3. Sources of Energy

Very Short Answer Type Questions-Pg-121

1. Question

Name a non-renewable source of energy other than fossil fuels.

Answer

The nuclear fuels like nuclear fuels are the non renewable sources of energy other than fossil fuels.

2. Question

Define calorific value of a fuel.

Answer

Calorific value of a fuel can be defined as the amount of heat produced by the combustion of 1 gram of that fuel completely.

3. Question

“The calorific value of cooking gas (LPG) is 50 kj/g”. What does it mean?

Answer

Since Calorific value is the amount of heat produced by burning a unit of the fuel completely, hence, calorific value of LPG is 50kJ/gm means that if 1 gram of LPG is burnt completely, then 50kJ of heat energy will be produced.

4. Question

Which of the following produces more heat (per unit mass) on burning? Coal or LPG

Answer

Since LPG has a higher calorific value than coal, hence, LPG produces more heat on burning.

5. Question

Define ignition temperature of a fuel.

Answer

The lowest temperature at which a combustible substance when heated catches fire in air and continues to burn is called ignition temperature.

6. Question

"The ignition temperature of a fuel is 800 C". What does this mean?

Answer

The ignition temperature of a fuel is 800 C means that 800C is the minimum temperature at which the particular fuel will catch fire or will ignite.

7. Question

Fill in the following blank with a suitable word:

The amount of heat produced by burning a unit mass of a fuel completely is known as its---value.

Answer

calorific value

Short Answer Type Questions-Pg-122

8. Question

What is a source of energy? What are the two main categories of the sources of energy?

Answer

A source of energy is one which can provide appropriate amount of energy in expedient form over a long period of time.

Two main categories of the source of energy are:

a) Renewable source of energy-source of energy that is not depleted when used. Such as wind or solar power.

b) Non- renewable source of energy-sources of energy that will run out or will not be replenished in our lifetimes or even in many, many lifetimes.

9. Question

State any four characteristic of good sources of energy.

Answer

A good source of energy should have the following characteristics:

a) It should do a large amount of work per unit mass or volume that means it should have high calorific value.

b) It should be easily accessible and provide energy over a long period of time. Example: coal and petroleum.

c) Should be easy to store and transport.

d) Safe and convenient to use - energy sources should be safe as it is used by a large number of people and should be convenient.

10. Question

What is meant by a non-renewable source of energy? Give two examples of non-renewable sources energy.

Answer

Non-renewable source of energy is one that will run out or will not be replenished in our lifetimes—or even in many, many lifetimes. Most non-renewable energy sources are fossil fuels: coal, petroleum, and natural gas.

11. Question

What is meant by a renewable source of energy? Give two examples of renewable sources of energy.

Answer

Renewable source of energy are those sources that generate energy from natural resources – such as sunlight, wind, rain, tides and geothermal heat – which are renewable (naturally replenished). Hence, they do not deplete with time.

12. Question

What is the difference between a renewable and non-renewable source of energy? Explain with examples.

Answer

Renewable energy resources: The energy resources which cannot be exhausted and can be used again and again are called renewable energy resources. For example solar energy, wind energy, tidal energy and hydroelectric etc.

Non-renewable energy resources: The energy resources which can be exhausted one day and cannot be used repeatedly are called non-renewable energy resources. The example of non-renewable energy resources are coal, petroleum, natural gases etc.

13. Question

Why are fossil fuels classified as non-renewable sources of energy?

Answer

Fossil fuels are non-renewable because they take millions of years to form. Fossil fuels make up most sources of non-renewable energy, and they were created millions of years ago as a result of marine creatures decaying under immense pressure and heat.

14. Question

Name two sources of energy that you think are renewable. Give reason for your choice.

Answer

Solar energy, wind energy, ocean energy etc., are renewable sources of energy due to the following reasons:

a) These forms of energy are available in plenty in our natural environment in the form of continuous currents of energy.

b) These energy sources will not be depleted because their supply is large and extraction of usable energy from these sources is negligible.

15. Question

Name two sources of energy which you consider to be non-renewable. Give reason for your choice.

Answer

Two examples of non renewable 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. 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.

16 A. Question

Classify the following into renewable and non-renewable sources of energy:

Coal, Wind, Tides, Petroleum, Wood, Natural gas

Answer

Renewable source of energy - wind, tides, wood.

16 B. Question

Non- Renewable source of energy - coal, petroleum, natural gas.

Answer

The above classification is based on the fact that renewable sources are inexhaustible, whereas non-renewable sources are exhaustible.

17. Question

Coal is said to be formed from the wood of trees. Why then is coal considered to be a non-renewable sources of energy whereas wood is a renewable sources of energy?

Answer

Coal is considered to be a non-renewable source of energy whereas wood is a renewable source of energy because coal is formed when dead plants got buried under the earth for a long period of time. It took millions of years to be replenished. So coal is considered to be non renewable source of energy.

Long Answer Type Questions-Pg-122

18 A. Question

What is a fuel? Give five examples of fuels.

Answer

A fuel is a substance which is burn to produce heat energy. Wood, Coal, LPG, Diesel are some common examples of fuel.

18 B. Question

What are the characteristics of an ideal fuel (or good fuel)?

Answer

The characteristics of an ideal fuel are:

It must have high calorific value.

It must burn without releasing any smoke or toxic gases.

It need to have proper ignition temperature.

It should be inexpensive and easily accessible.

18 C. Question

The calorific value and ignition temperature of fuel A are 55 kJ/g and 80oC, respectively. These values for fuel B are 80 kJ/g and 10°C, respectively. On burning, the fuel A produces CO_2 and H_2O while the fuel B produces CO_2, CO and SO_2. Give three points of relative advantages and disadvantages of these two fuels.

Answer

Fuel A:

Advantages:

No toxic gases are released.

Proper ignition temperature of around 80°C.

Disadvantages:

It has a lower calorific value of 55kJ/g.

Fuel B:

Advantages:

It has a high calorific value of 80kJ/g.

Disadvantages:

It releases toxic gases like CO and SO_2.

It has a very low ignition temperature of 10°C.

Multiple Choice Questions (MCQs)-Pg-122

19. Question

An example of a renewable sources of energy is :

A. Petrol

B. natural gas

C. biogas

D. kerosene

Answer

As it is prepared from the animal dung, vegetable waste, etc.

20. Question

A non-renewable sources of energy is:

A. Wood

B. alcohol

C. hydrogen gas

D. natural gas

Answer

As it is a fossil fuel.

21. Question

Which of the following is not a renewable sources of energy?

A. wind

B. flowing water

C. fossil fuels

D. fuel wood

Answer

As they take millions of years to be replenished again hence, considered non-renewable source of energy.

22. Question

A good fuel is one which process :

A. high calorific value and low ignition temperature

B. high calorific value and high ignition temperature

C. high calorific value and moderate ignition temperature

D. low calorific value and moderate ignition temperature

Answer

As it is the quality of an idle fuel.

23. Question

The fuel having a calorific value of 55 kJ/g is likely to be :

A. bio gas

B. methane gas

C. hydrogen gas

D. natural gas

Answer

It is present as a major component in biogas.

24. Question

A newly planted sapling usually grows and matures into a tree in more than:

A. 50 years

B. 25 years

C. 45 years

D. 15 years

Answer

A sapling is a tree seedling that has grown sufficiently to be planted in a Tree Patch.

25. Question

Which of the following fuels has the high calorific value ?

A. natural gas

B. methane gas

C. hydrogen gas

D. bio gas

Answer

Hydrogen has a calorific value of 15000Kj/kg.

26. Question

The fuel having the lowest calorific value is?

A. coal

B. wood

C. charcoal

D. kerosene

Answer

Calorific value of wood in dry state 3500kj/Kg and natural state 1500kj/Kg.

27. Question

There are four fuels which all contain only carbon and hydrogen. The fuel having highest calorific value will be one which has:

A. more of carbon but less of hydrogen

B. less of carbon but more of hydrogen

C. equal proportions of carbon and hydrogen

D. less of carbon as well as less of hydrogen

Answer

As carbon has a low calorific value so it would decrease the calorific value of the fuel if present in more amount, whereas Hydrogen has high calorific value so it would increase the calorific value of the fuel if present in excess.

28. Question

One of the following is not a characteristic of a good fuel. This is:

A. high calorific

B. no emission of smoke

C. smooth burning

D. high ignition temperature

Answer

A Good fuel require low or at least moderate ignition temperature.

29. Question

Which of the following is not a fossil fuel?

A. coal

B. petroleum gas

C. biogas

D. Natural gas

Answer

This is because Biogas isn't prepared from the remains of plants and animals whereas fossils fuels are prepared from the remains of plants and animals.

Questions Based on High Order Thinking Skills (HOTS)-Pg-123

30. Question

The calorific values of three fuels A, B and C are 33 KJ/g, 150 KJ/g, respectively. A is solid, B is liquid and C is a gas at room temperature. On combustion, both A and B produces carbon dioxide while C explodes forming steam. B and C leave no residue after combustion while A leaves behind some solid residue. Which one of the three fuels is the most ideal? Give two reasons to support your answer.

Answer

Fuel B is the most ideal fuel due to the following main reasons:

(i) As it leaves no reside on burning like the other two.

(ii) As an idle fuel it has a high calorific value of 48 KJ/g.

(iii) Moreover it does not burn explosively.

31. Question

Calorific value and ignition temperature of fuel X are 75 kJ/g and 200C respectively. These values for fuel Y are 50 kJ/g and 750C respectively. On burning, the fuel Y produces only CO_2 while fuel X produces CO_2 and CO. Which of the two is a better fuel? Give two reasons to support your answer.

Answer

Fuel Y is a better fuel due to the following main reasons:

(i) Y has a moderate ignition temperature of 75°C

(ii) As it do not produce any harmful gas (like CO) while burning.

32. Question

The calorific values of five fuels A, B, C, D and E are given below:

(A) 48 kJ/g

(B) 17 kJ/g

(C) 150 kJ/g

(D) 50 kJ/g

(E) 30kJ/g

Which of the fuels could be: (i) cooking gas (ii) alcohol (iii) wood (iv) hydrogen (v) kerosene ?

Answer

(i) D (calorific value of cooking gas)

(ii) E (calorific value of alcohol)

(iii) B (calorific value of wood)

(iv) C (calorific value of Hydrogen)

(v) A (calorific value of kerosene)

33. Question

Arrange the following fuels in the order of decreasing calorific values (keeping the fuels with highest calorific value first):

Biogas, Kerosene, Wood, Petrol, Hydrogen gas, Methane

Answer

Hydrogen gas>Methane> Petrol > Kerosene > Biogas > Wood

Hydrogen has the highest calorific value where as wood has the lowest calorific value.

34. Question

Arrange the following fuels in order of increasing calorific values (keeping the fuels with lowest calorific value first):

LPG, Coal, Alcohol, Dung cakes, Diesel

Answer

Dung cakes < Coal < Alcohol < Diesel < LPG

Dung cakes have the lowest calorific value where as LPG has the highest calorific value among them)

35. Question

Most of the fuels contain carbon as one of the constituents. Name a fuel which has very high calorific value but does not contain carbon.

Answer

Hydrogen is the fuel which has a very high calorific value and do not contain any carbon)

Very Short Answer Type Questions-Pg-130

1. Question

Name the product of petroleum that is used to drive heavy vehicles.

Answer

Diesel is the product of petroleum that is used to drive heavy vehicles. It is a mixture of hydrocarbons obtained by distillation of crude oil.

2. Question

Give one example of a good domestic fuel.

