

Source Of Energy

Check Point 01

Q. 1. What are the two characteristics of a good source of energy?

Answer: The basic characteristics of a good source of energy are as follows:

1. The source of energy should not cause any kind of environmental pollution.
2. The source of energy should produce a great amount of energy per unit mass or volume.
3. It should not cause any kind of harm to people and should not be risky to the health of people handling it.
4. The source of energy should be easily available and should have the capacity to generate energy for maximum amount of time.

Q. 2. When do you say that a source of energy is non-renewable?

Answer: Non-renewable sources of energy refer to that class of sources of energy which are dependent on materials which are limited in quantity and has the possibility of getting completely depleted in the future if used in very rapid rate. For example, petroleum or coal is available through the deposit which is formed over thousands of years back and thus is limited in quantity to the generation of coal or petroleum takes thousands to millions of years.

Q. 3. What is the difference between petroleum gas natural gas?

Answer:

Petroleum Gas	Natural Gas
1. Petroleum gas contains higher concentration of butane and propane.	Natural Gas contains higher concentration of methane in it.
2. Petroleum gas like LPG has higher calorific value [approx. 94MJ/m ³].	Natural Gas has lower calorific value [approx. MJ/m ³].
3. Petroleum Gas is a constituent of crude oil.	Natural gas is not at all a constituent of crude oil and it is found above the crude oil deposit.
4. Petroleum Gas is harmful to the environment as it causes a large amount of emission of carbon dioxide.	Natural Gas is safer for the environment as it emits very less amount of carbon dioxide in the atmosphere as compared to petroleum gas.

Q. 4. What are a conventional sources of energy?

Answer: Non-renewable sources or conventional sources of energy refer to that class of sources of energy which are dependent on materials which are limited in quantity and has the possibility of getting completely depleted in the future if used in very rapid rate. For example, petroleum or coal is available through the deposit which is formed over thousands of years back and thus is limited in quantity to the generation of coal or petroleum takes thousands to millions of years.

Conventional sources of energy cause environmental pollution as emit carbon dioxide and other pollutants on combustion.

Q. 5. Why should we avoid the use of fossil fuels as sources of energy?

Answer: The main reasons to avoid the use of fossil fuels as sources of energy:

1. Fossil Fuels cause heavy environmental pollution on being combusted as they emit carbon dioxide and other pollutants in the air.
2. Fossil fuels are limited or finite in quantity and hence their use should be limited to save it for future.

Check Point 02

Q. 1. Write any two points about good source of energy?

Answer: The basic characteristics of a good source of energy are as follows:

1. The source of energy should be sustainable and renewable.
2. It should not cause any kind of environmental pollution.
3. It should produce a great amount of energy per unit mass or volume.
4. It should not cause any kind of harm to people and should not be risky to the health of people handling it.
5. The source of energy should be easily available and should have the capacity
6. Energy and Good Fuel

Q. 2. According to pie-chart which of the fossil fuel is most widely used in India?

Answer: According to the pie chart, coal is the fossil fuel which is widely used in India for energy production.

Q. 3. Write two disadvantages of burning fossil fuels.

Answer: The main reasons to avoid the use of fossil fuels as sources of energy:

1. Fossil Fuels cause heavy environmental pollution on being combusted as they emit carbon dioxide and other pollutants in air.
2. Fossil fuels are limited or finite in quantity and hence their use should be limited to save it for future.
3. Incomplete combustion of fossil fuels causes liberation of carbon monoxide which is highly injurious to health.

Q. 4. Write anyone way in which a thermal power plant differs from a hydro power plant.

Answer:

Thermal Power Plant	Hydro Power Plant
1. Thermal Power Plant as the name suggests it refers to the generation of electricity by burning of fossil fuels.	Hydro Power Plant as the name suggests it refers to the generation of electricity by flowing water.
2. In this plants, the chemical energy of the fossil fuels is converted to electrical energy.	In this plants, the stored potential energy of water is converted into electrical energy.
3. Thermal Power plants release pollutants in the air and cause pollution.	Hydropower plants do not cause environmental pollution but the blocking of water causes harm to aquatic organisms.
4. Thermal power plant relies on conventional sources of energy that is fossil fuels.	Hydro Power energy rely on a renewable source of energy that is flowing of water.

Q. 5. What are the two negative impacts of a hydro power plant on the ecosystem?

Answer: The negative impacts of hydro power plant on ecosystem are as follows:

1. Since dams always have a reservoir where the abundant quantity of water is stored, the blocking of flowing water causes harm to aquatic animals and their migration.
2. Dams also causes submerging of the nearby lands and all the natural areas, agricultural lands and hence requires relocating of the people who lived previously near the dam area.
3. Water from the reservoirs of the dams is lost due to evaporation at a faster rate as compared to flowing water.
4. Normally reservoir water has a lesser amount of dissolved oxygen and is cooler as compared to normal water. So when such water is released, it causes negative impacts on the organisms and plants downstream.

