CHRIST KING HR. SEC SCHOOL KOHIMA
CLASS- 10
SUBJECT: SCIENCE (PHYSICS AND CHEMISTRY), SECOND TERM

CHAPTER-2
(ACIDS, BASES AND SALTS)

TEXTBOOK EXERCISES (Page number: 35-37)

1. A solution turns red litmus blue, its pH is likely to be
a) 1 (b) 4 (c) 5 (d) 10
Ans: (d).

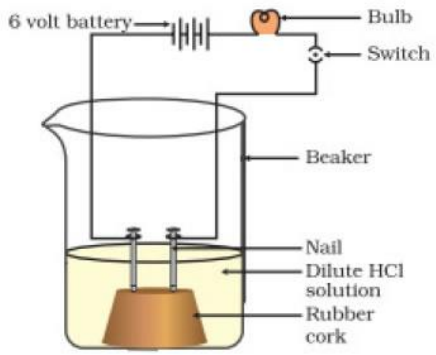
2. A solution reacts with crushed egg-shells to give a gas that turns lime-water milky. The solution contains a) NaCl (b) HCl (c) LiCl (d) KCl
Ans: (b).

3. 10 mL of a solution of NaOH is found to be completely neutralised by 8 mL of a given solution of HCl. If we take 20 mL of the same solution of NaOH, the amount HCl solution (the same solution as before) required to neutralise it will be
(a) 4 mL (b) 8 mL (c) 12 mL (d) 16 mL
Ans: (d).

4. Which one of the following types of medicines is used for treating indigestion?
(a) Antibiotic (b) Analgesic (c) Antacid (d) Antiseptic
Ans: (c).

5. Write word equations and then balanced equations for the reaction taking place when
(a) Dilute sulphuric acid reacts with zinc granules. (b) Dilute hydrochloric acid reacts with magnesium ribbon. (c) Dilute sulphuric acid reacts with aluminium powder. (d) Dilute hydrochloric acid reacts with iron filings.
Ans: (a) dilute sulphuric acid reacts with zinc granules:
$H_2SO_4(aq) + Zn \rightarrow ZnSO_4(aq) + H_2(g)$ (b) dilute hydrochloric acid reacts with magnesium ribbon.
$2HCl(aq) + Mg \rightarrow MgCl_2(aq) + H_2(g)$ (c) dilute sulphuric acid reacts with aluminium powder.
$3H_2SO_4(aq) + 2Al(s) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$ (d) dilute hydrochloric acid reacts with iron filings.
$6HCl(aq) + 3Fe(s) \rightarrow 3FeCl_2(aq) + 3H_2(g)$

6. Compounds such as alcohols and glucose also contain hydrogen but are not categorised as acids. Describe an Activity to prove it.
Ans: Insert two nails on the wooden or rubber cork and place them on a beaker as shown in figure. Connect iron nail to a bulb, 6 volt battery and a wire connected to switch. Pour some alcohol or glucose so as to dip the nails in glucose or alcohol. Turn the switch on and you the see the bulb not glowing despite of connection to switch. Now empty the beaker and add HCL solution. This time bulb glows. This proves acid can conduct electricity but alcohol and glucose does not conduct electricity.



7. Why does distilled water not conduct electricity, whereas rain water does?
Ans: Distilled water does not contain any ionic compounds in it whereas rainwater has a lot, more compounds. Rainwater has dissolved acidic gas such as carbon dioxide from the air and that forms carbonic acid. This means that it has hydrogen ions and carbonate ions. Therefore, with the presence of acids, rainwater can conduct electricity.
8. Why do acids not show acidic behaviour in the absence of water?
Ans: Acid does not show acidic behaviour in the absence of water because the dissociation of hydrogen ion from an acid occurs in the presence of water only. It is hydrogen ion that is responsible for the acidic behaviour.
9. Five solutions A, B, C, D and E when tested with universal indicator showed pH as 4, 1, 11, 7 and 9, respectively. Which solution is (a) neutral? (b) Strongly alkaline? (c) Strongly acidic? (d) Weakly acidic? (e) Weakly alkaline? Arrange the pH in increasing order of hydrogen-ion concentration.
Ans: (a). D (b). C (c). B (d). A (e). E
Increasing order of hydrogen ion concentration: 11< 9< 7< 4< 1
10. Equal lengths of magnesium ribbons are taken in test tubes A and B. Hydrochloric acid (HCl) is added to test tube A, while acetic acid (CH_3COOH) is added to test tube B. Amount and concentration taken for both the acids are same. In which test tube will the fizzing occur more vigorously and why?
Ans: In test tube A because HCl is stronger acid than acetic acid and therefore, reacts faster faster with magnesium ribbon.
11. Acids do not show acidic behaviour in the absence of water but do so in water. Justify this statement with the help of a chemical equation.
Ans: Acids do not show acidic behaviour in the absence of water but do so in water. This is because when they are put in water, they dissociate into their ions. These ions are responsible for conducting electricity. E.g- In HCl, $HCl \rightarrow H^+ + Cl^-$
12.What are antacids? Explain their role in providing relief from stomachache.
Ans: Antacids are actually alkaline ions that directly neutralize the gastric acids of the stomach. During indigestion the stomach produces too much acid and this causes pain and irritation. To get rid of this pain, people use antacids. These antacids neutralise the excess acid. Milk of magnesia is often used for this purpose.
13. The marble statues are often slowly corroded when kept in open for a long time. Give reason.
Ans: The gaseous oxides (CO_2,NO_2, SO_2) present in air as chemical pollutant mix with water in air to form acids such as Ca $(CO_3)_2$,HNO_3 and H_2SO_4 .This come down and cause corrosion of marble statues.
14. When soap is scrubbed on a stain of curry on a white cloth, why does it become reddish brown and turns yellow again when it is washed with plenty of water?
Ans: When soap is scrubbed on a stain of curry on a white cloth, it becomes reddish brown

because soap solution is basic in nature. On washing with plenty of water, it turns yellow again because soap is washed away.

15. (a) If we take hydrochloric acid and acetic acid of same concentration which produce less H^+ ion concentration? Out of two which one is a weak acid?

(b) If someone is suffering from acidity, which of the following would be suggest in order to cure it: vinegar, orange juice, baking soda solution? Give reason for your answer.

Answers: (a) Acetic acid produce less H^+ ions because it is a weak acid than HCl.

(b) Baking soda solution. This is because it is base and it neutralizes the acid.

16. Fresh milk has a pH of 6. How do you think the pH will change as it turns into curd? Explain your answer.

Ans: Fresh milk is turned to curd due to production of lactic acid. Lactic acid reduces the pH of the milk.

17. A milkman adds a very small amount of baking soda to fresh milk.

(a) Why does he shift the pH of the fresh milk from 6 to slightly alkaline?

(b) Why does this milk take a long time to set as curd?

Answer: (a) He shifted the pH of the fresh milk from 6 to slightly alkaline to prevent milk from getting sour due to production of lactic acid. (b) This milk takes long time to set into curd because the lactic acid produced reacts with the baking soda.

