# Combustion, Fuels And Flame

## Improve your learning

**Q. 1. Give four examples of combustible materials.**

**Answer :** Combustible materials are those materials which burn in the presence of air (oxygen) when brought near a flame. So the examples of such materials can be listed as follows:

● Petrol

● Paper

● Wax

● Dry leaves

**Q. 2. Give four examples of non-combustible materials.**

**Answer :** Noncombustible materials are those materials which do not burn on being brought near a flame. So the examples of such materials can be listed as follows:

● Water

● Iron

● Pebble

● Sand

**Q. 3. Why should not we store spirit or petrol near our living place?**

**Answer :** Spirit and petrol are highly inflammable i.e. they have very low ignition temperatures and thus very easily catch fire. Ignition temperature is the lowest temperature at which a substance catches fire. So there is a huge danger involved in storing spirit or petrol as it can lead to fire accident if exposed to even a small spark. Therefore we should not store spirit or petrol near our living place to avoid fire accidents.

**Q. 4. Give an example of a good fuel. How do you choose that fuel? Explain.**

**Answer :** CNG (Compact Natural Gas) is an example of good fuel. Whether a fuel is good enough for a specific use or not, it can be decided by observing its characteristic properties. So we choose a good fuel on the basis of following properties:

● It should be efficient and readily available.

● It should not be very expensive.

● It should have high calorific value.

(Calorific value is the amount of heat produced on complete combustion of 1kg of fuel)

● Transportation of the fuel should be easy.

● It should be safe to handle and easy to store.

● Less pollution should be caused on its burning i.e. it should not release polluting gases and leave residue on burning.

● It should get ignited and put off easily.

CNG possess all of the above said properties and thus it qualifies as a good fuel.

**Q. 5. The oil fires should not be sprayed with water. Why?**

**Answer :** Oil fires are caused when oil catches fire accidentally. The use of water to put off oil fires is not suitable. This is because water is heavier than oils. If we spray water in case of an oil fire, water will sink below the oil and oil on the top will keep burning. So in such fires water can't act as a barrier to cut off oxygen supply and thus oil fires should not be sprayed with water.

**Q. 6. What precautions are to be taken while pouring water on fire?**

**Answer :** The following precautions should be taken while pouring water on fire:

● Before pouring water firstly put off the electric mains otherwise there will be chances of short circuit.

● Water should not be poured to put off electric fires. This is because water may conduct electricity and harm those trying to douse the fire.

● Water should not be used to put off oil and petrol fires as water being heavier than oils sink below the oil and oil on the top keeps burning.

**Q. 7. Why a wick is not used in gas burners?**

**Answer :** A wick is required when a fuel in melted/liquid form is being used. The melted/liquid fuel rises through the wick and form vapours which then burn to give flame.

Example: Candle burns with the help of a wick in which molten wax rises through the wick and form vapours which then burn into flame.

So we can conclude that a wick is required in cases when fuel is not present in vapour form. But in case of gas burners, gas is used as fuel which has low ignition temperature and can be burnt directly without the help of wick. Therefore a wick is not used in gas burners.

**Q. 8. Water is not used to control fires involving electrical equipment. Why?**

**Answer :** Water is a good conductor of electricity. It conducts electricity due to the presence of dissolved salts in it. So if water is used to put off fires involving electrical equipment then it may conduct electricity and can harm (by giving electric shock) those trying to douse the fire.

**Q. 9. It is difficult to burn a heap of green leaves but not a heap of dry leaves. Explain why?**

**Answer :** For any substance to burn, it must reach its ignition temperature first. Ignition temperature is the lowest temperature at which a material catches fire. Green leaves contain water/moisture due to which their ignition temperature becomes high (i.e. the temperature at which they will catch fire becomes very high) as compared to that of dry leaves which do not contain water content. So it is difficult to burn green leaves due to their high ignition temperature. On the other hand dry leaves easily reach their ignition temperature even on receiving small amount of heat, so they burn easily.