Check Point 03

Q. 1. What are the popular biomass used in India?

Answer: The popular biomass used in India are as follows:

1. Cow Dung

2. Residues left after harvesting of crops.
3. Agricultural Waste
4. Sewage
5. Vegetable Waste
6. Wood

Q. 2. What is the composition of bio-gas?

Answer: The typical composition of biogas is as follows:

Methane lies in the range of 50-75%

Carbon Dioxide lies in the range of 25-50%

Nitrogen lies in the range of 0-10%

Hydrogen lies in the range of 0-1%

Q. 3. Why bio-gas is also known as gobar-gas?

Answer: Bio gas is the gas formed in the biogas plant due anaerobic oxidation of organic material. But the majority of the starting material for the biogas plant is the cow dung which is known as “gobar” in Hindi Language and hence the gas formed in the biogas plant is termed as the “gobar gas”

Q. 4. How does bio-gas plant help to reduce the problem of pollution?

Answer: Biogas is an excellent fuel for cooking purposes and it also contains 75% of methane because of which biogas burns without giving any kind of smoke and also do not leave any residue after being heated.

Since biogas also uses waste water, it removes the oxygen demanding pathogens present in the waste thereby preventing the pollution of water bodies.

Biogas plants contain the residue after all the organic matter is converted to gas. This residue is rich in phosphorous and nitrogen which are the two main nutrients for plants. Hence this residue can be used as an organic fertilizer for plants.

Q. 5. What are the two limitations of harnessing wind energy?

Answer: The limitations of harnessing wind energy are as follows:

1. The setting up and maintenance of the wind farms is a costly affair.
2. Wind Mills and Wind Farms requires a large area of their setup.
3. Wind farms can be established only those areas where wind flows throughout the year and the speed of wind remains above 15km/hr.

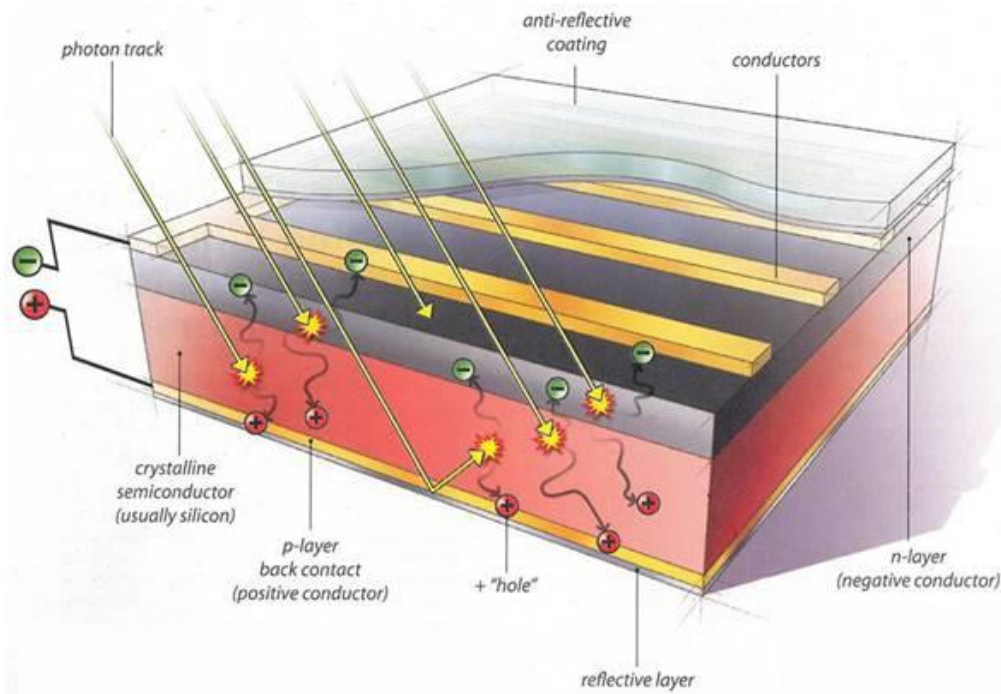
Check Point 04

Q. 1. Why is solar energy considered renewable?

Answer: The raw material required for the solar energy is sunlight which is freely available and sunlight is available as long as the sun exists and at the same time sunlight is inexhaustible. Hence solar energy is considered to be renewable source of energy.

Q. 2. Which element is used to make solar cells?

Answer: All the solar cells available in the market are made from silicon, germanium [rarely]. Silicon is the only material in which the electrons flow when it exposed to sunlight.



Q. 3. Why is the solar cooker box covered with a glass sheet?

Answer: Solar cooker box is used to cook food with help of sunlight. The sunlight when it shines on the solar cooker the food inside gets cooked due to the absorbed heat from sun rays.

To avoid the escaping of the heat from the solar cooker, the solar cooker is covered with glass as sunlight can pass through glass effectively but the heat inside the cooker will not be radiated out.