18. Plaster of Paris should be stored in a moisture-proof container. Explain why?

Ans: Plaster of Paris in contact with moisture (water) changes to solid hard mass, gypsum.Therefore, it gets wasted. Hence, it should be stored in moisture-proof container.

19. What is a neutralisation reaction? Give two examples

Ans: When an acid reacts with a base to form salt and water, it is called neutralization reaction. Examples: (i)$NaOH + HCl \rightarrow NaCl + H_2O$

(ii)$Mg(OH)_2 + H_2CO_3 \rightarrow MgCO_3 + 2H_2O$

20. Give two important uses of washing soda and baking soda.

Ans: Uses of Washing soda are: (i) It is used in glass, soap and paper industries.

(ii) It is used for removing permanent hardness of water. Uses of Baking soda are:

(i) It is commonly used in the kitchen for making tasty crispy pakoras.

(ii) It is used in soda-acid fire extinguishers.

Tick the correct option:

1. (b) 2. (a) 3. (a) 4. (d) 5. (c)

In-text questions page-19

1. Ans: We can identify the content in each of the test tubes using red litmus paper. This can be done by noticing the colour change of the red litmus paper. (i)If the red litmus paper changes to blue colour, the solution is a basic solution. (ii)If the red litmus paper changes to red colour, the solution is acidic solution. (iii)If you did not observe any colour change, the solution is distilled water.

In-text questions page-23

1. Ans: Curd and sour food substances contain acids; these acidic substances combine with metal. This reaction turns food to poison which damage people's health.

2. Ans: When an acid reacts with any metal, salt and hydrogen gas are formed. Metal + Acid → Salt + Hydrogen gas It can be tested by bringing a burning candle near the gas. This continues burning with a pop sound.

3. Ans: The gas evolved is carbon dioxide which extinguishes a burning candle. The compound may be Calcium Carbonate and the reaction is $CaCO_3 (s) + 2HCl (Aq) \rightarrow CaCl_2 (Aq) + CO_2 (g) + H_2O (l)$

In-text questions page-26

1. Ans: HCl, HNO_3 etc give H_3O^+ ions in aqueous solution and hence show acidic character.

$HCl + H_2O \rightarrow H_3O^+ + C$ $HNO_3 + H_2O \rightarrow H_3O^+ + NO_3^-$

On the other hand, the aqueous solutions of glucose and alcohol do not give H_3O^+ ions and hence do not show acidic character.

2. Ans: Charged particles are responsible for the conductance of electricity in an acid. These charged particles called as ions are the reason behind conductance of electricity in acid.
3. Ans: Dry HCl gas does not show any acidic character and therefore, does not change the colour of the dry litmus paper.
4. Ans: While diluting an acid, it is recommended that the acid should be added to water and not water to the acid because if water is added to concentrated acid, the heat generated may cause the mixture to splash out and cause burns. Therefore, acid must be added slowly to water with constant stirring.
5. Ans: When acid is diluted, the concentration of hydronium ion per unit volume decreases.
6. Ans: When excess base is added to a solution of sodium hydroxide the concentration of hydroxyl ions (OH^-) increases.

In-text questions page-29

1. Ans: Solution A having pH = 6 has more concentration of hydrogen ions. Solution A is acidic and solution B is basic.
2. Ans: Hydrogen ion concentration decides the nature of the solution. If Hydrogen ion concentration increases, then solution turns acidic and similarly if Hydrogen ion concentration decreases, then solution turns basic.
3. Ans: Yes, it has H^+ ions, but its concentration is less than the concentration of OH^- ions .So, they are basic solution
4. Ans: If the soil condition is more acidic than optimum conditions.

In-text questions page-34

1. Ans: Common name of $CaOCl_2$ is bleaching powder.
2. Ans: The substance which on treatment with chlorine yields bleaching powder is Calcium hydroxide.
3. Ans: Sodium carbonate is the compound which is used for softening hard water.
4. Ans: When a solution of sodium hydrocarbonate is heated, it gives sodium carbonate, carbon dioxide and water.

$$2NaHCO_3 \xrightarrow{heat} Na_2CO_3 + H_2O + CO_2$$

5. Ans:The chemical equation for the reaction of Plaster of Paris and water is $CaSO_4.1/2H_2O + 3/2H_2O \rightarrow CaSO_4.2H_2O$

CHAPTER- 4
(CARBON AND ITS COMPOUNDS)

TEXTBOOK EXERCISES (Page number: 80-82)

1. Ethane, with the molecular formula C_2H_6 has
(a) 6 covalent bonds.
(b) 7 covalent bonds.
(c) 8 covalent bonds.
(d) 9 covalent bonds
Ans: (b) 7 covalent bonds
2. Butanone is a four-carbon compound with the functional group
(a)carboxylic
(b)acid
(c)ketone
(d) alcohol
Ans: (c) Ketone.
3. While cooking, if the bottom of the vessel is getting blackened on the outside, it means that
(a) the food is not cooked completely.
(b) the fuel is not burning completely.
(c) the fuel is wet.
(d) the fuel is burning completely.

Ans: (b). the fuel is not burning completely.

4. Explain the nature of the covalent bond using the bond formation in CH3Cl.

Ans: Carbon can neither lose 4 electrons nor do gain four electrons as this process make the system unstable due to requirement of extra energy. Therefore CH_3Cl completes its octet configuration by sharing its 4 electrons with carbon atoms or with atoms of other elements. Hence the bonding that exists in CH_3Cl is a covalent bonding.

Here, carbon requires 4 electrons to complete its octet, while each hydrogen atom requires one electron to complete its duplet. Also, chlorine requires an electron to complete the octet. Therefore, all of these share the electrons and as a result, carbon forms 3 bonds with hydrogen and one with chlorine.

5. Draw the electron dot structures for

(a) ethanoic acid

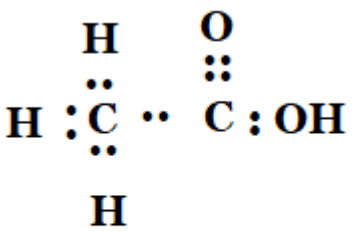
(b) H_2 S

(c) propanone

(d) F_2

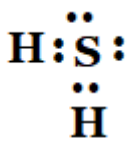
Solution:

a)



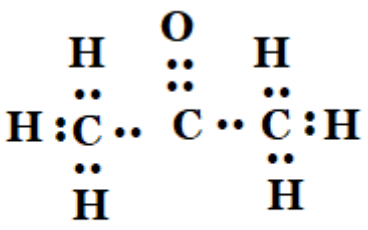
ethanoic acid

b)



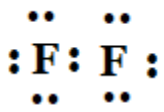
H_2S

c)



propanone

d)



F_2

6. What is a homologous series? Explain with an example.

Ans: A group of organic compounds having similar structures, same functional group and similar chemical properties but different physical properties, in which the successive compounds differ by a CH_2 group, is called homologous series. For example, methane, ethane, propane, butane, etc. are all part of the alkane homologous series. The general formula of this series is C_nH_{2n+2}. Methane CH_4 , Ethane CH_3CH_3 ,Propane $CH_3CH_2CH_3$,Butane $CH_3CH_2CH_2CH_3$. It can be noticed that there is a difference of −CH2 unit between each successive compound.