Answer

LPG i.e. Liquefied petroleum fuel. LPG is prepared by refining petroleum or "wet" natural gas, and is almost entirely derived from fossil fuel sources, being manufactured during the refining of petroleum.

3. Question

Name any one hydrocarbon fraction obtained during the fractional distillation of petroleum which is used as a domestic fuel.

Answer

Kerosene is one of the hydrocarbon fraction obtained during the fractional distillation of petroleum and used as a domestic fuel. It is widely used as a fuel in

industry and households.

4. Question

What are the various fuels which are used to generate electricity in a thermal power plant?

Answer

Fuels that are used to generate electricity in a thermal power plant are Coal, oil and gas.

5. Question

Name any four fractions obtained from petroleum which are used as fuels.

Answer

Various fractions obtained during the fractional distillation (refining) of petroleum (or crude oil). Few of them are:

Diesel, Petrol, Kerosene, Petroleum gas etc.

6. Question

What is the composition of liquefied petroleum gas (LPG)?

Answer

Liquefied Petroleum Gas (LPG) is made up of a combination of propane, butane, and trace amounts of other chemicals, including pentane. Butane comprises slightly less than 70 percent of the gas. Propane comprises nearly 29 percent of the gas, leaving just over 1 percent for the trace components.

7. Question

Which gaseous fuel is being used increasingly in transport vehicles like cars and buses these days?

Answer

Compressed natural gas (CNG) which is a methane stored at high pressure is being used increasingly in transport vehicles in place of gasoline (petrol), Diesel fuel and propane/LPG.

8. Question

Write the full form of: (i) LPG (ii) CNG.

Answer

(i) LPG stands for Liquefied Petroleum Gas. They are flammable mixtures of hydrocarbon gases used as fuel.

(ii) CNG stands for Compressed Natural Gas. It is methane stored at high pressure.

9. Question

What is the main constituent of:

(i) Petroleum gas

(ii) Natural gas

Answer

(i) The main constituent of petroleum gas is butane which is often abused as an inhalant.

(ii) The main constituent of natural gas is methane. It constitutes about 75% of the mixture.

10. Question

Name the component which is found in natural gas as well as in biogas.

Answer

Methane is found in both natural gas and biogas. In biogas it is about 50-65% whereas in natural gas it is around 75%.

11. Question

State two important uses of natural gas.

Answer

Uses of natural gas are:

i) Natural gas is a fossil fuel used as a source of energy for heating, cooking, and electricity generation.

ii) It is also used as a chemical feedstock in the manufacture of plastics and other commercially important organic chemicals.

12. Question

State one important use of CNG these days.

Answer

CNG combustion produces fewer undesirable gases than other fuels. It is safer than other fuels in the event of a spill. Hence, CNG is mostly used as a fuel in transport vehicles these days.

13. Question

Complete the following sentence:

Domestic gas cylinders like Indanecontain mainly ……..

Answer

Butane

Short Answer Type Questions-Pg-131

14. Question

Explain why, natural gas is considered to be a good fuel.

Answer

Natural gas is primarily made of methane (the lightest hydrocarbon).It burns more cleanly than other fossil fuels, emitting lower levels of harmful emissions such as carbon monoxide, carbon dioxide and nitrous oxides. It produces less greenhouse gases than other fossil fuels do. Hence, Natural gas is considered to be a good fuel.

15. Question

What is meant by conventional sources of energy? Write the names of two conventional sources of energy.

Answer

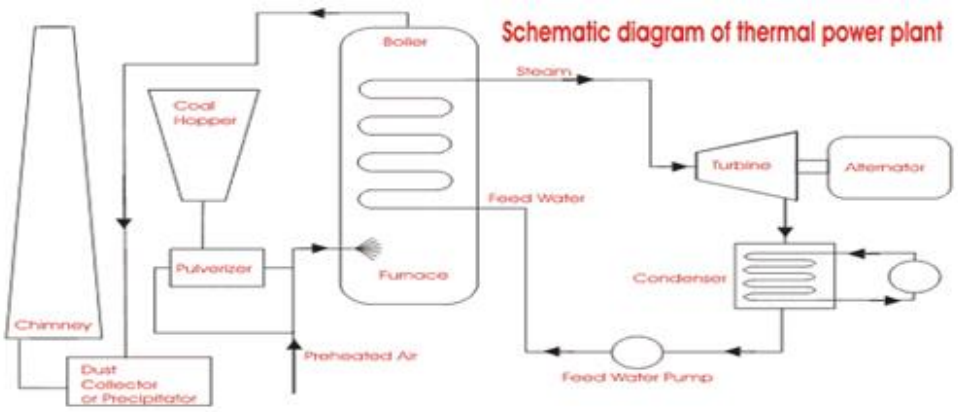
The conventional sources of energy are generally non-renewable sources of energy, which are being used since a long time. These sources of energy are being used extensively in such a way that their known reserves have been depleted to a great extent. Coal, oil and natural gas are a few examples of it.

16. Question

Explain the principle of working of a thermal power plant. Draw a labeled diagram to illustrate your answer.

Answer

In a thermal power plant, the heat that is generated by combustion of coal is used to boil water to form steam. Then, the steam, being at high temperature and pressure, rotates the turbine and its shaft, which drives the generator to produce electricity.



17. Question

What is the disadvantage of burning fossil fuels?

Answer

The disadvantages of burning fossil fuels are:

a)Fossil fuels have had a good run, but they're on their last legs.

b)Fossil fuels release carbon dioxide when they burn, which adds to the greenhouse effect and increases global warming.

c) Combustion of fossil fuels releases acidic gases.

d)The burning of fossil fuels produce smoke and leaves behind a lot of ash.

18. Question

Write a short note on the pollution caused by burning fossils fuels.

Answer

Most fossil fuels are burned to turn into energy, and the gasses released into the air by burning, in turn causes air and water pollution. Gases released by the burning of fossil fuels include carbon monoxide, nitrogen oxides, sulfur oxides and hydrocarbons. In the air, these gases become a carcinogen, which can be inhaled and can also mix with falling rain to form acid rain.Also, burning of fossil fuels produces smoke and a lot of ash.

19. Question

What are the various steps which can be taken to control (or reduce) pollution caused by burning fossil fuels?

Answer

We can reduce pollution by fossil fuels by following ways:

● We can reduce the consumptions of fossil fuels globally, by using less energy as an individual.

● By using more efficient machines that will emit less pollutant.

● By introducing techniques of treating the pollutant before emitting in the atmosphere.

● By using alternative safer, eco- friendly technologies.

20. Question

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

Answer

If I could use any sources of energy for heating my food, I would prefer LPG i.e. Liquefied Petroleum Gas because as an idle fuel it has a high calorific value and burns with smokeless flame.

21. Question

Why is LPG considered a good fuel?

Answer

Liquefied Petroleum Gas is considered a good fuel because of the following reasons:

a) LPG has a high calorific value. The calorific value of LPG is about 50 kj/g.

b) It is a very neat and clean domestic fuel. It burns with a smokeless flame and hence does not cause pollution.

c) It does not produce any poisonous gases on combustion.

d) LPG is easy to handle and convenient to store.

22. Question

Why is LPG considered a better fuel than coal?

Answer

LPG is better than Coal in the following points:

a) It can be easily transported to our homes through pipelines.

b) It has a high calorific value.

c) It does not leave a solid residue and neither forms harmful gases.

d) It is easy to store.

e) It is readily available.

f) It has a low ignition point.

g) It burns at a moderate rate and its combustion is controllable using a knob.

23. Question

Why is the leakage of LPG detected easily although it is odorless? State the steps to be taken in case its leakage is detected in the kitchen.

Answer

In order to detect the leakage, a foul smelling substance called ethyl mercaptane is added to the LPG. with that strong pungent smell, we can easily know if there is a leak.

In case of LPG leakage in the kitchen, following steps must be taken:

a) The door and windows should be opened to allow the gas to escape.

b) The source of gas leakage should be checked and then set right with the help of a gas mechanic.

Long Answer Type Questions-Pg-131

24 A. Question

What are fossils fuels? Give three examples of fossils fuels.

Answer

The fuels that are formed from the remains of dead plants and animals that lived millions of year ago are called fossil fuels. For e.g.: coal, petroleum, diesel, etc.

24 B. Question

Describe how fossil fuels were formed.

Answer

When the ancient plants and animals died, they decomposed and became buried under layers and layers of mud, rock, and sand. Eventually, hundreds and sometimes thousands of feet of earth covered them. In some areas, the decomposing materials were covered by ancient seas, then the seas dried up and receded. Hence, these materials away from the reach of oxygen, got converted into fossil fuels due to the chemical effects of pressure, heat and bacteria.

24 C. Question

Explain how, sun is considered to be the ultimate sources of fossil fuels.

Answer

The sun is the ultimate source of almost all kinds of energy on earth, either directly or indirectly. Fossil fuels are the transformed forms of plants and animals which once lived on the earth and grew capturing the energy of the sun. Biomass is a product of photosynthesis where the sun has the major role. Hydro-

electricity depends upon the water cycle which again is dependent on solar radiation. Similarly, wind energy, tidal power, wave power all, in some way or other, and depend on the sun.

24 D. Question

Which fossil fuels were formed by the buried remains of large land plants?

Answer

Petroleum and natural gas are such fuels.

24 E. Question

Which fossil fuel was formed by the buried remains of large land plants?

Answer

Coal

Multiple Choice Questions (MCQs)-Pg-131

25. Question

The main constituent of petroleum gas is:

A. methane

B. ethane

C. butane

D. propane

Answer

Petroleum gas consist mainly of butane with a very small amount of ethane and propane.

26. Question

The natural gas consist mainly of:

A. methane

B. ethane

C. Propane

D. butane

Answer

Typically if we see then natural gas consist 90% of methane.

27. Question

Which of the following is not produced by the burning of fossils fuels?

A. nitrogen gas

B. sulphur oxide

C. sodium oxides

D. carbon oxides

Answer

Burning of fossil fuels release various gasses like sulphur oxide, carbon dioxide, carbon monoxide, etc.

28. Question

The product of petroleum used to drive heavy vehicles like truck is:

A. petrol

B. kerosene

C. diesel

D. petroleum gas

Answer

Diesel fuel in general is any liquid fuel used in diesel engines, whose fuel ignition takes place, without any spark, as a result of compression of the inlet air mixture and then injection of fuel.

29. Question

The aviation fuel which is used in the engines of jet aeroplanes is:

A. diesel

B. kerosene

C. petrol

D. CNG

Answer

Kerosene, also known as paraffin, lamp oil and coal oil (an obsolete term), is a combustible hydrocarbon liquid which is derived from petroleum, widely used as a fuel in industry as well as households.

30. Question

The ultimate sources of energy stored in fossil fuels is:

A. moon

B. earth

C. sun

D. sea

Answer

Since plants and animals' existence depends on the sun directly or indirectly and fossil fuels are formed due to the remains of plants and animals hence, we can say that sun is the ultimate source of energy stored in fossil fuels.

31. Question

Which of the following is not a fossil sources of energy?

A. kerosene oil

B. cow- dung cakes

C. CNG

D. coal

Answer

It is the excretion of a cow and not the remains of dead and decaying plants and animals.

32. Question

The fuel which is not used at thermal power plants is:

A. coal

B. uranium

C. natural gas

D. fuel gas

Answer

It is a nuclear fuel used at nuclear power plants.

33. Question

LPG consists mainly of:

A. butane

B. ethane

C. butanone

D. methane

Answer

Liquified Petroleum Gas contains 60% of butane.

