

CHAPTER - 6

COMBUSTION AND FLAME

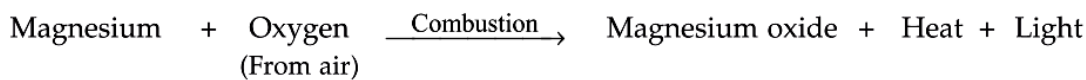
COMBUSTION

The burning of a substance in the oxygen of air in which heat and light are produced, is called combustion. *A chemical process in which a substance reacts with the oxygen (of air) to give heat and light is called combustion.* The light which is given off during combustion can be in the form of a 'flame' or as a 'glow'.

Combustible Substance: A substance which can undergo combustion is called a combustible substance. A combustible substance is also called fuel. It can be solid, liquid or gas.

Non-combustible Substance: A substance which cannot undergo combustion is called a non-combustible substance.

Example: Combustion of Magnesium. If a magnesium ribbon is heated, it starts burning (or undergoes combustion). When a magnesium ribbon burns, it combines with the oxygen of air to form magnesium oxide, and liberates heat and light. The combustion of magnesium can be written as follows:

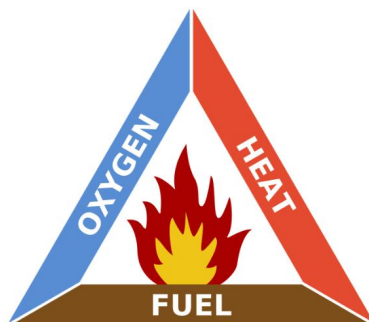


Thus, the burning of magnesium in air to produce heat and light is a combustion process. In this reaction, magnesium is a combustible substance. In the above example, we find that oxygen is necessary for combustion to take place.

Factors Required for Combustion:

- A combustible substance
- Oxygen
- **Ignition temperature:** The minimum temperature at which combustion starts in a substance is called ignition temperature of that substance.

The above factors can be represented by a fire triangle. According to the concept of the fire triangle, for the generation of fire, we need three things to be present simultaneously. These are fuel (something which can burn), a heat source (which can ignite the fuel) and air (for a constant supply of oxygen).



Inflammable Substance: A substance which has very low ignition temperature so that it can easily catch fire is called an inflammable substance. Examples of inflammable substances are petrol, alcohol, Liquefied Petroleum Gas (LPG), etc.

FIRE CONTROL

Fire is highly useful for human beings. But while controlled fire is beneficial for us, uncontrolled fire can be devastating for us. Fire can be controlled by removing any or all of the factors of combustion, i.e. fuel, oxygen (air) and ignition temperature (by lowering the temperature).

- The burning substance or fuel cannot be removed in most of the cases of fire.
- Different methods can be utilized to cut off the supply of air.
- If a suitable substance is poured over the burning material, it can reduce the temperature and even bring down the temperature below ignition temperature.

SOME COMMON FIRE EXTINGUISHERS

Water: Water is the most often used fire extinguisher. It helps in bringing down the temperature. When water is poured over a burning material then steam is created due to heat. The layer of steam cuts off air supply. Thus, water helps in putting off fire.

Drawbacks of Water: Water cannot be used for fire because of oil because oil is lighter than water. When water is poured over fire, oil comes on top and continues to burn. Water should not be used for fire because of short circuit. We know that normal water is a good conductor of electricity because it contains many salts. This increases the risk of electric shock for firefighters.

Blanket: If fire is at a small scale then a blanket can be very useful in controlling the fire. When the burning object is covered with blanket, it helps in cutting off oxygen supply. This helps in putting off fire.

Carbon Dioxide: This is the best fire extinguisher. Carbon dioxide creates a blanket over fire and cuts off air supply because it is heavier than air. Carbon dioxide expands quickly and brings down the temperature. This helps in putting off fire. For extinguishing fire, carbon dioxide can be supplied in any of the following ways:

- Carbon dioxide is stored in pressurized cylinder and can be released through a nozzle.
- In soda-acid fire extinguisher (foam spray), carbon dioxide is evolved because of reaction between soda and acid.
- A lot of dry powder of chemicals like Baking Soda (sodium bicarbonate) or potassium bicarbonate powder is sprayed on burning substance. The dry powder makes carbon dioxide because of heat.



