01 A combustible substance burnt for releasing and using its heat energy is known as a Fuel. Usually, fuels are compounds of carbon and hydrogen, thus they combine with oxygen on burning and liberate carbon dioxide and water vapour. A fuel is termed "Ideal" as it deems to be perfect in composition with little or no impurities. On its large scale use, it produces tremendous results with ease of availability, storage and safety by one and all. Being a fuel it is necessary to know its value. It is called calorific value.

(a) What is a fuel ? Write few examples of fuels.

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

(c) The calorific value and ignition temperature of fuel P are 55 kJ/g and 80 °C and these values for fuel Q are 80 kJ/g and 10 °C respectively. On burning, the fuel P produces CO_2 and H_2O while the fuel Q produces CO_2, CO and SO_2. Write three points of relative advantages and disadvantages of these two fuels.

(d) Which fuel is the best among the two fuels P and Q that has more advantages and less disadvantages ?

(a) The material which is burnt to produce heat energy is known as a Fuel. Examples of fuels are: Wood, Coal, Cooking gas (LPG), Kerosene, Diesel and Petrol.

(b) Characteristics of an Ideal Fuel (or Good Fuel) are:

(i) It should be cheap and easily available.

(ii) It should be easy to handle, safe to transport and convenient to store.

(iii) It should have a proper ignition temperature.

(iv) It should have a high calorific value.

(v) It should burn smoothly without leaving any residue after burning.

(vi) It should burn without giving out any smoke or harmful gases.

(c) Fuel P

(i) Low calorific value of 55 kJ/g (Disadvantage).

(ii) Moderate ignition temperature of 80 °C (Advantage)

(iii) No harmful gases are produced (Advantage);

Fuel Q

(i) High calorific value of 80 kJ/g (Advantage)

(ii) Very low ignition temperature of 10 °C (Disadvantage)

(iii) Harmful gases like CO and SO_2 are produced (Disadvantage)

(d) Fuel P has two advantages and one disadvantage.

Fuel Q has two disadvantages and one advantage.

So, fuel P is the best due to the above reasons.

02 The size of the air hole determines the type of flame produced. The Bunsen burner can produce three different types of flames at different temperatures on heating like cool, medium and hot flame.

(a) Which type of flame with its characteristics is produced when the air hole of a bunsen burner is closed fully ?

(b) What is the name of this flame ?

(c) What type of flame is produced when the air hole of a bunsen burner is opened to allow gas to burn completely in sufficient air ? What is its temperature and use ?

(d) Which type of flame makes a noise ? What is it called ? Indicate its temperature and use.

(a) Yellow or orange colour flame is produced when the air hole is closed fully. So, gas cannot burn completely due to insufficient air. Thus, soot (carbon particles) is produced. It burns at about 300 °C. It is not used for heating but to show that the Bunsen burner is turned on.

(b) It is called as Cool flame. It is also known as Safety flame or luminous, yellow flame.

(c) Luminous or blue flame is produced. It has about 500 °C temperature and used for gentle heating of substances.

(d) The only flame that makes a noise is the Hottest flame. It is also called as Roaring blue flame. It burns at 700 °C and used for strong heating of substances.

03 Acid rain is the rain that has a higher acidity level (or low pH) of 4 than the normal rain. The main air pollutants are sulfur dioxide and nitrogen oxides. These air pollutants react with oxygen and water to form Acid rain. Some of the undesirable effects of acid rain are:

(i) It lowers the pH of soil and affects the healthy growth of plants and crops.

(ii) The chemical reactions of acid rain release toxic metals which affects the growth of plants when they leach into water, they destroy marine life.

Buildings and statues made up of carbonates such as limestone or marble are weathered away as they can react with acid rain.

It damages the bark and leaves of trees and makes them vulnerable to diseases or unable to carry out photosynthesis.

(a) (i) What are the two air pollutants which are the main cause of Acid rain ?

(ii) Which acids are formed by these two air pollutants when they react with water and oxygen in air ?

(b) What is the pH of Acid rain ?

(c) What are the effects of Acid rain ?

(a) (i) Nitrogen oxides and sulfur dioxide

(ii) Nitric acid and sulfuric acid.

(b) The pH of acid rain is 4.

(c) It causes the water in the lakes to become acidic which can kill the marine life. Due to the release of toxic metals into the ground it leads to the unhealthy growth of plants.

04 All the fuels in solid, liquid or gaseous state produce different amounts of heat energy on burning. Some fuels produce more heat whereas others produce less heat. The usefulness of a fuel is measured in terms of its calorific value. Higher the calorific value, better the fuel will be. The amount of heat produced by burning a unit mass of the fuel completely is known as its Calorific value. The unit of its mass is usually measured in "gram". The amount of heat produced by burning 1 gram of a fuel completely is called its Calorific value. The common unit of measuring Calorific value is kilojoules per gram (kJ/g) or kJ/kg).

(a) Which type of fuels produce heat energy on burning ?

(b) What is the calorific value of a fuel ? How it is measured ?

(c) Write the names of fuels in the order of decreasing calorific values (keeping the fuel with highest calorific value first:

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

(a) Fuels in solid, liquid and gaseous form produce heat energy on burning.

(b) The amount of heat produced by burning a fuel completely is called Calorific value. It is measured in kJ/g or kJ/kg.

(c) Hydrogen gas > Methane > Petrol > Kerosene > Biogas > Wood.

05 Combustion is an important chemical reaction. In the world today, the burning of fuels such as petrol, natural gas and coal provides more than 90% of energy needed for transport, industries and homes.

Combustion can be classified into complete and incomplete.

A complete combustion takes place when a substance burns in sufficient amount of oxygen. Carbon dioxide is produced.

An incomplete combustion takes place when a substance burns in an insufficient amount of oxygen. Carbon monoxide or soot are produced.

Carbon monoxide is an air pollutant released from the car exhaust pipes.

(a) What is meant by air pollutant ?

(b) Explain how the carbon monoxide is produced from the car exhaust system.

(c) Explain why carbon monoxide is poisonous.

(a) They are unwanted chemical substances present in the air which can cause harmful effects to the environment and living things.

(b) Carbon monoxide is produced due to incomplete combustion of fuels.

(c) Carbon monoxide is poisonous as it deprives red blood cells from transporting oxygen in our bodies thereby it results in brain damage.