NCERT BOOK QUESTIONS AND EXERCISES (with answers)

Chapter : ELECTRICITY

NCERT Book, Page 200

Q. 1. What does an electric circuit mean ?

Ans. A continuous conducting path consisting of wires and other resistances (like electric bulb, etc.) and a switch, between the two terminals of a cell or battery, along which an electric current flows, is called a circuit.

Q. 2. Define the unit of current.

Ans. The SI unit of electric current is ampere (which is denoted by the letter A). When 1 coulomb of charge flows through any cross-section of a conductor in 1 second, the current flowing through it is said to be 1 ampere.

Q.3. Calculate the number of electrons constituting one coulomb of charge.

Ans. See Sample Problem on page 2 of this book.

NCERT Book, Page 202

Q. 1. Name a device that helps to maintain a potential difference across a conductor.

Ans. An electric cell (or a battery).

Q.2. What is meant by saying that the potential difference between two points is 1 V ?

Ans. The potential difference between two points is said to be 1 volt (1 V) if 1 joule of work is done in moving 1 coulomb of electric charge from one point to the other.

Q. 3. How much energy is given to each coulomb of charge passing through a 6 V battery ?

Ans. See Sample Problem 2 on page 5 of this book.

NCERT Book, Page 209

Q.1. On what factors does the resistance of a conductor depend ?

Ans. The electrical resistance of a conductor (or a wire) depends on the following factors :

(*i*) length of the conductor,

(*ii*) area of cross-section of the conductor (or thickness of the conductor),

(*iii*) nature of the material of the conductor, and

(*iv*) temperature of the conductor.

Q.2. Will current flow more easily through a thick wire or a thin wire of the same material, when connected to the same source ? Why ?

Ans. The current will flow more easily through a thick wire than through a thin wire of the same material when connected to the same source (like a battery). This is due to the fact that the resistance of a wire is inversely proportional to the square of its diameter. A thick wire has greater diameter and hence lesser resistance making the current to flow through it more easily. On the other hand, a thin wire has smaller diameter and hence greater resistance to the flow of current through it.

Q.3. Let the resistance of an electrical component remain constant while the potential difference across the two ends of the component decreases to half of its former value. What change will occur in the current through it ?

Ans. The current through the component will also decrease to half of its former value.

Q.4. Why are coils of electric toasters and electric irons made of an alloy rather than a pure metal ?

Ans. The coils (or heating elements) of toasters and electric irons are made of an alloy rather than a pure metal because :

(*i*) the resistivity of an alloy is much higher than that of a pure metal, and

(*ii*) an alloy does not undergo oxidation (or burn) easily even at high temperature, when it is red hot.

Q.5. Use the data in Table on page 23 of this book to answer the following :
(*a*) Which among iron and mercury is a better conductor ?
(*b*) Which material is the best conductor ?

Ans. (*a*) The electrical resistivity of iron is $10.0 \times 10^{-8}\ \Omega$ m whereas that of mercury is $94.0 \times 10^{-8}\ \Omega$ m. Since the resistivity of iron is less than that of mercury, therefore, iron is a better conductor than mercury.

(*b*) Silver metal has the lowest electrical resistivity (of $1.60 \times 10^{-8}\ \Omega$ m), therefore, silver metal is the best conductor of electricity.

NCERT Book, Page 213

Q.1. Draw a schematic diagram of a circuit consisting of a battery of three cells of 2 V each, a 5 Ω resistor, an 8 Ω resistor, and a 12 Ω resistor, and a plug key, all connected in series.

Ans. See Sample Problem 3(*a*) on page 32 of this book.

Q.2. Redraw the circuit of Question 1 putting an ammeter to measure the current through the resistors and a voltmeter to measure the potential difference across the 12 Ω resistor. What would be the reading in the ammeter and the voltmeter ?

Ans. See Sample Problem 3(*b*) on page 32 of this book.

NCERT Book, Page 216

Q.1. Judge the equivalent resistance when the following are connected in parallel :
(*a*) 1 Ω and 10^6 Ω (*b*) 1 Ω, 10^3 Ω and 10^6 Ω

Ans. (*a*) The equivalent resistance of two resistances 1 Ω and 10^6 Ω connected in parallel will be less than 1 Ω. This is because when a number of resistances are connected in parallel, then their equivalent resistance is less than the smallest individual resistance (which is 1 Ω in this case).

(*b*) The equivalent resistance of three resistances 1 Ω , 10^3 Ω and 10^6 Ω connected in parallel will be less than 1 Ω.