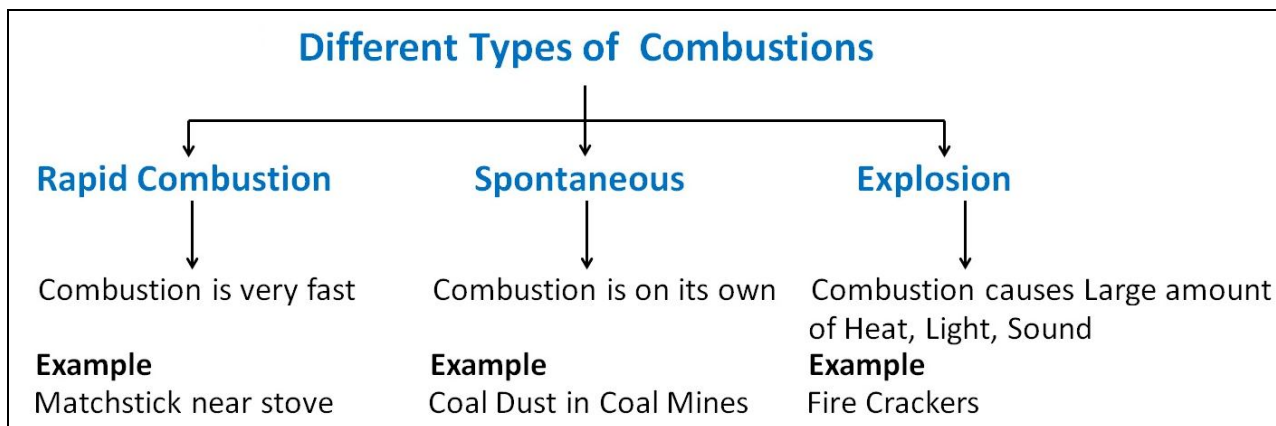
TYPES OF COMBUSTION

There are following types of combustion:

Rapid Combustion: When combustion happens at a faster rate, it is called rapid combustion. Petrol and gas show rapid combustion.

Spontaneous Combustion: When combustion starts on its own; without an apparent cause; it is called spontaneous combustion. For example; coal dust in coal mines can start burning on its own. Forest fires is spontaneous in most of the cases.

Explosion: When combustion reaction is so sudden that it releases a large amount of heat, light and sound, it is called explosion. Firecrackers explode because of this type of combustion.



FLAME

If we heat one end of a magnesium ribbon over a burner, we find that the magnesium ribbon burns by producing a brilliant white flame. We have also seen a candle flame, a kerosene lamp flame and a Bunsen burner flame (see the below figure).

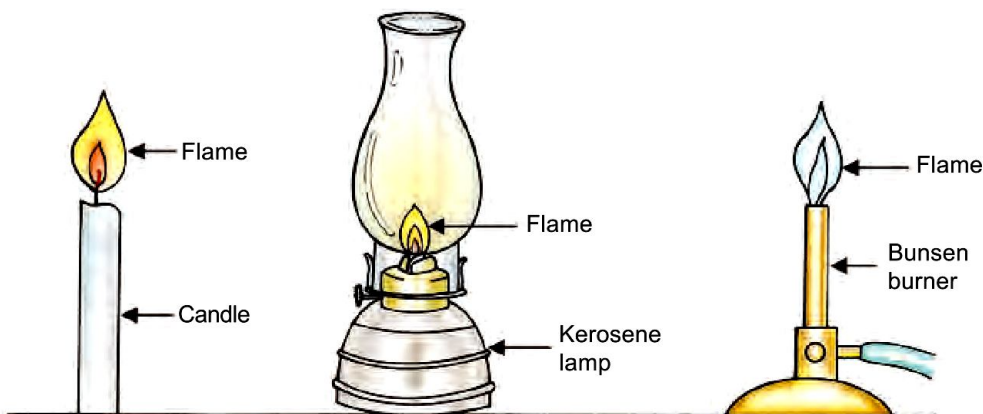


Figure. Flames of candle, kerosene lamp and Bunsen burner (Gas burner).

Flame is the visible and gaseous part of fire. A flame is a region where combustion (or burning) of gaseous substances takes place. All the gases which undergo combustion (or burn) produce flame. But only those solid and liquid fuels which vaporise on being heated, burn with a flame.

STRUCTURE OF A FLAME

A flame consists of three zones (or three parts). These are: innermost zone, middle zone and outer zone. The three zones of a flame have different colours and different temperatures.

(i) The innermost zone of a flame is dark (or black) (see the below Figure). The innermost zone of a flame consists of hot, unburnt vapours of the combustible material (say, wax vapours). The innermost zone is the least hot part of the flame.

(ii) The middle zone of a flame is yellow. It is bright and luminous (light giving). The fuel vapours burn partially in the middle zone because there is not enough air for burning in this zone. The partial (or incomplete) burning of fuel in the middle zone produces carbon particles. These carbon particles become white hot and emit light. This zone is the major part of a candle flame.

(iii) The outer zone of a flame is blue. It is non-luminous zone (which does not produce much light). In the outer zone of a flame, complete combustion of the fuel takes place because there is plenty of air around it. The outermost zone (or non-luminous zone) has the highest temperature in the flame. In other words, the outermost zone (or non-luminous zone) is the hottest part of the flame. The outermost zone of a flame is quite thin as compared to the middle zone.

