

IMPORTANT NOTES

1. Energy plays a vital role in all walks of life. For example, heat energy is essential for cooking our food and electrical energy is essential for lighting, running machines and factories.
2. Any substance which is available easily and burns in air at moderate rate, producing large amount of heat energy, without leaving behind any undesirable residue, is called fuel.
3. The sources of energy, which have accumulated in nature over a period of hundreds of million years, such that they cannot be replaced when exhausted, are called **non-renewable sources of energy**.
4. The non-renewable sources of energy are fossil fuels, such as, **coal, petroleum and natural gas**.
5. The sources of energy, which are being continuously produced in nature and are virtually inexhaustible are called renewable sources of energy.
6. The main renewable sources of energy are: Solar energy, wind energy, hydroenergy, biofuels (fuels from biomass, such as wood and biogas). Energy from oceans geothermal energy.
7. The fuels which are preserved under the Earth's crust as remains of plants and animals are called fossil fuels. Coal, petroleum and natural gas are examples of fossil fuel.
8. Fossil fuels are very precious. We must use them, when absolutely necessary. Otherwise, they will get exhausted in another hundred years or so, thereby causing unprecedented energy crisis, from which our world will never recover.
9. These days coal is extensively used in generating electric energy at the thermal stations or thermal power house.
10. Natural gas is also used for generating thermal electricity. It is also used as household fuel and the fuel for CNG buses.
11. Petroleum is refined into products such as petrol, diesel, kerosene oil, lubricating oil, furnace oil and petroleum gas.
12. All fossil fuels on burning produce large amount of carbon dioxide gas, small amounts of sulphur dioxide gas and nitrogen dioxide gas.

The carbon dioxide gas produces greenhouse effect, which in turn results in global warming. Sulphur dioxide gas and nitrogen dioxide gas, in addition to producing respiratory problems cause acid rain. The acid rain affects our soil, water and forest resources.

13. A hydroelectric power plant is an arrangement in which kinetic energy of flowing water is transformed into electric energy. The electric energy so generated is called **hydroelectric energy**.

Potential
energy of
water
stored
in dam

Kinetic
energy of
flowing
water

Kinetic
energy of
rotating
turbine

Kinetic
energy
generated
in
generator

Conversion of hydel energy into electric energy

14. Water stored in hydroelectric dams is gradually used throughout the year. As the dam gets periodically refilled when it rains, therefore, hydroenergy is a renewable source of energy.
15. Firewood and waste materials produced by the living beings and the dead materials of living beings are collectively called **biomass**.
16. Amongst the waste materials of the living beings, the dung and excreta from the animals constitute the biomass. Amongst the dead materials of living beings, firewood, the leaves shed by the trees, dry grasses and crop residues constitute biomass.
17. Biogas is a mixture of gases formed when the slurry of animal dung and water is allowed to ferment in the absence of oxygen (or air). **The fermentation of animal dung that takes place in the absence of air due to the presence of anaerobic bacteria present in animal dung is called anaerobic fermentation.**
18. The biogas is a mixture of **methane, carbon dioxide, hydrogen and traces of hydrogen sulphide**, along with water vapour. The chief constituent of biogas is **methane gas** and is about 65% by volume.

19. **Moving air is called wind.** Winds are formed due to **uneven heating** of land mass and oceans. In addition, **rotation of the earth** and **local conditions** such as presence of mountains, deserts, seas, lakes, etc., also help in the formation of winds.
 20. Moving wind has large amount of kinetic energy. This energy was traditionally used by sailors and fisherman to propel their boats. The same kinetic energy was used to run windmills.
 21. The energy radiated out by the sun in the form of electromagnetic waves is called solar energy.
 22. The amount of energy reaching perpendicularly per square metre per second in the outermost boundary of earth's atmosphere is called solar constant. The approximate value of solar constant is **1.4 kilojoules per square metre per second**.
 23. A greenhouse is a house-like structure whose roof as well as walls are made of sheets of glass. It is used in very **cold countries** to grow vegetables and flowers in winter. As the green plants grow within the glass house, it is called **greenhouse** and the phenomenon is called **greenhouse effect**.
 24. A device which directly converts solar energy into electric energy is called **Solar Cell**.
- Photovoltaic Effect:** The phenomenon due to

which light energy directly changes into electric energy, when light is incident on certain sensitive materials, is called **Photovoltaic Effect**.

