide reduction:
There are several method to lower the Sulphur dioxide emission from Coal – fired stations. Simplest of the lot is using Coal with low Sulphur content and physical coal cleaning.
Most Complex is by the process of “FLUE GAS DESULPHURISATION” and “FLUIDISED BED COMBUSTION”.

Physical coal cleaning:

Coal can be cleaned because, Sulphur in Coal is often in the form of mineral impurities (pyrites). This is achieved by finely crushing the Coal.

Flue gas Desulphurization:
In this method the Sulphur dioxide (flue gas) is absorbed using lime stone. This method is the most effective of removing Sulphur dioxide The process generates Solid wastes (Calcium Sulphate, $CaSO_3$ and $CaSO_4$) which require disposal.
$CaCO_3$(limestone)+SO_2=$CaSO_3$+$CaSO_4$+CO_2+H_2O.

Fluidized bed combustion

In this process, coal is crushed and passed into a fluidized “bed” for combustion.

The bed consists of fine particles of an absorbent material such as lime stone. Hot air is passed through it and this causes the particles to behave as through they are a fluid.
The sulphur dioxide can then be absorbed by the lime stone particles in the bed.
Fluidized bed combustion can be operated at lower temperatures and therefore produce less nitrogen oxide, but once again, solid waste is created and requires disposal.

What is affected by acid rain?

The acids in the acid rain can react chemically with any object they contact. Acids are corrosive chemical that react with other chemical by giving up hydrogen atoms. Acid rain or acid deposition has an adverse effect on environmental eco system as well as humans, animals,buildings, textiles. etc.

Soil: Acid rain dissolves in Soil and washes away nutrients needed by the plants. It can also dissolve toxic substances such as aluminum & mercury, releasing these toxins to pollute water or to poison plants that absorb them.
Trees: Removal of useful nutrients from the soil, acid rain slows the growth of plants, particularly trees. It also attacks trees more directly by eating holes in the waxy coating of needles & leaves, causing brown dead spots.
Acid rain has been blamed for the decline of Spruce forests on the highest ridges of Apalachian Mountains in the eastern United States. In the black forest of South Western Germany, half of the trees are damaged from the acid rain.

Agriculture: Most farm crops are less affected by acid rain than the forest. Farmers can prevent acid rain damage by monitoring the condition of the soil and, when necessary, adding crushed lime stone to the soil to neutralize acid.

Surface water: Acid rain falls into streams, lakes and marshes. Due to this the water life is destroyed. All Norway's major rivers have been damaged by acid rain, severely reducing the fish life.
Plants and Animals: The effects of acid rain on wild life can be far reaching, if a population of one plant or animal is adversely affected by acid rain, animals that feed on that organism may also suffer ultimately an entire ecosystem may become endangered. Land animals dependent on aquatic organisms are also affected.

Man made structure: Acid rain and dry deposition of acidic particles damage building, statues, automobiles, and other structures made of stone metal or any other material exposed to weather for long periods. Parthenon in Greece and the Taj- Mahal in India, are deteriorating due to acid deposition.

Human health: Acidification of Surface water cause little direct harm to human health, it is safe to swim in even the most acidified lakes.

In the air: acids join with other chemicals to produce urban smog, which can irritate the lungs an make breathing difficult, especially for people with respiratory diseases. Solid particles of sulphates can damage the lungs.

Acid rain and Global warming: Acid pollution has one surprising effect that may be beneficial. Sulphates in the upper atmosphere reflect some sunlight out into the space, and thus tend to slow down global warming.

OZONE LAYER DEPLECTION

•Ozone layer was discovered by a French physicists CHARLES FABRY and HENRI BUISSON in 1913.
•Its properties were explored in detail by G.M.B.DOBSON, a British Meteorologist.
•Dobson established a world wide network of ozone monitoring stations which operate even today.
•The total amount of zone in a column overhead is measured in "DOBSON Unit" (DU), 1DU=0.01mm
•Ozone layer a region of the atmosphere from 19 to 48 km above the earth's surface.
•Although the concentration of ozone is the ozone layer is very small, it is vitally important to life because it absorbs biologically harmful ultra violet (UV) radiation emitted from the Sun.
•UV radiation is divided into three categories basd on its wave length, ie., UV-A, UV-B, UV-C.
•Most of the UV-A (315 to 400nm) reaches the surface this radiation is significantly less harmful, although it can potentially cause genetic damage.
•UV-B (280 to 315nm) radiation is the main cause of Sun burn, excessive exposure can also cause genetic damage, resulting in problems such as Skin cancer. It rapidly damages biota of all types.
•UV-C < 280nm, the ozone layer is very effective at screening out UV-B, for radiation with a wave length of 290nm, the intensity at Earth's surface is 350 million times weaker at the top of the atmosphere.

Stratospheric Ozone layer:

Atomic oxygen O, oxygen molecules O_2 and Ozone O_3 are involved in the ozone – oxygen cycle.
Ozone is formed in the Stratosphere when oxygen molecules dissociate after absorbing the ultraviolet photon whose wave length is shorter than 240nm.
This produces two oxygen atoms. The atomic oxygen then combines with O_2 to create ozone O_3
Ozone molecules absorb UV light between 310 and 200nm, following which ozone splits into a molecule of O_2 and O. The process O_3 generation and splitting repeats as per the equations below.
$O_2 = O+O$
$O_2+O = O_3 O_3 = O_2+O$
$O_3+O=2O_2$Under normal conditions the creation and destruction of ozone molecules is roughly constant and ultimately result in effect absorption
Of short wave length ultraviolet raditions in the Stratospheric region.

Life underneath is thus protected from the harmful solar radiations.
The average thickness of ozone layer in stratosphere is approximately 300DU.

Ozone hole: Certain human produced pollutants lead to destroy the stratosphere ozone and causing an imbalance between formation and dissociation of ozone. This decrease in the ozone level is called depletion or thinning of ozone layer or zone hole.

