

Chapter 14: SOURCES OF ENERGY**P14****1. Why do we hear so much about the energy crisis?**

Even though energy can neither be created nor destroyed, still we need to worry about energy crisis because energy in usable form is being dissipated to the surrounding in less usable forms.

2. Can a source of energy which is used to do work be used again? Why?

No, any source of energy used to do work is consumed and cannot be used again. For example, if we take 100ml of water which has a temperature of 298K is left open; the heat is lost to the surroundings. This heat cannot be make the water hot once again.

3. What other products are obtained when we burn a candle?

The two gases that are produced when a wax candle is burned are carbon dioxide and water vapor. In the chemical reaction taking place in a burning wax candle, the paraffin in the candle and the oxygen in the air are the reactants, and the carbon dioxide and water vapor are the products.

4. (Activity 14.1) List four forms of energy that you use from morning, when you wake up, till you reach the school.

- Muscular energy to carry out physical work.
- Electrical energy for running various appliances.
- Chemical energy for cooking food or running vehicles.
- Light energy
- Heat energy

From where do we get these different forms of energy?

Light energy from electricity, muscular energy from body, heat energy from fuel, petrol/diesel from fossils.

Can we call these 'sources' of energy? Why or why not?

Only fuel is a source of energy. Others are derived energy.

5. (Activity 14.2) Consider the various options we have when we choose a fuel for cooking our food. What are the criteria you would consider when trying to categorise something as a good fuel?

A good fuel should have high caloric value, have proper ignition temperature, easy to handle and transport.

Would your choice be different if you lived (a) in a forest? (b) in a remote mountain village or small island? (c) in New Delhi? (d) lived five centuries ago?

- In a forest – Wood or leaves.
- In a remote mountain village or small island – cow dung or dry twigs
- In New Delhi – L.P.G or C.N.G
- 500 years ago – wood

How are the factors different in each case?

Availability and quality of fuel are the factors that determine the choice of fuel.

6. While selecting a fuel what are the three relevant questions to ask about a fuel?

- (i) How much heat does it release on burning?
- (ii) Does it produce a lot of smoke?
- (iii) Is it easily available?

7. Write the characteristics of a good source of energy.

A good source of energy:

- a) should give large amount of energy per unit volume or mass.
- b) must be easily accessible.
- c) must be easy to store and transport.
- d) must be economical.

8. What is a good source of energy?

The material that provides the required amount of energy is called source of energy.

9. What is a good fuel?

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

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

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.

Even though it is highly inflammable, it is easy to use, transport, and it produces a huge amount of heat on burning.

11. What has led to the growing demand for energy?

Increasing industrialization has led to better quality of life all over the world. This has led to global demand for energy.

12. Why is there a need to conserve fossil-fuels?

Fossil fuels are non-renewable source of energy. If we continue to consume at such a rate, soon we will run out of energy. Hence we need to conserve fossil fuels.

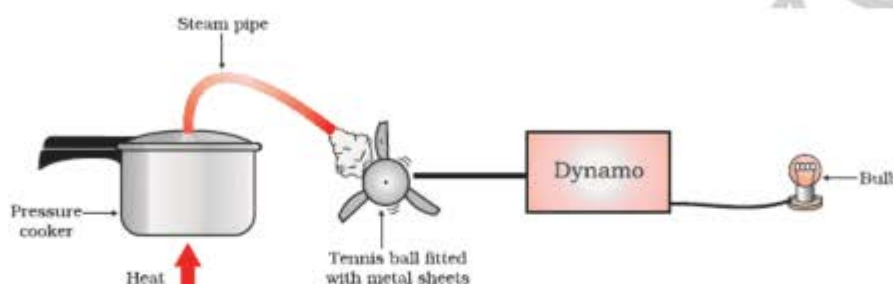
13. What are the disadvantages of burning fossil fuels?