7. How can ethanol and ethanoic acid be differentiated on the basis of their physical and chemical properties?

Ans:

Ethanol	Ethanoic acid
Physical properties:	
(i) No action in litmus paper	(i) Blue litmus paper to red
(ii) A good smell	(ii)A pungent Smell
Chemical properties :	
(i) It does not react with alkalies	(i)It reacts with alkalies forming salt and water.
(ii)It does not liberate CO_2 from bicarbonates and carbonates.	(ii)It liberates CO_2 from bicarbonates and carbonates.

8. Why does micelle formation take place when soap is added to water? Will a micelle be formed in other solvents such as ethanol also?

Ans: A soap molecule has two ends which have different properties, one end is polar,i.e hydrophilic and is water soluble while the other end is non-polar ,i.e hydrophobic and hence, water in soluble. When soap is added to water, the polar ends dissolved in water while the non-polar ends dissolve in each other.

As a result, the spherical ionic micelles are formed. Since soap is soluble in ethanol, therefore micelle formation does not occur.

9. Why are carbon and its compounds used as fuels for most applications?

Ans: Carbon and its compounds used as fuels for most applications for they have high calorific values and give out a lot of energy. Most of the carbon compounds give a lot of heat and light when burnt in air.

10. Explain the formation of scum when hard water is treated with soap?

Ans: Scum is produced from reaction of hard water with soap. Calcium and magnesium present in the hard water form an insoluble precipitate that stick as a white which is also called as scum.

11.”Saturated hydrocarbons burn with a blue flame while unsaturated hydrocarbons burns with a sooty flame”. Why?

Ans: Saturated hydrocarbons burn with a blue flame. This is because the percentage of in these compounds is low which gets oxidized completely by the oxygen present in the air. While unsaturated hydrocarbons burns with a sooty flame. This is because the percentage of carbon in these compounds is comparatively higher than saturated compounds.

12. Why vegetable oils are considered healthy as compared to vegetable ghee? How are vegetable oils converted into vegetable ghee? Name and define the process involved.

Ans: This is because vegetable oils contain long unsaturated carbon chains while vegetable ghee contains saturated carbon chains which are said to be harmful for health.

Vegetable oils are converted into vegetable ghee by adding hydrogen in the presence of catalysts such as palladium (Pd) or nickel (Ni). This addition reaction is known as hydrogenation.

13. Both soap and detergent are some type of salts. What is the difference between them? Describe in brief the cleansing action of soap. Why do soaps not form lather in hard water? List two problems that arise due to the use of detergents instead of soaps.

Ans: The difference between soap and detergent: soaps cannot be used in acidic solutions but detergents can be used in acidic solutions. Soaps form scum with hard water but detergents do not. The cleansing action of soap:

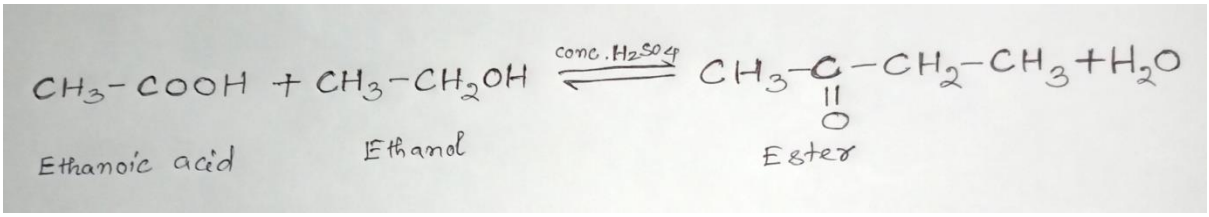
When soap is dissolved in water, many molecules come together and formed a group called micelle. These micelles are formed because their hydrocarbon chains come together and the polar ends are projected outwards. This outwardly projected polar ends attached to the dirt and the micelles dissolve in water and are washed away. Thus, the cloth gets cleaned.

Soap reacts with calcium and magnesium salts present in hard water forming scum.Hence; soap does not produce lather in hard water. Two problems that arise due to the use of detergents instead of soaps are:(i) Detergents are non-biodegradable.

(ii) Detergents are more reactive to human skin than soaps.

14. Give a name of the reaction which takes place between ethanoic acid and ethanol in presence of concentrated sulphuric acid .Write the chemical reaction and name of the product obtained.

Ans:The name of the reaction is esterification reaction.



When ethanoic acid and ethanol react each other in presence of concentrated sulphuric acid, a sweet smelling substance, ester is formed.

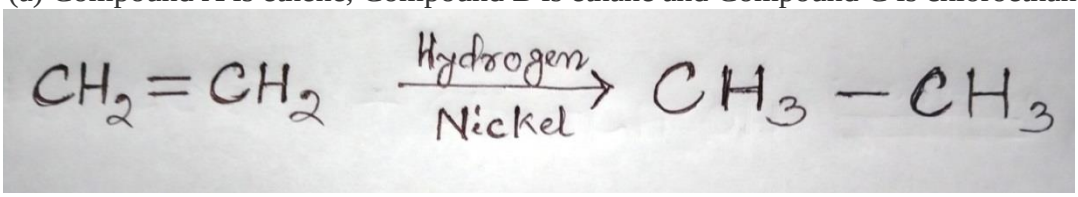
15.An organic compound A of molecular formula C_2H_4 on reduction gives another compound B of molecular formula C_2H_6 .B on reaction with chlorine in the presence of sunlight gives C of molecular formula C_2H_5Cl.

(a) Name the compounds A, B and C.

(b) Write the chemical equation for the conservation of A to B and name the type of reaction.

Answers:

(a) Compound A is ethene, Compound B is ethane and Compound C is chloroethane



(b) The type of the reaction is addition reaction.

16. What change will you observe if you test soap with litmus paper (red and blue)?

Ans: When soap is tested with red litmus paper, it turns blue indicating that soap is alkaline in nature.

17. What is hydrogenation? What is its industrial application?

Ans: Hydrogenation is a process of addition of hydrogen to unsaturated hydrocarbons in the presence of nickel or palladium catalyst to form saturated compound. Hydrogenation reaction is used in the manufacture of vanaspati ghee from vegetable oils.

18. Which of the following hydrocarbons undergo addition reactions: C_2H_6, C_3H_8, C_3H_6, C_2H_2 and CH_4.

Ans: The Hydrocarbons which undergo addition reactions are: C_3H_6 and C_2H_2

19. Give a test that can be used to differentiate between saturated and unsaturated hydrocarbons.

Ans: Bromine water test is used to differentiate between the unsaturated compounds and the saturated compounds. The color of bromine is brown. When bromine water is added to an unsaturated compound, it decolorizes bromine water. But when bromine water is added to saturated hydrocarbon, it does not decolorize bromine water.