**Q. 10. Give supporting arguments for both the statements (1) fire is useful (2) fire is harmful**

**Answer :** Fire is useful to us in the following ways:

● It is used to cook food.

● Fire is used to warm our houses in winter.

● It is used to generate electricity.

These are some of the major uses of fire which supports the statement that fire is useful to us.

But if it gets out of control, it can be dangerous. It can burn our houses, forests etc. It kills and injures hundreds of people every year. Also fire causes emission of smoke and poisonous gases (sometimes) which cause pollution. Due to all these reasons fire can be said harmful to us.

**Q. 11. In a few years the fuels on earth will be exhausted. Think, what would happen to human civilization?**

**Answer :** When fuels on earth will be exhausted, it will be a huge loss to human civilization. But also inexhaustible biofuels and alternate (non-conventional) sources of energy would be available to fulfill our basic energy requirements. So we need to develop ways to extract maximum energy out of alternate sources and need to maximize the use of biofuels such as biodiesel, biogas, hydrogen gas etc.

**Q. 12. What would happen if oxygen stops to support combustion? – Make a guess. And if it is the situation for what other works fuels are useful.**

**Answer :** If oxygen stops to support combustion then there will be no fire because oxygen is essential to carry out combustion. It can be seen from the activity of burning candle in which the candle flame goes off on covering with a glass tumbler as it cuts off the supply of oxygen.

Fuels can also be used for other non-combustion purposes. Petrochemicals obtained from petroleum are used for following purposes:

● They are used in manufacturing of plastics, detergents.

● They are used as lubricants.

● They are used to make fertilizers.

● Paraffin wax is used in ointments, skin creams etc.

● Coal tar from coal is used in roads, paints, synthetic dyes etc.

So fuels can be used in agricultural sector, industrial sector, domestic and other sectors for non-combustion uses also.

**Q. 13. Use of more fuels in our daily life causes air pollution and it is harmful to human being and the other life on earth. Suggest some remedies to avoid this.**

**Answer :** Burning of fuels release carbon dioxide which is a major greenhouse gas. Use of fuels in vehicles, industries, power plants emits smoke, poisonous gases which are harmful to human beings and other life on earth.

We can take following measures to avoid air pollution caused by use of more fuels:

● We must start making use of sustainable energy.

Example: solar energy, wind energy.

● Pollution causing fuels should be replaced with cleaner fuels such as natural gas, bio-fuels (bio-diesel).

● Gases emitted on burning of fuels shouldn’t be released directly in the atmosphere. These gases must be treated properly to combat their harmful effects before releasing them.

**Q. 14. Let us assume that you are on the moon. If you try to focus sunlight on a paper using magnifying glass, does the paper catch fire? or not? Why?**

**Answer :** If we shall try to focus sunlight on a paper using magnifying glass on moon, then the paper will not catch fire. This is because moon has no atmosphere like earth and thus there is no oxygen present there to support the combustion process. As we know presence of oxygen is an essential condition for the combustion, so paper will not catch fire.

**Q. 15. Can you heat water in a paper vessel? How is it possible?**

**Answer :** Yes, we can heat water in a paper vessel. This can be explained as follows:

When the paper vessel is heated, the heat gets transferred from paper to the water and water starts becoming hot. This transfer of heat from paper to water prevents the paper from reaching its ignition temperature. Ignition temperature is the lowest temperature at which a material catches fire. Thus paper doesn’t catch fire. In this way water can be heated in a paper vessel.

**Q. 16. “Is combustion possible without the supply of oxygen?" Discuss with your teacher**

**Answer :** No, combustion is not possible without the supply of oxygen. This can be proved with the help of an activity involving a burning candle.

The activity can be described as follows:

1. A burning candle is put on a table.

2. Candle is covered by a glass tumbler.

We observe that the flame of candle goes off as soon as we cover it with the tumbler. This is because the tumbler cuts off the supply of oxygen and thus flames goes off. This proves that combustion is not possible without the supply of oxygen.