- a) Air pollution is caused by burning coal or petroleum products.
- b) The oxides of carbon, nitrogen and sulphur that are released on burning fossil fuels form acidic oxides cause acid rain. Acid rain affects water and soil resources.
- c) Greenhouse effect is caused due to gases like carbon dioxide.

14. How is the pollution caused by burning fossil fuels reduced?

The pollution caused by burning fossil fuels can be somewhat reduced by increasing the efficiency of the combustion process and using various techniques to reduce the escape of harmful gases and ashes into the surroundings.

15. What are the various ways in which electrical energy can be generated?
 a) Thermal power plant b) Hydro power plants c) Wind mills
16. (Activity 14.3) Take a table-tennis ball and make three slits into it. Put semicircular fins cut out of a metal sheet into these slits. Pivot the tennis ball on an axle through its centre with a straight metal wire fixed to a rigid support. Ensure that the tennis ball rotates freely about the axle. Now connect a cycle dynamo to this. Connect a bulb in series. Direct a jet of water or steam produced in a pressure cooker at the fins. What do you observe?



The bulb will start glowing. It will remain glowing till the ball is rotating with the help of steam.

17. Write a note on thermal power plants.
 In a thermal power plant fossil fuels are burnt to heat water to produce steam. Steam runs the turbine to generate electricity.
18. Why are thermal power plants set up near coal or oil fields?
 Transmission of electricity is more efficient than transporting coal or petroleum over the same distance. Hence many thermal power plants are set up near coal or oil fields.
19. How is hydro electricity generated?
 Hydro power plants convert the potential energy of falling water into electricity by using the kinetic energy of the flowing water or the potential energy of water at a height.
20. Why are hydro power plants associated with dams?
 Since there are very few water-falls which could be used as a source of potential energy, hydro power plants are associated with dams.
21. What are the disadvantages of hydro power plants?
- Dams can be constructed only in limited number of places.
 - Large areas of agricultural land and human habitation are to be sacrificed as they get submerged.
 - Large ecosystems are destroyed when submerged under the water in dams.
 - The vegetation which is submerged rots under anaerobic conditions and gives rise to large amounts of methane which is also a green-house gas.
 - It creates the problem of satisfactory rehabilitation of displaced people.

22. Why was there opposition to the construction of Tehri dam on the river Ganga and Sardar Sarovar project on the river Narmada?

- Large areas of agricultural land and human habitation are to be sacrificed as they get submerged.
- Large ecosystems are destroyed when submerged under the water in dams.
- The vegetation which is submerged rots under anaerobic conditions and gives rise to large amounts of methane which is also a green-house gas.
- It creates the problem of satisfactory rehabilitation of displaced people.

23. What is bio-mass?

The materials obtained from plants and animals used as fuel is called bio-mass.

24. Why is there a need for improvement of efficiency in biomass fuel?

Biomass does not produce much heat on burning and a lot of smoke is given out when they are burnt. Therefore, there is a need to improve the efficiency of biomass.

25. How is charcoal produced?

When wood is burnt in a limited supply of oxygen, water and volatile materials present in it get removed and charcoal is left behind as the residue.

26. Write the characteristics of charcoal.

- Charcoal burns without flames.
- It is comparatively smokeless.
- It has higher heat generation efficiency.

27. Differentiate between biomass and charcoal.

Biomass fuel	Charcoal
It produces a lot of smoke when burnt.	It burns without smoke.
It has low heat generation efficiency.	It has higher heat generation efficiency.

28. What is bio-gas or gobar gas?

Biogas is a mixture of methane, hydrogen, carbon dioxide and hydrogen sulphide.

29. How is biogas produced?

Cow-dung, various plant materials like the residue after harvesting the crops, vegetable waste and sewage are decomposed in the absence of oxygen to give bio-gas.

30. Name the gases produced by the decomposition of organic matter.

The gases produced are Methane, carbon dioxide, hydrogen and hydrogen sulphide.