20. Explain the mechanism of the cleaning action of soaps.

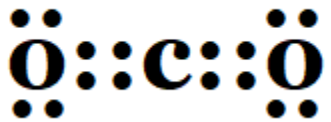
Ans: There are so many impurities and dirt mixed in water, and most of all the dirt does not dissolve in the water. Soap molecules are a combination of salts such as sodium or potassium. The molecules are of a long chain of carboxylic acids. The ionic - end of soap interacts with water while the carbon chain interacts with oil. The ionic-end of soap interacts with water while the carbon chain interacts with oil. The soap molecules thus form structures called micelles where one end of the molecules is towards the oil droplet while the ionic-end faces outside. This forms an emulsion in water. The soap micelle thus helps in pulling out the dirt in water and we can wash our clothes clean.

Tick the correct option:

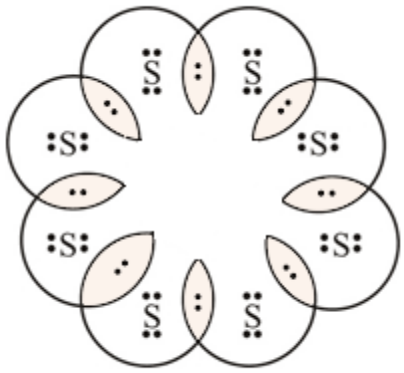
1. (c) 2. (d) 3. (a) 4. (c) 5. (c)

In-text questions page- 64

1. Ans:



2. Ans:

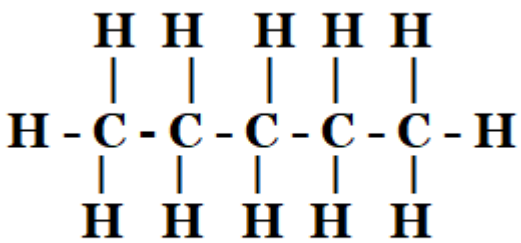


In-text questions page-71

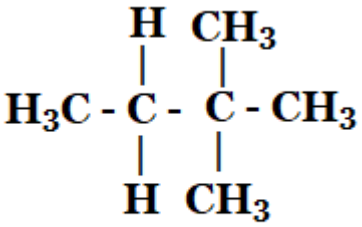
1. Ans: Structural isomer of pentane are n-pentane

2-methylbutane

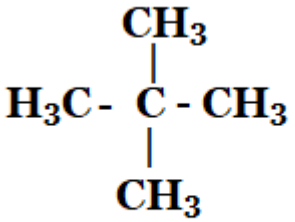
2, 2-dimethylpropane



n-pentane



2-methylbutane



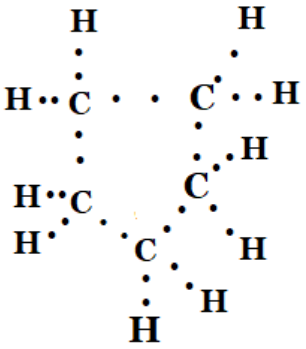
2,2 dimethylpropane

2. Ans: Two properties which lead to the huge number of carbon compounds are

(i) Carbon has maximum tendency to form bonds with itself. This property is known as catenation.

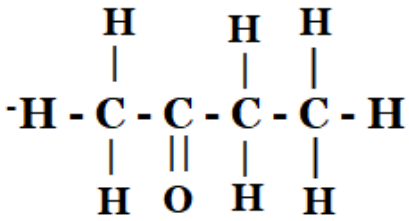
(ii) Carbon has tendency to form bonds with other carbon atoms or atoms of some other elements such as oxygen, chlorine, nitrogen, Sulphur, hydrogen and etc.

3. Ans:



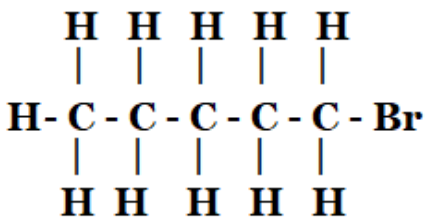
C_5H_{10}

4. Answers: (i)



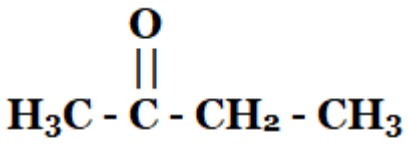
Ethanoic Acid

(ii)



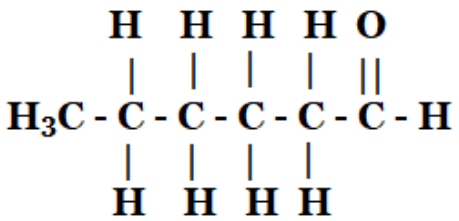
Bromopentane

(iii)



Butanone

(iv)

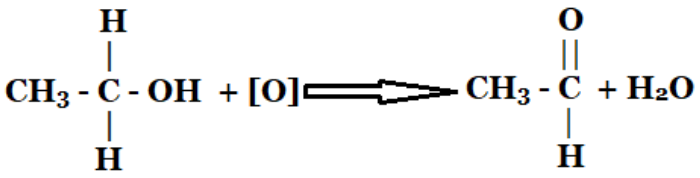


Hexanal

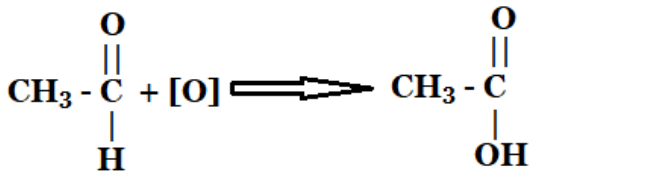
5. Answers: (i) Bromoethane
(ii) Methanal or Formaldehyde
(iii) 1-Hexy

In-text questions page-74

1. Ans:



ethanol ethanal



ethanal ethanoic acid

In the conversion of ethanol to ethanoic acid, oxygen is added and hence it is an oxidation reaction.

2. Ans: In air, ethyne will not be completely oxidized to give very high temperature.

In-text questions page-77

1. Ans: On reaction with Sodium Carbonate, Carboxylic acids produce carbon dioxide gas which turns lime water milky whereas alcohols do not give this reaction. This experiment can be used to distinguish an alcohol and carboxylic acid.

Reaction of Carboxylic acid with sodium carbonate:

$2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$

2. What are oxidising agents?

Solution: Oxidising agents are substances which are capable of adding oxygen to other substances.

In-text questions page-79

1. Ans: No, because detergents produce foam and do not produce curdy white precipitates even in hard water. 2. Ans: Agitation is necessary to get clean clothes as agitation aid soap micelles to trap the oil, grease or any other impurities that have to be removed. When they are being beaten or agitated, the particles are removed from the clothes' surfaces and go into the water, thus cleaning the clothes.

CHAPTER-12
(ELECTRICITY)

TEXTBOOK EXERCISES (Page number: 232 - 233)

1. A piece of wire of resistance R is cut into five equal parts. These parts are then connected in parallel. If the equivalent resistance of this combination is R′, then the ratio R/R′ is _____.