Q.2. An electric lamp of 100 Ω, a toaster of resistance 50 Ω, and a water filter of resistance 500 Ω are connected in parallel to a 220 V source. What is the resistance of an electric iron connected to the same source that takes as much current as all three appliances, and what is the current through it ?

Ans. The combined resistance R of three resistors (or electrical devices) R_1, R_2 and R_3, connected in parallel is given by the formula :

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Here, Resistance of electric lamp, $R_1 = 100\ \Omega$
Resistance of toaster, $R_2 = 50\ \Omega$
And, Resistance of water filter, $R_3 = 500\ \Omega$
Putting these values of R_1, R_2 and R_3 in the above formula, we get :

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

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

$$\frac{1}{R} = \frac{16}{500}$$

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

$$R = 31.25\ \Omega$$

Thus, the resistance of electric iron will also be 31.25 Ω.
Now, Potential difference, $V = 220$ V
Current, I = ? (To be calculated)
And, Resistance, R = 31.25 Ω (Calculated above)

By Ohm's law : $\frac{V}{I} = R$

$$\frac{220}{I} = 31.25$$

$$I = \frac{220}{31.25}$$

$$I = 7.04 \text{ A}$$

Thus, the current passing through the electric iron is 7.04 amperes.

Q. 3. What are the advantages of connecting electrical devices in parallel with the battery instead of connecting them in series ?

Ans. The advantages of connecting electrical devices in parallel are the following :

(*i*) In parallel circuits, if one electrical appliance stops working due to some defect, then all other appliances keep working normally. On the other hand, in series circuit, if one electrical appliance stops working due to some defect, then all other appliances also stop working (because the whole circuit is broken).

(*ii*) In parallel circuits, each electrical appliance has its own switch due to which it can be turned on or turned off independently, without affecting other appliances. In series circuit, all the electrical appliances have only one switch due to which they cannot be turned on or turned off independently.

(*iii*) In parallel circuits, each electrical appliance gets the same voltage as that of the battery due to which all the appliances work properly. In series circuit, the appliances do not get the same voltage as that of the battery because the voltage is shared by all the appliances.

(*iv*) In the parallel connection of electrical appliances, the overall resistance of the circuit is reduced due to which the current from the battery is high and hence each electrical appliance can draw the required amount of current. In the series connection of electrical appliances, the overall resistance of the circuit increases too much due to which the current from the battery is low and hence all the electrical appliances cannot draw sufficient current for their proper working.

Q.4. How can three resistors of resistances 2 Ω, 3 Ω, and 6 Ω be connected to give a total resistance of (*a*) 4 Ω, and (*b*) 1 Ω ?

Ans. (*a*) In order to obtain a total resistance of 4 Ω from three resistors of 2 Ω, 3 Ω and 6 Ω :

(*i*) First connect the two resistors of 3 Ω and 6 Ω in parallel to get a total resistance of 2 Ω . This is because in parallel combination :

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

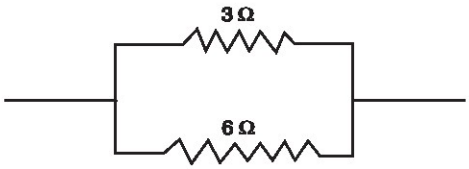
$$\frac{1}{R} = \frac{1}{3} + \frac{1}{6}$$

$$\frac{1}{R} = \frac{2+1}{6}$$

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

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

$$R = 2\ \Omega$$



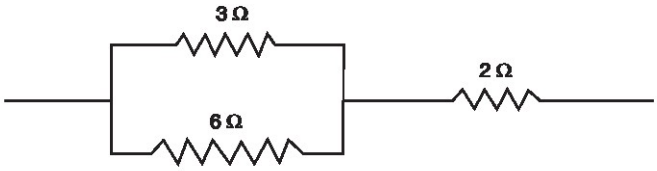
(*ii*) Then the parallel combination of 3 Ω and 6 Ω resistors (which is equivalent to 2 Ω resistance) is connected in series with the remaining 2 Ω resistor to get a total resistance of 4 Ω. This is because in series combination :

$$R = R_1 + R_2$$

$$R = 2 + 2$$

$$R = 4\ \Omega$$

The arrangement of three resistors of 2 Ω , 3 Ω and 6 Ω which gives a total resistance of 4 Ω can now be represented as follows :



Thus, we can obtain a total resistance of 4 Ω by connecting a parallel combination of 3 Ω and 6 Ω resistors in series with 2 Ω resistor.