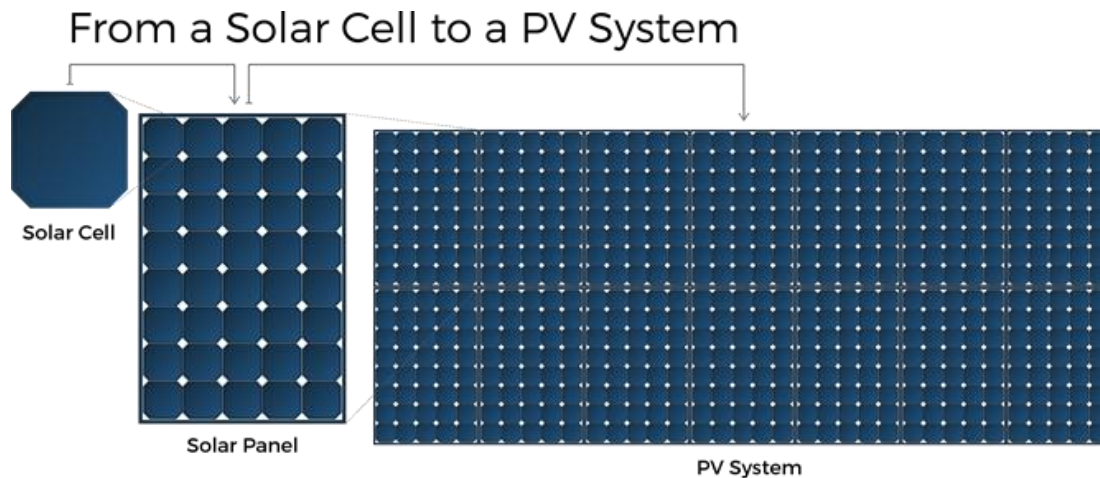
Q. 4. A solar cell transforms energy from one form into another form. What are these two forms of energy?

Answer: Solar Cell as the name suggests it has to deal with sun or more specifically sun's energy or solar energy. Cell means any device which gives electricity.

So a solar cell will convert solar energy into electrical energy.

Q. 5. What is a solar panel?

Answer: A single solar cell cannot generate large amount of electricity. So an array of connected solar cells constitute to form a solar panel which can give large amount of electricity.



Check Point 05

Q. 1. What are the different forms of energy available in ocean?

Answer: The different forms of energy available in ocean are as follows:

1. Tidal Energy due to tides in oceans.
2. Wave Energy due to fast-moving ocean waves.

3. Ocean current energy due to ocean currents under the ocean.
4. Ocean thermal energy due to difference in water's temperature at surface and deep inside the water.

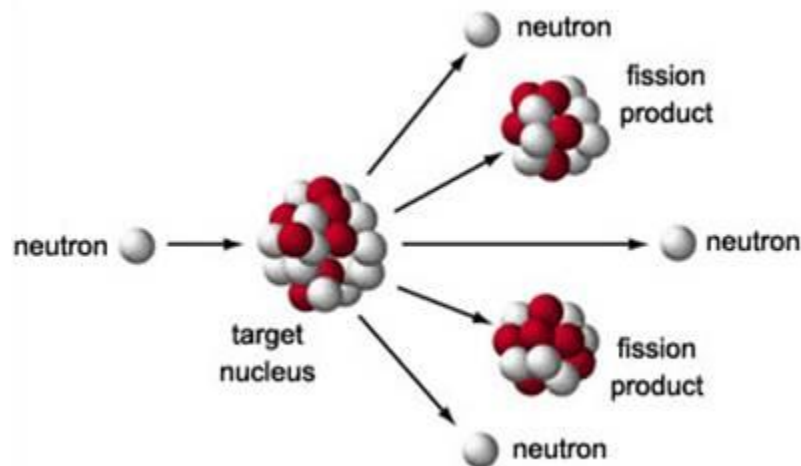
Q. 2. State one difference between tidal and wind energy.

Answer:

Tidal Energy	Wind Energy
1. Tidal energy is due to the rotation of propellers due to the tides occurring the in seas or oceans.	Wind energy is due to rotation of turbine due to the fast moving wind.
2. Since tidal energy is dependent on tides which are predictable.	Flowing of wind is cannot be predicted.

Q. 3. What is nuclear fission?

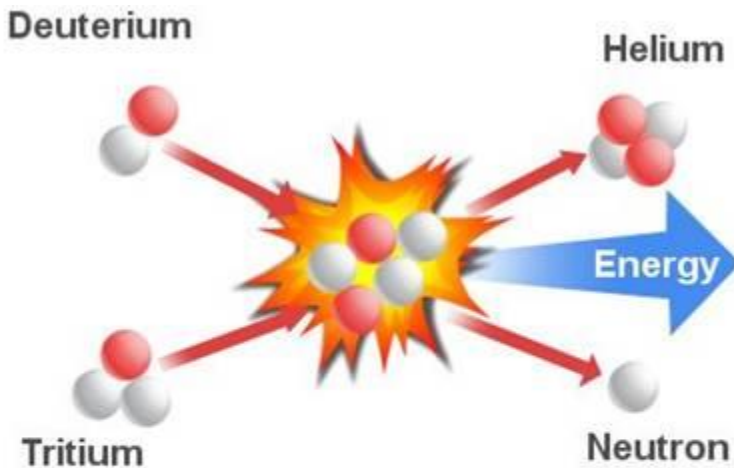
Answer: Nuclear Fission as the name suggests nuclear which means relating to nucleus and fission means to break. So nuclear fission is a process in which a heavy nucleus breaks into smaller particles spontaneously or due to collision with a moving particle releasing a vast amount of energy.



Q. 4. What is nuclear fusion?

Answer: Nuclear Fusion as the name suggests nuclear which means relating to nucleus and fusion means to join. So nuclear fusion is a process in which two lighter nuclei come close enough to form one or more different atomic nuclei releasing a large amount of energy. The nuclear fusion reaction takes place at Sun where two hydrogen

nuclei combine to form helium resulting in liberation of large amount of heat and light energy.