Cause of Ozone depletion:

Ozone can be destroyed by a number of free radical catalyst, like hydroxyl (OH), the nitric oxide (NO), atomic chlorine (Cl) and Bromine (Br).
All of these are generated by both natural and anthropogenic (man made) sources.
At preset most of the OH and NO is the stratosphere is of natural origin, but human activity has dramatically increased the chlorine and bromine.

•These elements are found in certain stable organic compounds, particularly chlorofluorocarbons (CFC's) .

•Once in the stratosphere, the Cl and Br atoms are liberated from the parent compounds by the action of ultra violet light and can destroy ozone molecules in a catalytic cycle.

$Cl + O_3 = ClO + O_2 ClO + 0 = Cl + O_2$ In sum, $O_3 + O = O_2 + O_2$

Final result is an oxygen molecule and a chlorine atom, which then reinitiates the cycle.

•A Single chlorine atom would keep on destroying ozone for up to two years. On a per atom basis, bromine is even more efficient than chlorine at destroying ozone, but there is much less bromine in the atmosphere. As a result both chlorine and Bromine contribute significantly to the overall ozone depletion.

•CFC's were used in air – conditioning / cooling units as aerosol spray propellants prior to the 1980's and in the cleaning process of electronic components.

•CFC's when reach the Stratosphere, are dissociated by ultraviolet light to relase chlorine atoms.

•The chlorine atoms act as Catalyst, and can breakdown many thousands of ozone molecules before removed from the Stratosphere.

•It is calculated that CFC molecules takes an average of 15 years to go from Ground level upto the upper atmosphere, and it can stay there for about a century, destroying up to one hundred thousand ozone molecules during that times.

•The Antarctic ozone hole is an area of the Antarctic Stratosphere in which the recent ozone levels have dropped to as low as 33% of their Pre- 1975 values.

•The ozone hole occurs during the Antarctic spring, from September to early December, as strong westerly winds start to circulate around the continent and create an atmospheric container, within this "polar vertex", over 50% of the lower stratospheric ozone is destroyed during the Antarctic spring.

•The overall cause of ozone depletion is th presence of chlorine – containing source gases (primarily CFC's and related hydrocarbons). In the presence of UV light, these gases dissociate releasing chlorine atoms, which then go on to catalyze ozone destruction. The chlorine catalyzed ozone depletion can take place in the gas phase, but it is dramatically enhanced in the presence of polar stratospheric clouds (PSC's)

•Polar Stratospheric clouds form during winter. In the extreme cold temperatures would be around -80^0C, without Sunlight and the 'polar vertex' trapping the chill air.
This enhances the Surfaces for chemical reactions that lead to ozone destruction.

•Most of the ozone that is destroyed is in the lower stratosphere. Warming temperatures near the end of Spring break up the vortex around mid – December.
As warm ozone – rich air flows in from lower latitudes, the PSC's are destroyed, the ozone depletion process shuts down, and the ozone hole heals.
•The decrease in the ozone layer was predicted in the early 1980's to be roughly 7% over a sixty – year period.
The term Ozone depletion for distinct but related, observations: a slow decline (about 3% per decade) in the total amount of ozone in the earth's stratosphere and much larger, but seasonal, decrease in Stratospheric ozone over the earth's polar regions during the same period. Cause of both trends is believed to be the Catalytic destruction of ozone by atomic chlorine and bromine.
The reactions that take place on polar stratospheric clouds (PSC's) are of great importance.
The PSC's only form in extreme cold. The Antarctic stratosphere is colder than the Arctic, and the PSC's form more readily, which is the reason for ozone hole formation over Antarctic. This is why the Arctic zone holes are not as deep. In middle latitudes declines are bout 3% below pre-1980 values for 35-60N and bout 6% for 35-60S. In the topics, there are no significant trends.

Consequences of Ozone depletion:

•Since the ozone layer absorbs UV-B light from the Sun, ozone layer depletion is expected to increase surface UV-B levels, which could lead to damage, including increase in skin cancer.
•Scientists have estimated that a one percent decrease in Stratospheric ozone would increase the incidence of skin cancers by 2%
•A direct correlation has been observed between cataract formation in eyes and UV radiations.
•An increase of UV radiation would also affect crops like rice.
•At ground level ozone is generally recognize to be a health risk, as ozone is toxi due to its strong oxidant properties
•Presently, ozone at ground level is produced mainly by the action of UV radiation as exhaust gases, from vehicles.
•Lower trophic level organisms shall be the worst sufferers as they have a simple cell wall for their protection against UV radiation. With the primary tropic levels drastically impaired the entire ecosystems could collapse.

Current events and future trends.

•In 1994 UN General, assembly voted to designate September 16 as "World Ozone day".
•A 2005 IPCC summary of ozonic issue observed that global average amount of ozone depletion is now approximately stabilized.
•The thickness of the ozone layer over Europe which has decreased by 8% since the 1980's has now slowed down to about 4% a decade. The Antarctic ozone hole reached its largest ever size in September 2000 at 11.5 million Square miles.

Animal Husbandry

•Animal husbandry or live stock implies the breeding, feeding and managing animals for the production of food, fiber, work and pleasure.
•Animals furnish about 28% of the world's total value of agricultural products. They supply a much higher proportion of human food in the developed countries than elsewhere.
•Traditional husbandry practices are closely associated with the degree of control needed over the animals that are kept and with the uses to which they are put.

Types of Livestock

The term "livestock is vague and may be defined narrowly or broadly.
Domesticated animals such as cows, pigs, deer, goats, sheep, horses, donkeys, chickens, yaks are livestock's. Hence the definition of livestock includes mammals and birds.
On a broader view, "livestock" could incorporate the international rearing of butterflies, silk & honey bees.
Purpose of Animal husbandry
•Meat: The production of a useful form of dietry, protein & energy.
•Dairy products: Mammals can be used a source of Milk, which can be turned into various dairy products.
•Using such livestock can often yield several time the food energy of slaughtering the animal outright.
•Fiber: Livestock produce a range of fiber or textile, Example: Sheep, can make leather, etc.
•Fertilizer: Manure can be spread on fields to increase crop yields. Manure is also used to make plaster for walls and floors and can be used as fuels for fires.
•**Labour:** Animals such as horses, donkies, yaks can be used for transportation of men & material, Agricultural purposes & even in military**.**
•Land management: The grazing of livestock is used to control weeds etc.