34. Question

Coke is more valuable when used

A. as a fuel for industrial

B. as an oxidizing agent

C. as a reducing agent

D. as a fuel in domestic ovens

Answer

This is because it is a non-metal and it combines with oxygen and forms its gaseous non-metallic oxides.

35. Question

Coal is more valuable when used:

A. coal gas

B. electricity

C. oil

D. charcoal

Answer

As charcoal do not produces smoke while burning and has a low ignition temperature and high calorific value.

36. Question

One of the following does not contribute to acid rain. That is:

A. nitrogen monoxide

B. sulphur dioxide

C. carbon monoxide

D. carbon dioxide

Answer

Acid rain is a rain or any other form of precipitation that is unusually acidic, meaning that it possesses elevated levels of hydrogen ions (low pH).

Questions Based on High Order Thinking Skills (HOTS)-Pg-132

37. Question

Fossil fuels are energy rich compounds of an element X which were originally made by the plants with the help of sun's energy.

(a) Name the element X

(b) Name another element which is usually found in combination with X in fossil fuels.

Answer

(a) X is carbon

(b) Hydrogen is another element which is usually found in combination with carbon in Fossil fuels.

38. Question

The energy in petrol originally came from the Sun. Explain how it got into petrol.

Answer

Fossil fuels are obtained from remains of animals and plants under the earth over a period of millions of years these existed and grew due to sun's energy thus the ultimate source of fossil fuels can be considered to be the sun's energy.

39. Question

A substance X is added to LPG cylinders while filling so as to make the detection of leakage of LPG from the cylinders easy.

(a) Name the substance X

(b) How does substance X make the detection of leakage of LPG easy?

Answer

(a) X is Ethyl mercaptan

(b) Ethyl mercaptan has a foul smell which can be detected easily at the time of leakage of LPG.

40. Question

The pollution of air caused by burning petroleum fuels (like petrol and diesel) in vehicles can be controlled by fitting a device X in the exhaust system of vehicles.

(a) Name the device X

(b) How does this device help in controlling air pollution ?

Answer

(a) Catalyltic converter- A catalytic converter is an emissions control device that converts toxic gases and pollutants in exhaust gas to less toxic pollutants by catalyzing a redox reaction (an oxidation and a reduction reaction)

(b) It helps in controlling air pollution by changing poisonous carbon monoxide into non-poisonous carbon dioxide and also converts harmful nitrogen oxides into harmless nitrogen gas.

Very Short Answer Type Questions-Pg-140

1. Question

A hydro-power plant converts one from of energy into another. Name the two forms of energy.

Answer

A hydroelectric power station converts the kinetic energy of flowing or falling water into electrical energy that can be used in homes and businesses.

2. Question

What type of energy is possessed by flowing water?

Answer

Kinetic energy is possessed by flowing water.

3. Question

Flowing water can rotate a turbine. Which type of energy is used up by the turbine?

Answer

Kinetic energy of flowing water is used up by the turbine and later it it is converted into electrical energy.

4. Question

Name the original source of wind energy.

Answer

Sun is the original source of wind energy. The sun's radiation warms different parts of the earth at different rates. The result of this uneven heating is atmospheric change. Hot air rises, leaving decreased atmospheric pressure near

the earth's surface, and cool air is drawn in to replace it. The result of this air exchange is wind.

5. Question

What should be the minimum wind speed for the satisfactory working of a wind-powered electric generator?

Answer

15km/hr should be the minimum wind speed for the satisfactory working of a wind- powered electric generator.

6. Question

Write one use of wind energy

(a) In the past

(b) At present.

Answer

a) In the past wind energy was used in the flour mills.

b) In the present days wind energy is mainly used for generating the electricity through wind-powered generators.

7. Question

Why is the copper tube of a solar water heater painted black from outside?

Answer

The copper tube is painted black to improve their ability to absorb thermal energy. Black reflects the least amount of radiation (about 3%) of any color, and therefore absorbs almost all the radiation energy to which it is exposed.

8. Question

What type of reactions occurring inside the sun produces solar energy?

Answer

Nuclear fusion reactions occur inside sun that produces solar energy. This reaction, converts hydrogen atoms into helium.

9. Question

Name some of the solar energy devices.

Answer

Solar panel, Solar charge controller, Solar inverter, Solar micro-inverter, Solar cable, Photovoltaic mounting system, etc are some of the solar energy devices.

10. Question

What type of reflector is used in a box-type solar cooker?

Answer

plane mirror with high specular reflectivity is used as a reflector in box-type solar cooker to concentrate light from the sun on to a small cooking area.

11. Question

What is the range of temperature which can be achieved in a box-type solarcooker in two to three hours?

Answer

The range of temperature which can be achieved in a box-type solarcooker in two to three hours is from 100°C to 140°C.

12. Question

Name the devices which converts sunlight into electricity.

Answer

Solar cells convert sunlight into electricity. It is a form of photoelectric cell.

13. Question

How much solar energy will be received by 1 m^2 area in one hour if the solar constant be 1.4 kW/m^2?

Answer

From the solar constant we deduce that

1.4 kW of power is incident upon every 1m2 of area.

i.e the total energy incident in 1 hr over an area of 1 m2 will be = 1.4 kW x 1 hr

(Since P=E/t or E=P x t)

Hence, energy = 1.4 kWh

Solar energy received by 1 m2 area in one hour (or 3600 s) = 1.4 x 3600 = 5040 kJ

14. Question

Fill in the following blanks with suitable words :

A solar cell converts …….. energy into …….. energy.

Answer

solar energy into electrical energy.

Short Answer Type Questions-Pg-140

15 A. Question

What is the difference between a thermal power plant and hydro power plant?

Answer

The main difference between Thermal Power plant and Hydro Power plant are: The thermal power is produced by burning coal, petroleum or natural gas in thermal generator whereas the Hydro-electricity or Hydro power is derived from the force of running water by means of dynamo driven by hydro-turbine.

15 B. Question

Which of the two causes serious air pollution and how?

Answer

Among them, thermal power plant causes serious air pollution because it emits harmful gases like nitrogen oxide, sulphur dioxide and fly-ash into the air.

16. Question

Compare the sun and the fossil fuels as the sources of energy.

Answer

Coal and petroleum are fossil fuels they are obtained from deep under Earth's crust. They are directly available to human beings for use. Therefore fossil fuels are the direct source of energy. But these are limited in amount also they are non-renewable.

Sun is also a direct source of energy. But it is renewable source of energy. The Sun has been shining for several years and will continue billions of years more. Solar energy is available free of cost to all in unlimited amount.

17. Question

What kind of mirror, concave, convex or plane, would be best suitable for use in a solar cooker? why?

Answer

A concave mirror would be best suited for use in a solar cooker. When a concave mirror reflector is attached to a solar cooker, it converges a large amount of Sun's heat radiations at its focus due to which a high temperature is produced at the focus area.

18 A. Question

Name that part of a box-type solar cooker which allows the sun's rays to enter the box but does not allow inside heat to go out.

Answer

The box is covered by a thick transparent sheet of glass. When the box is placed in the sunlight, the glass cover allows the infrared rays present in sunlight to pass into the box. Then these rays are absorbed by black surface of the box and the box becomes hot. But, after sometime when the black surface becomes hot it starts radiating out heat in the form of infrared rays. But, the glass sheet cover placed over the box does not allow the heat radiated by the black surface to go out from the box. In this way, the glass cover enables the cooker to entrap the heat inside it.

18 B. Question

Explain why, a plane mirror reflector is used in a box-type solar cooker.

Answer

Usually, a plane mirror reflector is attached on the top of the box. This is because the plane mirror reflector increases the efficiency of solar cooker by reflecting more and more sunlight inside the box.

19. Question

What are the advantages and disadvantage of using a solar cooker?

Answer

Advantages of using a solar cooker are:

a) There is no cost of fuel.

b) It is environment friendly and there is no residue like ash etc.

c) Cooking is hygienic and nutritious.

Disadvantages of using a solar cooker are:

a) The cooking is slow.

b) It cannot be used at all times.

c) A solar cooker can perform only limited functions.

d) Solar cookers have limited utility at the places where sunlight is less as in polar regions or where there are too much rains.

20 A. Question

What is a solar cell? Draw the labeled diagram of a solar cell.

Answer

A solar cell or photovoltaic cell, is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon.

20 B. Question

Name the semi-conductor material which is usually used for making solar cells.

Answer

Silicon is usually used for making solar cells.

20 C. Question

Write the uses of solar cells.

Answer

Uses of solar cells are:

● Solar cells are very useful in powering space vehicles such as satellites and telescopes (e.g. Hubble).

● solar cells see wide use as an off-grid energy source.

● To provide electricity to remote areas where normal electricity transmission lines do not exist.

● To provide electricity to light houses.

21. Question

State the advantage and disadvantage of using solar cells.

Answer

Advantages of using solar cells are:

●Electricity produced by solar cells is clean and silent.

●Photovoltaic systems are quiet and visually unobtrusive.

●Small-scale solar plants can take advantage of unused space on rooftops of existing buildings.

●Solar energy is a locally available renewable resource.

Disadvantage of using solar cells are:

●Some toxic chemicals, like cadmium and arsenic, are used in the PV production process.

●Solar energy is somewhat more expensive to produce.

●Solar power is a variable energy source, with energy production dependent on the sun.

22. Question

What is a solar cell panel? For what purpose is it used? State its two main advantages.

Answer

Solar panels are devices that convert light into electricity. They are called "solar" panels because most of the time, the most powerful source of light available is the Sun, called Sol by astronomers. Two main advantages of using solar panels are:

a) It provides much more electric power than a single solar cell.

b) It is used to provide electricity in remote and inaccessible rural areas.

23 A. Question

What is solar constant? What is the value of solar constant?

Answer

Solar constant is the rate at which energy reaches the earth's surface from the sun, usually taken to be 1,388 watts per square metre.

Its value is $1.4 kJ/s/m^2$.

23 B. Question

If the energy received by 5 m2 area in 10 minutes is 4200 kJ, calculate the value of solar constant.

Answer

Area, $A=5\ m^2$

Time, t=10 min

=600sec

E=4200 kJ

Solar constant =E/(A x t)

=4200/(5x600)

$=1.4\ kJ/s/m^2$

24. Question

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

Answer

Traditionally, waterfalls were used as a source of potential energy in which water is allowed to fall on the blades of the turbine where the rotatory motion of the blades of the turbine is converted into electrical energy. But waterfalls are few in number therefore water dams have been constructed. Nowadays, hydro-electric power stations are used in order to harness potential energy of stored water.

25. Question

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

Answer

Earlier, the windmills were used to harness wind energy to do mechanical work such as lifting or drawing water from a well. But now a day's windmills are used to generate electricity. In windmills the rotatory motion of the blades turns the blades of turbine to generate electricity.