Fusion

Q. 5. What are the disadvantages of using nuclear power?

Answer: The disadvantages of nuclear power are as follows:

1. Nuclear power is mainly generated due to fission of a heavy nucleus and this reaction results in a chain reaction which can become uncontrollable.
2. Nuclear power generates large amount of radiation which is harmful to all living beings as this radiation can cause incurable diseases and genetic disorders.
3. Radioactive waste generated due to nuclear power plants cannot be disposed of easily.

Chapter Exercise

Q. 1. Justify in one sentence that hydro power (hydroelectricity) is a renewable source of energy.

Answer: Conventional sources of energy or Renewable Sources of Energy are those energy sources which will never be depleted as they are virtually unlimited in quantity.

In case of hydro power plant, flowing water causes the turbines to rotate and the water can be refilled due to rains and hence Hydro energy is considered to a renewable source of energy.

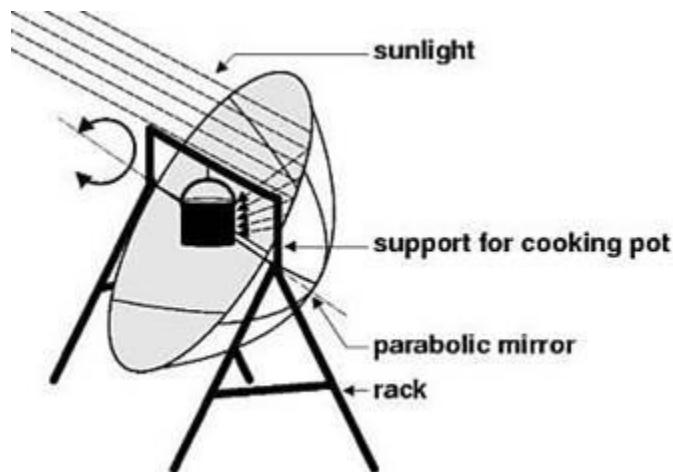
Q. 2. Name any two devices used to harness solar energy.

Answer: The two solar based devices which use solar energy are as follows:

1. Solar Cell
2. Solar Cooker
3. Solar Water Heater

Q. 3. In parabolic reflector type cookers, even temperature up to 1800oC-2000o can be attained. How?

Answer: The reason for the attainment of such high temperatures is that by the use of parabolic reflectors the rays of sunlight get concentrated at a particular point causing a greater elevation in temperature.



Q. 4. What type of energy transformation takes place during winding of spring of a clock?

Answer: During the winding of the spring of a clock, the kinetic energy gets converted into stored potential energy of the spring.

Q. 5. In many applications, solar cells are connected to rechargeable batteries. Why is it so?

Answer: A solar cell is a type of cell in which the electrons flow when sunlight is concentrated on it. Thus the flow of electron constitutes an electric current. So when we connect rechargeable batteries to solar cell, the batteries get charged due to the current

flowing out of solar cell and hence in many applications solar cells are connected to rechargeable batteries.

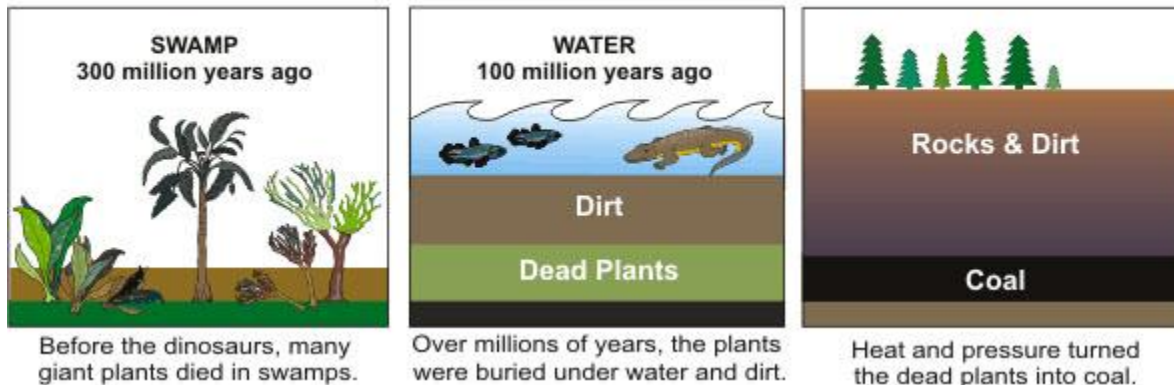
Q. 6. How is the increase in demand for energy affecting our environment adversely?

Answer: The major energy production sources in the present world are due to fossil fuels and petroleum. Since the rise in energy demand, causes an extensive use of these resources and at the same time, the use of such resources causes heavy environmental pollution. Also, the extensive use of fossil fuels for energy production will cause the fossil fuel to deplete off completely in near future.