31. Name the parts of a biogas plant.

Mixing tank, digester and Outlet tank

32. Draw the schematic diagram of a biogas plant.

33. What are the characteristics of biogas?

- a) Bio-gas is an excellent fuel.
- b) It burns without smoke.
- c) It leaves no residue on burning.
- d) Its heating capacity is high.

34. How is the spent slurry useful?

The slurry left behind is removed periodically and used as excellent manure, rich in nitrogen and phosphorous.

35. What are the advantages of producing biogas?

- a) The large-scale utilisation of bio-waste and sewage material provides a safe and efficient method of waste-disposal.
- b) It supplies energy.
- c) Spent slurry can be used as manure.

36. Name two nutrients that the slurry left behind in the bio-gas plant contains.

Nitrogen & phosphorous

37. Is biomass a renewable source of energy?

Biomass is a renewable source of energy because it can be produced/reproduced easily in a short period of time.

38. How is wind energy derived from solar energy?

Unequal heating of the landmass and water bodies by solar radiation generates air movement and causes winds to blow. So wind energy is derived from solar energy,

39. How is electricity generated using wind mills?

To generate electricity, the rotatory motion of the windmill is used to turn the turbine of the electric generator.

**40. Why the output of a single windmill cannot be used for commercial purposes?
OR why a large number of windmills are setup over a large area?**

The output of a single windmill is quite small and cannot be used for commercial purposes.

The energy output of each windmill in a farm is combined together to get electricity on a commercial scale.

41. What is a wind energy farm?

A number of windmills erected over a large area is known as wind energy farm.

42. What are the advantages of wind energy?

- a) Wind energy is environment-friendly.
- b) It is an efficient source of renewable energy.
- c) It requires no recurring expenses for the production of electricity.

43. What are the limitations of wind energy?

- a) Wind energy farms can be established only at those places where wind blows for the greater part of a year.
- b) The wind speed should also be higher than 15 km/h to maintain the required speed of the turbine.
- c) There should be some back-up facilities (like storage cells) to take care of the energy needs during a period when there is no wind.
- d) Establishment of wind energy farms requires large area of land.
- e) The initial cost of establishment of the farm is quite high.
- f) Since the tower and blades are exposed to rain, Sun, storm and cyclone, they need a high level of maintenance.

44. (Activity 14.4) Find out from your grand-parents or other elders –**(a) How did they go to school?**

They used to walk or animal driven vehicle or cycle.

(b) How did they get water for their daily needs when they were young?

They used to draw water from wells or rivers.

(c) What means of entertainment did they use?

Fairs, group games or dance etc. were the source of entertainment.

Compare the above answers with how you do these tasks now.

Nowadays we use fuel or electricity for all our needs

Is there a difference? If yes, in which case more energy from external sources is consumed?

There is a lot of difference. Now much more energy is consumed from external sources.

- 45. Some people say that if we start living as our ancestors, this would conserve energy and our ecosystem. Do you think this idea is feasible?**

Yes, living like our ancestors will certainly save energy. Our ancestors didn't use electricity which is produced by burning coal and natural gas. They used natural lighting and fire etc. They didn't use any automobile vehicle for transportation, they used horses which did not pollute the environment. Living like them would prevent us from doing a lot in the world. The progress of science would be hindered. The ecological balance would be disturbed and so on.

Instead we should try to conserve energy by using renewable sources and minimising the use of fossil fuels which will provide better inhabitation for humans.

- 46. But we cannot live a harsh life like them now, so living like them is not possible for us. However we can use renewable sources of energy to prevent pollution. We can stop polluting our environment.**

- 47. Why are we looking at alternate 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.

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

Earlier waterfalls were used as a source of potential energy which was converted to electricity with the help of turbines. As the waterfalls are few in number, water dams have been constructed in large numbers. Now hydro dams are used to convert potential energy of stored water to produce electricity.