(*b*) In order to obtain a total resistance of 1 Ω from three resistors of 2 Ω, 3 Ω and 6 Ω, all the three resistors should be connected in parallel. This is because in parallel combination :

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

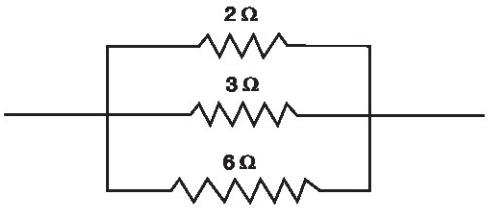
$$\frac{1}{R} = \frac{1}{2} + \frac{1}{3} + \frac{1}{6}$$

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

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

$$R = \frac{6}{6}$$

$$R = 1\ \Omega$$



Q.5. What is (*a*) the highest, and (*b*) the lowest, total resistance that can be secured by the combination of four coils of resistances 4 Ω, 8 Ω, 12 Ω and 24 Ω ?

Ans. (*a*) The highest resistance can be secured (or obtained) by connecting all the four coils in series. In this case :

$$R = R_1 + R_2 + R_3 + R_4$$

$$R = 4 + 8 + 12 + 24$$

$$R = 48\ \Omega$$

Thus, the highest resistance which can be secured is 48 ohms.

(*b*) The lowest resistance can be secured by connecting all the four coils in parallel. In this case :

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$$

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

$$\frac{1}{R} = \frac{6 + 3 + 2 + 1}{24}$$

$$\frac{1}{R} = \frac{12}{24}$$

$$\frac{1}{R} = \frac{1}{2}$$

$$R = 2\ \Omega$$

Thus, the lowest resistance which can be secured is 2 ohms.

NCERT Book, Page 218

Q. 1 Why does the cord of an electric heater not glow while the heating element does ?

Ans. The heating element of an electric heater is made of an alloy (such as nichrome) which has high resistance whereas the cord is made of copper metal which has very, very low resistance. Now, the heating element of an electric heater made of nichrome glows because it becomes red-hot due to the large amount of heat produced on passing current (because of its high resistance). On the other hand, the connecting cord of the electric heater made of copper does not glow because negligible heat is produced in it by passing the same current (due to its extremely low resistance).

Q.2. Compute the heat generated while transferring 96000 coulombs of charge in one hour through a potential difference of 50 V.

Ans. First of all we will calculate the current (I) by using the given values of charge (Q) and time (t). We know that :

$$\text{Current, } I = \frac{Q}{t} = \frac{96000\ \text{C}}{1\ \text{h}} = \frac{96000\ \text{C}}{60 \times 60\ \text{s}}$$

$$\text{or} \qquad I = 26.67\ \text{A} \qquad \text{.....(1)}$$

We will now calculate the resistance by using Ohm's law :

Resistance, $R = \frac{V}{I} = \frac{50\ V}{26.67\ A}$

or $R = 1.87\ \Omega$ .....(2)

And, Time, $t = 1\ h = 60 \times 60\ s$

$= 3600\ s$ ..... (3)

Heat generated, $H = I^2 \times R \times t$

$= (26.67)^2 \times 1.87 \times 3600\ J$

$= 4788397\ J$

$= 4.79 \times 10^6\ J$ or $4.8 \times 10^6\ J$

Thus, the heat generated is 4.8×10^6 joules.

Q.3. An electric iron of resistance 20 Ω takes a current of 5 A. Calculate the heat developed in 30 s.

Ans. Here, Current, $I = 5\ A$

Resistance, $R = 20\ \Omega$

And, Time, $t = 30\ s$

Now, Heat produced, $H = I^2 \times R \times t$

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

$H = 25 \times 20 \times 30$

$H = 15000\ J$

Thus, the heat developed is 15000 joules.

NCERT Book, Page 220

Q.1. What determines the rate at which energy is delivered by a current ?

Ans. Electric power of the appliance.

Q.2. An electric motor takes 5 A from a 220 V line. Determine the power of the motor and the energy consumed in 2 h.

Ans. Here, Voltage, $V = 220\ V$

And, Current, $I = 5\ A$

Now, Power, $P = V \times I$

So, $P = 220 \times 5\ W$

$P = 1100\ W$

Thus, the power of the motor is 1100 watts.

Now, Power, $P = 1100\ W$ (Calculated above)

Time, $t = 2\ h$

$= 2 \times 60 \times 60\ s$

$= 7200\ s$

So, Energy, $E = P \times t$

$E = 1100 \times 7200\ J$

$E = 7.92 \times 10^6\ J$

Thus, the energy consumed is 7.92×10^6 joules.