Impacts of Animal Husbandry on Environment:

•If livestocks are very large in numbers or unnaturally concentrated numbers, their most basic needs can place burdens on ecosystems. However, such environmental impacts can be eliminated or lessened by regulating the number of animals in a given area and other animal husbandry techniques.

•Impacts of animal husbandry on environment can be summarized as follows:

On vegetation: animal husbandry causes un favorable changes in vegetation composition and structure as a result of overgrazing. Damage by animals can cause soil erosion, while roughening up of the ground can also create better conditions for germination & hence of plant regeneration.

On global warming: Methane is a major green house gas. The annual global generation of methane from ruminants accounts for 15% of total amount released into the atmosphere. This rate is increasing steadily at 1% per year. It is interesting to note that cattle produce methane 2 to3 times more than that from the ruminants.

On water sources: Inadequately protected wells and watering places can easily be contaminated by animal waste, which is a big health risk.
Proper care should be taken in controlling the quantity of liquid & solid fertilizers, so that the positive effects on soil fertility & soil structure are enhanced.

On soil: Fodder growing within a crop rotation system can have positive effects on soil structure & soil fertility. However, when mineral fertilizers and herbicides are used in fodder production, surface water & ground water may get contaminated.

Exercise-1 (ENERGY)

1. The word energy is derived from
a) English b) Arabic c) Greek d) Latin

2.Energy means,
a) Capacity to do work b) Capacity to see
c) Capacity to hear d) None of the above

3. Energy is measured in
a) Blu b) Bhu c) Btu d) Ntu

4.James prescott Joule was a English
a) Chemist b) Physicist
c) Mathematician d) Astronomer

5. One Btu is equivalent to
a) 1000 Joules b) 10 Joules
c) 100 Joules d) 10000 Joules

6.A piece of buttered bread toast contains about
a) 200 kilo joules b) 200 Joules
c) 315 Kilojoules d) 315 Joules

7.The energy equivalent derived after consuming a piece of buttered bread toast is sufficient enough to jog for
a) 16min b) 16 secs c) 6 secs d) 6min

8. The energy equivalent of a piece of buttered bread is sufficient to light a 60W bulb for
a) 19min b) 90min c) 90secs d) 19sec

9.Energy of motion is known as
a) Heat Energy b) Potential energy
c) Kinetic energy d) None of the above

10.Energy due to position is known as
a) Heat energy b) Potential energy
c) Kinetic energy d) Wind energy

11. Renewable energy is
a) Primary source b) Secondary source
c) Tertiary source d) None of the above

12. Coal, lignite & natural gas are
a) Renewable b) Fossil fuels
c) Secondary sources d) All the above
13. Nuclear energy is obtained from
a) Barium b) Calcium
c) Platinum d) Uranium

14. Hydro energy is obtained from
a) Still water b) Falling water
c) Stored water d) None of the above

15. Electromagnetic radiation from the sun is known as
a) Nuclear energy b) Hydro energy
c) Solar energy d) Tidal energy

16. Electric energy from Coal burning is an example of
a) Secondary energy b) Primary energy
c) Solar energy d) All the above

17. The energy consumption for Global transportation is about
a) 42% b) 24% c) 4% d) 34%

18. Energy consumption for Domestic & Commercial purposes is about
a)30% b) 13% c) 3% d)50%

19. Ninety nine percent of our energy comes from
a) Moon b) Earth c) Sun d) Wind

20. The annual oil consumption of the top 20 richest countries is about
a) 35% b) 50% c) 10% d) 65%

21. For cooking and heating, about Three billion people of the third world mainly depend upon
a) Electricity b) Coal
c) Nuclear energy d) Solar energy

22. _____Percentage of the total energy represents the Non – renewable sources
a) 82 b) 28 c) 8.2 d) None of the above

23. The largest energy consumer in the world is
a) India b) USA c) UK d) Russia

24. Annual coal consumption of India is about
a) 100million tonnes b) 100 billion tons
c) 10 million tons d) 10 billion tons

25. Annual oil consumption of India is about
a) 3.25 million tons b) 325 million tons
c) 32.5 million tons d) 32.5 million tons
26. Official estimates of coal availability in India is about
a) 40 million tons b) 4 million tons
c) 4 billion tons d) 40 billion tons

27. Projected demand for coal in India till the year 2020 is
a) 2.3 billion tons b) 23 billion tons
c) 23 billion tons d) None of the above

28. Projected demand for hydroelectric power in India by 2020 is _____times more than the present installed capacity of about 15,000 Mu
a)120 b) 1.2 c) 0.12 d) 12

29. Gas reserves of India is about
a)100 million cubic meters b) 10 million cubic tons
c) 100 cubic meters d) None of the above

30. World gas reserves is estimated as
a) 6300 million cubic meters b) 630000 million cubic meters
c) 630 million cubic meters d) 63000 million cubic meters

31. Electromagnetic radiation is an energy in the form of a
a) Light b) Wave c) Heat d) All the above.

32. Electromagnetic radiation energy is due to changing of
a) Electric and magnetic fields b) Electric and Heat fields
c) Magnetic and Heat fields d) None of the above

33. Speed of Electromagnetic radiation waves is of the order of
a) 30000 km/sec b) 30000 kmph
c) 300000kmph d) 300000 km/sec

34. Electromagnetic radiation travels through space at the speed of
a) Sound b) Wind c) Light d) all the above.

35. Cosmic rays, Gamma rays, X-rays and Ultraviolet radiation are known as
a) Primary radiation b) Ionizing radiation
c) Non-Ionizing radiation d) Secondary radiation

36. Cancer and related diseases are caused due to
a) Primary radiation b) Non-Ionizing radiation
c) Ionizing radiation d) Secondary radiation.