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

- 49. (Activity 14.5) Take two conical flasks and paint one white and the other black. Fill both with water. Place the conical flasks in direct sunlight for half an hour to one hour. Touch the conical flasks. Which one is hotter?**

The one with a black paint will be hotter and will give a higher temperature.

You could also measure the temperature of the water in the two conical flasks with a thermometer. Can you think of ways in which this finding could be used in your daily life?

In daily life, we can wear light coloured clothes in summer and dark coloured clothes in winter. We can use this property to use heat from the sun for cooking and heating water.

- 50. What is solar energy?**

The energy produced by the sun in the form of heat and light energy is called as solar energy.

51. What is a solar cooker?

Solar cooker is a device which uses solar energy to cook food.

52. Why is a glass plate used in a solar cooker?

The glass plate does not allow heat rays to pass through it and go outside the box. As a result, the infrared rays get absorbed in the box, which increases its internal temperature up to about 100°C.

53. How can higher temperature be achieved in a solar cooker?

Solar cookers achieve a higher temperature by using mirrors to focus the rays of the Sun.

54. What are the advantages of using solar cooker?

- a) Solar energy is renewable source of energy.
- b) It is eco-friendly.
- c) It is abundantly available.
- d) It does not pollute the environment.

55. What are the limitations of using solar cooker?

- a) Solar cooker can be used only at certain times of the day.
- b) It cannot be used on cloudy day and during night.
- c) It cannot be used for frying.
- d) It takes long time for cooking.

56. Write the function of the following in a solar cooker.

- a) Mirror – It is kept facing the sun so that a strong beam of light falls in the cooker top after reflecting from the mirror.
- b) Glass sheet – It allows infrared radiations from the sun to pass through but does not allow heat from the box to go outside.
- c) Black surface – Black surface absorbs more heat than other surfaces.

57. A student constructed a box type solar cooker. He found that it did not work efficiently. What could this be due to? Give any four possible mistakes in the construction and operation of the solar cooker. What maximum temperature can be reached inside a solar cooker?

The student must have used a transparent plastic sheet instead of glass sheet.

Possible mistakes:

- a) Reflector mirror is not properly adjusted.
- b) Glass sheet is not properly covered or closed.
- c) Box is not fully insulated.
- d) Inside of the box is not black.

Maximum temperature inside the solar cooker is 100 – 140°C

- 58. Explain the advantage of painting black colour on the inner and outer surfaces of the cooker and that of cooking vessels in a solar cooker.**

Painting the inner surface and outer surface of the cooker helps to absorb maximum heat as black surface absorbs more heat than any other colour.

- 59. Out of two solar cookers, one was covered with a plane glass slab and the other was left open. Which of the two solar cookers will be more efficient and why?**

The solar cooker with glass slab will be more efficient as glass sheet traps the heat energy and increases the temperature of the box.

- 60. A solar water heater cannot be used to get hot water on a cloudy day. Give reason.**

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. Solar energy is not available for the solar heater to work properly. Hence, solar water heater does not function on a cloudy day.

- 61. What is a solar cell?**

A Solar cell is a device which converts solar energy into electricity.

- 62. What is a solar panel?**

A large number of solar cells combined in an arrangement is called solar panel.

- 63. What are the advantages of solar cells?**

- Solar cells have no moving parts, so they require little maintenance.
- They work satisfactorily without the use of any focusing device.
- They can be set up in remote and inaccessible areas where laying of power transmission lines may be expensive or not possible.

- 64. Why are solar energy devices costly?**

- Availability of special grade silicon for making solar cells is limited.
- Silver used for interconnection of cells in the panel adds to the cost.

- 65. List two reasons which limit the usage of solar cells.**

- The cost of installation of solar cells is very high.
- It produces direct current which needs to be converted into alternating current for use.

- 66. Mention the applications of solar cells.**

- Solar cells are used in artificial satellites and space probes.
- Radio & wireless transmission systems.
- Traffic signals, calculators and many toys are fitted with solar cells.

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

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.