**Q. 17. Explain giving reasons: In which of the following situations water will get heated in a shorter time?**

**a) Srikar kept water beaker near the wick in the yellow part of a candle flame.**
**b) Sonu kept water beaker in the outer most part of the flame.**

**Answer :** In situation (b) water will get heated in a shorter span of time where Sonu kept water beaker in the outer most part of the flame. This is because the outermost part of the flame is the hottest zone of a flame as in this zone complete combustion takes place due to good supply of oxygen. This zone is blue in colour.

Whereas in the yellow part of a candle flame incomplete combustion takes place due to which it is moderately hot. That's why the water beaker kept in outer most part of the flame will get heated first.

**Q. 18. Project work: Collect information about the experiments of Joseph Priestly. Write a two page report describing Priestly's experiments proving that oxygen is needed for burning.**

**Answer :** Joseph Priestly, a British clergyman, performed series of experiments which led to the discovery of oxygen. Some of his experiments also involved the process of photosynthesis. He conducted a burning candle experiment which can be described as follows:

1. Joseph Priestly lit a candle.

2. He then covered the burning candle with a glass jar.

3. He observed that the flame of the candle immediately died out.

Inference: He reasoned that something in air was necessary to keep the flame burning.

He then made some changes to the first experiment:

1. He placed fresh mint leaves underneath the jar and left the entire setup undisturbed for two days.

2. He found that he could relight the candle and it burnt for a while.

nference: He concluded that the plant had produced the substance required for burning.

So the conclusions that came out of these two experiments were:

● Due to the absence of oxygen, candle flame died out in first case.

● Plant must have generated oxygen which was used to relight the candle.

He also performed an experiment which showed that oxygen supports combustion:

● He focused sunlight on mercuric oxide inside a glass tube.

● A gas was liberated.

● He observed that the candle burnt brighter in the presence of this gas.

Conclusion: The liberated gas was oxygen which made the candle to burn brightly.

**Q. 19. List the ways adopted by fire fighters to combat fires.**

**Answer :** The following ways are adopted by fire fighters to combat fires:

● They use different fire extinguishers depending upon the type of fire.

For example: water can be used when cloth, wood, paper are on fire but can't be used in case of electric fires or oil and petrol fires. So in such cases chemical retardants or other fire extinguishers are used such as $CO_2$.

● They sometimes use air support to carry large amount of water or chemical retardants which is not possible with fire trucks.

● They cut off the fire lines to create fire breaks so that fire can be prevented from spreading.

**Q. 20. Collect information available on different fuels. Find out the cost per kg. Compare the cost with calorific value. Prepare report on that.**

**Answer :** The costs and calorific values of majorly used fuels are as follows:

| Fuel | Cost(rupees) | Calorific value (kJ/kg) |
|---|---|---|
| Petrol | 77.97/L | 45000 |
| Kerosene | 42/L | 45000 |
| Diesel | 68.90/L | 45000 |
| CNG | 40.61/kg | 50000 |
| LPG | 46.64/kg | 55000 |

On comparing the cost of the fuels with their calorific values we can conclude that CNG is a very efficient fuel as it provides the value for money. It has lowest price and a very high calorific value which makes it one of the best fuels. It is also a clean fuel.

**Q. 21. Collect the information about annual fuel consumption in different parts of the world. How many years more the fossil fuels last? Make a poster with this information and issue an appeal to save fuel.**