NCERT Book, Pages 221-222

Q.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. The resistance of wire is *R*. This wire is cut into five equal pieces, so the resistance of each piece of the wire will be $\frac{R}{5}$. Now, five pieces of wire, each piece of wire having resistance of $\frac{R}{5}$ are connected in parallel to give the equivalent resistance R'. So,

$$\frac{1}{R'} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5}$$

$$\frac{1}{R'} = \frac{5}{R} + \frac{5}{R} + \frac{5}{R} + \frac{5}{R} + \frac{5}{R}$$

$$\frac{1}{R'} = \frac{5 + 5 + 5 + 5 + 5}{R}$$

$$\frac{1}{R'} = \frac{25}{R}$$

To obtain the ratio $\frac{R}{R'}$ we multiply both sides of the above equation by R. This will give us :

$$\frac{R}{R'} = \frac{25 \times R}{R}$$

or $$\frac{R}{R'} = 25$$

Thus, the correct answer is : (*d*) 25.

Q.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

Q.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. See Sample Problem 2 on page 53 of this book.

Q.4. Two conducting wires of the same material and of equal lengths and equal diameters are first connected in series and then in parallel in a circuit across the same potential difference. The ratio of heat produced in series and parallel combination would be :
(*a*) 1 : 2 (*b*) 2 : 1 (*c*) 1 : 4 (*d*) 4 : 1

Ans. See Sample Problem 3 on page 64 of this book.

Q.5. How is a voltmeter connected in the circuit to measure the potential difference between two points ?

Ans. The voltmeter is always connected in parallel across the two points (in the circuit) where the potential difference is to be measured.

Q. 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 ?

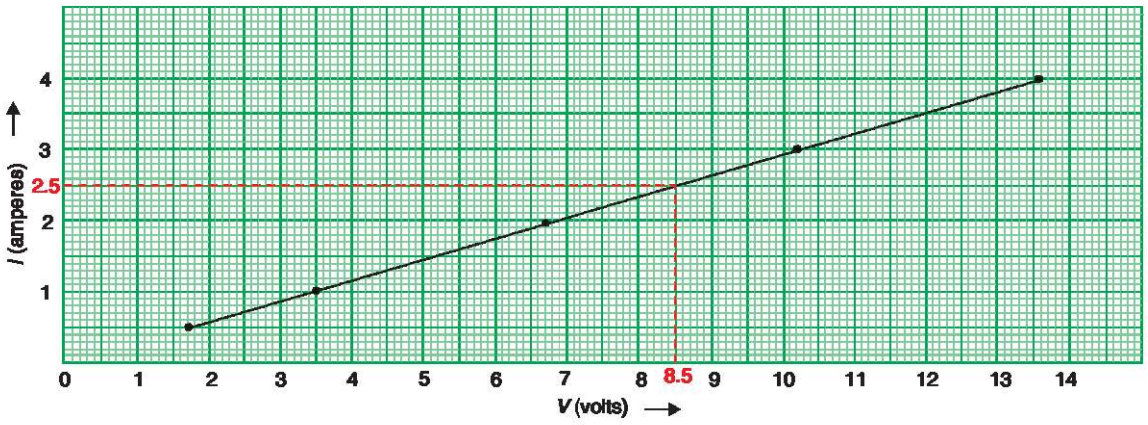
Ans. See Sample Problem 2 on page 24 of this book.

Q.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* (amperes) :**	**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 the resistor.

Ans. The graph between *V* and *I* plotted by using the given data is shown below :



If we look at the above graph, we find that when potential difference *V* is 8.5 volts, then the corresponding current value is 2.5 amperes. Now,

$$\text{Resistance, } R = \frac{V}{I}$$

$$R = \frac{8.5}{2.5}$$

$$R = 3.4\ \Omega$$

Thus, the resistance of the resistor is 3.4 ohms.

Q.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.

Ans. In this problem, the current is given in the units of milliamperes (mA), so the current is to be converted into the units of amperes (A) by dividing the given milliamperes value by 1000.

Here, Potential difference, $V = 12$ V

Current , $I = 2.5$ mA

$$= \frac{2.5}{1000}\ \text{A}$$

$$= 0.0025\ \text{A}$$

And, Resistance, R = ? (To be calculated)

From Ohm's law : $\frac{V}{I} = R$

So, $\frac{12}{0.0025} = R$

And, Resistance, $R = 4800\ \Omega$ (or 4.8 kΩ)

Q.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 ?

Ans. All the resistors are connected in series. So,

Combined resistance, $R = 0.2 + 0.3 + 0.4 + 0.5 + 12$

$$= 13.4\ \Omega$$

Potential difference, $V = 9$ V

And, Current, I = ? (To be calculated)

Current flowing through the whole circuit can be calculated by using Ohm's law :

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

So, $\frac{9}{I} = 13.4$

And, $I = \frac{9}{13.4}$

Current, $I = 0.67$ A

Since the same current flows through all the resistors connected in series in a circuit, therefore, 0.67 ampere of current would flow through the 12 Ω resistor.