68. What are high tides and low tides?

The periodic rising of the sea due to the gravitational pull of the moon on the spinning earth is called high tide.

The periodic lowering of the sea due to the gravitational pull of the moon on the spinning earth is called low tide.

69. What is tidal energy?

The energy harnessed by constructing dam across a narrow opening to the sea is called tidal energy.

70. What are the limitations of harnessing tidal energy?

The electricity generated is not high enough to generate electricity on large scale. The sites where dams can be constructed across narrow openings to the sea is limited.

71. What is wave energy?

The kinetic energy possessed by huge waves near sea shore is trapped to generate electricity called wave energy.

72. Where can wave energy be produced?

Wave energy can be produced only where waves are very strong.

73. What is ocean thermal energy?

The energy obtained because of the difference in temperature of sea surface heated by the sun and colder water found at the deeper layers of ocean is called ocean thermal energy.

74. Explain how the ocean thermal energy is used to generate electricity.

The water at the surface of the sea or ocean is heated by the Sun while the water in deeper sections is relatively cold. The warm surface-water is used to boil a volatile liquid like ammonia. The vapours of the liquid are then used to run the turbine of generator. The cold water from the depth of the ocean is pumped up is used to condense vapour again to liquid.

75. What are the ways by which energy can be produced from the sea?

The three ways by which energy of the sea can be utilized is Tidal energy, wave energy and ocean thermal energy.

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

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.

- a) Tidal energy depends on the relative positioning of the Earth, moon, and the Sun.
- b) High dams are required to be built to convert tidal energy into electricity.
- c) Very strong waves are required to obtain electricity from wave energy.
- d) 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.

77. What are 'hot spots' in the earth?

The molten rocks formed in the deeper hot regions of earth's crust are pushed upward and trapped in certain regions called 'hot spots'.

78. What are 'hot springs'?

When underground water comes in contact with the hot spot, steam is generated which finds outlets at the surface known as hot springs.

79. What is geothermal energy?

The energy obtained from hot molten rocks and trapped hot fluids inside the earth is called geothermal energy.

80. How is geothermal energy produced?

When underground water comes in contact with the hot spot, steam is generated. The steam trapped in rocks is routed through a pipe to a turbine and used to generate electricity.

81. What is nuclear fission?

The process in which nucleus of a heavy atom (such as uranium, plutonium or thorium), when bombarded with low-energy neutrons splits apart into lighter nuclei with release of a tremendous amount of energy is released is called nuclear fission.

82. What is a nuclear reactor?

Nuclear reactor is a device in which converts nuclear energy into electrical energy.

83. What is the principle of a nuclear reactor?

In a nuclear reactor, nuclear 'fuel' undergoes self-sustaining fission chain reaction that releases energy at a controlled rate.

84. How is nuclear energy used to generate electricity?

In a nuclear reactor, nuclear 'fuel' undergoes self-sustaining fission chain reaction that releases energy at a controlled rate. The released energy is used to produce steam which rotates the turbine to generate electricity.

85. What are the major hazards of nuclear energy?

The major hazard of nuclear power generation is the storage and disposal of spent or used fuels.

86. What are the advantages of nuclear energy?

- 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.

87. What are the limitations of nuclear energy?

- a) Improper nuclear-waste storage and disposal result in environmental contamination.
- b) There is a risk of accidental leakage of nuclear radiation.
- c) The cost of installation of a nuclear power plant is high.
- d) There is limited availability of uranium.

88. (Activity 14.7) Discuss in class the question of what is the ultimate source of energy for bio-mass, wind and ocean thermal energy.

Sun is the ultimate source of energy because the energy we get from plants, wind, ocean thermal energy are because of sun's energy.

Is geothermal energy and nuclear energy different in this respect? Why?

Geothermal energy and nuclear energy are not influenced by the sun. Geothermal energy arises because deeper regions of earth's crust are very hot. Nuclear energy arises due to radioactive substance.