(a) 1/25
(b) 1/5
(c) 5
(d) 25

Ans: (d) 25

2. Which of the following terms does not represent electrical power in a circuit?

(a) I^2R
(b) IR^2
(c) VI
(d) V^2/R

Ans:(b) IR^2

3. An electric bulb is rated 220 V and 100 W. When it is operated on 110 V, the power consumed will be _____.

(a) 100 W
(b) 75 W
(c) 50 W
(d) 25 W

Ans: (d) 25 W

.4. Two conducting wires of the same material and of equal lengths and equal diameters are first connected in series and then parallel in a circuit across the same potential difference. The ratio of heat produced in series and parallel combinations would be _____.

(a) 1:2
(b) 2:1
(c) 1:4
(d) 4:1

Ans:(c)) 1:4

5. How is a voltmeter connected in the circuit to measure the potential difference between two points?
Ans: Voltmeter is connected in parallel because potential difference across parallel combination remains the same.
6. A copper wire has diameter 0.5 mm and resistivity of 1.6×10^{-8} Ω m. What will be the length of this wire to make its resistance 10 Ω? How much does the resistance change if the diameter is doubled?
Solution:
The resistance of the copper wire of length in meters and area of cross-section m^2 is given by the formula

$$R = \rho \frac{l}{A}$$

The area of cross-section of the wire can be calculated as follows

$$A = \pi(\frac{Diameter}{2})^2$$

Substituting the values in the formula, we get

$$l = \frac{RA}{\rho} = \frac{10 \times 3.14 \times (\frac{0.0005^2}{2})}{(1.6 \times 10^{-8})} = \frac{10 \times 3.14 \times 25}{4 \times 1.6} = 122.72 \text{ m}$$

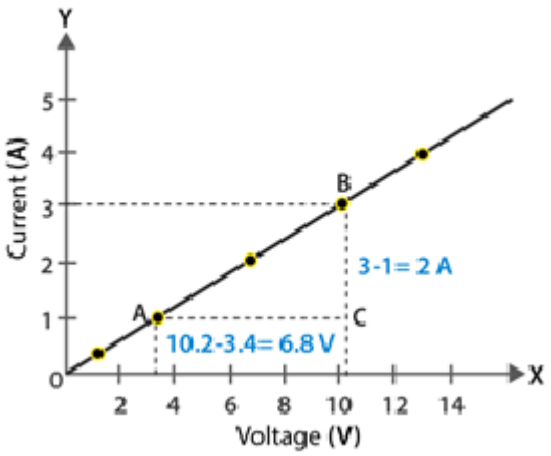
If the diameter of the wire is doubled, then the new diameter will be 1 mm or 0.001 m.
Therefore, the resistance can be calculated as follows:

$$R = \rho \frac{l}{A} = 1.6 \times 10^{-8} \times \frac{122.72 \text{ m}}{\pi(\frac{0.001}{2})^2} = 250.2 \times 10^{-2} = 2.5\ \Omega$$

The length of the wire is 122.72 m and the new resistance is 2.5 Ω.
7. The values of current I flowing in a given resistor for the corresponding values of potential difference V across the resistor are given below –

I(Ampere)	0.5	1.0	2.0	3.0	4.0
V (Volts)	1.6	3.4	6.7	10.2	13.2

Plot a graph between V and I and calculate the resistance of that resistor.
Solution:
The plot between voltage and current is known as IV characteristic. The current is plotted in the y-axis while the voltage is plotted in the x-axis. The different values of current for different values of voltage are given in the table. The I V characteristics for the given resistor are shown below.



The slope of the line gives the value of resistance.

The slope can be calculated as follows:
Slope = $1/R = BC/AC = 2/6.8$
To calculate R,
$R = 6.8/2 = 3.4\ \Omega$
The resistance of the resistor is 3.4 Ω.
8. When a 12 V battery is connected across an unknown resistor, there is a current of 2.5 mA in the circuit. Find the value of the resistance of the resistor
Solution: Given, v= 12 V,I= 2.5 mA
The value of the resistor can be calculated using Ohm's Law as follows:
$R = \frac{V}{I}$
Substituting the values in the equation, we get
$R = \frac{12}{2.5\times10^{-3}} = 4.8 \times 10^3\ \Omega = 4.8\ \text{k}\Omega$
9. A battery of 9 V is connected in series with resistors of 0.2 Ω, 0.3 Ω, 0.4 Ω, 0.5 Ω and 12 Ω, respectively. How much current would flow through the 12 Ω resistor?
Solution:
In series connection, there is no division of current. The current flowing across all the resistors is the same.
To calculate the amount of current flowing across the resistors, we use Ohm's law.
But first, let us find out the equivalent resistance as follows:
$R = 0.2\ \Omega + 0.3\ \Omega + 0.4\ \Omega + 0.5\ \Omega + 12\ \Omega = 13.4\ \Omega$
Now, using Ohm's law,
$I = \frac{V}{R} = \frac{9\ \text{V}}{13.4\ \Omega} = 0.671\ \text{A}$
The current flowing across the 12 Ω is 0.671 A.
10. (a) List the factors on which the resistance of a conductor in the shape of a wire depends.
(b) Why are alloys commonly used in electrical heating devices?
(c) What material is used in making the filament of an electric bulb?
Answers: (a) The factors on which the resistance of a conductor in the shape of a wire depends upon (i) On its length (ii) On its area of cross- section and (iii) on the nature of its material. (b) This is because alloys have a high resistivity in comparison to pure metals.
(C)Tungsten is used in making the filament of an electric bulb.
11. Why are copper or aluminium wires generally used for electrical transmission and distribution purposes?
Ans: This is because copper or aluminium has low resistivity.
12. Name and state the law that gives relationship between the current through a conductor and the potential difference across its two terminals. Also, express this law mathematically.
Ans: Ohm's law gives relationship between the current through a conductor and the potential difference across its two terminals.
Ohm's law states that the potential difference, V across the ends of a given metallic wire in an electric circuit is directly proportional to the current, I flowing through it, provided its temperature remains the same.
Mathematically, $V \alpha I$
Or V/I = Constant
= R
Or $V = IR$
13.Explain how do we classify materials as conductor and insulators on the basis of their resistance.
Ans: Conductors: Those substances which have very low electrical resistivity are called conductors.
Eg: Copper
Insulators: Those substances which have infinitely high electrical resistivity are called

insulators. Eg: Rubber

14.State the factors on which the heat produced in a current carrying conductor depends .Give one practical application of this effect.

Ans: The factors on which the heat produced in a current carrying conductor depends are Square of the current, the resistance of the given conductor, time on which the which the current flows. Application – Electric heating devices like electric iron

15. Why is very less heat generated in long electric cables than in filaments of electric bulbs?

Ans: This because the filaments of electric bulbs has very high resistance whereas electric cables have very low resistance.

16. How many 176 Ω resistors (in parallel) are required to carry 5 A on a 220 V line?

Solution: Let us consider the number of resistors required as 'x.'