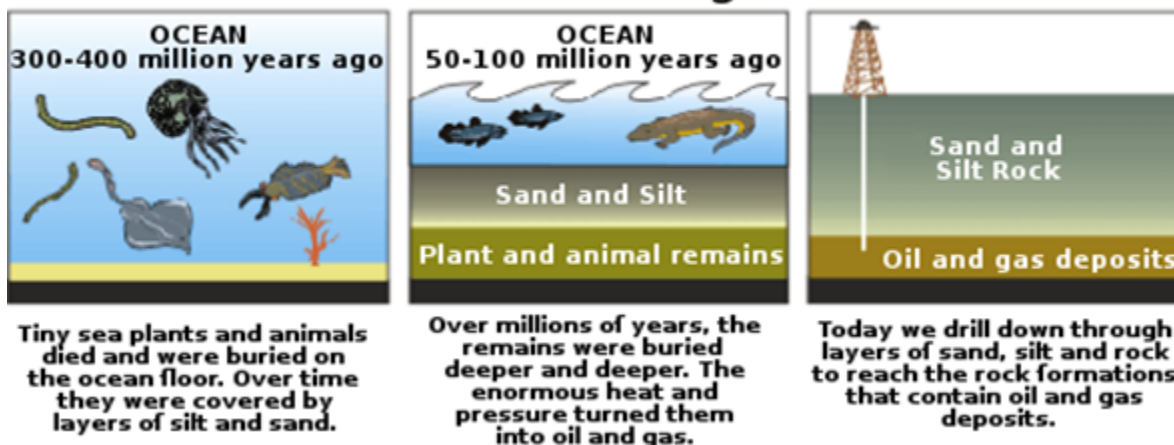
Q. 7. How were fossil fuel formed?

Answer: Fossil fuels are formed due to decaying of remains of plants, animals and organic matter over the period of thousands of years where the matter gets converted to solid form due to action of environmental agents like temperature pressure and heat.

HOW COAL WAS FORMED



Petroleum and natural gas formation



Q. 8. Name four gases commonly present in biogas. State two advantages of using this gas over fossil fuels.

Answer: The typical gases present in biogas are as follows:

1. Methane
2. Carbon Dioxide
3. Hydrogen
4. Hydrogen Sulphide

Biogas is more efficient as fuel as compared to fossil fuels in the following ways:

1. Biogas does not leave any ash and residue after combustion.
2. Biogas does not burn with a smoke and does not cause pollution.

Q. 9. Of the major requirement of different forms of energies, write which one is the greater requirement of India and which is the least? What is the percentage of the hydro energy requirement of India?

Answer: India requires tidal energy on a larger scale as it is covered with water on all the three parts and on the other hand it requires the nuclear energy the least as it has less reserves of nuclear raw material.

Hydro power makes up 14.01 percent, with 44,189.43 MW of the total power generated in the country.

Q. 10. For producing electricity, the energy from flowing water is preferred to energy obtained by burning coke. State two reasons for it.

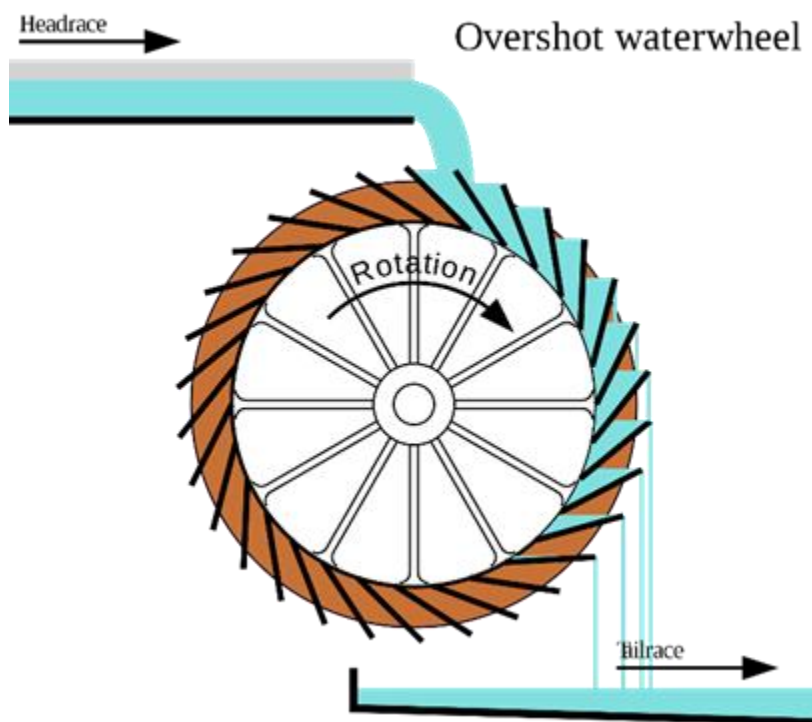
Answer: In case of hydro power plant, flowing water causes the turbines to rotate and the water can be refilled due to rains and hence Hydro energy is considered to renewable source of energy. Moreover, hydro energy does not release any kind of environmental pollutants.

Coke, on the other hand, belongs to the category of non-renewable sources of energy and also leads to the evolution of gaseous pollutants.

Q. 11. Give a few examples of how our ancestors used the energy possessed by the wind and water.

Answer: In older days the energy of the wind was used for sailing purposes on a large scale as the wind used to drive the boat or raft in the direction of wind.

Water was used in water wheels which were used to grind the wheat into flour and also the water steam used in steam engine.



Q. 12. Out of two solar cookers, one was covered by a plane glass slab and the other was left open. Which of the two solar cookers will be more efficient and why?

Answer: Solar cooker is used to cook food with help of sunlight. The sunlight when it shines on the solar cooker the food inside gets cooked due to the absorbed heat from sun rays.