Q.10. How many 176 Ω resistors in parallel are required to carry 5 A on a 220 V line ?

Ans. Here, Potential difference (V) is 220 V and current (I) is 5 A.

So, Resistance , $R = \frac{V}{I}$

$$R = \frac{220}{5}$$

$$R = 44\ \Omega$$

Thus, the total resistance of the circuit is 44 ohms. Now, all that we have to do is to find out how many 176 ohm resistors should be connected in parallel to obtain a resultant resistance of 44 Ω. Suppose the number of 176 Ω resistors required is x.

Then : $\frac{1}{44} = \frac{1}{176} \times x$ (Resistances in parallel)

$$44\,x = 176$$

$$x = \frac{176}{44}$$

$$x = 4$$

Thus, 4 resistors of 176 Ω each should be connected in parallel.

Q.11. Show how you would connect three resistors, each of resistance 6 Ω, so that the combination has a resistance of (*i*) 9 Ω, and (*ii*) 4 Ω.

Ans. (*i*) In order to get a resistance of 9 Ω from three resistors of 6 Ω each, we connect two 6 Ω resistors in parallel and then this parallel combination is connected in series with the third 6 Ω resistor [as shown in Figure (*i*)]. This is because : $\frac{1}{R} = \frac{1}{6} + \frac{1}{6} = \frac{1+1}{6} = \frac{2}{6} = \frac{1}{3}$ or $R = 3\ \Omega$; And $3\ \Omega + 6\ \Omega = 9\ \Omega$.

(*i*) (*ii*)

(*ii*) In order to get a resistance of 4 Ω from three resistors of 6 Ω each, we connect all the three 6 Ω resistors in parallel and then connect two such parallel combinations in series [as shown in Figure (*ii*)]. This is because :

$$\frac{1}{R} = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{1+1+1}{6} = \frac{3}{6} = \frac{1}{2} \quad \text{or} \quad R = 2\ \Omega\ ; \text{And } 2\ \Omega + 2\ \Omega = 4\ \Omega\ .$$

Q.12. Several electric bulbs designed to be used on a 220 V electric supply line are rated 10 W each. How many bulbs can be connected in parallel with each other across the two wires of 220 V line if the maximum allowable current is 5 A ?

Ans. First we will calculate the resistance (R) of one bulb by using the given power (P) and voltage (V) values.

Now, Power, $P = \frac{V^2}{R}$

So, $10 = \frac{(220)^2}{R}$

And, $R = \frac{220 \times 220}{10}$

Resistance of 1 bulb, $R = 4840\ \Omega$ .....(1)

We will now calculate the total resistance of the circuit by using the given V (voltage) and I (current) values. Now,

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

So, $\frac{220}{5} = R$

Total resistance, $R = 44\ \Omega$

Thus, the total resistance of the circuit is 44 ohms. Now, all that we have to do is to find out how many 4840 Ω bulbs should be connected in parallel to obtain a total resistance of 44 Ω. Suppose the number of 4840 Ω bulbs required is x. Then :

$$\frac{1}{44} = \frac{1}{4840} \times x \qquad \text{(Resistances in parallel)}$$

$$x = \frac{4840}{44}$$

$$x = 110$$

Thus, 110 bulbs can be connected in parallel in this circuit.

Q.13. 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 ?

Ans. (*i*) *Calculation of current when each coil is used separately*

Here, Potential difference, $V = 220$ V

And, Resistance, $R = 24\ \Omega$ (One coil only)

Now, Current, $I = \frac{V}{R}$

$$I = \frac{220}{24}$$

$$I = 9.17 \text{ A} \quad \text{... (1)}$$

(*ii*) *Calculation of current when the two coils are connected in series*

When the two coils of 24 Ω each are connected in series, then their combined resistance will be 24 Ω + 24 Ω = 48 Ω

Here, Potential difference, $V = 220$ V

And, Resistance, $R = 48\ \Omega$ (Two coils in series)

Now, Current, $I = \frac{V}{R}$

$$I = \frac{220}{48}$$

$$I = 4.58 \text{ A} \quad \text{... (2)}$$

(*iii*) *Calculation of current when the two coils are connected in parallel*

When the two coils of 24 Ω each are connected in parallel, then their combined resistance will be 12 Ω. This is because :

$$\frac{1}{R} = \frac{1}{24} + \frac{1}{24} = \frac{1+1}{24} = \frac{2}{24} = \frac{1}{12} \quad \text{So, } R = 12\ \Omega$$

Here, Potential difference, $V = 220$ V

Resistance, $R = 12\ \Omega$ (Two coils in parallel)

Now, Current, $I = \frac{V}{R}$

$$I = \frac{220}{12}$$

$$I = 18.34 \text{ A} \quad \text{... (3)}$$

Q.14. 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.