The equivalent resistance of the parallel combination of resistor R is given by

$$\frac{1}{R} = x \times \frac{1}{176} = R = \frac{176}{x}$$

Now, using Ohm's law, the number of resistors can be calculated as follows:

$$R = \frac{V}{I}$$

Substituting the values, we get

$$\frac{176}{x} = \frac{V}{I}$$

$$x = \frac{176 \times 5}{220} = 4$$

The number of resistors required is 4.

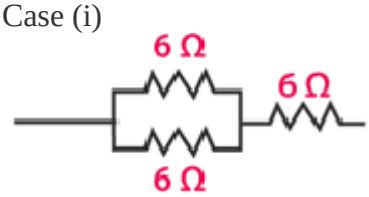
17. Show how you would connect three resistors, each of resistance 6 Ω, so that the combination has a resistance of (i) 9 Ω, (ii) 4 Ω.

Solution: If we connect all the three resistors in series, their equivalent resistor would 6 Ω + 6 Ω + 6 Ω =18 Ω, which is not the desired value. Similarly, if we connect all the three resistors in parallel, their equivalent resistor would be

$R = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{18}{6} = \frac{6}{2}$, which is again not the desired value.

We can obtain the desired value by connecting any two of the resistors in either series or parallel.

Case (i)



If two resistors are connected in parallel, then their equivalent resistance is

$$\frac{1}{\frac{1}{6} + \frac{1}{6}} = \frac{6 \times 6}{6 + 6} = 3\ \Omega$$

The third resistor is in series, hence the equivalent resistance is calculated as follows:

$R = 6\ \Omega + 3\ \Omega = 9\ \Omega$

Case (ii)

When two resistors are connected in series, their equivalent resistance is given by
$R = 6\ \Omega + 6\ \Omega = 12\ \Omega$
The third resistor is connected in parallel with 12 Ω. Hence the equivalent resistance is calculated as follows:

$$R = \frac{1}{6} + \frac{1}{12} = \frac{12 \times 6}{12 + 6} = 4\ \Omega$$

18. Several electric bulbs designed to be used on a 220 V electric supply line, are rated 10 W. How many lamps can be connected in parallel with each other across the two wires of 220 V line if the maximum allowable current is 5 A?
Solution:
The resistance of the bulb can be calculated using the expression
$P_1 = V^2/R_1$
$R_1 = V^2/P_1$
Substituting the values, we get

$$R = \frac{(220)^2}{10} = 4840\ \Omega$$

The resistance of x number of electric bulbs is calculated as follows:
$R = V/I = 220/5 = 44\ \Omega$
The resistance of each electric bulb is 4840 Ω.
The equivalent resistance of x bulbs is given by

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_1} + \frac{1}{R_1} \pm \cdots upto\ x\ times$$

$$\frac{1}{R} = \frac{1}{R_1} \times x$$

$$x = \frac{R_1}{R} = \frac{4840}{44} = 110$$

Hence, 110 lamps can be connected in parallel.
19. A hot plate of an electric oven connected to a 220 V line has two resistance coils A and B, each of 24 Ω resistance, which may be used separately, in series, or in parallel. What are the currents in the three cases?
Solution:
Case (i) When coils are used separately
Using Ohm's law, we can find the current flowing through each coil as follows:

$$I = \frac{V}{R}$$

Substituting the values, we get

$$I = \frac{220\ \text{V}}{24\ \Omega} = 9.166\ \text{A}$$

9.166 A of current flows through each resistor when they are used separately.
Case (ii) When coils connected in series
The total resistance in the series circuit is $24\ \Omega + 24\ \Omega = 48\ \Omega$
The current flowing through the series circuit is calculated as follows:

$$I = \frac{V}{R} = \frac{220\ \text{V}}{48\ \Omega} = 4.58\ \text{A}$$

Therefore, a current of 4.58 A flows through the series circuit.
Case (iii) When coils connected in parallel
When the coils are connected in parallel, the equivalent resistance is calculated as follows:

$$R = \frac{24 \times 24}{24 + 24} = \frac{576}{48} = 12\ \Omega$$

Using Ohm's law, the current flowing through the parallel circuit is given by

$$I = \frac{V}{R} = \frac{220}{12} = 18.33\ \text{A}$$

The current in the parallel circuit is 18.33 A.

20. Compare the power used in the 2 Ω resistor in each of the following circuits: (i) a 6 V battery in series with 1 Ω and 2 Ω resistors, and (ii) a 4 V battery in parallel with 12 Ω and 2 Ω resistors.
Solution:
(i) The potential difference is 6 V and the resistors 1 Ω and 2 Ω are connected in series, hence their equivalent resistance is given by 1 Ω + 2 Ω = 3 Ω. The current in the circuit can be calculated using the Ohm's law as follows:

$$I = \frac{V}{R} = \frac{6}{3} = 2\text{ A}$$

2 A current will flow across all the components in the circuit because there is no division of current in a series circuit.
The power in 2 Ω resistor can be calculated as follows:

$$P = I^2R = (2)^2 \times 2 = 8\text{ W}$$

Therefore, the power consumed by the 2 Ω is 8 W.
(ii) When 12 Ω and 2 Ω resistors are connected in parallel, the voltage across the resistors remains the same. Knowing that the voltage across 2 Ω resistor is 4 V, we can calculate the power consumed by the resistor as follows:

$$P = \frac{V^2}{R} = \frac{4^2}{2} = 8\text{ W}$$

The power consumed by the 2 Ω resistor is 8 W.
21. Two lamps, one rated 100 W at 220 V, and the other 60 W at 220 V, are connected in parallel to electric mains supply. What current is drawn from the line if the supply voltage is 220 V?
Solution:
Since both the bulbs are connected in parallel, the voltage across each of them will be the same.
Current drawn by the bulb of rating 100 W can be calculated as follows:
P = V × I
I = P/V
Substituting the values in the equation, we get
I = 100 W/220 V = 100/220 A
Similarly, the current drawn by the bulb of rating 60 W can be calculated as follows:
I = 60 W/220 V = 60/220 A
Therefore, the current drawn from the line is $\frac{100}{220} + \frac{60}{220} = 0.727\text{ A}$
22. Which uses more energy, a 250 W TV set in 1 hr, or a 1200 W toaster in 10 minutes?
Solution:
The energy consumed by electrical appliances is given by the equation
H = *Pt*, where *P* is the power of the appliance and *t* is the time
Using this formula, the energy consumed by a TV of power ration 250 W, can be calculated as follows:
H = 250 W × 3600 seconds = 9×10^5 J
Similarly, the energy consumed by a toaster of power rating 1200 W is
H = 1200 W × 600 s = 7.2×10^5 J
From the calculations, it can be said that the energy consumed by the TV is greater than the toaster.
23. An electric heater of resistance 8 Ω draws 15 A from the service mains 2 hours. Calculate the rate at which heat is developed in the heater.
Solution:
The rate at which the heat develops in the heater can be calculated using the following formula
$P = I^2 R$
Substituting the values in the equation, we get