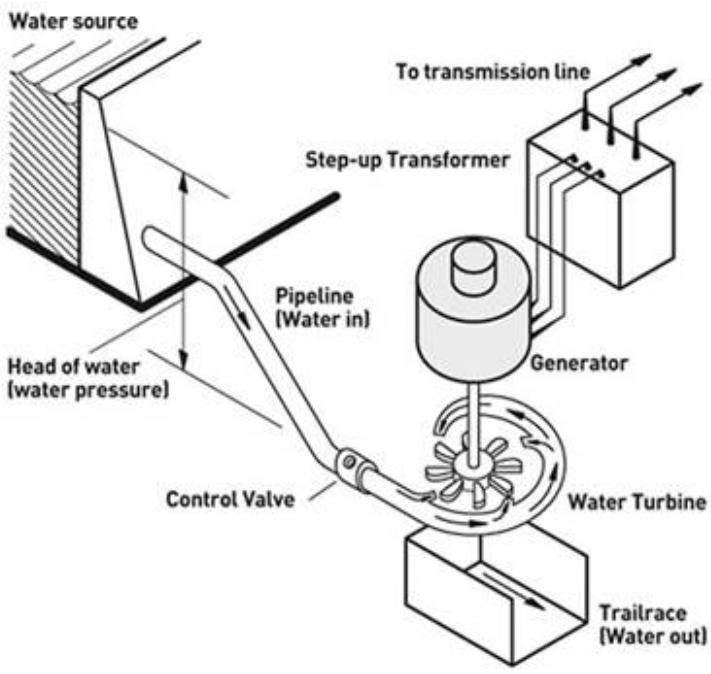
Long Answer Type Questions-Pg-141

26 A. Question

What is hydro electricity? Explain the basic principle of generation of hydroelectricity with the help of a labeled diagram.

Answer

As the name indicates hydroelectricity is the electricity that is produced through water. Conservation of energy is the basic principle that is used for the generation of hydroelectricity which is explained in the following diagram:



26 B. Question

State two advantage of producing hydroelectricity.

Answer

The two advantages of using hydroelectricity are:

i) Hydropower is fueled by water, so it's a clean fuel source, meaning it won't pollute the air like power plants that burn fossil fuels.

ii) Hydroelectric power is a domestic source of energy, allowing each state to produce their own energy without being reliant on international fuel sources.

26 C. Question

State two disadvantage of producing hydroelectricity.

Answer

Disadvantages:

i) Hydroelectricity plants are very expensive.

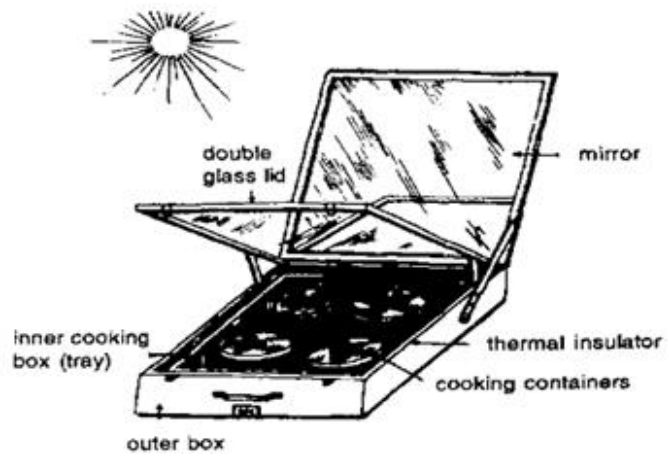
ii) The building of dams for hydroelectric power can also cause a lot of water access problems.

27 A. Question

With the help of a labeled diagram, explain the construction and working of a solar cooker.

Answer

Solar cookers vary in design, but many feature a chamber lined with reflective surfaces, such as aluminum foil and a clear, plastic or glass window, through which the sunlight enters. When sunlight passes through plastic or glass, its spectrum shifts, and much of the ultraviolet radiation is filtered out. However, this filtered light transforms into heat, which raises the temperature inside the solar cooker.



27 B. Question

Why is the solar cooker box painted black from inside?

Answer

As we know that dark colors are a good conductor of heat. Therefore to absorb a large amount of heat solar cookers are painted black.

27 C. Question

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

Answer

When sunlight falls over the solar cooker top, the sun rays pass through the glass sheet cover and get absorbed inside the cooker box.

This glass sheet covers does not allow the solar energy to flow out in the form of radiant heat. Thus it traps more and more heat rays of the sun thereby producing greenhouse effect. That is why glass lid is used in the solar cooker.

28 A. Question

What is wind? What type of energy is possessed by wind?

Answer

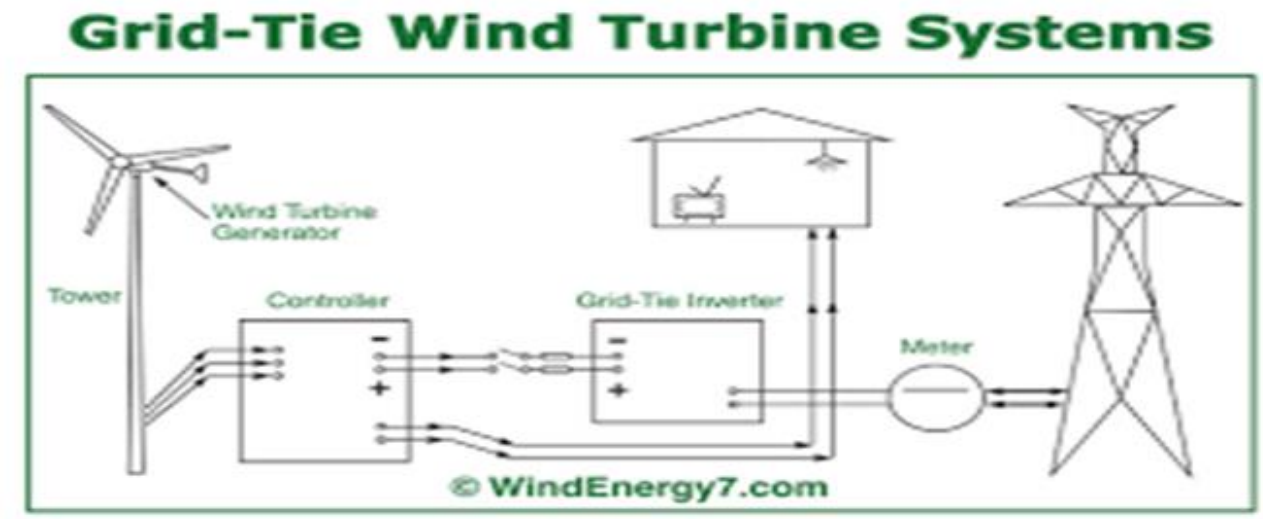
Wind is moving air and is caused by differences in air pressure within our atmosphere. Wind possesses a form of energy referred to as kinetic energy. Kinetic energy is energy of motion i.e. energy that a body possesses because it is in motion.

28 B. Question

Explain how, wind energy can be used to generate electricity. Illustrate your answer with the help of a labeled diagram.

Answer

Wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can be used for specific tasks (such as grinding grain or pumping water) or a generator can convert this mechanical power into electricity.



28 C. Question

State two advantage of using wind energy for generating electricity.

Answer

Advantages of using wind energy for generating electricity are:

(i)Wind energy itself is both renewable and sustainable. The wind will never run out.

(ii)Wind turbines have a relatively small land footprint.

28 D. Question

Mention two limitations of wind energy for generating electricity.

Answer

Limitations of wind energy are

(i) Wind energy has a similar drawback to solar energy in that it is not a constant energy source.

(ii) Although costs are reducing over time, the installation of a wind turbine is considered expensive.

Multiple Choice Questions (MCQs)-Pg-141

29. Question

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

A. a sunny day

B. a cloud day

C. a hot day

D. a windy day

Answer

At it won't get the sufficient sunlight to create greenhouse effect.

30. Question

At a hydro power plant:

A. kinetic energy possessed by stored water is converted into electrical energy

B. electricity is extracted from water

C. water is converted into steam to turn turbines and produces electricity.

D. potential energy possessed by stored water is converted into electricity.

Answer

A hydro power plant is a complex of installations and equipment that is used to convert the energy of a stream of water into electrical energy.

31. Question

The part of box-type solar cooker which is responsible for producing greenhouse effect is:

A. plane mirror reflector

B. black coating inside the box

C. glass sheet cover

D. utensils placed in the cooker box

Answer

As it traps the absorbed radiations inside traping more and more heat.

32. Question

Solar cells are made of:

A. conductors

B. insulators

C. semi-conductors

D. super-conductors

Answer

Because in semiconductors, the energy band gap is quite less. The photons can easily eject the electrons out of it provided the energy of the electrons is more than the threshold energy required.

33. Question

The value of solar constant is

A. 1.4 kWh

B. 1.4 kW/m

C. 1.4 kW/m^2

D. 1.4 kW/m^3

Answer

The solar constant, is the conventional name for the mean solar electromagnetic radiation (the solar irradiance) per unit area that would be incident on a plane perpendicular to the rays, at a distance of one astronomical unit (AU) from the Sun (roughly the mean distance from the Sun to the Earth).

34. Question

The radiations present in sunlight which make a solar cooker work are

A. visible light rays

B. ultraviolet rays

C. cosmic rays

D. infrared rays

Answer

Infrared radiation, or simply infrared or IR, is electromagnetic radiation (EMR) with longer wavelengths than those of visible light, and is therefore invisible.

35. Question

In order to make an efficient solar cooker, the cover box should be made of :

A. transparent plastic sheet

B. shining alluminium sheet

C. butter paper sheet

D. transparent glass sheet

Answer

As it do not allows the absorbed radiations to pass out hence, traping out more and more heat.

36. Question

The minimum speed of wind necessary for the satisfactory working of a wind generator to produce electricity is about :

A. 15 km/h

B. 25km/h

C. 35km/h

D. 45km/h

Answer

A wind turbine is a device that converts the wind's kinetic energy into electrical power.

37. Question

If the solar constant is 1.4 kW/m^2, then the solar energy received by 1 m^2 area in one hour is :

A. 5040 J

B. 504.0 Kj

C. 5040 Kj

D. 5.04 Kj

Answer

From the solar constant we deduce that

1.4 kW of power is incident upon every $1m^2$ of area.

i.e. the total energy incident in 1 hr over an area of 1 m^2 will be

= 1.4 kW x 1 hr

(Since P=E/t or E=P x t)

Hence, energy = 1.4 kWh

Converting into Kj we get 5040 Kj)

38. Question

A solar cooker may not cook food if :

A. the solar cooker is not placed in the shade

B. the glass sheet cover of solar cooker is not closed

C. a convex mirror reflector is not used

D. the food containers of insulating material are not used

Answer

Glass sheet covers does not allow the solar energy to flow out in the form of radiant heat. Thus it traps more and more heat rays of the sun thereby producing green house effect. That is why glass lid are closed in the solar cooker in order to trap more and more heat.

Questions Based on High Order Thinking Skills (HOTS)-Pg-142

39. Question

A large coal-fired power station producers 2000 MW of electrical energy. A wind turbine with 33 m blades can produces 300 kW.

(a) How many turbines would be needed to replace the power station?

(b) Why, in actual practice, this number of turbines could not replace the coal-fired power station?

Answer

(a) Electrical energy produced by coal-fired plant,

= 2000MW

= 2000x106W

Electrical energy produced by wind turbine

= 300kW

= 300x103W

No. of wind turbine required,

= 2000x106/300x103 = 6666.6

Hence, 6667 wind turbines would be needed to replace the power station.

(b) In actual practice, this no. of wind turbines could not replace the coal-fired power plant because the efficiency of wind turbines keeps changing due to changes in wind speed but the efficiency of steam turbines used in coal-fired power stations remains the same.

40. Question

In a solar water heater, why is the storage tank placed at a higher level than the solar panel containing coils?

Answer

In a solar water heater, the storage tank placed at a higher level than the solar panel containing coils because hot water, being lighter and less denser, rises to the top.

41. Question

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

Answer

The electricity that is produced by the solar cells during the day time is stored in the rechargeable batteries so that the produced electricity can be used later on, for instance, at night.