**Answer :** Annual fuel consumption in per capita for different countries can be summarized through following table:

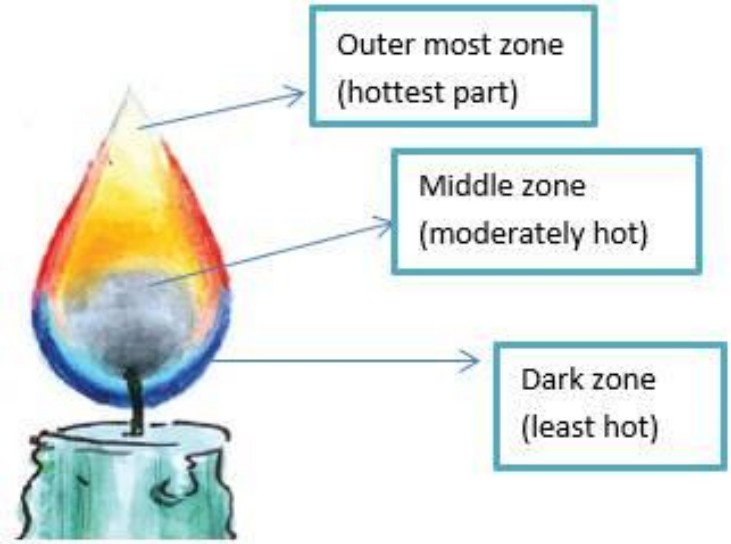
| Country | Per capita (liters per year) |
|---|---|
| India | 175.3 |
| China | 476.0 |
| USA | 3,526.0 |
| Japan | 1,881.2 |
| Russia | 1,504.2 |
| Germany | 1,685.1 |

If we continue to deplete our fossil fuels at the current rate then oil reservoirs will run out in 53 years, natural gas in around 54 years and coal in 100 years.

Therefore it is appealed that we must stop the overuse of our fossil fuels to save them for our future generations. We must shift our focus on alternate sources to harness energy such as solar energy, wind energy, tidal energy etc.

**Q. 22. Draw the diagram of candle flame and label all the zones.**

**Answer :** The candle flame is divided into three major zones which are differentiated on the basis of their colour and temperature. Following diagram can be used to understand about different zones of a candle flame:




1. **<u>Outer most zone</u>:** This is the hottest part of a candle flame. It is blue in colour. Here complete combustion takes place due to the good supply of oxygen.

2. **Middle zone:** This region is moderately hot. It is yellow in colour. Here incomplete combustion of oxygen takes place due to limited supply of oxygen.

3. **Dark zone:** This region is least hot. It is black in colour. Formation of vapours takes place in this region. Here no combustion takes place.

**Q. 23. Where do you find spontaneous combustion and rapid combustion in your daily life?**

**Answer :** Spontaneous combustion is the type of combustion in which the combustible material suddenly starts burning into flames without applying any external agent.

● Such combustion is observed in forest fires where dry leaves catch fire on getting heat from the sun or catch spark from lightening.

● We also observe spontaneous combustion in case of match stick in which phosphorous readily starts burning from the heat generated by friction on rubbing.

When a material burns rapidly to produce heat and light on applying an external agent to it, such combustion is called rapid combustion.

● Rapid combustion is observed in gas stoves in kitchen where the gas burns rapidly on bringing a lighter or burning matchstick near to it.

**Q. 24. How do you organize your daily works with fuels to conserve bio-diversity?**

**Answer :** Excessive use of fuels causes air pollution, greenhouse effect, global warming, acid rain and many health problems. Therefore we must organize our daily works with fuels so that bio-diversity can be conserved from these problems.

We can organize our daily works with fuels in following ways:

● We can dry our clothes in heat from sun instead of using dryers which consume electricity. Electricity is generated from fuels, so by cutting the use of electricity we can limit the use of fuels.

● Practice of walking or using bicycles should be adopted to save fuel.

● All electric appliances should be switched off when not in use.

**Q. 25. How do you feel about “Fuels have become a part of human life”?**

**Answer :** It is true that fuels have become an important part of human life. This is because we need fuels for our energy requirements.

We use fuels for our following requirements:

● **Domestic purpose:** In our homes we require fuel for cooking and heating.

Example: We use LPG stored in gas cylinders to run gas stoves for cooking.

● **Transportation:** We need fuel for running automobiles, aircrafts, trains, rockets.

Example: Petrol, diesel, CNG are used to run automobiles.

● **Industry**: Fuels such as coal are used in industries to generate steam in boilers. Steam is used to rotate turbines to generate electricity and for other uses in factories.