Where would you place hydroelectricity and wave energy?

Hydroelectricity and wave energy are influenced by the sun.

89. (Activity 14.8) Gather information about various energy sources and how each one affects the environment.

Various sources of energy	Effect on environment
1. Hydroelectricity	Dams can cause imbalance in environment
2. Thermal electricity	Pollution, fossil fuels get exhausted
3. Petroleum	Pollution, fossil fuels get exhausted
4. Bio-mass	Pollution
5. Tidal/wave energy	No effect
6. Solar energy	No effect
7. Geothermal energy	No effect
8. Nuclear energy	Pollution

Debate the merits and demerits of each source and select the best source of energy on this basis.

The table shows that wave energy, solar energy and geothermal energy would be the best if tapped properly.

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

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.

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.

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

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

92. What are renewable sources of energy?

Renewable sources of energy are those which can be regenerated. They are inexhaustible.

Examples: Solar energy, Wind Energy, water energy (hydro-energy), geothermal energy, ocean energy, biomass energy (firewood, animal dung and biodegradable waste from cities and crop residues constitute biomass).

93. What are the advantages of Renewable Sources of Energy?

- Renewable sources will last as long as the Earth receives light from the sun.
- These sources are freely available in nature.
- These sources do not cause any pollution.

94. What are non-renewable sources of energy?

Non-renewable sources of energy are those which are exhaustible and cannot be replaced once they have been used.

Examples: Coal, Oil and Natural gas.

95. (Activity 14.8) Debate the following two issues in class.

(a) The estimated coal reserves are said to be enough to last us for another two hundred years. Do you think we need to worry about coal getting depleted in this case? Why or why not?

We should worry coal reserves are likely to be exhausted within 200 years because it got millions of years for buried plants to be converted into coal.

(b) It is estimated that the Sun will last for another five billion years. Do we have to worry about solar energy getting exhausted? Why or why not?

We should not worry about solar energy getting exhausted in another five billion years because it is a very long time for any civilization to exist.

On the basis of the debate, decide which energy sources can be considered (i) exhaustible, (ii) inexhaustible, (iii) renewable and (iv) non-renewable. Give your reasons for each choice.

Coal is exhaustible and is non-renewable. Solar energy is in exhaustible and is renewable.

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

Two renewable sources of energy are:

- 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.
- 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.

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

Two exhaustible energy sources are:

- 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. 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.

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

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. 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.

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.

- 99. Compare and contrast bio-mass and hydroelectricity as sources of energy.**

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 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.

- 100. What are the limitations of extracting energy from (a) the wind? (b) Waves? (c) Tides?**

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.

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

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

- 101. 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?**

(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.

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

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.

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

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 greenhouse 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. 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.

Fill in the blanks:

- 1) The energy used for carrying out physical work is Muscular energy.
- 2) The energy used for running various appliances is Electrical energy.
- 3) The energy used for cooking or running a vehicle is Chemical energy.
- 4) In ancient times, the most common source of heat energy is wood.
- 5) The source of energy that made the industrial revolution possible is coal.
- 6) The growing demand for energy is largely met by coal & petroleum.
- 7) The simplest turbine having one moving part is rotor-blade assembly.
- 8) Plant and animal products are called biomass.
- 9) The main component of biogas is Methane.

- 10) Biomass is a renewable source of energy.
- 11) A number of windmills erected over a large area is known as wind energy farm.
- 12) The minimum wind speed required for setting up wind farms is 15 km/h.
- 13) The amount of solar energy received by the earth is 1.4kW/m².
- 14) A solar water heater cannot be used to get hot water on a cloudy day.
- 15) A typical solar cell develops a voltage of 0.5 – 1V.
- 16) The power produced by a typical solar cell is 0.7W of electricity.
- 17) The device which converts solar energy into electricity is called solar cell.
- 18) A large number of solar cells combined in an arrangement is called solar panel.
- 19) The element used for interconnection of cells in the panel is silver.
- 20) The type of mirror used in a solar cooker is concave.
- 21) Ocean thermal plants can operate when the temperature difference between the water at the surface and water at depths up to 2 km is 20 K or more.
- 22) The fission of an atom of uranium produces 10 million times the energy produced by the combustion of an atom of carbon from coal.