42 A. Question

Solar cells are used to provide the electric current to charge the batteries of a car driven by an electric motor. Describe the energy changes which take place.

Answer

At first, with the help of solar cells, solar energy is converted into electrical energy. Then, while charging the batteries this electrical energy gets converted into chemical energy.

Later, while using the batteries, chemical energy again gets converted into the electrical energy and then the electric motor converts electrical energy into kinetic energy.

42 B. Question

What difference would you expect in the charging of car battries

(i) in bright sunlight

(ii) on a cloudy day

(iii) at night?

Answer

(i) Due to the large amount of solar energy, batteries of the car gets charged quickly.

(ii) As on a cloudy day less amount of sunlight is present therefore batteries charge up very slowly.

(iii) Due to the absence of light batteries do not charge up a tall.

Very Short Answer Type Questions-Pg-148

1. Question

What substance is obtained as a residue when wood is burned in a limited supply of air?

Answer

Charcoal is obtained as a residue when wood is burned in a limited supply of air.

2. Question

Name one source of energy which is not derived from solar energy directly or indirectly.

Answer

Geothermal energy is neither derived from the sun directly or indirectly. It is the heat present inside the earth.

3. Question

What name is given to the heat energy obtained from hot rocks inside the earth?

Answer

Geothermal energy is the heat energy obtained from hot rocks inside the earth. It's clean and sustainable. Resources of geothermal energy range from the shallow ground to hot water and hot rock found a few miles beneath the Earth's surface, and down even deeper to the extremely high temperatures of molten rock called magma.

4. Question

Name the agent which decomposes animal dung into biogas.

Answer

Anaerobic bacteria decomposes animal dung into biogas. It digests the animal dung into a closed system and produces the biogas.

5. Question

Which component of biogas is used as a fuel?

Answer

Biogas contains 54-70% of methane which is used as a fuel.

6. Question

Name the constituents of biogas.

Answer

The constituents of biogas are mentioned below along with their % Constitution:

Methane: 54 – 70%

Carbon dioxide: 27 – 45%

Nitrogen: 0.5 – 3%

Hydrogen: 1 – 10%

Carbon monoxide: 0.1%

Oxygen: 0.1%

Hydrogen sulfide: traces.

7. Question

Which of the following is needed for the formation of biogas from cow-dung and which not?

Water, Oxygen

Answer

Water is required in the formation of biogas from cow-dung. And biogas is produced in the absence of oxygen in a closed system.

8. Question

Name the clean fuel which can be obtained from cow-dung.

Answer

Biogas is the cleanest fuel that can be obtained from cow-dung. It typically refers to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen.

9. Question

Apart from cattle dung, what other substances can be added to a biogas plant?

Answer

Apart from cattle dung, human excreta, agriculture wastes, vegetable wastes, poultry droppings, paper scrap etc. can also be added to a biogas plant. A biogas plant is an anaerobic digester that produces biogas.

10. Question

Name any three forms of energy which could be harnessed from the sea.

Answer

the three forms of energy are:

(i) Tidal energy

It is a form of hydropower that converts the energy obtained from tides into useful forms of power, mainly electricity.

(ii) Wave energy

It describes the process by which wind is used to generate electricity.

(iii) Ocean thermal energy

It is a process that can produce electricity by using the temperature difference between deep cold ocean water and warm tropical surface waters.

11. Question

Write two forms in which solar energy manifests itself in sea.

Answer

Sea-waves energy and Ocean thermal energy manifests itself in sea.

12. Question

Write the full form of OTE.

Answer

OTE stands for Ocean Thermal Energy. Ocean thermal energy is derived from the solar energy that is absorbed by the oceans.

13. Question

What is the function of anaerobic micro-organisms such as anaerobic bacteria in a biogas plant?

Answer

Anaerobic bacteria help in the degradation of cow-dung in the presence of water but in the absence of oxygen and hence produces biogas. The most of the important bacteria involved in biogas production process are anaerobes.

14. Question

State whether the following statement is true or false:

Tidal energy is one of the forms in which solar energy manifests itself in oceans.

Answer

False- Sea-waves energy and Ocean thermal energy are the forms of energy which solar energy manifests itself in oceans.

15. Question

Fill in the following blanks with suitable words:

(a) Biomass is another form in which ..... energy manifests itself.

(b) Tidal waves build up and recede ..... a day.

Answer

(a) solar (b) twice

Short Answer Type Questions-Pg-148

16 A. Question

What is biomass? Give three examples of biomass.

Answer

Biomass is fuel that is developed from organic materials, a renewable and sustainable source of energy used to create electricity or other forms of power. Examples of biomass include landfill gas, wood, crops, garbage and alcohol fuels.

16 B. Question

Name the biomass which is still widely used as a source of heat energy in many households of country.

Answer

Wood is still widely used as a source of heat energy in many households of country.

17. Question

What are the two ways in which cow-dung can be used as a fuel? Which of them is better and why?

Answer

Two ways in which cow-dung can be used as a fuel are:

a) In the form of cow-dung cakes, which can be used directly as a fuel.

b) By preparing biogas from cow-dung.

18. Question

How is charcoal prepared? Explain why, charcoal is a better fuel than wood.

Answer

Charcoal is a lightweight, black residue, consisting of carbon and any remaining ash, obtained by removing water and other volatile constituents from animal and vegetation substances. Charcoal is usually produced by slow process-the heating of wood in the absence of oxygen.

Charcoal is better fuel than wood because: When the same amount of charcoal and wood are burnt, charcoal produces almost twice the heat produced by wood. Charcoal produces much less smoke than wood. Charcoal is a compact fuel that is more convenient to handle than wood.

19. Question

Compare and contrast biomass and hydroelectricity as sources of energy.

Answer

Bio-mass is renewable sources of energy. It mass is derived from dead plants and animal wastes. Therefore it is naturally replenished. Wood, gobar gas etc. are some of the examples of bio-mass.

Hydro-electricity is also renewable sources of energy. But it is obtained from the potential energy stored in water at a height. Energy from it can be produced again and again.

20. Question

Why biogas is considered an ideal fuel for domestic use?

Answer

Biogas is considered as an ideal fuel due to the following reasons:

a) It has an appropriate calorific value.

b) It is easy to store, handle and transport.

c) It is easily processed from cow dung and other waste materials.

d) It has also an appropriate ignition temperature.

e) It is also environment friendly and don't cause much harm to the environment.

f) It burns smoothly and does not leave behind much residue. Infact it contains negligible non-volatile material.

21 A. Question

Explain how tidal energy can be used to generate electricity.

Answer

During high tide, when the level of water in the sea is high, sea-water flows into the reservoir of the barrage and turns the turbines. The turbines then turn the generator and the electricity is produced. And during the low tide, when the level of sea-water is low, the sea-water stored in the barrage reservoir is allowed to flow out into the sea. This flowing water also turns the turbines and generates electricity.

21 B. Question

Why is tidal energy not likely to be a potential source of energy?

Answer

The tidal energy is not likely to be a potential source of energy because:

(i) The rise and fall of sea-water during high and low tide is not so high to generate electricity on a large-scale.(ii) There are very few sites in the sea around the world that are suitable to build dams.(iii) Start up cost to build a tidal energy plant is high.

22. Question

State two ways in which the energy of sea-waves can be harnessed.

Answer

Sea-waves energy can be harnessed by the following ways:

a) By setting up floating generators in the sea. They would move up and down with the sea-waves and their movement would drive the generators to generate electricity.

b) By letting the sea-waves move up and down inside large tubes so that when the waves move up, the air in the tubes is compressed and this compressed air can then be used to turn a turbine of a generator to produce electricity.

23. Question

What is meant by ocean thermal energy? Explain how ocean thermal energy can be used to generate electricity.

Answer

The energy present due to the difference in the temperature of water at the upper surface and the deeper layers of ocean is known as ocean thermal energy.

Ocean thermal energy is used to produce electricity in an Ocean Thermal Energy Conversion power plant. A temperature difference of 20°C or more between the surface water and deeper water is needed for the working of these plants. The warm surface water of ocean is used to boil a liquid like ammonia or chlorofluorocarbon. The high pressure of liquid vapors is used to turn the turbine of a generator and produce electricity.

24. Question

What are the limitations of energy that can be harnessed from the sea ?

Answer

There are certain limitations to harness energy from the sea. Those limitations are

a) High dams are required to be built to convert tidal energy into electricity which incurs lot of cost.

b) Very strong waves are required, which are not possible all the time.

c) Tidal energy depends on the relative positioning of the Earth, moon, and the Sun.

d) To harness ocean thermal energy the difference in the temperature of surface hot water and the cold water at depth must be 20°C or more.

25. Question

Suggest a safe and efficient method for the disposal of bio wastes and sewage materials. How is this method advantageous to us?

Answer

Biogas is a safe and efficient method for the disposal of bio wastes and sewage materials. In a biogas plant all the organic wastes such as cow dunk, plant wastes or the residue of any crop is used as a fuel for the production of biogas. Other waste products such as kitchen waste is also used. Hence, all waste is being disposed and converted into biogas.

26. Question

Which of the following sources of energy are not derived from the sun?

Biomass, Wind, Ocean thermal energy, Geothermal energy, Nuclear fuels, Hydroelectricity, Wave energy, Coal, Petroleum, Tidal energy

Answer

Following sources of energy are not derived from the sun:

- Geothermal energy-The heat present within the Earth.
- Nuclear fuels-The energy related to radioactive material.
- Tidal energy-The energy generated using the potential energy of water.

Long Answer Type Questions-Pg-149

27 A. Question

What is biogas? Name the major component of biogas.

Answer

Biogas typically refers to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen. Methane is the major component of biogas constituting about 60%.

27 B. Question

What are the raw materials used for making biogas?

Answer

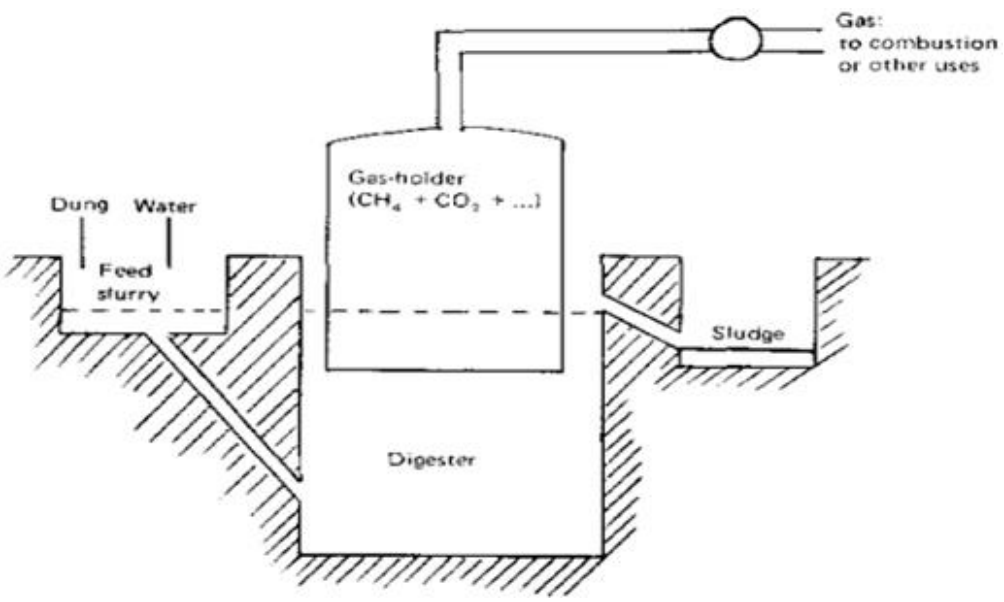
Biogas is produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste.