To avoid the escaping of the heat from the solar cooker, solar cooker is covered with glass as sunlight can pass through glass effectively but the heat inside the cooker will not be radiated out.

Hence the solar cooker covered by a plane glass slab will be more efficient as compared to the uncovered one.

Q. 13. People living on hills often get sunburns on their skin. Which component of sunlight is responsible for this effect? Why is this effect generally not observed near sea level?

Answer: People living in the hilly areas are exposed to the strong rays of the sun because of which they get sunburns. Sunburns are normally caused due to the ultraviolet rays present in the sunlight which has the intense heating effect causing the skin to get reddened.

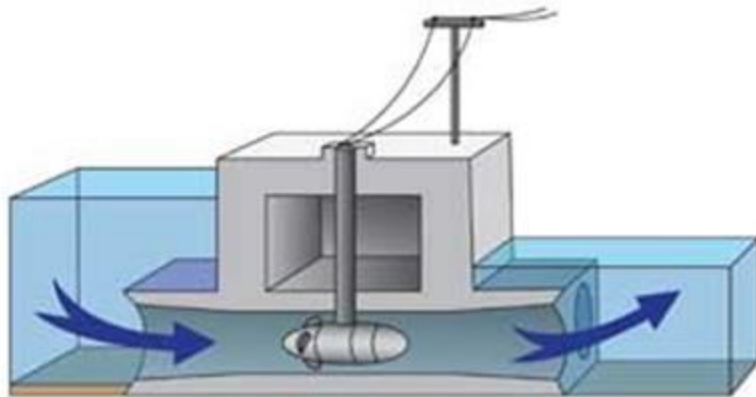
This effect is not generally observed near the sea regions because the sun rays are not that strong near the sea surface in technical terms the intensity of sun rays is less at sea level.

Q. 14. A certain form of energy which is not sourced directly or indirectly from the sun and does not cause any pollution is very easily converted into electricity. This form of energy is however, not available everywhere. Moreover, it is technically very difficult and expensive to obtain it. Name the form of energy.

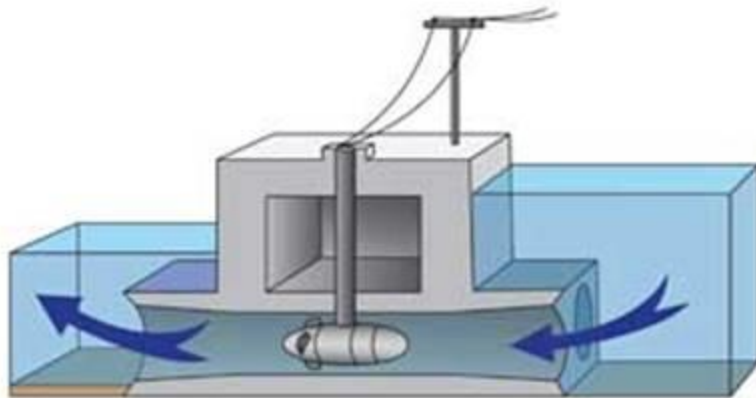
Answer: Since the given source of energy is not sourced directly or indirectly from the sun, chances of solar energy are eliminated.

Since the energy is pollution free and at the same time technically difficult and also costly which implies that the energy is tidal energy.

Tidal energy is not available everywhere and also the initial cost for tidal energy is very high as compared to other forms of energy. Tidal energy is difficult to construct and it is also pollution free.



Tide Coming In



Tide Going Out

Q. 15. Why any source of energy has less consequence? Explain your answer with suitable example.

Answer: Any source of energy whether renewable or non-renewable source of energy contributes to environmental pollution directly or indirectly.

Let us take the example of hydro energy. Hydro energy does not emit any air pollutant but it harms environment in the following ways:

The negative impacts of hydro power plant on ecosystem are as follows:

1. Since dams always have a reservoir where abundant quantity of water is stored, the blocking of flowing water causes harm to aquatic animals and their migration.
2. Dams also cause submerging of the nearby lands and all the natural areas, agricultural lands and hence requires relocating of the people who lived previously near the dam area.

In case of wind energy the windmill blades are injurious to the birds.

Q. 16. What is the cause of release of unusually large energies in nuclear fission reactions? How is the energy per fission calculated?

Answer: During the nuclear fission process a heavy nucleus splits to form particles. As we know that the subatomic particles are held together by strong nuclear forces and when the particle breaks it releases a tremendous amount of energy. The energy released during the fission reaction is calculated by using the famous relation:

$$E = mc^2$$

Where:

E = Energy released

m = mass defect = Total Mass before the reaction – Total mass after the reaction

c = speed of light

Q. 17. The solar constant at a place is 1.4 kW/m². How much will solar energy be received at this place per second over an area of 5 m²?

Answer: Given:

Solar Constant = 1.4 kW/m²

Solution:

Solar energy received at area of 1 m² = 1.4 kW/m²

So the energy received at an area of 5m² = 5 × 1.4

= 7 kW/m²

Q. 18. What is the basic cause for winds to blow? Name a part of India, where wind energy is commercially harnessed. Compare wind power and power of water flow in respect of generating mechanical and electrical energies. What is the hindrance in developing them?

Answer: As in physics we know that electric current flow from higher potential to lower potential due to potential difference.