(*ii*) a 4 V battery in parallel with 12 Ω and 2 Ω resistors.

Ans. (*i*) *In the First Case :*

Potential difference, $V = 6$ V

Current, $I = ?$ (To be calculated)

And, Resistance, $R = 1\ \Omega + 2\ \Omega$ (Resistors in series)

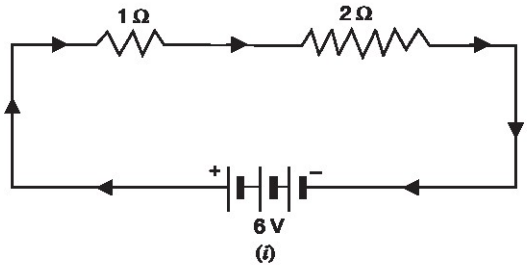
$R = 3\ \Omega$

Now , by Ohm's law : (for whole circuit) $\frac{V}{I} = R$

So, $\frac{6}{I} = 3$

And, Current, $I = \frac{6}{3}$

$I = 2$ A



(*i*)

Thus, the current flowing in the circuit containing 1 Ω and 2 Ω resistors in series is 2 A. In a series circuit, the same current flows throughout the circuit. So, the current flowing through the 2 Ω resistor is also 2 A [see Figure (*i*)]. Now, we know that the current (in 2 Ω resistor) is 2 A and its resistance is 2 Ω.

So, Power used in 2 Ω resistor, $P_1 = I^2 \times R$

(In first case) $P_1 = (2)^2 \times 2$

$P_1 = 4 \times 2$

$P_1 = 8$ W ... (1)

Thus, the power P_1 used in 2 Ω resistor in the first case is 8 watts.

(*ii*) *In the Second Case :*

Here, 4 V battery is attached across the parallel combination of 12 Ω and 2 Ω resistors, so the potential difference across the 2 Ω resistor will also be 4 V [see Figure (*ii*)].

Now, Potential difference, $V = 4$ V (Across the 2 Ω resistor)

And Resistance, $R = 2$ Ω

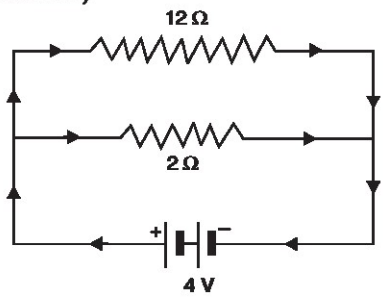
So, Power used in 2 Ω resistor, $P_2 = \frac{V^2}{R}$

(in second case)

$P_2 = \frac{(4)^2}{2}$

$P_2 = \frac{16}{2}$

$P_2 = 8$ W ... (2)



(*ii*)

Thus, the power P_2 used in the 2 Ω resistor in the second case is also 8 watts.

In order to compare the power used in 2 Ω resistor in the two circuits, let us divide P_1 by P_2.

So, $\frac{P_1}{P_2} = \frac{8\text{ W}}{8\text{ W}}$

or $\frac{P_1}{P_2} = 1$

or $P_1 = P_2$

The 2 Ω resistor uses equal power in both the circuits.

Q.15. 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 ?

Ans. In order to solve this problem, first we have to calculate the resistances R_1 and R_2 of two lamps separately.

Now, Power, $P = \frac{V^2}{R}$

For first lamp : $100 = \frac{(220)^2}{R_1}$

Resistance of first lamp, $R_1 = \frac{(220)^2}{100} = \frac{220 \times 220}{100} = \frac{48400}{100}$

$= 484$ Ω ... (1)

Again, Power, $P = \frac{V^2}{R}$

For second lamp : $60 = \frac{(220)^2}{R_2}$

Resistance of second lamp, $R_2 = \frac{(220)^2}{60} = \frac{220 \times 220}{60} = \frac{48400}{60}$

$= 806.7$ Ω ... (2)

The two lamps of resistances 484 Ω and 806.7 Ω are connected in parallel. So, the combined resistance of two lamps can be calculated as follows :

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R} = \frac{1}{484} + \frac{1}{806.7}$$

$$\frac{1}{R} = \frac{806.7 + 484}{484 \times 806.7} = \frac{1290.7}{390442.8}$$

$$R = \frac{390442.8}{1290.7}$$

Total resistance, $R = 302.5\ \Omega$

Current drawn from the line can now be calculated by using Ohm's law as follows :

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

$$\frac{220}{I} = 302.5$$

$$I = \frac{220}{302.5}$$

$I = 0.727$ A or 0.73 A

Thus, the current drawn from line is 0.73 ampere.