27 C. Question

Describe the construction and working of a biogas plant with the help of a labelled diagram.

Answer

Manure and dung are also fed into the biogas plant. In the fermenter, heated to approx. 38-40 °C, the substrate is decomposed by the micro-organisms under exclusion of light and oxygen. The final product of this fermentation process is biogas with methane as the main ingredient.



27 D. Question

Write any two uses of biogas.

Answer

Uses of biogas:

• It can be used for any heating purpose, such as cooking.

• It can also be used in a gas engine to convert the energy in the gas into electricity and heat.

27 E. Question

Write any two advantages of using biogas.

Answer

Advantages and Benefits of Biogas:

• Provides a non-polluting and renewable source of energy.

• Efficient way of energy conversion (saves fuel wood).

• Provides a source for decentralized power generation.

28 A. Question

What is geothermal energy?

Answer

Geothermal energy is the heat from the Earth. It's clean and sustainable. Resources of geothermal energy range from the shallow ground to hot water and hot rock found a few miles beneath the Earth's surface, and down even deeper to the extremely high temperatures of molten rock called magma.

28 B. Question

What is the source of heat contained in geothermal energy?

Answer

Hot rocks present inside the earth are the source of heat contained in geothermal energy.

28 C. Question

Explain how, geothermal energy is used to generate electricity.

Answer

Extremely hot rocks present below the surface of earth heat the underground water converting it into steam. When more and more steam is formed between the rocks, it gets compressed to high pressures. This high pressure steam is brought up through pipes and is used to run the turbine of a generator to produce electricity.

28 D. Question

State two advantages of geothermal energy.

Answer

Advantages of geothermal energy

i. It is a renewable source of energy.

ii. By far, it is non-polluting and environment friendly.

iii. There is no wastage or generation of by-products.

28 E. Question

State two disadvantages of geothermal energy.

Answer

Disadvantage of geothermal energy:

i. Only few sites have the potential of Geothermal Energy.

ii. Most of the sites, where geothermal energy is produced, are far from markets or cities, where it needs to be consumed.

iii. Total generation potential of this source is too small.

Multiple Choice Questions (MCQs)-Pg-149

29. Question

Which of the following is not an example of a biomass energy source?

A. wood

B. biogas

C. atomic energy

D. cow-dung

Answer

It is a energy carried by atoms.

30. Question

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

A. wind energy

B. geothermal energy

C. fossil fuels

D. biomass

Answer

It is the energy present inside the earth.

31. Question

The constituent of biogas which makes it an excellent fuel is :

A. butane

B. methane

C. propane

D. ethane

Answer

Biogas constitutes methane gas about 60% within it.

32. Question

The major component of biogas is :

A. hydrogen

B. butane

C. hydrogensulphide

D. methane

Answer

Biogas contains around 60% of the methane.

33. Question

Which of the following is more environment friendly ?

A. burning of diesel

B. burning of coal

C. burning of charcoal

D. burning of wood

Answer

It is a smokeless fuel with high calorific value.

34. Question

Which one of the following is not renewable energy technology?

A. solar cells

B. windmills

C. nuclear power

D. tidal power

Answer

nuclear powerplants usually use a very rare type of uranium, U-235 as a fuel hence categorizing it as a non-renewable source.

35. Question

The rise of sea-water during high tide is caused by the gravitational pull of the:

A. Sun

B. Earth

C. Moon

D. Mars

Answer

It is caused by the attractive forces of the Moon and Sun's gravitational fields as well as the centrifugal force due to the Earth's spin.

36. Question

One of the following is not required in the formation of biogas in a biogas plant. This is:

A. cow-dung

B. water

C. oxygen

D. anaerobic bacteria

Answer

As biogas can be prepared only in the absence of oxygen.

37. Question

The fuel which is not obtained from biomass is:

A. firewood

B. cow-dung cakes

C. coke

D. charcoal

Answer

Coke is derived from destructive distillation of low-ash, low-sulfur bituminous coal.

38. Question

The non-renewable source of energy among the following is :

A. hydroelectricity

B. sewage gas

C. natural gas

D. gobar gas

Answer

Natural gas is a fossil fuel which is a non-renewable source.

39. Question

Geothermal energy is produced by the:

A. fission of radioactive materials

B. burning of coal inside the coal mines

C. combustion of natural gas deep inside the earth

D. fusion of radioactive substances

Answer

Geothermal energy is heat energy generated and stored in the Earth. The geothermal energy of the Earth's crust originates from the original formation of the planet and from radioactive decay of materials.

40. Question

The harnessing of which of the following leads to the destruction of large eco-systems?

A. thermal power

B. tidal power

C. hydro power

D. geothermal power

Answer

Construction of dams require a large amount of area.

41. Question

Which of the following is not a consequence of establishing hydroelectric power plants ?

A. displacement of people

B. production of methane

C. occurrence of floods

D. ecological disturbance

Answer

The cost of hydroelectricity is relatively low, making it a competitive source of renewable electricity. The hydro station consumes no water, unlike coal or gas plants.

Questions Based on High Order Thinking Skills (HOTS)-Pg-150

42. Question

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.

(a) Name the form of energy.

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

(c) Explain how this form of energy can be converted into electricity.

(d) What is the minimum temperature difference in water at the surface of ocean and its deeper level which is required to operate power plants based on this energy ?

Answer

(a) Ocean thermal energy is the energy generated due to the difference in the temperature of water at the surface of the ocean and its deeper levels.

(b)No this Energy isn't derived from the sun.

(c) Ocean thermal energy is used to generate electricity in an Ocean Thermal Energy Conversion power plant also called as OTEC power plant. A temperature difference of 20°C or more between the surface water and deeper water is needed for the operation of these plants. The warm surface water of ocean is used to boil a liquid like ammonia or chlorofluorocarbon. The high pressure of the vapors of liquid is used to turn the turbine of a generator and produce electricity.

(d)20°C is the minimum temperature difference in water at the surface of ocean and its deeper level which is required to operate power plants based on this energy.

43. Question

The gravitational pull of the moon causes the sea-water to rise periodically.

(a) What name is given to the condition of the sea when its water is raised?

(b) What name is given to the condition of the sea when its raised water recedes?

(c) What name is given to the energy which can be harnessed from this natural phenomenon?

(d) Draw labelled diagram to show how this energy can be harnessed to generate electricity.

Answer

(a) The condition when the sea water rises is termed as high tide.

(b)When the rised water of the sea resides, the situation is termed as low tide.

(c)Tidal Energy (Tidal energy is a form of hydropower that converts the energy obtained from tides into useful forms of power, mainly electricity)

(d)At high tide, water flows from sea into reservoir and turns the turbine.

At low tide, stored water flows out from reservoir into sea and turns the turbine.

44. Question

When the material A mined from the earth ,is heated strongly in an insufficeint supply of air, it produces a solid fuel B which consists mainly of carbon. When another material C obtained from trees is heated in an insufficient supply of air, it produces another solid fuel D which also consists mainly of carbon. Name A, B, C and D.

Answer

A is coal; It is mainly made up of 65-95% carbon and also contains hydrogen, sulphur, oxygen and nitrogen.

B is coke; Coke is a fuel with few impurities and a high carbon content, usually made from coal.

C is wood;

D is charcoal; Charcoal is a lightweight, black residue, consisting of carbon and any remaining ash, obtained by removing water and other volatile constituents from animal and vegetation substances.

45. Question

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

Geothermal Energy is the form of energy which is not sourced directly or indirectly from the sun.

Very Short Answer Type Questions-Pg-156

1. Question

What type of nuclear reaction is responsible for the liberation of energy:

(a) In a nuclear reactor?

(b) In the sun?

Answer

a) Nuclear fission-Nuclear fission is a process where the nucleus of an atom is split into two or more smaller nuclei, known as fission products.

b) Nuclear fusion-nuclear fusion is a reaction in which two or more atomic nuclei come close enough to form one or more different atomic nuclei and subatomic particles.

2. Question

Which product of the nuclear fission of uranium-235 is utilized to cause further fission of its nuclei?

Answer

neutrons of uranium-235 are utilized to cause further fission of its nuclei. A uranium-235 atom absorbs a neutron and fissions into two new atoms (fission fragments), releasing three new neutrons and some binding energy.

3. Question

Which particles bring about the fission of uranium-235?

Answer

Neutrons bring about the fission of uranium-235.

4. Question

State whether the fission of uranium-235 is caused by low energy neutrons or high energy neutrons.

Answer

The fission of uranium-235 is caused by low energy neutrons because a fast neutron will not be captured, so neutrons must be slowed down by moderation to increase their capture probability in fission reactors.

5. Question

Name the type of nuclear reaction which is involved in the working of:

(a) A hydrogen bomb.

(b) An atom bomb.

Answer

a) Nuclear fusion-It's a mixture of deuterium and tritium (both of them rare forms of hydrogen) for nuclear fusion.

b) Nuclear fission-It's either uranium or plutonium for fission bombs.

6. Question

Name the moderator used in a nuclear reactor.

Answer

Commonly used moderators include regular (light) water (roughly 75% of the world's reactors), solid graphite (20% of reactors) and heavy water (5% of reactors).

7. Question

Of what material are the control rods of a nuclear reactor made?

Answer

Control rods of a nuclear reactor are made of boron. Control rods are used in nuclear reactors to control the fission rate of uranium and plutonium.

8. Question

What do you think is the purpose of the thick, concrete chamber surrounding the reactor of a nuclear power plant?

Answer

Nuclear reaction produces heavy hazardous radiations in the nuclear power plants. Hence, thick concrete chamber is required to prevent the radioactive rays to travel outside.

9. Question

Where, in a nuclear power station, is uranium used up?

Answer

Uranium is used up in the reactors in a nuclear power station.

10. Question

State one use of nuclear fission reactions.

Answer

Nuclear fission is used to generate electricity, for the destructive component of nuclear weapons and to break down radioactive elements into other elements.

11. Question

Name the unit which is commonly used for expressing the energy released in nuclear reactions.

Answer

Million electron volt (MeV) is used for expressing the energy released in nuclear reactions.

12. Question

How many MeV are equivalent to 1 atomic mass unit (u)?

Answer

1 atomic mass unit=931 MeV, where MeV stands for Million electron Volt.

13. Question

Fill in the following blanks with suitable words:

(a) Splitting of a heavy nucleus into two lighter nuclei is called .....

(b) Uranium-235 atoms will split when hit by ..... This is called .....

(c) Nuclear ..... is used in nuclear power stations for the production of electricity.

(d) In a nuclear power station, nuclear fission takes place in the .....

Answer

(a) Nuclear fission

(b) Neutrons; nuclear fission

(c) Fission

(d) Reactor

Short Answer Type Questions-Pg-157

14. Question

What is nuclear fission? Explain with an example. Write the equation of the nuclear reaction involved.

Answer

Nuclear fission is a nuclear reaction in which the nucleus of an atom splits into smaller parts (lighter nuclei).The fission process often produces free neutrons and photons (in the form of gamma rays), and releases a large amount of energy.

E.g., When uranium-235 atoms are bombarded with slow moving neutrons, the heavy uranium nucleus breaks up to produce two medium-weighted atoms and 3 neutrons, with the emission of tremendous amount of energy.