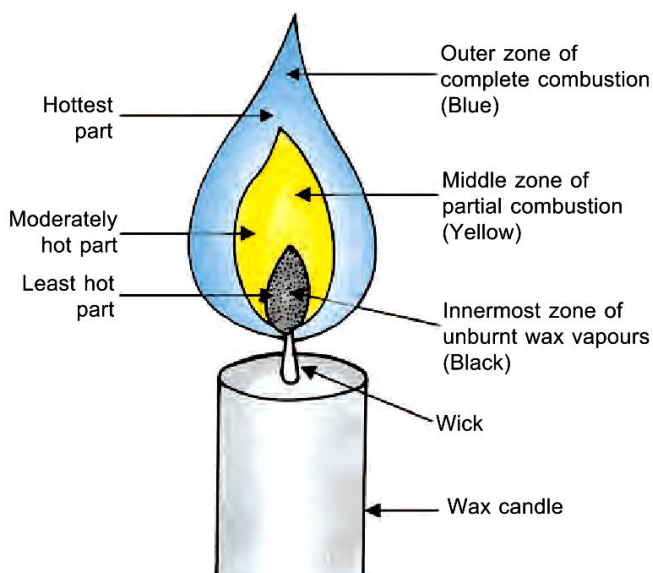


Figure . The three zones of a candle flame.

FUELS

A material which is burnt to produce heat is called a fuel. Some of the common fuels are: Wood, Coal, LPG (Cooking gas), Kerosene, Petrol, Diesel, Natural gas and Biogas. A fuel is a very good source of heat energy. The fuels which we use for various purposes can be in the form of a solid, a liquid or a gas. Thus, there are three types of fuels: Solid fuels, Liquid fuels and Gaseous fuels.

(i) Some of the examples of solid fuels are : Wood, Charcoal, Coal, Coke, Agricultural wastes and Cow—dung cakes (tiple).

(ii) The examples of liquid fuels are : Kerosene, Petrol, Diesel, and Alcohol (Ethanol).

(iii) The examples of gaseous fuels are : Natural gas, Petroleum gas, Biogas and Coal gas.

Characteristics of a Good Fuel:

- It is readily available.
- It is cheap.
- It burns easily in air.
- It burns at a moderate rate.
- It produces a large amount of heat.
- It does not leave behind any undesirable substance.

There is probably no fuel which can be considered as ideal fuel.

FUEL EFFICIENCY: CALORIFIC VALUE OF FUELS

All the fuels produce heat on burning. All the fuels, however, do not produce the same amount of heat. Different fuels produce different amounts of heat on burning. Some fuels produce more heat whereas other fuels produce less heat. The efficiency of a fuel is expressed in terms of its calorific value. The amount of heat produced by the complete burning (or complete combustion) of 1 kilogram of a fuel is called its calorific value. The calorific value of a fuel is expressed in the unit of 'kilojoules per kilogram' (which is written in short form as kJ / kg). Calorific values of some fuels are given in below Table:

Table : Calorific Values of Different Fuels

| Fuel | Calorific Value (kJ/kg) |
|---------------|--------------------------------|
| Cow dung cake | 6000-8000 |
| Wood | 17000-22000 |
| Coal | 25000-33000 |
| Petrol | 45000 |
| Kerosene | 45000 |
| Diesel | 45000 |
| Methane | 50000 |
| CNG | 50000 |
| LPG | 55000 |
| Biogas | 35000-40000 |
| Hydrogen | 150000 |

HARMS OF BURNING OF FUEL

- Burning of carbon fuels (wood, coal, petroleum) results in release of unburnt carbon particles in air. These particles cause respiratory disease; like asthma.
- Burning of most fuels releases carbon monoxide. It is a poisonous gas; even at low concentration. Hence, coal should not be burnt in a closed room.
- Burning of most fuels results in release of carbon dioxide in atmosphere. Higher level of carbon dioxide in the atmosphere causes global warming.
- Burning of coal and diesel results in release of sulphur dioxide in air. Burning of petrol produces oxides of nitrogen. Oxides of sulphur and nitrogen mix with rainwater; to cause acid rain. Acid rain is harmful for living beings, buildings, and for monuments.



NCERT EXERCISE QUESTIONS AND ANSWERS

1: List conditions under which combustion can take place.

Answer: Following are the conditions under which combustion can take place:

- Presence of oxygen
- Presence of inflammable substance
- Ignition temperature

2: Fill in the blanks:

- (a) Burning of wood and coal causesof air.
- (b) A liquid fuel, used in homes is
- (c) Fuel must be heated to itsbefore it starts burning.
- (d) Fire produced by oil cannot be controlled by

Answer: (a) pollution, (b) kerosene, (c) ignition temperature, (d) water

3: Explain how the use of CNG in automobiles has reduced pollution in our cities.

Answer: CNG is a cleaner fuel; compared to petrol and diesel. CNG produces lesser amount of harmful gases on burning. Due to this, CNG is now being used in automobiles in many cities; which has helped in reducing pollution in our cities.

4: Compare LPG and wood as fuels.