$P = (15A)^2 \times 8\ \Omega = 1800$ J/s
The electric heater produces heat at the rate of 1800 J/s
24. Explain the following.
a. Why is the tungsten used almost exclusively for filament of electric lamps?
b. Why are the conductors of electric heating devices, such as bread-toasters and electric irons, made of an alloy rather than a pure metal?
c. Why is the series arrangement not used for domestic circuits?
d. How does the resistance of a wire vary with its area of cross-section?
e. Why copper and aluminium wires are usually employed for electricity transmission?
Answers:
a. This is because tungsten has a high melting point and becomes incandescent at 2400k.
b. This is because the resistivity of an alloy is generally higher than that of pure metals of which it is made of.
c. The voltage is divided in series circuit as result each component in the circuit receives a small voltage so the amount of current decreases and the device gets hot and does not work properly. This is why series arrangements are not used in domestic circuits.
d. Resistance is inversely proportional to the area of cross section. When the area of cross section increases the resistance decreases and vice versa.
e. Copper and aluminium are good conductors of electricity and have low resistivity because of which they are usually employed for electricity transmission.
Tick the correct option:
1. (d) 2. (c) 3. (a) 4. (a)
In-text questions page- 211

1. Ans: A continuous and closed path of an electric current is known as an electric circuit.

2. Ans: The unit of current is ampere. Ampere is defined by the flow of one coulomb of charge per second.
3. Solution:
The value of the charge of an electron is 1.6×10^{-19} C.
According to charge quantization,
$Q = nq_e$, where n is the number of electrons and q_e is the charge of an electron.
Substituting the values in the above equation, the number of electrons in a coulomb of charge can be calculated as follows:

$$1\ C = n \times 1.6 \times 10^{-19}$$

$$n = \frac{1}{1.6 \times 10^{-19}} = 6.25 \times 10^{18}$$

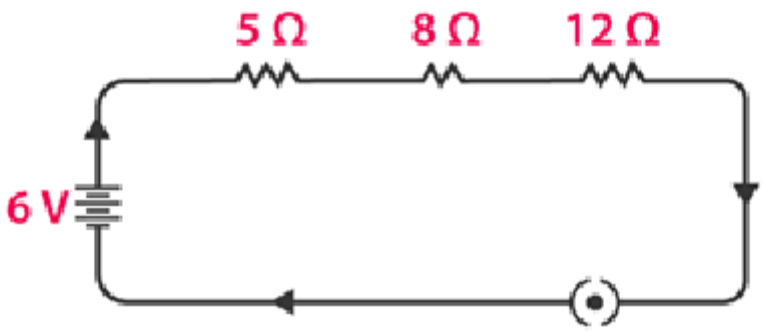
In-text questions page- 213
1. Ans: Battery
2. Ans: When 1 J of work is done to move a charge of 1 C from one point to another, it is said that the potential difference between two points is 1 V.
3. Solution: Given, Q = 1C, V = 6 volt
We have,
$W = V \times Q$
$= 6x\ 1$
$= 1$ J
In-text questions page- 220
1. Ans: The resistance of the conductor depends on the following factors:
a. On its length
b. On its area of cross-section
c. On the nature of its material
2. Solution:

Resistance is given by the equation,
R = ρ l/A
where,
ρ is the resistivity of the material of the wire,
l is the length of the wire
A is the area of the cross-section of the wire.
From the equation, it is evident that the area of the cross-section of wire is inversely proportional to the resistance. Therefore, thinner the wire, more the resistance and vice versa. Hence, current flows more easily through a thick wire than a thin wire.
3. Solution:
The change in the current flowing through the electrical component can be determined by Ohm's Law.
Using Ohm's Law, we have, current, I = V/R
Now, the potential difference is reduced to half keeping the resistance constant,
Let the new voltage be V' = V/2
Let the new resistance be R' = R and the new amount of current be I'.
The change in the current can be determined using Ohm's law as follows:

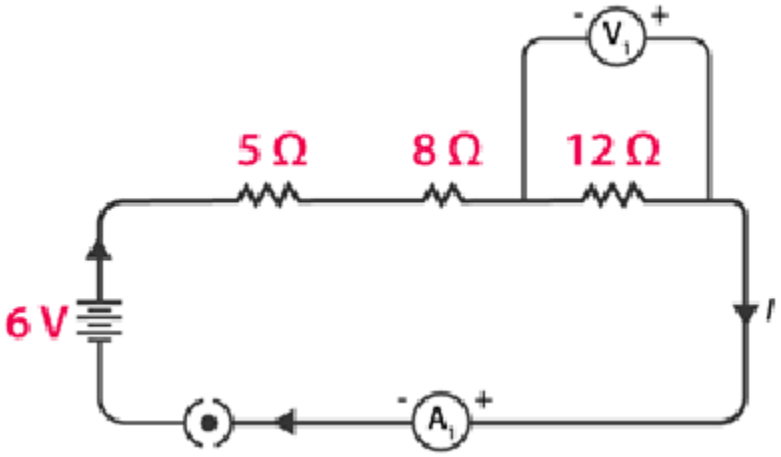
$$I' = \frac{V'}{R'} = \frac{(\frac{V}{2})}{R} = \frac{1}{2}\frac{V}{R} = \frac{1}{2}$$

Therefore, the current flowing the electrical component is reduced by half.
4. Ans: This is because resistivity of an alloy is generally higher than that of its constituent metals and also it has a high melting point.
5. Answers: (a) Iron is a better conductor than mercury because the resistivity of mercury is more than the resistivity of iron.
(b) Among all the materials listed in the table, silver is the best conductor because the resistivity of silver is lowest among all, i.e., 1.60×10^{-8}.

In-text questions page- 224
1. Ans: A battery of three cells of 2 V each equals to battery of potential 6 V. The circuit diagram below shows three resistors of resistance 12 Ω, 8 Ω and 5 Ω connected in series along with a battery of potential 6 V.



2. Ans: An ammeter should always be connected in series with resistors while the voltmeter should be connected in parallel to the resistor to measure the potential difference as shown in the figure below.



Using Ohm's Law, we can obtain the reading of the ammeter and the voltmeter.
The total resistance of the circuit is 5 Ω + 8 Ω +12 Ω = 25 Ω.
We know that the potential difference of the circuit is 6 V, hence the current flowing through the circuit or the resistors can be calculated as follows:
I = V/R = 6/25 = 0.24A
Let the potential difference across the 12 Ω resistor be V_1.
From the obtained current V_1 can be calculated as follows:
V_1 = 0.24A × 12 Ω = 2.88 V
Therefore, the ammeter reading will be 0.24 A and the voltmeter reading be 2.88 V.