37. The forms of electromagnetic radiation not containing enough energy to form ions are known as
a) Thermal radiation b) Primary radiation
c) Ionizing radiation d) Non-Ionizing radiation
38. The visible light that can be detected by our eyes is a form of
a) Non-Ionizing radiation b) Ionizing radiation
c) Solar radiation d) Black body radiation

39. Ionizing radiation waves have
a) Low energy & short wave length b) Low energy & long wave length
c) High energy & short wave length d) High energy & long wave length

40. The wave length range of ionizing radiation waves falls in the range of
a) 10^{+4} to 10^{+7}m b) 10^{-4} to 10^{+7}m
c) 10^{+4} to 10^{-7}m d) 10^{-4} to 10^{-6}m

41. Non ionizing radiation electro magnetic waves have
a) Low energy, short wave length b) Low energy, long wave length
c) High energy, short wave length d) High energy, long wave length

42. In the early days the energy demands were met by
a) Wind b) Muscular effort
c) Water power d) None of the above

43. Example of renewable source of energy form is
a) Uranium b) Wind c) Coal d) Oil

44. Example of non-conventional source of energy is
a) Natural gas b) Oil c) Nuclear d) Biofuels

45. Which of the following is not a fossil fuel

a) Oil b) Gas c) Coal d) Uranium

46. Which of the following is not a non-conventional energy
a) Wind energy b) Solar energy
c) Bio energy d) Hydro electric energy

47. Wind patterns and water flow is due to
a) Sun b) Moon
c) Earth d) None of the above

48. Per Capita annual electric consumption in India is about
a) 3550 KW b) 3550 MW
c) 355 KW d) 355MW

49. The annual power consumption of a computer working continuously is
a) 876 Watt hours b) 876 KWh
c) 8760 KWh d) 8760 Watt hours

50. One calorie is the amount of energy required to heat
a) One litre of water to 1^0C b) One gram of water to 1^0C
c) One cubic meter of water to 1^0C d) None of the above

Answers (exercise-1)

1.c, 2.a, 3.c, 4.b, 5.a, 6.c, 7.c, 8.b, 9.c, 10.b
11.a, 12.b, 13.d, 14.b, 15.c, 16.a, 17.b, 18.a, 19.c,
20.d, 21.b, 22.a, 23.b, 24.a, 25.c, 26.d, 27.b, 28.d
29.a, 30.d, 31.b, 32.a, 33.d, 34.c, 35.b, 36.c, 37.d,
38.a, 39.c, 40.d, 41.b, 42.b, 43.b, 44.d, 45.d, 46.d,
47.a, 48.c, 49.b, 50.b

Exercise- 2 (ENERGY)

1. Hydroelectricity is produced from
a) Stream b) Falling water
c) Ocean d) All the above

2. Hydroelectricity is generated by
a) Lifting the water by the turbine b) Lifting the water by the Generator
c) The turbine rotating the Generator d) The generator rotating the turbine

3. In 2001, Hydropower supplied about ____ percent of world's total commercial energy.
a) 7 b) 17 c) 71 d) 0.7

4. In 2001, Hydropower supplied about ____ percent of world's electricity
a) 2 b) 17 c) 71 d) 0.7

5. By the end of fourth five- year plan India was able to generate _____MW of hydropower
a) 690 b) 69 c) 6900 d) 69000

6. Due to increase in demand, the hydropower production at the end of Eighth plan fell down by about
a) 25% b) 2.5%
c) 0.25% d) None of the above

7. Hydropower potential of India is estimated to be
a) $4x10^{11}$ MW hours b) $4x10^{11}$KW hours
c) $40x10^{11}$MW hours d) $40x10^{11}$KW hours

8. World commission on_____has reported that hydropower in tropical countries is major emitter of green house gases
a) Hydraulics b) Environment
c) Atomic energy d) Dams.

9. Efficiency of hydropower is of the order of
a) 80% b) 8% c) 0.8% d) 18%

10. Major disadvantages of an Hydropower project is due to its
a) Low construction cost & High flood risk b) Low construction cost & low flood risk
c) High construction cost & low flood risk d) High construction cost & high flood risk

11. According to unit nation's report, the percentage of world's hydropower exploited is
a) 13% b) 31% c) 130% d) 1.3%

12. Much of the untapped hydropower is in
a) Europe b) USA
c) Canada d) South America

13. Fossil fuels are
a) Energy rich substance b) Less energy substances
c) No energy substances d) None of the above

14. Fossil fuels are formed from the remains of organisms that lived
a) 200 to 500 years ago b) 200 to 500 billion yrs ago
c) 2000 to 500yrs ago d) 200 to 500 million yrs ago

15. Between 1859 & 1969 total oil production of the world was
a) 2270 barrels b) 227 million barrels
c) 227 billion barrels d) 22.7 billion barrels

16. Fossil fuels largely consists of
a) Hydrocarbons b) Hydrogen Sulphide
c) Hydrochloric acid d) carbon dioxide

17. One barrel is equivalent to
a) 15ltrs b) 159ltrs
c) 1590ltrs d) 1.59ltrs

18. The coal deposits in our planet is about
a) 27350 million metric tons b) 27350 metric tons
c) 27350 billion metric tons d) 2735 billion metric tons

19. The coal available in India is
a) Not good quality b) Excellent quality
c) Very good quality d) Medium quality

20. In India coal is available in
a) Karnataka b) Tamil Nadu
c) Rajasthan d) Madhya Pradesh

21. The carbon content of Anthracite or hard coal is
a) 90% b) 9% c) 900% d) 0.9%

22. Anthracite & lignite are examples of
a) Petroleum b) Natural gas
c) Coal d) Wood

23. Present annual extraction rate of coal is about
a) 3000 million metric tons b) 3000 metric tons
c) 300 billion metric tons d) 3000 billion metric tons