Answer: Wood has traditionally been used as kitchen fuel and is still predominantly being used in rural areas. Burning of wood creates many air pollutants which can result in respiratory problems. Moreover, incomplete oxidation during burning of wood creates carbon monoxide which is a poisonous gas. LPG is much better because it burns without giving smoke. It produces lesser amount of air pollutants. Complete oxidation during burning of LPG does not lead to carbon monoxide production.

5: Give reasons:

(a) Water is not used to control fires involving electrical equipment.

Answer: Pure water is a bad conductor of electricity but normal water contains many salts and hence is a good conductor of electricity. Trying to douse fires; involving electrical equipment; with water can result in electric shock. Due to this, water is not used to control fires involving electrical equipment.

(b) LPG is a better domestic fuel than wood.

Answer: LPG is a better domestic fuel than wood because of several reasons. Unlike wood, LPG burns without smoke. This makes the life of housewives more comfortable and they do not have to worry about blackening of pots and pans. Moreover, use of LPG as domestic fuel also rules out the chances of getting respiratory disorders which may happen when someone uses wood as kitchen fuel. Storage and transportation of LPG is easier compared to that of wood.

(c) Paper by itself catches fire easily whereas a piece of paper wrapped around an aluminium pipe does not.

Answer: The ignition temperature of paper is lower compared to that of aluminium. When paper is wrapped around an aluminium pipe; the ignition temperature increases. That is why paper itself catches fire easily whereas a piece of paper wrapped around an aluminium pipe does not.

6: Make a labelled diagram of a candle flame.

Answer:

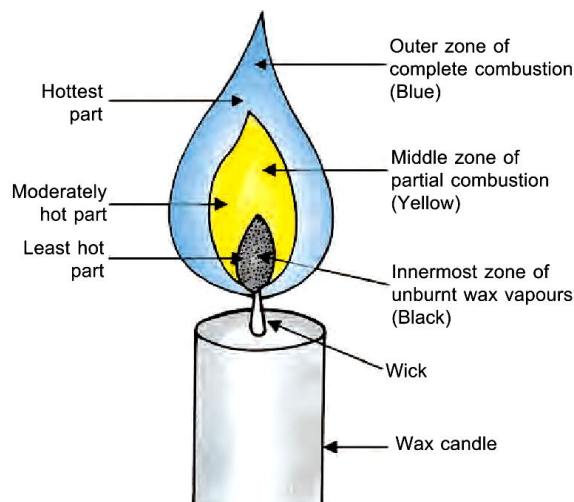


Figure . The three zones of a candle flame.

7: Name the unit in which the calorific value of a fuel is expressed.

Answer: Kilo Joule Per Kilogram

8: Explain how CO₂ is able to control fires.

Answer: Carbon dioxide is heavier than oxygen. Due to this, carbon dioxide forms a blanket around the burning material and makes a barrier between the burning material and oxygen. As oxygen supply is cutoff, it helps in extinguishing the fire.

9: It is difficult to burn a heap of green leaves but dry leaves catch fire easily. Explain.

Answer: Green leaves contain moisture and as a result, the ignition temperature of green leaves is much higher than that of dry leaves. Due to this, it is difficult to burn a heap of green leaves but dry leaves catch fire easily.

10: Which zone of a flame does a goldsmith use for melting gold and silver and why?

Answer: The outermost zone of a flame is the hottest zone. Due to this, goldsmith uses the outermost zone of a flame for melting gold and silver.

11: In an experiment 4.5 kg of a fuel was completely burnt. The heat produced was measured to be 180,000 kJ. Calculate the calorific value of the fuel.

Answer: Total mass of fuel = 4.5 kg

Heat produced by burning the given mass of fuel = 180,000 kJ.

We know that $\text{Calorific value of fuel} = \frac{\text{Heat produced in kJ}}{\text{Total mass burnt}} = \frac{180,000 \text{ kJ}}{4.5 \text{ kg}} = 40,000 \text{ kJ/kg}$

Hence, the calorific value of the given fuel = 40,000 kJ/kg

12: Can the process of rusting be called combustion? Discuss.

Answer: Although the process of rusting also involves oxidation but it cannot be termed as combustion. The reason for this is that combustion is defined as a process in which oxidation is accompanied by heat, and heat is not produced during rusting.

13: Abida and Ramesh were doing an experiment in which water was to be heated in a beaker. Abida kept the beaker near the wick in the yellow part of the candle flame. Ramesh kept the beaker in the outermost part of the flame. Whose water will get heated in a shorter time?

Answer: Since Abida has kept the beaker in the luminous zone of the flame, the beaker will take more time to get heated. On the other hand, Ramesh has kept the beaker in the non-luminous zone of the flame so his beaker will be heated in shorter time.