Q.16. Which uses more energy, a 250 W TV set in 1 hr or a 1200 W toaster in 10 minutes ?

Ans. (*i*) *For TV set :* Power, $P = 250\ \text{W} = \frac{250}{1000}\ \text{kW} = 0.25\ \text{kW}$

Time, $t = 1$ h

So, Electric energy, $E = P \times t$

(used by TV set) $E = 0.25 \times 1\ \text{kWh}$

$E = 0.25$ kWh ... (1)

(*ii*) *For toaster :* Power, $P = 1200\ \text{W} = \frac{1200}{1000}\ \text{kW} = 1.2\ \text{kW}$

Time, $t = 10\ \text{min} = \frac{10}{60}\ \text{h} = 0.167$ h

So, Electric energy, $E = P \times t$

(used by toaster) $E = 1.2 \times 0.167\ \text{kWh}$

$E = 0.20$ kWh ... (2)

From the above calculations, it is clear that the TV set uses more energy (0.25 kWh) whereas toaster uses less energy (0.20 kWh).

Q.17. An electric heater of resistance 8 Ω draws 15 A from the service mains for 2 hours. Calculate the rate at which heat is developed in the heater.

Ans. The rate at which heat is developed in the electric heater will be given by the power of the heater.

Now, Power, $P = I^2 \times R$

$P = (15)^2 \times 8$

$P = 225 \times 8$

$P = 1800$ W or 1800 J/s

Thus, the rate at which heat is developed in the heater is 1800 joules per second.

Q.18 Explain the following :

(*a*) Why is the tungsten used almost exclusively for the 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 are copper and aluminium wires usually employed for electricity transmission ?

Ans. (*a*) Tungsten is used almost exclusively for making the filaments of electric lamps (or electric bulbs) because it has very high melting point (of 3380°C) due to which the tungsten filament can be kept white-hot without melting away. Moreover, tungsten has high flexibility and low rate of evaporation at high temperature.

(*b*) See Q. 4 on page 321 of this book.

(*c*) The series arrangement is not used for domestic circuits because of the following disadvantages :

(*i*) In series arrangement, if one electrical appliance stops working due to some defect, then all other appliances also stop working (because the whole circuit is broken).

(*ii*) In series arrangement, all the electrical appliances can have only one switch due to which they cannot be turned 'on' or 'off' independently.

(*iii*) In series arrangement, all the appliances do not get the same voltage (220 V) as that of the power supply line (because the line voltage is shared by all the appliances). Due to this, the appliances do not work properly.

(*iv*) In series arrangement of electrical appliances, the overall resistance of the circuit increases too much due to which the current from power supply is low. Because of this, all the appliances of different power ratings cannot draw sufficient current for their proper working.

(*d*) The resistance of a wire is inversely proportional to its area of cross-section. That is : $R \propto \frac{1}{A}$. So, when the area of cross-section of wire increases (or thickness of wire increases), then its resistance decreases. And when the area of cross-section of wire decreases (or thickness of wire decreases), then its resistance increases.

(*e*) Copper and aluminium wires are usually employed for transmission of electricity because copper and aluminium have low electrical resistivity (due to which they are very good conductors of electricity).

Chapter : MAGNETIC EFFECT OF ELECTRIC CURRENT

NCERT Book, Page 224

Q.1. Why does a compass needle get deflected when brought near a bar magnet ?

Ans. A compass needle gets deflected when brought near a bar magnet because the bar magnet exerts a magnetic force on the compass needle which is itself a tiny pivoted magnet (free to move in the horizontal plane).

NCERT Book, Page 228

Q.1. Draw magnetic field lines around a bar magnet.

Ans. See Figure 8 on page 71 of this book.

Q.2. List the properties of magnetic lines of force.

Ans. (*i*) The magnetic lines of force originate from the north pole of a magnet and end at its south pole.

(*ii*) The magnetic lines of force come closer to one another near the poles of a magnet but they are widely separated at other places.