24. The existing coal deposits may last for about
a) 20yrs b) 2000yrs
c) 2 years d) 200yrs

25. Energy content of petroleum when compared to coal is
a) Equal b) High
c) Low d) None of the above.

26. Lifeline of global energy is
a) Coal b) Electricity
c) Petroleum d) All the above

27. Petroleum when burnt
a) Leaves residue b) Leaves no residue

c) Emits large quantities of Sulphur d) Emits large quantities of carbon dioxide

28. OPEC is formed by a group of _____ oil rich countries
a) 13 b) 31 c) 130 d) 310

29. One of the major oil producing country in the world is
a) Japan b) Africa
c) New Zealand d) Mexico

30. _____ of the world's oil reserves are available in Saudi Arabia
a) ¼ b) ½ c) 1/3 d) 1/8

31. Total oil reserves of the world is
a) 356.2 trillion metric tons b) 356.2 million metric tons
c) 356.2 billion metric tons d) 356.2 metric tons

32. World's Annual extraction of petroleum is about
a) 2874 million tons b) 2874 billion tons
c) 287.4 million tons d) 28700 billion tons

33. Existing oil reserves could last for about
a) 5000yrs b) 500yrs c) 5yrs d) 50yrs

34. Oil bearing potential of India is about
a) One Million km^2 b) 1000km^2 c) 10,000 km^2 d) 100,000 km^2

35. Natural gas mainly consists of
a) Carbon dioxide b) Hydrogen
c) Methane d) Oxygen

36. A good example of cleanest source of fossil fuel energy is
a) Petroleum b) Natural Gas
c) Coal d) Lignite

37. Total natural gas reserves of the world is about
a) 600,000 million $meter^3$ b) 600,00 m^3
c) 600,000 billion $meter^3$ d) 60000 million m^3

38. Natural gas reserves of Russia is about
a) 34% b) 3.4% c) 50% d) 85%

39. Annual production of natural gas is about
a) 1250 million cubic meters b) 1250 billion cubic meters
c) 125 million cubic meters d) 125 billion cubic meters

40. Natural gas reserves are expected to last for about

a) 500yrs b) 5000yrs c) 50yrs d) 5yrs

41. Burning of fossil fuels results in
a) Acid rain b) Alkali rain
c) Heavy rain d) No rain

42. Unburnt fuel particles are known as
a) Smoke b) fog
c) smog d) Ash particles

43. Example of green house gas is
a) Nitrogen b) Hydrogen
c) Carbon dioxide d) Hydrogen Sulphide

44. Between 19^{th} & 20^{th} Century the green house gas liberation from fossil fuel burning has increased by
a) 2.8% b) 28% c) 280% d) 128%

45. Disrupted weather patter & polar ice melting is due to
a) Global warming b) Global cooling
c) Heavy rains d) Deforestation

46. Nuclear energy is an example of
a) Renewable energy b) Non-renewable energy
c) Bio degradable energy d) Degradable energy

47. Reserves of Nuclear fuels is about ____times than fossil fuels
a) 10times b) 100times
c) 1000times d) million times

48. 1000 kgs of Nuclear fuel can produce energy equivalent to ____ barrels of oil
a) 12millions b) 12 billion
c) 12,000 d) 1200

49. Nuclear reactors operate at about
a) 625^0C b) 625k
c) 62.5K d) 62.5^0C

50. Nuclear fusion is the process of
a) Absorbing energy b) adsorbing energy
c) Releasing energy d) removing energy

51. Radio active waste can remain for
a) Few days only b) for months
c) For years d) for centuries

52. Chernobyl (Russia) nuclear accident occurred in the year
a)1986 b) 1976 c) 2006 d) 1876

53. Fuel for Nuclear fusing is
a)Oxygen b) Carbon dioxide
c) Hydrogen d) Helium

54. Fusion process is _____ fission
a) Same as b) Not safer than
c) Safer than d) None of the above

55. When compared to fission the pollution problems from the fusion process is
a) Same b) High
c) Nominal d) all the above.

Answers (exercise-2)

1.b, 2.c, 3.a, 4.d, 5.c, 6.a, 7.b, 8.d, 9.a, 10.a
11.a, 12.d, 13.a, 14.d, 15.a, 16.c, 17.b, 18.c, 19.a,
20.d, 21.a, 22.c, 23.a, 24.d, 25.b, 26.c, 27.b, 28.a
29.d, 30.a, 31.c, 32.a, 33.d, 34.a, 35.c, 36.b, 37.c,
38.a, 39.b, 40.c, 41.a, 42.d, 43.c, 44.b, 45.a, 46.b,
47.a, 48.a, 49.b, 50.c, 51.d, 52.a, 53.c, 54.c, 55.c

Exercise-3 (ENERGY)

1.Solar energy orginates from the
a) Thermo nuclear fusion reaction taking place in the Sun.
b) Nuclear fission taking place in the Sun.
c) Burning of oxygen on the surface of Sun.
d) None of the above.

2. Solar energy is a potential
a) Conventional energy Source b) Converted energy
c) Non conventional energy source d) Electric energy

3. 92% of the solar radiation reaching the Earth will be in the range of

a) 315 to 1400m b) 315 to 1400 m
c) 315 to 1400nM d) 315 to 1400mm

4. 45% of the Solar radiation reaching the Earth will be in the
a) Invisible range b) Dark range
c) bright range d) visible range
5. Earth emits radiations in the
a) Yellow region b) Brown region
c) Infra red region d) Black region

6. The heat equivalent of the Solar radiation reaching the estimated to be about
a) $2.68x10^{24}$ Joules per year b) $2.68x10^{24}$ kilo Joules per year
c) $2.68x10^{24}$ Joules per day d) $2.68x10^{24}$ Joules per month

7. Solar energy is
a) Non-polluting & deplete b) Non-polluting & non-deplete
c) Polluting & non – deplete d) Polluting & deplete

8. In India, Solar volatile systems are being installed by the Department of

a) Space b) Atomic energy
c) Geology d) Non – conventional energy resources

9. The maintenance free life of solar cells is
a) Ten or more years b) One hundred years
c) Ten months d) One thousand yrs