QUESTION BANK (SET 01)

1. Which of these is a combustible substance?
(a) Asbestos
(b) Paper
(c) Stone
(d) Sand
Answer: (b) Paper
2. Which of the following is non-combustible substance?
(a) Alcohol
(b) Coal
(c) Iron
(d) Wood
Answer: (c) Iron
3. Which of the following is an inflammatory substance?
(a) Coal
(b) Alcohol
(c) Wood
(d) Stone
Answer: (b) Alcohol
4. A flame has how many zones?
(a) One
(b) Two
(c) Three
(d) Four
Answer: (c) Three
5. The outermost zone of flame is of which colour?
(a) Blue
(b) Orange
(c) Brown
(d) Dark
Answer: (a) Blue
6. The middle zone of flame is of which colour?
(a) Blue
(b) Orange
(c) Transparent
(d) Black
Answer: (b) Orange
7. Which is the best fuel for kitchen; in present times?
(a) LPG
(b) Coal
(c) Kerosne
(d) Petrol
Answer: (a) LPG
8. Which part of flame is used by goldsmith?

- (a) Blue
 - (b) Orange
 - (c) Black
 - (d) Green
- Answer: (a) Blue

9. Which of the following does not produce flame while burning?

- (a) Wax
 - (b) Petrol
 - (c) Diesel
 - (d) Coal
- Answer: (d) Coal

VERY SHORT ANSWER TYPE QUESTIONS

10. Define combustion?

Answer:

Combustion is a chemical process in which a substance reacts with oxygen to give off heat.

11. What is combustible substance?

Answer:

A substance which can undergo combustion is called a combustible substance.

12. What is a non-combustible substance?

Answer:

A substance which cannot undergo combustion is called a non-combustible substance.

13. What is ignition temperature?

Answer:

Ignition temperature is the minimum temperature at which combustion starts in a substance.

14. What is an inflammable substance?

Answer:

A substance which has very low ignition temperature so that it can easily catch fire is called an inflammable substance, e.g. petrol, alcohol, etc.

15. What is a fire extinguisher?

Answer:

The substance which is used for putting off fire is called fire extinguisher.

16. What is rapid combustion?

Answer:

When combustion happens at a faster rate, it is called rapid combustion.

17. Define calorific value of a fuel.

Answer:

The amount of heat energy produced on combustion of 1 kg of a fuel is called calorific value of that fuel. It is expressed as kilo Joule per kg (kJ/kg).

18. What is spontaneous combustion?

Answer:

When combustion starts on its own; without an apparent cause; it is called spontaneous combustion.

19. Which of the two has a lower ignition temperature: petrol or kerosene?

Answer:

Petrol has a lower ignition temperature. Kerosene molecules are larger than petrol molecules and hence don't mix easily with oxygen present in air. Thus, it has higher ignition temperature than petrol.

20. Name the most common fire extinguisher.

Answer:

There are mainly five types of fire extinguisher – Water, Foam, Dry Powder, CO and Wet Chemical. Water is one of the best, cheapest and most common fire extinguishers.

1. Water fire extinguisher

2. Foam fire extinguisher

3. Dry Powder fire extinguisher

4. CO fire extinguisher and,

5. Wet Chemical fire extinguisher. Water is one of the best, cheapest and most common fire extinguishers. Out of all these, the Water fire extinguisher is one of the best, cheapest and most common fire extinguishers.

21. Which is the best fire extinguisher for fires involving electrical equipment and inflammable materials like petrol?

Answer:

Carbon dioxide does not support combustion and hence is considered as the best fire extinguisher for fires involving electrical equipment and inflammable materials like petrol.

22. Name one substance which undergoes spontaneous combustion(or burns in air at room temperature).

Answer:

When white phosphorus is left out open in the room temperature for sometime, it burns all by itself.

23. Name the unit in which the calorific value is expressed.

Answer:

It is measured in units of energy per unit of the mass of the substance, such as: kJ/kg, J/Kg.

24. Which of the following fuels has the lowest calorific value?

Answer:

Coal has the lowest calorific value. Coal contains moisture. When coal burns the moisture in coal evaporates taking away some heat of combustion which is not available for our use.

25. Which of the following fuels has the highest calorific value?

Diesel, Methane, CNG, Coal, Petrol

Answer:

CNG and methane have the highest calorific value. Both of them have calorific value of 50000 KJ/Kg.

26. Name the term which is used to express the efficiency of a fuel.

Answer:

Calorific Value is the term which is used to express the efficiency of a fuel.

27. Name one solid, one liquid and one gas which burn by producing a flame.

Answer:

Molten wax(Solid), Kerosene oil(Liquid) and LPG(gas) are the substances which burn by producing flames.

28. Which of the following does not produce a flame on burning?

Answer:

Charcoal does not vaporize and so does not produce a flame.

29. Name one fuel which burns without producing a flame.

Answer:

Charcoal does not vaporize and so does not produce a flame.

30. How many zones are there in a flame?

Answer:

A flame consists of three zones. These are innermost zone, middle zone, outer zone. The three zones of a flame have different colors and different temperatures.