25. The group of solar cells connected in specific pattern to produce desired potential difference and magnitude of current is called **Solar Panel**.
26. The solar cell is also called **photovoltaic cell**. The term **photo** stands for **light** and **voltaic** stands for generation of **potential difference**. Thus, a **photovoltaic cell** is a device which converts light energy into electric energy due to the generation of potential difference.
27. During tides an enormous amount of water in the sea rises up through a good height and then falls down. The tides have enormous amount of mechanical energy (potential energy + kinetic energy). This energy can be used to generate electricity.
28. Nuclear energy is generated by two methods. The basic principle is that when a heavy nucleus of elements such as uranium, thorium or plutonium is split or when the lighter elements such as hydrogen or deuterium is fused to form heavy element, such that the total mass of products is less than that of participating atoms, then the difference in mass is converted into energy. The energy released is given by famous equation $E = mc^2$, first derived by Albert Einstein in 1905.

ASSIGNMENTS FOR SUMMATIVE ASSESSMENT

I. VERY SHORT ANSWER QUESTIONS

(1 Mark)

A. IMPORTANT QUESTIONS

1. What is the main source of energy for earth?
2. How is biomass used as fuel?
3. Give two examples of primary fuels.
4. Give two examples of secondary fuels.
5. Name two fuels which can be derived from coal.
6. What is the major difference between renewable sources and non-renewable sources of energy?
7. Name the component of sunlight that mainly carries heat with it.
8. Name the type of radiation emitted by a hot electric iron.
9. Name any two materials that are used for making solar cells.
10. Name two forms in which solar energy manifests itself in oceans.
11. Name any two components of solar radiation that are not visible to us.
12. Fill in the blank space :
 - (a) _____ is a dark coloured viscous and foul smelling fossil fuel.
 - (b) The decomposition of animal dung or biomass in the absence of air is called _____.
 - (c) The chief constituent of natural gas is _____.
13. Name two renewable sources of energy.
14. What is the minimum wind velocity required for obtaining useful energy in a windmill?
15. Name the process that convert solar energy into chemical energy in nature.
16. Give two examples of fossil fuels.

17. Name any three varieties of coal found in nature.
18. Name any two components obtained by the fractional distillation of petroleum that are not used as a fuel.
19. State two forms in which energy is mainly utilised at our homes.
20. Write the full forms of LPG and CNG.
21. Exposure to which component of solar radiation could be health hazard?
22. Why do we use black surface in solar devices?
23. What is the advantage of using parabolic concentrator in solar heating devices?
24. What is the advantage with the use of semiconductors in the solar cells?
25. What percentage of solar energy is directly received by our Earth?
26. Define solar constant.
27. What is the magnitude of solar constant for the Earth?
28. Name three important constituents of solar light.
29. What kind of radiations are emitted by hot bodies?
30. What happens to the wavelength of radiations emitted as the temperature of hot body falls?
31. What is a solar panel?
32. Name one property of water which makes it act as storehouse of solar energy.

B. QUESTIONS FROM CBSE EXAMINATION PAPERS

1. Name two main combustible components of biogas. [2004, 2010 (T-I)]
2. Why should solar cookers are to be covered with glass plate? [2010 (T-I)]
3. Construction of dams submerges large areas of forests, how does this contribute to the green house effect? [2010 (T-I)]
4. Name chief component of solar cells. What energy conversion takes place in a solar cell? [2010 (T-I)]
5. Name two sources of energy which are pollution free. [2010 (T-I)]
6. What is biomass? [2010 (T-I)]
7. What type of energy is possessed by huge waves near the sea shore? [2010 (T-I)]
8. Write two different ways of harnessing energy from ocean. [2010 (T-I)]
9. What steps would you suggest to minimise environmental pollution caused by burning of fossil fuels? [2010 (T-I)]
10. The use of drywood as domestic fuel is not considered as good. State two reasons for it? [2010 (T-I)]
11. What type of reflector is usually used in box type solar cooker? [2010 (T-I)]
12. Name the device which directly converts solar energy into electrical energy. [2010 (T-I)]
13. What are the two disadvantages of burning fossil fuels? [2010 (T-I)]
14. What are wind energy farms? [2010 (T-I)]
15. Thermal power plants are set up near coal or oil fields. Give reason. [2010 (T-I)]
16. What is solar panel? [2010 (T-I)]
17. What is green house effect? [2010 (T-I)]
18. Classify CNG and hydrogen in to renewable and non renewable sources of energy. [2010 (T-I)]
19. Why do we blacken the outer surface of a solar cooker? [2010 (T-I)]
20. Which one of the following is a renewable resource?
Natural gas, petroleum, ground water, coal. [2008]
21. Firewood is our conventional fuel. List any four reasons for replacing it by the alternative sources of energy. [2008]
22. Which one of the following gases is the major constituent of biogas?
Carbon monoxide, hydrogen, methane, carbon dioxide. [2008]
23. Why is biogas considered an ideal fuel for domestic use? [2007]
24. What is a solar cell? [2007]
25. Define the term 'energy'. [2003]
26. Write the largest constituent of liquefied Petroleum Gas (LPG). [2003]
27. Name the type of mechanical energy possessed by water stored behind a dam. [2003]
28. Can a solar panel be used as a source of energy in a space probe sent to Uranus or beyond? [2002]