15 A. Question

What is nuclear fusion? Explain with an example. Write the equation of the reaction involved.

Answer

The process that fuels our sun and allows it to give off that much energy is called nuclear fusion. Nuclear fusion is a reaction where two atomic nuclei fuse together to create a larger nucleus and in the process release energy.

When deuterium atoms are heated to an extremely high temperature under extremely high pressure, then two deuterium nuclei combine together to form a heavy nucleus of helium, and a neutron is emitted. A tremendous amount of energy is liberated in the process.

15 B. Question

Why are very high temperatures required for fusion to occur?

Answer

For a nuclear fusion reaction to occur, it is necessary to bring two nuclei so close that nuclear forces become active and glue the nuclei together. This is the reason why nuclear fusion reactions occur mostly in high density, high temperature environment.

16. Question

What is the nuclear fuel in the sun? Describe the process by which energy is released in the sun. Write the equation of the nuclear reaction involved.

Answer

Hydrogen gas is the nuclear fuel in the sun. The sun can be assumed as a huge thermonuclear furnace where hydrogen atoms continuously get fused into helium atoms. Hence, the mass during these fusion reactions gets lost and as a product energy is being produced.

Nuclear reaction:

$4\,{}^{1}_{1}H \xrightarrow{\text{Fusion}} {}^{4}_{2}He + 2\,{}^{0}_{+1}e$ + tremendous amount of energy

17 A. Question

Write Einstein's mass-energy equation. Give the meaning of each symbol which occurs in it.

Answer

Einstein's mass-energy equation is, $E=mc^2$,

The equation is derived directly from Einstein's Special Theory of Relativity

Each of the letters of $E = mc^2$ stands for a particular physical quantity. Writing them out in full we get:

E = energy (measured in joules, J)

m = mass (measured in kilograms, kg)

c = the speed of light (measured in meter per second, ms^{-1})

17 B. Question

If 25 atomic mass units (u) of a radioactive material are destroyed in a nuclear reaction, how much energy is released in MeV?

Answer

As,

1 atomic mass unit = 931 MeV

25 atomic mass unit

= 931 x 25 MeV

= 23275 MeV

Hence, 23275 MeV of energy is released.

18 A. Question

What is the source of energy of this sun and other stars?

Answer

The source of energy of this sun and other stars is nuclear fusion reactions of hydrogen. The net process is the fusion of four Hydrogen nuclei to make one helium nucleus plus some energy. The balance between gravity compression and outward thermal pressure controls the rate of the nuclear fusion reactions.

18 B. Question

Describe the working of a hydrogen bomb.

Answer

The hydrogen bomb consists of heavy isotopes of hydrogen called deuterium and tritium along with lithium-6. Atom bomb is used for the explosion of hydrogen bomb. While the atom bomb is exploded, since its fission reaction a lot of heat is produced which raises the temperature of deuterium and tritium to 107°C in a few microseconds. Then fusion reactions of deuterium and tritium take place which produces a tremendous amount of energy. This explodes the hydrogen bomb. Lithium-6 is used to produce more tritium needed for fusion.

18 C. Question

What is common between the sun and a hydrogen bomb?

Answer

The source of energy is same for both the sun and the hydrogen atom, that is nuclear fusion.

19 A. Question

What will happen if slow moving neutrons are made to strike the atoms of a heavy element 23592U? What is the name of this process?

Answer

When slow moving neutrons are made to strike the atoms of a heavy element uranium-235, the heavy uranium nucleus breaks up to produce two medium-weighted atoms and 3 neutrons, with the emission of tremendous amount of energy. This process is called nuclear fission..

19 B. Question

Write a nuclear equation to represent the process which takes place.

Answer

$$^{235}_{92}U + ^{1}_{0}n \xrightarrow{\text{fission}} ^{139}_{56}Ba + ^{94}_{36}Kr + \text{Trem}$$

19 C. Question

Name one installation where such a process is utilized.

Answer

At nuclear power station such process are utilized.

20 A. Question

What are the advantages of nuclear energy?

Answer

advantages of nuclear energy are as follows:

1. Expense

Less uranium is needed to produce the same amount of energy as coal or oil, which lowers the cost of producing the same amount of energy.

2. Reliability

When a nuclear power plant is functioning properly, it can run uninterrupted for up to 540 days.

3. No Greenhouse Gases

While nuclear energy does have some emissions, the plant itself does not give off greenhouse gasses.

20 B. Question

State the disadvantages of nuclear energy.

Answer

Disadvantages of nuclear energy are as follows:

1.Raw Material

Since, uranium is naturally unstable therefore special precautions must be taken during the mining, transporting and storing of the uranium.

2.Water Pollutant

The water that is pumped outside into nearby wetlands contains immense heat that can be damaging to eco systems located nearby the reactor.

3. If it has structural flaws or are improperly installed, a nuclear reactor could release harmful amounts of radiation into the environment during the process of regular use.

21. Question

The following questions are about the nuclear reactor of a power plant.

a) Which isotope of uranium produces the energy in the fuel rods?

b) Will the fuel rods last forever?

c) Is the energy produced by nuclear fission or nuclear fusion?

d) What is the purpose of using the graphite moderator ?

e) What is the function of boron rods in the nuclear reactor?

f) Why is liquid sodium (or carbon dioxide gas) pumped through the reactor?

Answer

a) Uranium-235 produces the energy in the fuel rods

b) No they won't last forever.

c) Energy is produced by nuclear fission.

d) In a nuclear reactor, a moderator is mixed with the uranium fuel to slow down the fast neutrons to the speed of thermal neutrons, which enables fission to occur in a controlled nuclear chain reaction.

e) Boron rods are used in nuclear reactors to control the fission rate of uranium and plutonium.

f) Liquid sodium or carbon dioxide gas is used as a 'coolant' to transfer the heat produced to heat exchanger for converting water into steam.

22. Question

In the reactor of a nuclear power plant, name the material which is used :

(a) As a moderator

(b) To absorb radiations

(c) In the fuel rods

(d) In the control rods

(e) To carry away heat

Answer

(a) Graphite is used as a moderator.

(b) Concrete are used to absorb the radiations

(c) U-235 is used in control rods

(d) Boron can be used as control rods

(e) Liquid sodium is used to carry away heat.

23. Question

In the nuclear reactor of a power plant:

(a) How do control rods control the rate of fission?

(b) How is heat removed from the reactor core, and what use is made of this heat?

Answer

a) In Nuclear reactors control rods are stick down into the fuel to absorb neutrons, to slow the reaction down, or withdraw to speed the reaction up.

b) Heat is removed from the nuclear reactor core with the help of liquid sodium. It absorbs the heat and transfers it to the heat exchanger. Then, this heat is used for converting water into steam in the heat exchanger, which is later used to produce electricity by rotating a turbine and its shaft which is connected to a generator.

24. Question

How does inserting the control rods in the graphite core affect the fission in the reactor? Explain your answer.

Answer

On inserting the control rods in the graphite core, the rods begin absorbing the excess neutrons and maintain the rate of reaction as it is required . We can raise or lower the rods in the reactor from outside as per our requirement. The part which is present inside the reactor absorbs neutrons.

25. Question

What are the advantages and disadvantages of using nuclear fuel for generating electricity ?

Answer

Advantages of nuclear energy:

i) It produces a large amount of useful energy from a very small amount of a nuclear fuel.

ii) Once the nuclear fuel is loaded into the reactor, the nuclear power plant can go on producing electricity for two to three years at a stretch. There is no need of feeding the fuel again and again.

iii) It does not produce gases like CO_2 or SO_2.

Disadvantages of nuclear energy:

i) The waste products of nuclear fission reactions are radioactive which keep on emitting harmful radiations for thousands of years and are difficult to store or dispose safely.

ii) Very high cost of installation is required.

iii) There is a limited availability of uranium fuel.

Long Answer Type Questions-Pg-157

26 A. Question

What is a nuclear reactor ? What is the fuel used in a nuclear reactor?

Answer

A nuclear reactor, formerly known as an atomic pile, is a device used to initiate and control a sustained nuclear chain reaction. Nuclear reactors are used at nuclear power plants for electricity generation and in propulsion of ships. U-235 is the fuel used in a nuclear reactor.

26 B. Question

With the help of a labelled diagram, describe the working of a nuclear power plant.

Answer

In a nuclear power plant, the fission of uranium-235 is carried out in a reactor R. Uranium-235 rods are inserted in a graphite core which acts as a moderator to slow down the neutrons. Boron rods B absorb excess neutrons and controls the rate of reaction. Liquid sodium or carbon dioxide gas, which is pumped continuously through pipes embedded in reactor by using a pump P, is used as a 'coolant' to transfer the heat produced to heat exchanger for converting water into steam. The hot steam at high pressure goes into a turbine chamber and makes the turbine rotate. The shaft of the generator also rotates and drives a generator connected to it.

26 C. Question

How is the working nuclear reactor of a power plant shut down in an emergency?

Answer

The working nuclear reactor of a power plant can be shut down in an emergency by inserting the control rods of Boron completely. They absorb all the neutrons, shutting down the reactor.

26 D. Question

Name five places in India where nuclear power plants are located

Answer

Five places in India where nuclear powerplants are located are:

(i) Tarapur

(ii) Kalpakkam

(iii) Narora

(iv) Kaprapur

(vi) kaiga

27 A. Question

Differentiate between nuclear fission and nuclear fusion.

Answer

Both fission and fusion are nuclear reactions that produce energy, but the applications are not the same. Fissions the splitting of a heavy, unstable nucleus into two lighter nuclei, and fusion is the process where two light nuclei combine together releasing vast amounts of energy.

27 B. Question

Which of the two, nuclear fission and nuclear fusion, is made use of:

(i) for the production of electricity?

(ii) for making a hydrogen bomb?

Answer

(i) nuclear fission

(ii) nuclear fusion

27 C. Question

Which produces more energy: nuclear fusion or nuclear fission?

Answer

Among both the process nuclear fusion produces more energy

27 D. Question

Calculate the energy released in joules when 5 g of a material is completely converted into energy during a nuclear reaction.

Answer

Mass of material,

m = 5g = 0.005kg,

Speed of light, c = 3×10^8m/s

We know that, $E = mc^2$

$E = 0.005 \times (3 \times 10^8)^2$

$E = 4.5 \times 10^{14}$J

Hence, energy released= 4.5×10^{14}J

27 E. Question

How much is this energy in Me V? (Speed of light= 3 x 10^8 m/s)

Answer

The energy in MeV is given by:

$$\frac{1}{1.6\times10^{-13}}\times 4.5\times 10^{14}$$

(Since 1 MeV = 1.6×10^{-13} J)

= 2.8×10^{27} MeV

Multiple Choice Questions (MCQs)-Pg-158

28. Question

Which of the following is used as a moderator in the reactor of a nuclear power station?

A. Liquid sodium

B. boron

C. Graphite

D. carbon dioxide

Answer

Graphite is a crystalline form of carbon, a semimetal, a native element mineral, and one of the allotropes of carbon. Graphite is the most stable form of carbon under standard conditions.

29. Question

The control rods used in the reactor of a nuclear power plant are made of :

A. steel

B. graphite

C. uranium

D. boron

Answer

Because boron is capable of absorbing many neutrons without itself fissioning.

30. Question

The 'coolants' which can be used in the reactor of a nuclear power station are:

A. liquid mercury and nitrogen dioxid

B. liquid sodium and carbon dioxide

C. liquid ammonia and carbon monoxide

D. liquid boron and uranium oxide.

Answer

A nuclear reactor, formerly known as an atomic pile, is a device used to initiate and control a sustained nuclear chain reaction.