31. Which zone of a candle flame is the hottest?

Answer:

The outermost zone has the highest temperature in the flame. It is the hottest part of the flame. It is quite thin as compared to the middle zone.

32. In a candle flame, what is the colour of: (a) innermost zone (b) middle zone and (c) outer zone?

Answer:

(a) innermost zone- The innermost zone of a flame is dark or black

(b) middle zone- The middle zone of a flame is yellow

(c) outer zone- The outer zone of a flame is blue. It is a non-luminous zone

33. Name any harmful product released by the burning of fuels.

Answer:

Incomplete combustion of fuels produces a very poisonous gas called carbon monoxide.

34. Name the very poisonous gas produced by the incomplete combustion of fuels.

Answer:

Incomplete combustion of fuels produces a very poisonous gas called carbon monoxide.

35. Name the fuel which is gradually replacing petrol and diesel in automobiles.

Answer:

The use of diesel and petrol as fuels in automobiles is being replaced by CNG (Compressed Natural Gas), because CNG produces the harmful products in very small amounts. CNG is a cleaner fuel.

36. Name two substances having low ignition temperature and two having high ignition temperatures.

Answer:

LPG and petrol catch fire at very low temperature and thus have low ignition temperature, while wood and coal have high ignition temperature.

SHORT ANSWER TYPE QUESTIONS

37. What are fuels? Name any two common fuels.

Answer:

A fuel is a very good source of heat. The heat energy produced by burning a fuel can be used directly to cook food, for running motor vehicles and factory machines, can be converted into electrical energy at thermal power stations. Wood and Petrol are examples of two common fuels.

38. State any four characteristic of an ideal fuel(or good fuel).

Answer:

Characteristics of ideal fuel-

1. It has a high calorific value
2. It burns easily in air at a moderate rate
3. It has proper ignition temperature
4. It does not produce any harmful gases or leaves any residue after burning.

39. Define the calorific value of a fuel.

Answer:

The amount of heat produced by the complete burning or combustion of 1 Kilo gram of a fuel is called its calorific value. The calorific value of a fuel is expressed in the unit of Kilo joules per kilogram.

40. “The calorific value of LPG is 55000 KJ/kg”. What does it mean?

Answer:

The calorific value of LPG is 55000 KJ/Kg. It means when 1 Kg of LPG is burned completely, then 55000 KJ of heat energy is produced.

41. Can you burn a piece of wood by bringing a lighted matchstick near it? Explain.

Answer:

A matchstick can light a tiny splinter of wood but not a big log of wood. A splinter of wood has a low ignition temperature. A burning matchstick can produce sufficient heat to reach the ignition temperature of the splinter of wood therefore a matchstick can light a splinter of wood directly.

42. Why do you have to use paper or kerosene oil to start fire in wood or coal?

Answer:

The ignition temperature of wood or coal is very high, as it requires too much of time to get heated before burning. We use paper or kerosene to start fire because they have low ignition temperature which helps to catch fire immediately and helps the wood or the coal to reach its required ignition temperature.

43. What is meant by rapid combustion? Give one example of rapid combustion.

Answer:

Rapid combustion is the combustion in which a substance burns rapidly with the help of an external source and produces heat within a very short time. Eg:- Burning of LPG.

44. What is meant spontaneous combustion? Give one example of spontaneous combustion.

Answer:

Spontaneous combustion is the combustion in which a substance burns spontaneously and produces heat and light without the help of external source of heat. Eg:- phosphorus burns spontaneously at room temperature.

45. What is meant by explosive combustion (or explosion)? Give one example of explosive combustion (or explosion).

Answer:

Explosive combustion is the combustion in which a substance burns suddenly and produces heat, light and sound with the help of external source of heat or pressure. Eg:- explosion of crackers on applying heat or pressure.

46. How will you show that air is necessary of combustion?

Answer:

Oxygen helps in combustion. Air contains about 29% of oxygen, thus supply of air makes the oxygen available which helps in combustion. Without oxygen, combustion will not take place.

47. Can the process of rusting be called combustion? Give reason for your Answer:.

Answer:

Combustion is a chemical process in which a substance reacts with oxygen and gives out energy during the process in the form of either heat or light or both. Rusting of iron is an exothermic process as heat is released during rusting. Hence, it is a kind of slow combustion.

48. Why are fires produced by burning oil not extinguished by pouring water?

Answer:

As water is heavier than petrol therefore slips down permitting the petrol to rise to the surface and continue to burn. Besides, the existing temperature is so high that the water poured on the fire evaporates even before it can extinguisher the fire.

49. Explain why, fire caused by electricity should not be extinguished by pouring water.

Answer:

Water is conductive in nature and hence the electricity in the equipment could reach the extinguisher (the person dousing the fire using water) and can electrocute him/her.