In a similar manner in nature there exists pressure difference between two locations or areas which causes the wind to flow.

A wind is air in motion and so the wind flows from area of high pressure to area of low pressure.

Wind energy is harnessed in following states of Tamil Nadu, Gujarat, Maharashtra, Karnataka, Kerala etc. A wind farm is also located at Kanyakumari which is the farthest point of Indian mainland.

Wind Energy	Hydro Energy
1. Wind Energy is harnessed due to the moving causing the turbines to rotate.	Hydro Energy is harnessed by flowing water causing the propellers to move.

The major hindrances in development of these energy sources are as follows:

1. Environmental degradation of the area.
2. Availability of areas where the moving wind or flowing water is available.
3. Transportation of equipment to the selected area.
4. Heavy initial investment.

Q. 19. A certain form of energy is available due to the difference in the temperature of water at the surface of the ocean and its deeper levels.

(i) Name the form of energy.

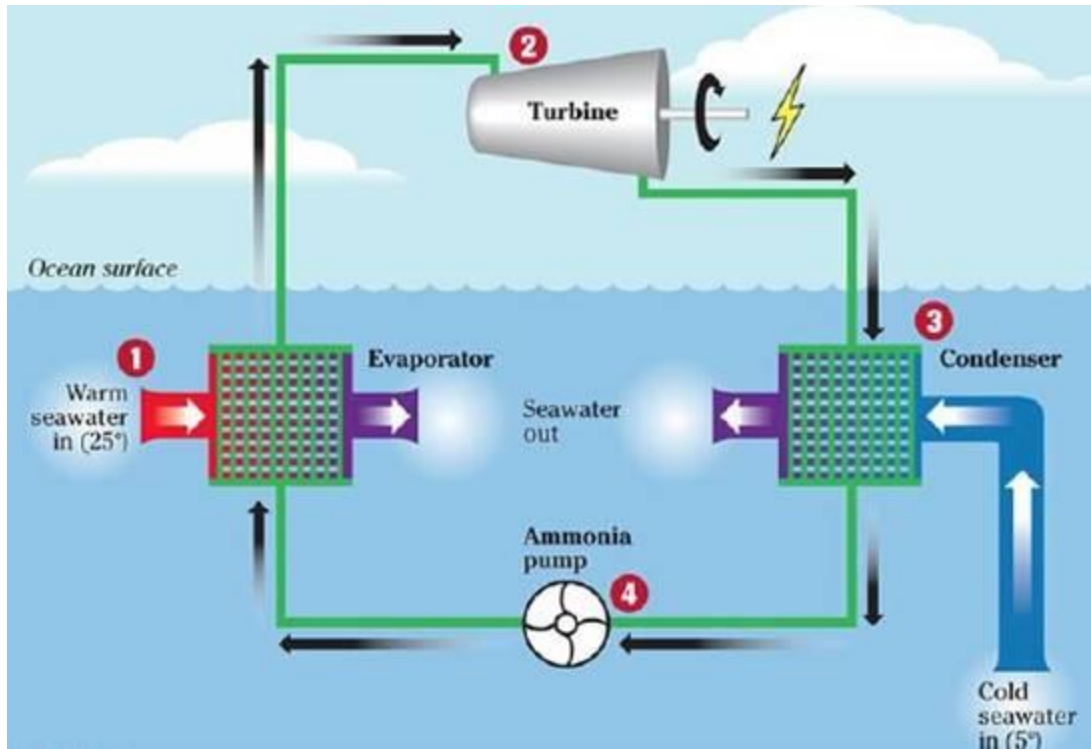
(ii) Is this energy ultimately derived from the sun or not?

(iii) Explain, how this form of energy can be converted into electricity?

Answer: (i) Ocean thermal energy due to difference in water's temperature at surface and deep inside the water.

(ii) This form of energy is ultimately derived from sun because it is the sun rays which are causing the upper surface of the ocean to heat up and cause the temperature difference.

(iii) The warm water of the surface is used to boil a volatile liquid like ammonia and the vapors of the liquid cause the turbine to rotate and the cold water the lower levels are used to condense this gas to turn it to liquid and the process continues.



Q. 20. Nikhil and Neha went to a remote village in Kerala to meet their grandmother. They were surprised to see bio-gas plant in Mr. Nair's house in the neighborhood. There was plenty of livestock and the house hold use cooking gas from the plant. Also, their farm had rich vegetation. They contacted sarpanch of the village and convinced him to set up a bio-gas plant for village community.

(i) Mention the values displayed by Mr. Nair, Nikhil and Neha.

(ii) Explain the possible arguments given by Nikhil and Neha to the sarpanch to convince him to set up a bio-gas plant.

Answer: **(i)** The values displayed by Mr. Nair, Nikhil and Neha are as follows:

1. Energy from renewable source of energy
2. Energy production does not contribute to pollution.

They all possess high degree of general awareness, helping nature and at the same they are nature conserver.

(ii) The possible arguments are as follows:

1. Economic and cheaper way to generate fuel
2. Use of your own organic and agricultural waste to generate fuel.

3. Efficient burning of biogas as compared to other fuels.
4. The slurry from biogas plant can be used as fertilizer for the fields.
5. Burning biogas does not pollute environment and also leaves no ash.