II. SHORT ANSWER QUESTIONS–I

(2 Marks)

A. IMPORTANT QUESTIONS

1. Explain why fossil fuels are classified as non-renewable sources of energy.
2. Why is the use of wood as a fuel not advised, although forests can be replenished?
3. Why are the secondary fuels better than primary fuels?
4. Why is the burning of firewood in traditional chulhas considered disadvantages?
5. Name three characteristics of fuels that determine their quality.
6. How will the hydroenergy be affected, if there is no solar energy?
7. Name three types of fuels. Which of them is the best and why?
8. How much solar energy will be received by 1 m^2 area in one hour, if the solar constant is 1.4 kilowatt per square metre?
9. State any two activities from our daily life in which solar energy is utilised.
10. What prevent us in making use of solar cell panels to meet all our domestic needs of electricity?
11. Why is tidal energy not likely to be a potential source of energy?
12. Explain why only a part of solar energy that strikes the upper regions of atmosphere, reaches the surface of earth.
13. Mention any four areas where solar cells are being used as a source of energy.
14. Describe the potential of the following as future source of energy from the oceans:
(i) biomass (ii) deuterium
15. Why is the efficiency of solar devices much lower than that of similar devices operated upon by electricity?
16. Why solar cells have gained much importance in the recent past?
17. Why is the zigzag copper tube painted black in a solar water heater?
18. Why should we harness solar energy? Name some devices which are used for harnessing solar energy.
19. State the function of the following in a box type solar cooker
(i) glass sheet (ii) plane mirror

B. QUESTIONS FROM CBSE EXAMINATION PAPERS

1. State in brief the reaction involved in harnessing nuclear energy from uranium. Mention any two environmental hazards involved in harnessing nuclear energy. [2010 (T-I)]
2. What is biomass? Name the process by which biogas is prepared from biomass. Why is this gas called gobar gas? [2010 (T-I)]
3. Write any two advantages of using biogas. [2010 (T-I)]
4. Write the general principle involved in generating nuclear energy. Name a fuel used in a nuclear reactor. [2010 (T-I)]
5. The difference in temperature between the surface of the sea and deeper sections can be used to obtain energy. Explain how this is done? [2010 (T-I)]
6. Give the disadvantages of constructing big dams across the river. How does construction of dams across the river get linked with production of green house gases? [2010 (T-I)]
7. What do you mean by 'ocean thermal energy'?
- How electricity can be generated from the energy? [2010 (T-I)]
8. Explain why?
(a) Solar cookers are covered with glass plate.
(b) The solar cooker is painted black from inside. [2007, 2010 (T-I)]
9. A student constructed a model of box type solar cooker. He used a transparent plastic sheet to cover the open face of the box. He found that this cooker does not function well. What could be the possible drawbacks in his model? List any four draw backs. [2010 (T-I)]
10. What steps can be taken to minimize environmental pollution caused by the burning of fossil fuels? [2010 (T-I)]
11. How has the traditional use of wind and water energy been modified for our convenience? [2010 (T-I)]
12. Differentiate between renewable and non-renewable sources of energy with one example for each. [2010 (T-I)]

13. Large scale use of nuclear energy becomes prohibitive due to some hazards. Discuss major hazards associated with nuclear power plant. [2010 (T-I)]
14. You are given with two solar cookers, one with a plane mirror as reflector and the other with concave mirror as reflector. Which one is more efficient? Give reason for your answer. [2010 (T-I)]
15. What are the constituents of biogas? Write any two uses of this gas. [2010 (T-I)]
16. What are renewable sources of energy? Give two examples. [2010 (T-I)]
17. What are the disadvantages of using fossil fuels? [2010 (T-I)]
18. You have wood, kerosene and L.P.G. Which one source of energy would you use for preparing your food and why? Give three reasons. [2010 (T-I)]
19. What are the disadvantages of constructing dams for hydroelectric power station? [2010 (T-I)]
20. Describe how hydro-energy can be converted into electrical energy. Write any two limitations of hydro-energy. [2009]
21. List any four characteristics of biogas on account of which it is considered an ideal fuel. [2008]
22. Write two advantages of classifying energy sources as renewable and non-renewable. [2008]
23. What are fossil fuels? Give two examples of fossils fuels. [2008]
24. Discuss one limitation each for extracting energy from:
(a) winds (b) tides [2008]
25. What is the importance of hydropower plants in India? Describe how electric energy is generated in such plants. [2008]
26. What is a solar cell panel? Write two advantages associated with such panels. [2008]
27. Explain the principle of working of a windmill. [2007]
28. Why is energy of water flowing in a river considered to be an indirect form of solar energy? [2007]
29. Write two examples of fossil fuel. Why are they preferred to wood? [2003]
30. Name two places of our country where fields of natural gas are found. Why is it called a clean fuel? Give two reasons. [2003]
31. Describe two ways of getting useful energy from water of ocean. [2003]
32. Electricity generated with windmill is another form of solar energy. Explain. [2002]
33. People at hill stations often get sunburns on their skin. Which component of sunlight is responsible for this? Why is this effect not usually observed near sea level? [2002]