QUESTION BANK (SET 02)

1. A substance which reacts with oxygen giving heat is called a combustible substance. Which, one of the following is a combustible substance?
(a) iron nail (c) stone piece
(b) glass (d) wood
2. Which one of the following has the highest calorific value?
(a) kerosene (c) LPG
(b) biogas (d) petrol
3. Magnesium ribbon on burning in air produces
(a) magnesium oxide, water and light
(b) magnesium oxide and heat
(c) magnesium oxide, heat and light
(d) magnesium oxide, water and heat
4. Which of the following is not a combustible substance?
(a) camphor (c) straw
(b) glass (d) alcohol
5. The substance that does not burn with flame is
(a) LPG (c) dry grass
(b) camphor (d) charcoal
6. On placing an inverted tumbler over a burning candle, the flame extinguishes after some time. This is because of nonavailability of
(a) oxygen (c) carbon dioxide
(b) water vapours (d) wax
7. If a person's clothes catches fire, the best way to extinguish the fire is to:
(a) throw water on the clothes.
(b) use fire extinguisher.
(c) cover the person with a woolen blanket.
(d) cover the person with a polythene sheet.
8. The substance expected to have the highest ignition temperature out of the following is
(a) kerosene (c) coal
(b) petrol (d) alcohol
9. Choose the correct statement about inflammable substances from the following. They have:
(a) low ignition temperature and cannot catch fire easily.
(b) high ignition temperature and can catch fire easily.
(c) low ignition temperature and can catch fire easily.
(d) high ignition temperature and cannot catch fire easily.
10. Choose the incorrect statement from the following. Forest fires are usually due to:
(a) carelessness of humans (c) cutting of trees
(b) heat of sun (d) lightning strike
11. The calorific value of a fuel is expressed in a unit called
(a) kilojoule per litre (c) kilojoule per gram

(b) kilogram per millilitre (d) kilojoule per kilogram

12. In villages, people use wood as fuel because:

- (a) it is considered to be an ideal fuel.
- (b) of its easy availability and low cost.
- (c) it is environment friendly.
- (d) it catches fire easily.

13. Which among the following is considered as the cleanest fuel?

- (a) cow dung cake
- (b) petrol
- (c) kerosene
- (d) hydrogen gas

14. Choose the incorrect statement from the following. A good fuel is one which:

- (a) is readily available.
- (b) produces a large amount of heat.
- (c) leaves behind many undesirable substances.
- (d) burns easily in air at a moderate rate.

15. Shyam was cooking potato curry on a chulha. To his surprise he observed that the copper vessel was getting blackened from outside. It may be due to:

- (a) proper combustion of fuel.
- (b) improper cooking of potato curry.
- (c) improper combustion of the fuel.
- (d) burning of copper vessel.

16. Which of the following substances has the lowest ignition temperature?

- (a) kerosene
- (b) spirit
- (c) diesel
- (d) mustard oil

17. One of the following is not a combustible substance. This one is :

- (a) alcohol
- (b) hydrogen
- (c) asbestos
- (d) chaff

18. Which of the following is not used in making matchsticks these days ?

- (a) potassium chlorate
- (b) white phosphorus
- (c) antimony trisulphide
- (d) red phosphorus

19. Which of the following undergoes spontaneous combustion ?

- (a) yellow sulphur
- (b) red phosphorus
- (c) white phosphorus
- (d) brown sulphur

20. Which of the following statement is not correct about carbon dioxide acting as a fire extinguisher for electrical fires ?

- (a) it is heavier than air
- (b) it is lighter than air
- (c) it is not combustible
- (d) it does not support combustion

21. Fires in underground coal mines usually occur due to the ;

- (a) explosive combustion
- (b) deliberate combustion
- (c) spontaneous combustion
- (d) rapid combustion

22. The calorific value of a fuel is 40000 kJ/kg. This fuel is most likely to be :

- (a) biogas
- (b) methane
- (c) hydrogen gas
- (d) liquefied petroleum gas

23. Which of the following fuels has the highest calorific value ?

- (a) natural gas
 - (b) liquefied petroleum gas
 - (c) coal gas
 - (d) hydrogen gas
-
-