In-text questions page- 227

1. Solution:
(a) When 1 Ω and 10^6 are connected in parallel, the equivalent resistance is given by

$$\frac{1}{R} = \frac{1}{1} + \frac{1}{10^6}$$

$$R = \frac{10^6}{1 + 10^6} \approx \frac{10^6}{10^6} = 1\,\Omega$$

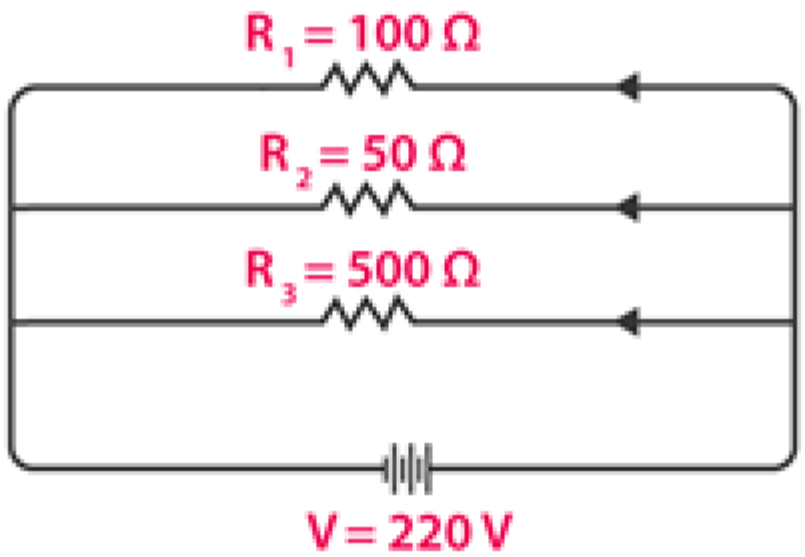
Therefore, the equivalent resistance is 1 Ω.
(b) When 1 Ω, 10^3 Ω, and 10^6 Ω are connected in parallel, the equivalent resistance is given by

$$\frac{1}{R} = \frac{1}{1} + \frac{1}{10^3} + \frac{1}{10^6}$$

Solving, we get

$$R = \frac{10^6 + 10^3 + 1}{10^6} = \frac{1000000}{1000001} = 0.999\,\Omega$$

Therefore, the equivalent resistance is 0.999 Ω.
2. Solution: The electric lamp, the toaster and the water filter connected in parallel to a 220 V source can be shown as using a circuit diagram as follows:



The equivalent resistance of the resistors can be calculated as follows:

$$\frac{1}{R} = \frac{1}{100} + \frac{1}{50} + \frac{1}{500}$$

$$= \frac{5 + 10 + 1}{500} = \frac{16}{500}$$

$$R = \frac{500}{16}\ \Omega$$

Now, using Ohm's law, the current flowing across the circuit can be calculated as follows:

$$I = \frac{V}{R} = \frac{220}{\frac{500}{16}}$$

$$I = \frac{220 \times 16}{500} = 7.04\ A$$

As the appliances are connected in parallel, the current drawn across all of them is 7.04 A.
Hence, the current drawn by the electric iron connected in parallel to the same source is 7.04 A.
We can find the resistance of the iron box using Ohm's law as follows:

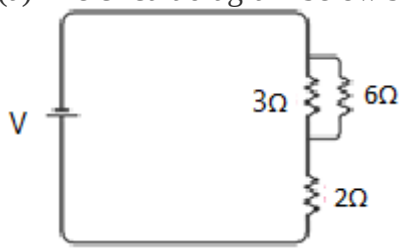
$$R = \frac{V}{I} = \frac{220\ V}{7.04\ A} = 31.25\ \Omega$$

The resistance of the electric iron box is 31.25 Ω.

3. Ans : When the electrical devices are connected in parallel there is no division of voltage among the appliances. The potential difference across the devices is equal to supply voltage. Parallel connection of devices also reduces the effective resistance of the circuit.

4. Solution:

(a) The circuit diagram below shows the connection of three resistors



From the circuit above, it is understood that 3 Ω and 6 Ω are connected in parallel. Hence, their equivalent resistance is given by

$$\frac{1}{R} = \frac{1}{3} + \frac{1}{6}$$

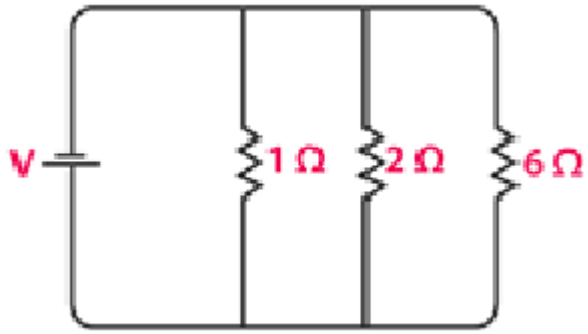
$$R = \frac{1}{\frac{1}{6} + \frac{1}{3}} = \frac{6 \times 3}{6 + 3} = 2\,\Omega$$

The equivalent resistor 2 Ω is in series with the 2 Ω resistor. Now the equivalent resistance can be calculated as follows:

R_{eq}= 2 Ω +2 Ω = 4 Ω

Hence, the total resistance of the circuit is 4 Ω.

(b) The circuit diagram below shows the connection of three resistors.



From the circuit, it is understood that all the resistors are connected in parallel. Therefore, their equivalent resistance can be calculated as follows:

$$R = \frac{1}{\frac{1}{2} + \frac{1}{3} + \frac{1}{6}} = \frac{1}{\frac{3+2+1}{6}} = \frac{6}{6} = 1\,\Omega$$

The total resistance of the circuit is 1 Ω.

5. Solution:

(a) If the four resistors are connected in series, their total resistance will be the sum of their individual resistances and it will be the highest. The total equivalent resistance of the resistors connected in series will be 4 Ω + 8 Ω + 12 Ω + 24 Ω = 48 Ω.

(b) If the resistors are connected in parallel, then their equivalent resistances will be the lowest.

Their equivalent resistance connected in parallel is

$$R = \frac{1}{\frac{1}{4} + \frac{1}{8} + \frac{1}{12} + \frac{1}{24}} = \frac{24}{12} = 2\,\Omega$$

Hence, the lowest total resistance is 2 Ω.

In-text questions page- 229

1. Ans: The heating element of an electric heater is made of an alloy which has a high resistance. When the current flows through the heating element, the heating element becomes too hot and glows red. The cord is usually made of copper or aluminum which has low resistance. Hence the cord doesn't glow.

2. Solution: Given, Q=96000 C, t= 1h = 60x60=3600 s, V= 50 V

We have, Heat produced, W=QV=96000x 50 V = 48x 10^5 J

3.Solution:

Given, $R = 20\,\Omega$, $I = 5A$, $t = 30s$

we have, $H = I^2Rt$

$= (5)^2 \times 20 \times 30$

$= 15000\,J$

Thus, heat developed $= 15000\,J$

In-text questions page- 231

1. Ans: The rate at which energy is delivered by a current is determined by power.

2. Solution: Given, I= 5A, V= 220 V, t = 2x60x60 sec

We have, P = VI = 220V X 5A = 1100 W

Also, P= E/t

$E = P \times t$

$= 1100 \times 2 \times 60 \times 60$

$= 7.92 \times 10^6$ J