III. SHORT ANSWER QUESTIONS–II

(3 Marks)

A. IMPORTANT QUESTIONS

1. State the advantages of obtaining biogas from animal dung and biowastes.
2. Why are fossil fuels classified as non-renewable sources of energy. What steps should be taken to conserve them?
3. Mention any two advantages and two disadvantages of producing hydroelectricity by building dams on the rivers.
4. How can the energy of tides be harnessed?
5. It is difficult to use hydrogen as a source of energy, although its calorific value is quite high. Explain.
6. Mention three advantages of a solar cell.

B. QUESTIONS FROM CBSE EXAMINATION PAPERS

1. State in brief the process of harnessing kinetic energy of the wind to do work. Mention any four limitations of harnessing wind energy on a large scale. [2010 (T-I)]
2. How is nuclear energy generated? State in brief the process of utilizing this energy in the production of electricity. Mention the major hazards of nuclear power generation. [2010 (T-I)]
3. How is charcoal different from coal? How is it prepared? State two criteria for considering charcoal a better fuel than wood for domestic purposes. [2010 (T-I)]
4. (a) What is a fuel?
(b) Write any two characteristics of a good fuel. [2010 (T-I)]

5. Giving a schematic diagram of biogas plant explain the production of biogas and manure. Give the composition of bio-gas. [2010 (T-I)]
6. What is biomass? Draw a schematic diagram of biogas plant. Give the composition of biomass. [2010 (T-I)]
7. (a) How charcoal is better fuel than wood?
(b) How does biogas plant help to reduce the problem of pollution? [2010 (T-I)]
8. (a) What is Geothermal energy?
(b) What are the advantages of wind energy? [2010 (T-I)]
9. How does construction of dams across the river get linked with production of green house gas. How do technological inputs improve the efficiency of biomass fuels. [2010 (T-I)]
10. What is biomass? Explain the principle and working of a biogas plant using a labelled schematic diagram. [2010 (T-I)]
11. Biogas is considered to be a boon to the farmers. Give reasons. [2010 (T-I)]
12. What is nuclear energy? Give two advantages and two hazards of nuclear energy. [2010 (T-I)]
13. Why is it not possible to make use of solar cells to meet all our energy needs? State at least three reasons to support your answer. [2010 (T-I)]
24. Write four characteristics of good source of energy. Explain how burning of fossil fuels cause acid rain. [2010 (T-I)]
15. List the disadvantages of using biomass as fuel in the conventional manner. Give two examples of technological input to improve efficiency of these fuels. [2010 (T-I)]
16. What is biogas? How is it obtained? Why is the use of biogas obtained from cow dung preferred to burning of cow dung cakes? [2010 (T-I)]
17. Write the problems faced in construction of big dams. [2010 (T-I)]
18. Write three limitations of harnessing three types of energy from oceans. [2010 (T-I)]
19. Write three advantages and three limitations of using Solar cooker. [2010 (T-I)]
20. Draw a labelled diagram of a biogas plant. [2010 (T-I)]
21. Name two semiconductors used in solar cell. What is solar cell panel? State two main advantages of solar panel. [2010 (T-I)]
22. What are renewable sources of energy? Classify the following into renewable and non-renewable sources of energy. [2010 (T-I)]
Wind, Coal, Tide, Natural gas.
23. (a) Distinguish between renewable and non-renewable sources of energy.
(b) Choose the renewable sources of energy from the following list:
Coal, Biogas, Sun, Natural gas [2009]
24. What is biogas? Why is biogas considered an ideal fuel for domestic use? [2009]
25. How is charcoal obtained from wood? Why is charcoal considered a better fuel than wood? [2009]
26. How is energy generated in a nuclear fission reaction? What is the large scale use of nuclear energy pro-hibitive? [2008]
27. Describe the various steps involved in obtaining biogas and explain what is meant by anaerobic decom-position. [2007]
28. Explain how the oceans regulate the temperature of the globe. [2003]

IV. LONG ANSWER QUESTIONS

(5 Marks)

A. IMPORTANT QUESTIONS

1. With the help of a diagram, explain the construction and working of a box type solar cooker.
2. State the energy changes taking place in and around a hydroelectric power station when:
 - (i) Water flows into the reservoir from catchment area, such that level of water in the reservoir rises.
 - (ii) Water is released from the reservoir through iron gates by control valve.
 - (iii) The water is directed towards the turbine of hydroelectric plant.
 - (iv) The turbine is coupled to the armature of the generator.
 - (v) The coil of the armature rotates in magnetic field.
3. Make a list of conventional and non-conventional sources of energy. Give a brief description of harnessing one non-conventional source of energy.