10. The Earth's surface area required for producing 1000MW of electricity is
a) $120km^2$ b) $1.2km^2$ c) $12km^2$ d) $1200km^2$

11. The electricity saved in heating about 100 litres of water daily to 60^0C using solar energy results in saving
a) 1200 – 1500 units per month b) 1200-1500 units per day
c) 1200-1500 units per year d) 12000-1500 units per hour

12. Solar energy collection process can damage the fragile ecosystem of the
a) Oceans b) Mountains c) Rivers d) Deserts

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13. Active & Passive systems are the terms using in
a) Air conditioning b) Nuclear reactors
c) Solar heating systems d) None of the above

14. Passive solar heating system depends upon
a) Pumps b) Natural convection currents
c) Turbines d) Blowers

15. Passive solar energy needs access to the sun ____ percent of the time
a) 5 b) 0.5 c) 60 d) 600

16. Solar cell contains
a) Semi conductor material b) Thermo couple
c) Batteries d) Capacitors

17. Sunlight energizes and causes ___ in the semi conductor to flow, creating an electric current
a)Protons b) Neutrons
c) Electrons d) All the above

18. Solar cells reduces dependence on
a) Nuclear power b) Fossil fuels
c) Hydrogen d) Biomass

19. Solar energy is an ideal energy source because of
a) Unlimited supply b) No air & water pollution
c) Free of by-products d) All the above

20. A Solar cell generates electricity from Sunlight by
a)Flow of charge carriers b) Flow of heat
c) Flow of energy d) Flow of electrolyte

21) Biomass is a ____energy source
a) Non renewable b) Renewable
c) Alternative d) None of the above

22. Biomass is the term for all organic matter produced by
a) Photography b) Photo electric effect
c) Photosynthesis d) Combustion

23. The source of all energy is biomass is the
a) Moon b) Earth c) Jupiter d) Sun

24. Extraction of energy from biomass is split into
a) Solid biomass, Biogas & liquid bio fuels b) Petrol, Coal & Peat
c) Solar energy, nuclear energy & Hydro energy. d) None of the above

25. Heat from Solid biomass is derived from
a) Conduction b) Combustion
c) Convection d) Digestion

26. Biogas is the result of _____ organic materials
a) Anaerobic digestion b) Aerobic digestion
c) Combustion d) Compression

27. Many of the World's poorer countries with wood supplies, crop residues & animal wastes are in
a) Temperature regions b) Humid tropic regions
c) Arid regions d) Polar regions

28. Bagasse is a left over of
a) Paddy b) Wheat c) Vegetables d) Sugarcane

29. In India the estimates of electricity generation from bagasse is about
a) 350MW b) 3500KW c) 3500MW d) 35000MW

30. In India, around ____ of power from biomass has already bee commissioned
a) 270KW b) 270MW c) 2700KW d) 2700MW

31. Production of biomass energy mainly involved
a) Water damage b) Sulphur dioxide
c) Release of Methane d) Soil damage

32. Biogas is obtained by _____ organic material
a) Photosynthesis b) Anaerobic digestion
c) Aerobic digestion d) All the above

33. The cattle population of India is about
a) 4 million b) 400 million
c) 400 billion d) 40 billion

34. Biogas production has the capacity to provide about ___ of our energy needs
a) ¼ b) 1/3 c) ½ d) ¾

35. By the end of 2003 the number of biogas plants in India was
a) 37.1 million b) 3.71 million
c) 371 million d) 0.371 million

36. Only ____ percent of the total estimated 12 million biogas plants are being utilized world over
a) 3.1 b) 13 c) 0.31 d) 31

37. The pay back period of biogas plants is only
a) 2 to 3 years b) 2 to 3 months
c) 20 to 30 years d) 200 to 300 years

38. The biogas needs of an average family size can be met by a biogas plant with a capacity of about
a) 200m^3 b) 20m^3 c) 2m^3 d) 0.2m^3

39. Fermentation in the biogas plant is carried out between
a) 350 to 500^{0}C b) 35 to 50^{0}C
c) 85 to 150^{0}C d) None of the above

40. One kilogram weight of cowdung produces about ___ liters of biogas
a) 1600 b) 16 c) 1.6 d) 160

41. Percentage Methane, content of Biogas is
a) 5.5 b) 85 c) 55 d) 0.55

42. The average gross calorific value of biogas is
a) 530 kilo cal/m^3 b) 53 kilo Cal/m^3
c) 5300 kilo Cal/m^3 d) 5.3 kilo Cal/m^3

43. Hydrogen is colourless, odourless gas that accounts for the ____ percent of the entire Universe's mass
a) 25 b) 50 c) 5 d) 75

44. Hydrogen as an energy source is
a) Alternative b) renewable
c) non renewable d) all the above

45. Hydrogen is found on Earth in combination with
a) Sulphur b) Helium c) Copper d) Oxygen

46. Reforming hydrogen means producing hydrogen from molecules of hydro carbon by
a) Cooling b) melting c) freezing d) heating

47. Electrolysis is the process used to separate water into
a) Oxygen & Nitrogen b) Oxygen & Hydrogen
c) Nitrogen & Hydrogen d) Hydrogen & Carbon

48. Hydrogen as a fuel has
a) No energy b) Low energy
c) High energy d) None of the above

49. A machine that burns pure hydrogen produces
a)High pollution b) Medium pollution
c) Smoke d) Almost zero pollution

50. NASA has used liquid hydrogen for propelling rockets & space shuttles since.
a) 1870 b) 2000 c) 1920 d) 1970

51. The pure water which the space shuttle crew drink is the by product of
a) Oxygen b) Hydrogen c) Nitrogen d) Carbon

52. Hydrogen can be stored in
a) Compressed gas tanks b) Air tight tanks
c) Petrol tanks d) None of the above

53.In 2002 scientists were able to trap hydrogen in a frame- work of water molecules known as
a) Clathrate Hydrates b) Clathrate Hydrogen
c) Clear hydrates d) Clear Hydrogen