31. Question

In a nuclear power plant, coolant is a substance :

A. which cools the hot, spent steam to condense it back to water

B. which transfers heat from reactor to water in heat exchanger

C. which is boiled to make steam to turn the turbine

D. which cools the generator coils to prevent their overheating.

Answer

A nuclear reactor coolant is a coolant in a nuclear reactor used to remove heat from the nuclear reactor core and transfer it to electrical generators and the environment.

32. Question

Which of the following is ultimately not derived from the sun's energy (or solar energy)?

A. wind energy

B. nuclear energy

C. biomass energy

D. ocean thermal energy

Answer

Nuclear power is the use of nuclear reactions that release nuclear energy to generate heat, which most frequently is then used in steam turbines to produce electricity in a nuclear power plant

33. Question

One atomic mass unit (u) is equivalent to an energy of :

A. 931 eV

B. 9.31 MeV

C. 1 MeV

D. 931 MeV

Answer

1 a.m.u is defined as 1/12th of the mass of an atom of $6C^{12}$ isotope. Hence a change in mass of 1a.m.u (called mass defect) releases an energy equal to 931 MeV.1 amu = 931 MeV is used as a standard conversion.

34. Question

The energy in the reactor of a nuclear power station is produced by the process of :

A. nuclear diffusion

B. nuclear fission

C. nuclear fusion

D. nuclear fermentation

Answer

In nuclear physics and nuclear chemistry, nuclear fission is either a nuclear reaction or a radioactive decay process in which the nucleus of an atom splits into smaller parts (lighter nuclei).

35. Question

One eV (electron volt) of nuclear energy is equivalent to :

A. $1.6 \text{ X } 10^{-14}$ J

B. $1.6 \text{ X } 10^{-12}$ J

C. $1.6 \text{ X } 10^{-19}$ J

D. $1.6 \text{ X } 10^{-13}$ J

Answer

(W = qV)

= (1.6 x 10-19 C) x (1 J/C)

= 1.6 x 10-19 J)

36. Question

Which of the following can be produced during the nuclear fission as well as nuclear fusion reactions ?

A. protons

B. deutrons

C. electrons

D. neutron

Answer

Nuclear Fusion and nuclear fission are similar in that they both release large amounts of energy.

37. Question

Nuclear fission reactions are not a source of energy for one of the following. This is:

A. Atom bomb

B. power plants

C. Sun

D. pacemaker

Answer

Nuclear fusion is sun's source of energy.

38. Question

The energy produced by converting 1 gram mass of a nuclear fuel into energy completely is:

A. $9 \text{ X } 10^{16}$ J

B. $9 \text{ X } 10^{14}$ J

C. $9 \text{ X } 10^{15}$ J

D. $9 \text{ X } 10^{13}$ J

Answer

Nuclear fuel is a substance that is used in nuclear power stations to produce heat to power turbines. Heat is created when nuclear fuel undergoes nuclear fission.

39. Question

The source of energy of the sun is :

A. Conversion of hydrogen gas into helium

B. Conversion of carbon fuel into carbon dioxide

C. Burning of hydrogen gas present in the sun

D. Disintegration of uranium into barium and krypton

Answer

Nuclear fusion converts Hydrogen gas into helium producing tremendous amount of energy.

40. Question

An uncontrolled nuclear chain reaction forms the basis of:

A. Nuclear power plant

B. Hydrogen bomb

C. Thermal power station

D. Atom bomb

Answer

An atom bomb, known as the A-bomb for short, is a bomb that creates its devastating explosive force by the splitting of atoms' nuclei through a process known as nuclear fission.s

41. Question

One MeV of nuclear energy is equivalent to:

A. 1.6×10^{-13} J

B. 1.6×10^{-19} J

C. 1.6×10^{-16} J

D. $1.6 \text{ X } 10^{-15}$ J

Answer

Nuclear energy is the energy obtained by manipulating the internal structure of atoms.

42. Question

One type of energy which has not been controlled so far is:

A. Ocean thermal energy

B. Nuclear fusion energy

C. Geothermal energy

D. Nuclear fission energy

Answer

nuclear fusion is a reaction in which two or more atomic nuclei come close enough to form one or more different atomic nuclei and subatomic particles.

43. Question

The disposal of wastes produced in a nuclear power plant poses a big problem because it is:

A. Too heavy

B. Highly inflammable

C. Extremely foul smelling

D. Highly radioactive

Answer

Nuclear Waste is radioactive and that is the primary cause of the negative effects on human health and bodies.

44. Question

The heat energy released during nuclear fission and fusion is due to the :

A. Conversion of stored chemicals into energy

B. Conversion of momentum into energy

C. Conversion of mass into energy

D. Conversion of magnetism into energy

Answer

Energy is released from fission and fusion because breaking and formation of bond takes place.

45. Question

Which of the following can undergo nuclear fusion reaction?

A. Uranium

B. Deuterium

C. Barium

D. krypton

Answer

Deuterium (symbol D or 2H, also known as heavy hydrogen) is one of two stable isotopes of hydrogen.

Questions Based on High Order Thinking Skills (HOTS)-Pg-159

46. Question

A nuclear reaction is represented by the following equation:

$$^{235}_{92}U + ^{1}_{0}n \longrightarrow ^{139}_{56}Ba + ^{94}_{36}Kr + xc + E$$

(a) Name the process represented by this equation and describe what takes place in this reaction.

(b) Identify the particle c and the number x of such particles produced in the reaction.

(c) What does E represent?

(d) Name one installation where the above nuclear reaction is utilized.

(e) What type of bomb is based on similar type of reactions?

Answer

(a) Nuclear fission in which large nucleus splits into two smaller nuclei with the release of energy, brought about by the absorption of a neutron.

(b) Particle c is neutron; x = 3

(c) E represents the Energy liberated

(d) The reaction is utilized in Nuclear Power Station

(e) Atom bomb is based on similar type of reaction called nuclear fusion.

47. Question

A nuclear reaction is represented by the equation :

$$^{2}_{1}H + ^{2}_{1}H \longrightarrow ^{3}_{2}He + xc + E$$

(a) Name the process represented by this equation and describe what happens during this reaction.

(b) Identify the particle c and the number x of such particles produced in the reaction.

(c) What does E represent?

(d) State two conditions under which such a reaction takes place.

(e) What type of nuclear bomb is based on similar reactions ?

Answer

(a) Nuclear fusion in which two smaller nuclei combine in order to form a bigger nucleus with the release of energy, brought about under the conditions of high temperature and pressure.

(b) Particle c is neutron; x = 1

(c) E is the Energy liberated

(d) Such reactions takes place user the two following conditions:

• Millions of degrees of temperature and

• Millions of pascals of pressure

(e) Hydrogen bomb is based on similar reaction.

48. Question

The mass numbers of four elements A, B, C and Dare 2, 20, 135 and 235, respectively. Which one of them will be most suitable to make:

(i) an atom bomb, and

(ii) a hydrogen bomb?

Answer

(i)D with a Mass number of 235

(ii) A with a Mass number of 2

49. Question

A nuclear power plant is working normally. What would you do it the reactor core suddenly got too hot?

Answer

If the reactor core all of a sudden gets too hot then it indicates that the rate of nuclear fission is intensified excessively so in order to reduce the rate of nuclear fission process insert the control rods of boron a little more into the reactor and hence the reactor would start working normally.

49. Question

A nuclear reactor has half the length of all its control rods inserted in graphite. What must be done so that the reactor produces more heat? Explain your answer.

Answer

If such circumstances happens then we would withdraw the control rods a little more from inside the reactor. Doing this will increase the rate of nuclear fission

process and hence would produce more heat .

50. Question

Explain why, in a nuclear reactor, the chain reaction stops if the control rods are fully inserted into the graphite.

Answer

In a nuclear reactor, the chain reaction stops if the control rods are fully inserted into the graphite because the control rods absorb all the neutrons, and hence stopping the nuclear chain reaction.

Very Short Answer Type Questions-Pg-161

1. Question

Which of the two is a cleaner fuel: hydrogen or CNG? Why?

Answer

Hydrogen fuel 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.

2. Question

Which of the two is more energy efficient : filament type electric bulb or CFL ? Why?

Answer

CFLs are more energy efficient as they last from 8-10 times longer, use about 75% less energy, and produce 90% less heat while delivering more light per Watt.

3. Question

How long are the energy resources of the earth like coal, petroleum and natural gas expected to last?

Answer

Coal is expected to last for about 200 years,

Petroleum is expected to last for 40 years and

Natural Gas may last for 60 years

4. Question

Name two devices which can be utilized for the cooking of food so as to save fuel.

Answer

Solar cooker and pressure cooker can be utilized for the cooking of food so as to save fuel as they use less energy to cook food in comparison of others.

Short Answer Type Questions-Pg-161

5. Question

What are the various factors which we should keep in mind while choosing a source of energy?

Answer

Factors which we should keep in mind while choosing a source of energy are:

It should do a large amount of work per unit mass or volume - it means that the output energy must be more than the input energy. It should have high calorific value.

It should be easily accessible - the energy source should be able to provide energy over a long period of time. Example: coal and petroleum.

Should be easy to store and transport - most common sources of energy such as coal, petrol and LPG need to be transported to users from their points of production. They also need proper storage. Thus it is important to store and transport these sources safely and economically.

Safe and convenient to use - energy sources should be safe as it is used by a large number of people and should be convenient.

6. Question

Can any source of energy be pollution free? Explain your answer with an example.

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 107 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.

7. Question

What are the environmental consequences of the increasing demand for energy?

Answer

The increasing demand for energy is largely being met by the use of fossil fuel - coal and petroleum. But these fuels are exhaustible and non-renewable sources of energy. Moreover, burning of fossil fuels causes air pollution. Release of acidic oxides leading to acid rain affects our water and soil resources. These gases also produce greenhouse effect leading to rise in temperature. Then, there is a problem of disposal of ash produced due to burning of coal. Thus, our environment is being degraded.

8. Question

What steps would you suggest to reduce energy consumption?

Answer

To reduce energy consumption:

● we should lead a simple and a natural life. As an example, instead of using an air conditioner in a closed room we should live in an airy room having appropriate number of windows.

● Turn your monitor off at night and ditch the screensaver.

● Use LED bulbs as LED bulbs use 75% less electricity than incandescent bulbs.

Multiple Choice Questions (MCQs)-Pg-161

9. Question

The major cause of environmental pollution is the use of :

A. Hydrogen as fuel

B. Biomass energy

C. Ocean energy

D. Fossil fuels

Answer

Gases released by the burning and combustion of fossil fuels include carbon monoxide, nitrogen oxides, sulfur oxides and hydrocarbons. In the air, these gases become a carcinogen, which can be inhaled and can also mix with falling rain to form acid rain.

10. Question

The world's known coal reserves are expected to last for about:

A. 200 years

B. 400 years

C. 500 years

D. 100 years

Answer

Ultimate reserves designates all the coal that can eventually be mined in a given zone (that can be the whole planet).

11. Question

The fossil fuel whose known reserves in the earth are expected to last for the minimum period is :

A. Coal

B. Uranium

C. Petroleum

D. Natural gas

Answer

Petroleum is a naturally occurring, yellow-to-black liquid found in geological formations beneath the Earth's surface, which is commonly refined into various types of fuels.

12. Question

An energy efficient device for producing light is :

A. DLF

B. CFL

C. FCL

D. LPG

Answer

CFLs use much less energy than incandescent lamps