B. QUESTIONS FROM CBSE EXAMINATION PAPERS

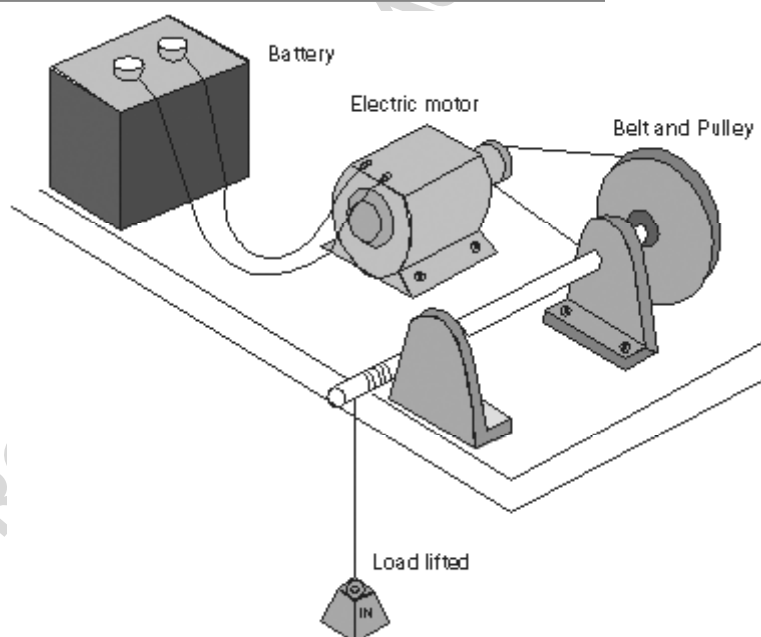
1. What is the main basic cause for winds to blow? Name a part of India where wind energy is commercially harnessed. Compare wind power and power of water flow in respect of generating mechanical and electrical energies. What is the hindrance in developing them? [2004]
2. Name any three forms of energy of the oceans which can be converted into usable energy forms. Describe how it is done in each case. What is the likelihood of their use on a large scale? [2004]
3. What are : (i) solar concentrators and (ii) solar cell panels? How are they an improvement on simple devices? Why is it that solar cell panels are costly? [2004]
4. Describe the construction and working of a fixed dome type biogas plant with the help of a labelled diagram. [2001]
5. Describe sequentially the events that resulted in the formation of petroleum. Name four places where it is found in India. Name the aviation fuel used in aeroplane jet engines. [2000]

ASSIGNMENTS FOR FORMATIVE ASSESSMENT

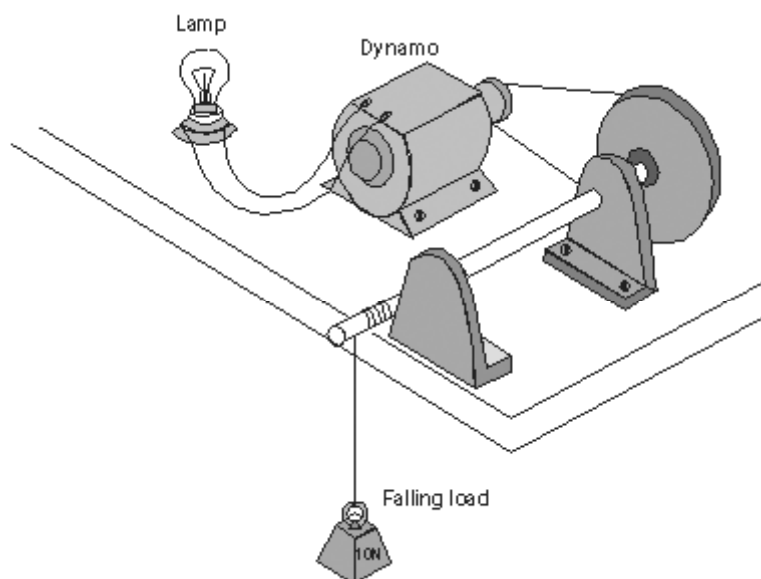
A. Models

1. To show electric energy can be converted into kinetic energy and then potential energy

Arrange a small electric motor (capable working at 6 V) as in the diagram. When the electrical current flows through motor, the electrical energy changes into kinetic energy. The kinetic energy then changes into potential energy as the load is lifted.