54. Hydrogen contained in the form of metal hydrides in a vehicle's tank____ even if the tank is ruptured in an accident
a) Melt b) Freeze c) Explode d) Expand

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55. The disadvantage of hydrogen energy source is
a) Energy is needed to produce it b) Causes air & water pollution
c) Hazardness effect due to risk of leakage d) Releases toxic by –products

56. Excessive hydrogen leaks results in
a) Production of ozone b) Increasing ozone
c) Depletion ozone d) None of the above

57. Sequence of production of electricity from hydrogen is
a) Electrolysis of water, fuel cell reaction, storage of hydrogen.

b) Production of Hydrogen, Electrolysis of water, fuel cell reaction
c) Electrolysis of water, Storage of hydrogen, fuel cell reaction
d) Fuel cell reaction, Electrolysis of water, Storage of hydrogen at present

58. The performance coefficient of Solar cells at present stands between
a) 10 to 16% b) 25 to 35%
c) 45 to 55% d) 80 to 90%

59. The solar flux reaching the earth's upper atmosphere is estimated to be about
a) 1400 kilowatts/m^2/min b) 1400 watts/m^2/min
c) 1400 kilowatts/m^2/sec d) 1400 watts/m^2/sec

60. Soil erosion, water pollution and loss of wild life habitat is a major disadvantage of
a) Solid biomass b) Hydrogen
c) Ethanol fuel d) Solar energy

Answers (Exercise-3)

1. a, 2.b, 3.c, 4.a, 5.c, 6.a, 7.b, 8.d, 9.a, 10.c, 11.c, 12.d, 13.c, 14.b, 15.c, 16.a, 17.c, 18.b, 19.d, 20.a, 21.b, 22.c, 23.d, 24.a, 25.b, 26.a, 27.b, 28.d, 29.c, 30.b, 31.c, 32.b, 33.b, 34.c, 35.b, 36.d, 37.a, 38.c, 39.b, 40.d, 41.c, 42.b, 43.d, 44.a, 45.d, 46.d, 47.b, 48.c, 49.d, 50.d, 51.b, 52.a, 53.a, 54.c, 55.a, 56.c, 57.c, 58.a, 59.b, 60.a.

Exercise-4 (Acid Rain, Ozone depletion, Animal Husbandry)

1. The term Acid Rain was coined in the year.
a) 1952 b) 1852 c) 1652, d) 1752

2. The Term Acid Rain was coined by
   a) ROBERT ANGUS WHALES
   b) CHARLES ANGUS SMITH
   c) ROBERT ANGUS SMITH
   d) NONE OF THE ABOVE

3. Acid Rain is a form of
a. Soil Pollution b) Water Pollution
c. Solar pollution d) Air pollution

4. The major contributors to acid rain are known as
a. Precursors b) Processors
c. Protons d) Pollutants

5. Two acids responsible for acid rain are
   a. Nitric acid & Sulphuric acid
   b. Nitric acid & Hydrochloric acid
   c. Sulphuric acid & phosphoric acid
   d. Sulphuric acid & Acitic acid

6. Precursors mainly come from
   a. Chemical & physical sources
   b. Biogenic and anthropogenic sources
   c. Biotic & abiotic sources
   d. Arctic & Antarctic sources

7. Anthropogenic or Man made sources of air pollution are:
   a. Spread over large areas.
   b. Concentrated around the source
   c. Spread all over the Earth
   d. None of the above.

8. Volcanic eruptions and Decay of organic matter are good examples of
   a) Volcanic source
   b) Natural resources
   c) Biogenic source
   d) Anthropogenic source

9. Example of Anthropogenic sources is
   a) Bush fire b) Burning of fossil fuels
   c) Microbial process d) lighting discharges.

10. Particulates falling directly from the atmosphere to the ground are known as
a) Wet forms b) solid forms
c) Dry deposition d) None of the above.

11. Catalytic reduction is a process adopted to
   a) Increase the levels of Sulphur dioxide
   b) Decrease the levels of Sulphur dioxide
   c) Increase the levels of Nitrogen oxides
   d) Decrease the levels of Nitrogen oxides

12. Catalytic converter in a vehicle will convert engine gases into
   a) Nitrogen & oxygen
   b) Hydrogen & Oxygen
   c) Hydrogen & Nitrogen
   d) None of the above.

13. Using less air for combustion can
    a) Increase nitrogen oxides
    b) Increase Sulphur oxides
    c) Decrease Sulphur oxides
    d) Decrease Nitrogen oxides.

14. Lower the temperature of combustion, lower will be the production of
    a) Nitrogen b) Hydrogen
    c) Nitrogen oxides d) Water

15. Two stage combustion and flue gas recirculation results in
    a) Reduction in temperature
    b) Increase in temperature
    c) Reduction in emissions
    d) None of the above.

16. Fluidized bed combustion is a complex process of reducing.
    a) Nitrogen b) Oxygen
    c) Hydrogen d) Sulphur dioxide

17. Flue gas desulphurization is achieved by using
    a) Lime stone b) Coal
    c) Sand stone d) Diesel

18. Fluidized bed combustion produces
    a) Liquid waste b) Air pollution
    c) Solid waste d) none of the above

19. Acids are corrosive chemicals that react with other chemical by giving
    a) Oxygen atom b) Hydrogen atom
    c) Nitrogen atom d) Chlorine atom

20. Acid rain on trees results in
    a) Brown dead spots b) Photosynthesis
    c) White patches d) Plasma
21. In Black forests of South Western Germany, half of the trees are damaged from
    a) Snow b) Water pollution
    c) Air pollution d) Acid rain.
22. Most farm crops are _____affected by Acid Rain.
    a) Most b) Very little
    c) Not at all d) Less.