Q. 21. Hemant visited his neighboring village, where a bio-gas plant has been installed recently. He was surprised to see the working of the bio-gas plant. He told his village elders about the advantages of setting up a bio-gas plant in their village. Now. Answer the following question:

- (i) What are the advantages of a biogas plant?**
- (ii) Why is a bio-gas plant commonly called as gobar gas plant?**
- (iii) Why were the villagers are very much impressed with Hemant?**

Answer: (i) Biogas is an excellent fuel for cooking purposes and it also contains 75% of methane because of which biogas burns without giving any kind of smoke and also do not leave any residue after being heated.

Since biogas also uses wastewater, it removes the oxygen-demanding pathogens present in the waste thereby preventing the pollution of water bodies.

Biogas plants contain the residue after all the organic matter is converted to gas. This residue is rich in phosphorous and nitrogen which are the two main nutrients for plants. Hence this residue can be used as an organic fertilizer for plants.

Biogas is a cheaper and economic way for villagers to obtain cooking fuel.

(ii) Bio gas is the gas formed in the biogas plant due to anaerobic oxidation of organic material. But the majority or the starting material for the biogas plant in India is the cow dung which is known as “gobar” in Hindi Language and hence the gas formed in the biogas plant is termed as the “gobar gas”

(iii) The villagers were very much impressed because of following reasons:

1. For generation of biogas the raw material is all the organic and agricultural waste which is readily available in their homes.
2. The slurry from biogas plant can be used as fertilizer for the fields as it is rich in phosphorous and nitrogen.
3. Efficient burning of biogas as compared to other fuels.

Challengers

Q. 1. When the material P mined from the earth is heated strongly in an insufficient supply of air, it produces a solid fuel Q which mainly consist of carbon. When another material R obtained from trees is heated in an insufficient supply of air, it produces another solid fuel S which also consists mainly of carbon. Then, which of the following is true?

- A. P-coke**
- B. Q-coal**
- C. R-charcoal**
- D. None of the above**

Answer: The material mined from earth and when heated strongly in an insufficient supply of air gives a solid fuel which is rich in carbon indicates that the material P is also very rich in carbon and hence the material has to be coal because coal is mined from earth and on incomplete combustion it gives a solid fuel.

The solid fuel Q is coke.

R obtained from trees which signify that wood is the only tree part which when heated in insufficient supply of oxygen gives a carbon-rich compound.

S obtained on burning wood is charcoal.

But none of the options match with our answers.

So correct answer is D.

Q. 2. 100 W/m^2 of solar energy is received by the Earth. If all the energy was to be absorbed by a bucket of water (mass 30 kg) in 30 minutes, then the rise in temperature of water will be

- A. 18°C**
- B. 15°C**
- C. 1.43°C**
- D. 12.3°C**

Answer: Given:

Power = 100 W/m^2

Mass of water = 30 kg

Time = 30 minutes

Specific Heat of Water = $4200 \text{ J/kg } ^\circ\text{C}$

Solution:

Heat Generated = Mass \times Specific Heat \times Temperature Rise.

Heat Generated = Power \times time

Mass \times Specific Heat \times Temperature Rise = Power \times time

$$\text{Temperature Rise} = \frac{\text{Power} \times \text{time}}{\text{Mass} \times \text{Specific Heat}}$$

$$\text{Temperature Rise} = \frac{100 \times 30 \times 60}{30 \times 4200}$$

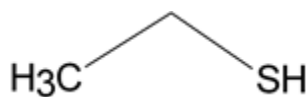
Temperature Rise = 1.43 °C

So correct answer is C.

Q. 3. While filling LPG in cylinders, a substance X is added to make the detection of leakage of LPG from the cylinder easy. The substance X is

- A. ethanol
- B. ethanethiol
- C. methanethiol
- D. methanol

Answer: Ethanethiol is added to LPG in cylinders so that the leak of the LPG gas from the cylinders becomes noticeable quickly as ethanethiol has very foul smell. The structure is as follows:



So the correct answer is B.

Q. 4. For a nuclear reactor, 48 kJ of energy is produced per minute. If the energy released per fission is 3.2×10^{-11} J, then the number of fission which would be taking place in a reactor per second is

- A. 5×10^{14}
- B. 2×10^{14}
- C. 52×10^{13}
- D. 2.5×10^{13}

Answer: Given:

Total energy released per minute = 48 kJ

$$= 48 \times 10^3 \text{ J}$$

$$\text{Energy produced per second} = \frac{(48 \times 10^3)}{60}$$

$$= 0.8 \times 10^3 \text{ J}$$

Energy release per fission = $3.2 \times 10^{-11} \text{ J}$

$$\text{Solution Number of fission per second} = \frac{[\text{Energy produced per second}]}{[\text{energy released per fission}]}$$

$$= \frac{[0.8 \times 10^3]}{[3.2 \times 10^{-11}]}$$

$$= 2.5 \times 10^{13}$$

Therefore number of fission per second is 2.5×10^{13} .

So the correct answer is D.

Q. 5. The mass number of four different elements A, B, C and D are 2, 35, 135 and 239, respectively. Which of them would provide the most suitable the most suitable for nuclear fission?

- A. A
- B. B
- C. C
- D. D

Answer: Elements with greater mass number indicate that their nucleus is highly unstable and when such nucleus is bombarded with a moving particle, it splits the nucleus easily.

So the correct answer is D.