2. To show potential energy can be converted into kinetic energy and then electrical energy.



In the set up on previous page, disconnect battery and connect a 3V lamp. Start with heavy load raised high and let it fall to drive the motor, which will now act as dynamo to produce electricity to light the bulb.

B. Charts

1. Make a chart showing energy conversions from the Sun to the formation plants, then to coal and the coal used to generate electricity at thermo-electric power station.
2. Make a chart of generation of hydroelectricity.
3. Make a chart of fixed dome type biogas plant.
4. Make a chart of solar cooker box type.

C. Classroom Discussions

1. Discuss (i) characteristics of good source of

energy (ii) characteristics of a good fuel.

2. Discuss the advantage and disadvantages of generating electricity.
3. Discuss the advantages and disadvantages of solar electricity.
4. Discuss the harnessing of wind power. Why it cannot be harnessed at all the places on the earth.
5. Discuss the environmental consequences of :
 - (i) Traditional sources of energy, such as firewood, cow dung, farm residue.
 - (ii) Fossil fuels
 - (iii) Hydro- energy
 - (iv) Wind energy
 - (v) Solar energy
 - (vi) Nuclear energy

**Question 1:**

What is a good source of energy?

Answer:

A good source of energy fulfils the following criteria:

- (I) It produces a lot of heat per unit mass.
- (II) It does a huge amount of work per unit mass.
- (III) It is easily accessible.
- (IV) It is easy to store and transport.
- (V) It is economical.
- (VI) It produces less amount of smoke.

Question 2:

What is a good fuel?

Answer:

A good fuel produces a huge amount of heat on burning, does not produce a lot of smoke, and is easily available.

Question 3:

If you could use any source of energy for heating your food, which one would you use and why?

Answer:

Natural gas can be used for heating and cooking food because it is a clean source of energy. It does not produce huge amount of smoke on burning. Although it is highly inflammable, it is easy to use, transport, and it produces a huge amount of heat on burning.

**Question 1:**

What are the disadvantages of fossil fuels?

Answer:

The disadvantages of fossil fuels are as follows:

- (a) Burning of coal and petroleum produces a lot of pollutants causing air pollution.
- (b) Fossil fuels release oxides of carbon, nitrogen, sulphur, etc. that cause acid rain, which affects the soil fertility and potable water.
- (c) Burning of fossil fuels produce gases such as carbon dioxide that causes global warming.

Question 2:

Why are we looking at alternate sources of energy?

Answer:

Fossil fuels, which have been traditionally used by human beings as an energy sources, are non-renewable sources of energy. These sources of energy are limited and cannot replenish on their own. They are being consumed at a large rate. If this rate of consumption continues, then the fossil fuels would be exhausted from the Earth. Therefore, we have to conserve the energy sources. Hence, we should look for alternate sources of energy.

Question 3:

How has the traditional use of wind and water energy been modified for our convenience?

Answer:

Traditionally, waterfalls were used as a source of potential energy which was converted to electricity with the help of turbines. Since waterfalls are few in number, water dams have been constructed in large numbers. Nowadays, hydro-dams are used in order to harness potential energy of stored water. In water dams, water falls from a height on the turbine, which produces electricity.

Earlier, the windmills were used to harness wind energy to do mechanical work such as lifting/drawing water from a well. Today, windmills are used to generate electricity. In windmills, the kinetic energy of wind is harnessed and converted into electricity. The rotatory motion of the blades turns the turbine of the electric generator to generate electricity.

**Question 1:**

What kind of mirror – concave, convex or plain – would be best suited for use in a solar cooker? Why?

Answer:

A solar cooker uses heat of the sunlight to cook and heat food. A mirror is used in order to reflect and focus sunlight at a point. A concave mirror is used in a solar cooker for this purpose. The mirror focuses all the incident sunlight at a point. The temperature at that point increases, thereby cooking and heating the food placed at that point.

Question 2:

What are the limitations of the energy that can be obtained from the oceans?

Answer:

The forms of energy that can be obtained from the ocean are tidal energy, wave energy, and ocean thermal energy. There are several limitations in order to harness these energies.

- (i) Tidal energy depends on the relative positioning of the Earth, moon, and the Sun.
- (ii) High dams are required to be built to convert tidal energy into electricity.
- (iii) Very strong waves are required to obtain electricity from wave energy.
- (iv) To harness ocean thermal energy efficiently, the difference in the temperature of surface water (hot) and the water at depth (cold) must be 20°C or more.

Question 3:

What is geothermal energy?

Answer:

Geothermal power plants use heat of the Earth to generate electricity. This heat energy of the Earth is known as geothermal energy.

When there are geological changes, the molten rocks present in the core of the earth are pushed to the earth's crust. This forms regions of hot spot. Steam is generated when the underground water comes in contact with these hot spots forming hot springs. This trapped steam is used to generate electricity in the geothermal power plants.