24. On a cold winter night, the persons sleeping in a room with closed door and windows with a coal fire burning inside may die due to the excessive accumulation of:
(a) nitrogen monoxide (b) nitrogen dioxide (c) carbon dioxide (d) carbon monoxide
25. Which of the following burns without producing a flame ?
(a) camphor (b) coke (c) cooking gas (d) kerosene
26. Which of the following fuels has the lowest calorific value ?
(a) kerosene (b) CNG (c) biogas (d) LPG
27. Which of the following is the main cause of global warming ?
(a) nitrogen dioxide (b) Sulphur dioxide (c) carbon dioxide (d) ozone
28. Which of the following gas does not contribute to the formation of acid rain ?
(a) nitrogen monoxide (b) carbon monoxide (c) sulphur dioxide (d) nitrogen dioxide
29. Which of the following is the most environment friendly fuel to be used in automobiles ?
(a) petrol (b) diesel (c) natural gas (d) petroleum gas
30. Which of the following does not involve a combustion reaction ?
(a) production of heat and light from kerosene in a lantern
(b) production of heat and light from hydrogen in a rocket
(c) production of heat and light from hydrogen in the sun
(d) production of heat and light from wood in a bonfire
31. A heap of green leaves is lying in one corner of a park. The green leaves in the heap burn with difficulty because :
(a) they contain a tough material called cellulose
(b) they contain a lot of water
(c) they contain a green pigment chlorophyll
(d) they do not get sufficient oxygen for burning
32. If the clothes of a person working in the kitchen catch fire, then to extinguish the fire ;
(a) sand should be thrown over the burning clothes
(b) water should be thrown over the burning clothes
(c) polyester blanket should be used to cover the burning clothes
(d) woollen blanket should be used to cover the burning clothes
33. The outermost zone of a candle flame is the:
(a) least hot part (b) coldest part (c) hottest part (d) moderately hot part
34. Fill in the blanks in the following sentences.
(a) A _____ process in which a substance reacts with _____ to give off heat is called combustion.
(b) When the clothes of a person catch _____, the person is covered with a _____ to extinguish fire.
(c) The _____ temperature at which a substance catches fire is called its _____ temperature.
(d) The substances which have very _____ ignition temperature and can easily catch fire with a flame are called _____ substances.
(e) The substances which vapourise during _____, give flame.
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35. Fill in the blanks using the words given in the box.

ignition, petrol, combustion, calorific value, combustible, inflammable

- (a) A chemical process in which a substance reacts with oxygen to give off heat is called _____.
- (b) Wood, paper, CNG are _____ substances.
- (c) The lowest temperature at which a substance catches fire is called its _____ temperature.
- (d) Ignition temperature of _____ is lower than that of wood.
- (e) The substances which have very low _____ temperature and can easily catch fire with a flame are called _____ substances.
- (f) The amount of heat energy produced on complete combustion of 1kg of a fuel is called its _____.
36. Write True/False against the following statements and also correct the false statement.
- (a) A physical process in which a substance reacts with oxygen to give off heat is called combustion.
- (b) Water is the best extinguisher for fires involving electrical equipment.
- (c) Alcohol, CNG and LPG are inflammable substances.
- (d) Increased concentration of nitrogen in air is believed to cause global warming.
- (e) Greater the calorific value, better is the fuel.
- (f) Middle zone is the hottest zone of a flame.
- (g) The substances which vapourise during burning, give flame.
37. Fill in the blanks with suitable words:
- (a) A fuel must be heated to its..... before it starts burning.
- (b) The most common supporter of combustion around us is.....
- (c) Fire produced by burning oil cannot be controlled by.....
- (d) A liquid fuel used in homes is.....
- (e) The amount of heat evolved when 1kg of a fuel is burnt completely is called its.....
- (f) The substance which vaporize during, give.....
- (g) Burning of wood and coal causes..... of air.
38. A drum full of kerosene catches fire. What is the simplest way to put off this fire?
39. What is the first thing you should do if a fire caused by burning wood or paper.
40. What does a Fire Brigade do when it arrives at a place where a building is on fire.
41. Describe one method of putting out a fire caused by burning wood or paper.
42. What is a flame? What type of substance, on burning, give a flame?
43. Explain why, we are advised not to sleep in a room having closed doors and windows, with a coal fire burning inside.
44. What is the difference between the burning of a candle and the burning of a fuel like coal.
45. How does pouring water extinguished a fire.
46. Explain how, carbon dioxide is able to control fires?
47. If you see a person whose clothes are on fire, how will you extinguish the fire? Give reason for your Answer.
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- 48.** Give two examples each of:
- (a) solid fuels
 - (b) liquid fuels
 - (c) gaseous fuels
- 49.** Name the various zones of a candle flame. Which zone(or part) of a candle flame is the least hot(or coldest)?
- 50.** In which zone of a candle flame:
- (a) partial combustion of fuel takes places, and
 - (b) complete combustion of fuel takes place?
- 51.** Explain how, the use of CNG in automobiles has reduced pollution in cities.
- 52.** What are the disadvantage of burning wood as fuel?
- 53.** Why LPG is a better domestic fuel than wood.
- 54.** What are combustible substances? Name three combustible substances.
- 55.** What are non-combustible substance? Name three non-combustible substances.
- 56.** What is meant by ‘combustion’? Explain with an example.
- 57.** What are the conditions necessary for combustion to take place.
- 58.** What makes the middle zone of a candle flame luminous(or light-giving)?
- 59.** Cracker on ignition produces sound. Why?
- 60.** The calorific values of petrol and CNG are 45000 kJ/kg and 50,000 kJ/kg, respectively. If you have vehicle which can run on petrol as well as CNG, which fuel will you prefer and why?
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