23. Parthenon in Greece and Taj mahal in India are deteriorating due to
a) Alkali deposition b) Snow fall
c) Acid rain d) All the above

24. It is _____ to swim in even the most acidified lakes.
a) Safe b) Unsafe
c) Not advisable d) None of the above
.

25. Acid rain tends to _____ global warming
a) Increase b) No effect on
c) Slow down d) All the above

26. Acid Rain can be controlled by
a) Reducing CO2 and Hydrocarbon emission
b) Reducing SO2 and NO2 emissions
c) Increasing number of vehicles
d) Increasing number of lakes.

27. Ozone layer was discovered by
a) Charles Fabry b) Charles Darwin
c) Henry Charles d) Henry Darwin

28. Ozone layer was discovered in the year
a) 1613 b) 1713 c) 1913 d) 1813

29. Properties of ozone layer were explored by
a) Johnson b) Kingston c) Polson d) Dobson.

30. The equivalent of one Dobson Unit (DU) is
a) 0.1mm b) 0.01mm c) 0.1m d) 0.01m

31. Ozone layer is at a height of ____ above the Earth's Surface
a) 19 to 48m b) 19 to 480m
c) 19 to 48km d) 190 to 148km

32. Ozone layer is very important because it absorbs Ultra violet radiation emissions from
a) Sun b) Moon c) Stars d) Jupiter

33. UV radiation is divided into three categories based on its
a) Frequency b) Intensity
c) Wave length d) None of the above

34. The wave length range of UV-A is in the range of
a) 315 to 400nm b) 315 to 400nm
c) 315 to 400cm d) 315 to 400m.

35. Excessive exposure to UV-B radiation can cause
a) Kidney failure b) Skin cancer
c) Blood cancer d) None of the above.

36. UV-C rapidly damages all types of
a) Biota b) Buildings
c) Water bodies d) All the above.

37. Ozone is formed in the
a) Lithosphere b) Atmosphere
c) Hydrosphere d) Stratosphere

38. Ozone molecules absorb UV light between
a) 310 to 200nm b) 310 and 200m
c) 310 and 200mm d) 310 and 200nm

39. The average thickness of ozone layer in the stratosphere is approximately
a) 3000Du b) 30DU
c) 30,000DU d) 300DU

40. Ozone holes is due to
a) Increase in oxygen level
b) Increase in ozone level
c) Decrease in oxygen level
d) Decrease in ozone level

41. Ozone hole is said to occur when the ozone level decreases below
a) 200DU b) 2000DU c) 20DU d) 2 DU

42. Hydroxyl, Nitric oxide, atomic chlorine and Bromine can result in _____ of ozone.
a) Increase
b) Balancing
c) Decreasing
d) Neutralizises

43. UV-C radiation lies in the region
a) <280nm b) >280nm
c) 315 to 400nm d) 280 to 315nm.

44. Many thousands of ozone molecules are removed from the stratosphere due atoms of
a) Sulphur b) Oxygen
c) Hydrogen d) Chlorine

45. CFC molecules can stay in the atmosphere for about
a) 1 year b) 10 yrs c) 100yrs d) 1000yrs

46. In the Antarctic zone, ozone layer occurs during the period
a) Sept to Dec b) Jan to Mar
c) April to June d) July to Sep

47. The decrease in the ozone layer was predicted in the early
a) 1960 b) 1970 c) 1980 d) 1880.

48. The Antarctic stratosphere is _____ than the Arctic, hence the reason for ozone hole.
a) Colder b) Warmer
c) Brighter d) None of the above

49. One percent decrease in Stratospheric ozone would increase the incidence of skin cancer by
a) 0.2% b) 20% c) 2% d) 0.02%

50. Ozone at ground level is health risky due to its strong ____ property
a) Acid b) Alkaline
c) Oxidant d) Hydroscopic.

51. World ozone day is celebrated on
a) 16th Sep b) 18th Sep c) 16th Mar d) 15th Aug

52. The Antarctic ozone hole reached its largest ever size
a) Sep 2000 b) Jan 2000
c) Jan 2005 d) Sep 2005

53. The largest ozone hole size on Antarctic region is reported as
a) 11.5 thousand square miles
b) 11.5 million square miles
c) 11,500 square miles
d) 1,15,000 square miles

54. Breeding, feeding and managing animals for the production of food, fiber, work and pleasure is termed as
a)Cattle feeding b) Poultry
c) Animal building d) Animal husbandry

55. Animals furnish about ___ percent of world's total value of agricultural products.
a) 2.8 b) 0.28 c) 28 d) 58

56. Good example of domesticated animals is
a) Cow b) Tiger c) Elephant d) Snake

57. The purpose of animal husbandry is
   a) Conservation of biodiversity
   b) production of meat.
   c) Conservation of wild life
   d) None of the above.

58. Live stock does not include
   a) Sericulture b) Honey bees
   c) Horticulture d) None of the above

59. The annual global generation of methane from ruminants accounts for _____ percent of the total amount released into the atmosphere
   a) 15% b) 1.5% c) 0.15 d) 150

60. Methane produced form cattle is ____ that from the ruminants.
   a) Less than b) Equal to
   c) More than d) None of the above

61. Over fishing is
   a) Desirable
   b) Necessary
   c) Undesirable
   d) None of the above

62. Animal husbandry may result in
   a) Acid rain b) Ozone depletion
   c) Global warming d) Snow fall

ANSWERS (Exercise-4)

1. b, 2.c, 3.d, 4.a, 5.a, 6.b, 7.b, 8.c, 9.b, 10.c,
11. d, 12.a, 13.d, 14.c, 15.a, 16.d, 17.a, 18.c
19. b, 20.a, 21.d, 22.d, 23.c, 24.a, 25.c, 26.b
27. a, 28.c, 29.d, 30.b, 31.c, 32.a, 33.c, 34.a,
35. b, 36.a, 37.d, 38.a, 39.d, 40.d, 41.a, 42.c,
43. a, 44.d, 45.c, 46.a, 47.c, 48.a, 49.c, 50.c,
51 .b, 52.a, 53.b, 54.d, 55.c, 56.a, 57.b, 58.c,
59. a, 60.c, 61.c, 62.c.

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