Question 4:

What are the advantages of nuclear energy?

Answer:

The advantages of nuclear energy are as follows:

- (a) Large amount of energy is produced per unit mass.



- (b) It does not produce smoke. It is a clean energy.
- (c) Fission of one atom of uranium produces 10 million times the energy released by burning of one atom of carbon.
- (d) Fusion of four hydrogen atoms produces huge amount of energy approximately equal to 27 MeV.

**Question 1:**

Can any source of energy be pollution-free? Why or why not?

Answer:

No source of energy can be pollution-free. It is considered that solar cells are pollution-free. However, even their making causes environmental damage indirectly.

Also, in the case of nuclear energy, there is no waste produced after the fusion reactions. However, it is not totally pollution-free. To start the fusion reactions, approximately 10^7 K temperature is required, which is provided by fission reactions. The wastes released from fission reactions are very hazardous. Hence, no source of energy is pollution-free.

Question 2:

Hydrogen has been used as a rocket fuel. Would you consider it a cleaner fuel than CNG? Why or why not?

Answer:

Hydrogen gas is cleaner than CNG. CNG contains hydrocarbons. Therefore, it has carbon contents. Carbon is a form of pollutant present in CNG. On the other hand, hydrogen is waste-free. The fusion of hydrogen does not produce any waste. Hence, hydrogen is cleaner than CNG.

**Question 1:**

Name two energy sources that you would consider to be renewable. Give reasons for your choices.

Answer:

Two renewable sources of energy are as follows:

(a) Sun: The energy derived from the Sun is known as solar energy. Solar energy is produced by the fusion of hydrogen into helium, fusion of helium into other heavy elements, and so on. A large amount of hydrogen and helium is present in the Sun. Therefore, solar energy can replenish on its own. The Sun has 5 billion years more to burn. Hence, solar energy is a renewable source of energy.

(b) Wind: Wind energy is derived from air blowing with high speed. Wind energy is harnessed by windmills in order to generate electricity. Air blows because of uneven heating of the Earth. Since the heating of the Earth will continue forever, wind energy will also be available forever.

Question 2:

Give the names of two energy sources that you would consider to be exhaustible. Give reasons for your choices.

Answer:

Two exhaustible energy sources are as follows:

(a) Coal: It is produced from dead remains of plants and animals that remain buried under the earth's crust for millions of years. It takes millions of years to produce coal. Industrialization has increased the demand of coal. However, coal cannot replenish within a short period of time. Hence, it is a non-renewable or exhaustible source of energy.

(b) Wood: It is obtained from forests. Deforestation at a faster rate has caused a reduction in the number of forests on the Earth. It takes hundreds of years to grow a forest. If deforestation is continued at this rate, then there would be no wood left on the Earth. Hence, wood is an exhaustible source of energy.

**Question 1:**

A solar water heater cannot be used to get hot water on

- (a) a sunny day (b) a cloudy day
(c) a hot day (d) a windy day

Answer:

(b) A solar water heater uses solar energy to heat water. It requires bright and intense sunlight to function properly. On a cloudy day, the sunlight reflects back in the sky from the clouds and is unable to reach the ground. Therefore, solar energy is not available for the solar heater to work properly. Hence, solar water heater does not function on a cloudy day.

Question 2:

Which of the following is not an example of a bio-mass energy source?

- (a) wood (b) *gobar* gas
(c) nuclear energy (d) coal

Answer:

(c) Bio-mass is a source of energy that is obtained from plant materials and animal wastes. Nuclear energy is released during nuclear fission and fusion. In nuclear fission, uranium atom is bombarded with low-energy neutrons. Hence, uranium atom splits into two relatively lighter nuclei. This reaction produces huge amount of energy. In nuclear fusion reaction, lighter nuclei are fused together to form a relatively heavier nuclei. This reaction produces tremendous amount of energy. Hence, nuclear energy is not an example of bio-mass energy source.

Wood is a plant material, *gobar* gas is formed from animal dung, and coal is a fossil fuel obtained from the buried remains of plants and animals. Hence, these are bio-mass products.

Question 3:

Most of the sources of energy we use represent stored solar energy. Which of the following is not ultimately derived from the Sun's energy?

- (a) Geothermal energy
(b) Wind energy
(c) Nuclear energy
(d) Bio-mass



Answer:

(c) Nuclear energy is released during nuclear fission and fusion. In nuclear fission, uranium atom is bombarded with low-energy neutrons. Hence, uranium atom splits into two relatively lighter nuclei. This reaction produces huge amount of energy. In nuclear fusion reaction, lighter nuclei are fused together to form a relatively heavier nuclei. The energy required to fuse the lighter nuclei is provided by fission reactions. This reaction produces tremendous amount of energy. These reactions can be carried out in the absence or presence of sunlight. There is no effect of sunlight on these reactions. Hence, nuclear energy is not ultimately derived from Sun's energy.