Multiple choice questions

- 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.
- 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
- 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.
- 4) **Which of the following is a non-renewable source of energy?**
(a) Wood (b) Sun **(c) Fossil fuels** (d) Wind
- 5) **Acid rain happens because:**
(a) sun leads to heating of upper layer of atmosphere
(b) burning of fossil fuels release oxides of carbon, nitrogen and sulphur in the atmosphere
(c) electrical charges are produced due to friction amongst clouds
(d) earth atmosphere contains acids
- 6) **Fuel used in thermal power plants is:**
(a) water (b) uranium (c) biomass **(d) fossil fuels**

- 7) **In a hydro power plant:**
(a) **Potential energy possessed by stored water is converted into electricity**
(b) Kinetic energy possessed by stored water is converted into potential energy
(c) Electricity is extracted from water
(d) Water is converted into steam to produce electricity
- 8) **Which is the ultimate source of energy?**
(a) Water (b) **Sun** (c) Uranium (d) Fossil fuels
- 9) **Which one of the following forms of energy leads to least environmental pollution in the process of its harnessing and utilisation?**
(a) Nuclear energy (b) Thermal energy
(c) **Solar energy** (d) Geothermal energy
- 10) **Ocean thermal energy is due to:**
(a) energy stored by waves in the ocean
(b) **temperature difference at different levels in the ocean**
(c) pressure difference at different levels in the ocean
(d) tides arising out in the ocean
- 11) **The major problem in harnessing nuclear energy is how to**
(a) split nuclei? (b) sustain the reaction?
(c) **dispose off spent fuel safely?**
(d) convert nuclear energy into electrical energy?
- 12) **Which part of the solar cooker is responsible for greenhouse effect?**
(a) Coating with black colour inside the box
(b) Mirror
(c) **Glass sheet**
(d) Outer cover of the solar cooker
- 13) **The main constituent of biogas is:**
(a) **methane** (b) carbon dioxide (c) hydrogen (d) hydrogen sulphide
- 14) **The power generated in a windmill:**
(a) is more in rainy season since damp air would mean more air mass hitting the blades
(b) depends on the height of the tower
(c) **depends on wind velocity**
(d) can be increased by planting tall trees close to the tower
- 15) **Choose the correct statement:**
(a) **Sun can be taken as an inexhaustible source of energy**
(b) There is infinite storage of fossil fuel inside the earth
(c) Hydro and wind energy plants are non-polluting sources of energy
(d) Waste from a nuclear power plant can be easily disposed off

- 16) **In a hydroelectric power plant more electrical power can be generated if water falls from a greater height because:**
- (a) its temperature increases
 - (b) larger amount of potential energy is converted into kinetic energy**
 - (c) the electricity content of water increases with height
 - (d) more water molecules dissociate into ions
- 17) **Choose the incorrect statement regarding wind power**
- (a) It is expected to harness wind power to minimum in open space
 - (b) The potential energy content of wind blowing at high altitudes is the source of wind power**
 - (c) Wind hitting at the blades of a windmill causes them to rotate. The rotation thus achieved can be utilised further
 - (d) One possible method of utilising the energy of rotational motion of the blades of a windmill is to run the turbine of an electric generator
- 18) **Choose the incorrect statement:**
- (a) We are encouraged to plant more trees so as to ensure clean environment and also provide bio-mass fuel.
 - (b) Gobar-gas is produced when crops, vegetable wastes etc., decompose in the absence of oxygen.
 - (c) The main ingredient of bio-gas is ethane and it gives a lot of smoke and also produces a lot of residual ash.**
 - (d) Bio-mass is a renewable source of energy.