Geothermal energy, wind energy, and bio-mass are all ultimately derived from solar energy.

Geothermal energy is stored deep inside the earth's crust in the form of heat energy. The heating is caused by the absorption of atmospheric and oceanic heat. It is the sunlight that heats the atmosphere and oceans.

Wind energy is harnessed from the blowing of winds. The uneven heating of the earth's surface by the Sun causes wind.

Bio-mass is derived from dead plants and animal wastes. Chemical changes occur in these dead plants and animal wastes in the presence of water and sunlight. Hence, bio-mass is indirectly related to sunlight.

Question 4:

Compare and contrast fossil fuels and the Sun as direct sources of energy.

Answer:

Fossil fuels are energy sources, such as coal and petroleum, obtained from underneath the Earth's crust. They are directly available to human beings for use. Hence, fossil fuels are the direct source of energy. These are limited in amount. These are non-renewable sources of energy because these cannot be replenished in nature. Fossil fuels take millions of years for their formation. If the present fossil fuel of the Earth gets exhausted, its formation will take several years. Fossil fuels are also very costly.

On the other hand, solar energy is a renewable and direct source of energy. The Sun has been shining for several years and will do so for the next five billion years. Solar energy is available free of cost to all in unlimited amount. It replenishes in the Sun itself.

Question 5:

Compare and contrast bio-mass and hydro electricity as sources of energy.



Answer:

Bio-mass and hydro-electricity both are renewable sources of energy. Bio-mass is derived from dead plants and animal wastes. Hence, it is naturally replenished. It is the result of natural processes. Wood, *gobar* gas, etc. are some of the examples of bio-mass.

Hydro-electricity, on the other hand, is obtained from the potential energy stored in water at a height. Energy from it can be produced again and again. It is harnessed from water and obtained from mechanical processes.

Question 6:

What are the limitations of extracting energy from –

(a) the wind? (b) waves? (c) tides?

Answer:

(a) Wind energy is harnessed by windmills. One of the limitations of extracting energy from wind is that a windmill requires wind of speed more than 15 km/h to generate electricity. Also, a large number of windmills are required, which covers a huge area.

(b) Very strong ocean waves are required in order to extract energy from waves.

(c) Very high tides are required in order to extract energy from tides. Also, occurrence of tides depends on the relative positions of the Sun, moon, and the Earth.

Question 7:

On what basis would you classify energy sources as

(a) renewable and non-renewable?

(b) exhaustible and inexhaustible?

Are the options given in (a) and (b) the same?

Answer:

(a) The source of energy that replenishes in nature is known as renewable source of energy. Sun, wind, moving water, bio-mass, etc. are some of the examples of renewable sources of energy.

The source of energy that does not replenish in nature is known as non-renewable source of energy. Coal, petroleum, natural gas, etc. are some of the examples of non-renewable sources of energy.

(b) Exhaustible sources are those sources of energy, which will deplete and exhaust after a few hundred years. Coal, petroleum, etc. are the exhaustible sources of energy.



Inexhaustible resources of energy are those sources, which will not exhaust in future. These are unlimited. Bio-mass is one of the inexhaustible sources of energy.

Yes. The options given in (a) and (b) are the same.

Question 8:

What are the qualities of an ideal source of energy?

Answer:

An ideal source of energy must be:

- I. Economical
- II. Easily accessible
- III. Smoke/pollution free
- IV. Easy to store and transport
- V. Able to produce huge amount of heat and energy on burning

Question 9:

What are the advantages and disadvantages of using a solar cooker? Are there places where solar cookers would have limited utility?

Answer:

Solar cooker uses Sun's energy to heat and cook food. It is inexhaustible and clean renewable source of energy. It is free for all and available in unlimited amount. Hence, operating a solar cooker is not expensive.

Disadvantage of a solar cooker is that it is very expensive. It does not work without sunlight. Hence, on cloudy day, it becomes useless.

The places where the days are too short or places with cloud covers round the year, have limited utility for solar cooker.

Question 10:

What are the environmental consequences of the increasing demand for energy? What steps would you suggest to reduce energy consumption?

Answer:

Industrialization increases the demand for energy. Fossil fuels are easily accessible sources of energy that fulfil this demand. The increased use of fossil fuels has a harsh effect on the environment. Too much exploitation of fossil fuels increases the level of green house gas content in the atmosphere, resulting in global warming and a rise in the sea level.



It is not possible to completely reduce the consumption of fossil fuels. However, some measures can be taken such as using electrical appliances wisely and not wasting electricity. Unnecessary usage of water should be avoided. Public transport system with mass transit must be adopted on a large scale. These small steps may help in reducing the consumption of natural resources and conserving them.