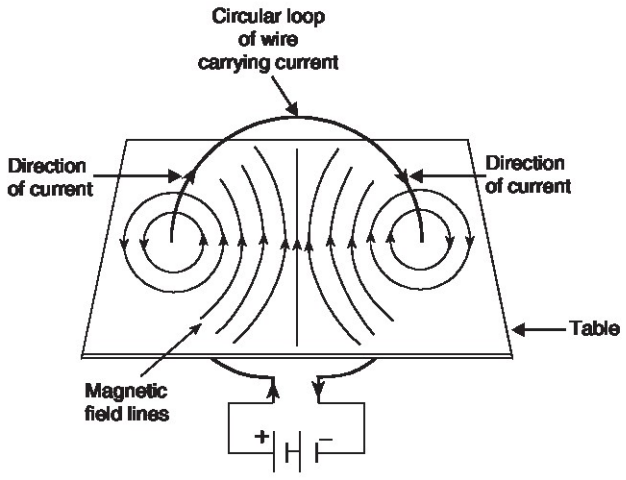
(*iii*) The magnetic lines of force do not intersect (or cross) one another.

Q.3. Why don't two magnetic lines of force intersect with each other ?

Ans. The two magnetic lines of force do not intersect each other because the resultant force on a north pole at any point on a magnetic line of force can be only in one direction. If, however, the two magnetic lines of force intersected (or crossed) each other, it would mean that at the point of intersection, the compass needle would point in two directions at the same time, which is not possible.

NCERT Book, Pages 229-230

Q.1. Consider a circular loop of wire lying in the plane of the table. Let the current pass through the loop clockwise. Apply the right hand rule to find out the direction of the magnetic field inside and outside the loop.



Ans. A circular loop of wire lying in the plane of the table is shown in Figure given alongside. A battery is passing current through the loop of wire in the clockwise direction. Now, by applying Right-hand thumb rule to the left side of circular loop, we find that the direction of magnetic field around it is anticlockwise but the magnetic field is perpendicular to the plane of table (or plane of paper). And by applying Right-hand thumb rule to the right side of circular loop, we find that the direction of magnetic field around it is clockwise but again, the magnetic field is perpendicular to the plane of table (or plane of paper).

Q.2. The magnetic field in a given region is uniform. Draw a diagram to represent it.

Ans. See Sample Problem on page 81 of this book.

Q.3. Choose the correct option :

The magnetic field inside a long, straight solenoid carrying current :

(*a*) is zero

(*b*) decreases as we move towards its end

(*c*) increases as we move towards its end

(*d*) is the same at all points

Ans. (*d*) is the same at all points.

NCERT Book, Pages 231-232

Q.1. Which of the following property/properties of a proton can change while it moves freely in a magnetic field ? (There may be more than one correct answer) :

(*a*) mass (*b*) speed (*c*) velocity (*d*) momentum

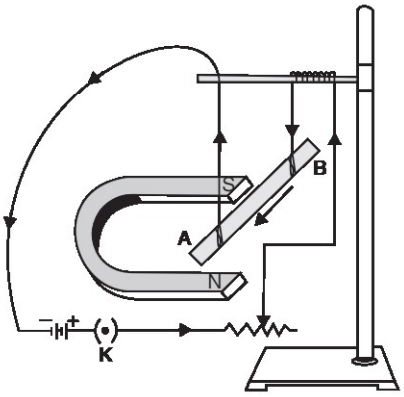
Ans. (*c*) velocity, and (*d*) momentum.

Q.2. A small aluminium rod AB is suspended horizontally from a stand by the ends of two connecting wires as shown in the Figure given here. A horseshoe magnet is placed in such a way that north pole of the magnet is vertically below and its south pole vertically above the aluminium rod. The aluminium rod is connected in series with a battery, a key and a rheostat. How do you think the displacement of rod AB will be affected if :

(*i*) current in rod AB is increased ?

(*ii*) a stronger horseshoe magnet is used ?

(*iii*) length of the rod AB is increased ?



Ans. In order to answer this question, we have to remember that : When a current-carrying conductor is perpendicular to the magnetic field, the force acting on it is directly proportional to (*a*) magnitude of current flowing in the conductor (*b*) strength of magnetic field applied, and (*c*) length of the conductor. And greater the force, greater will be the displacement of the conductor (which is an aluminium rod in this case). Now :

(*i*) if the current in rod AB is increased, then more force will act on the rod and hence the displacement of rod will also be more.

(*ii*) if a stronger horseshoe magnet is used, then the strength of magnetic field will increase leading to greater force on the rod. And due to greater force, the displacement of rod will also be more.

(*iii*) If the length of rod AB is increased, then more force will act on the rod and hence the displacement of rod will also be more.

Q.3. A positively charged particle (alpha particle) projected towards west is deflected towards north by a magnetic field. The direction of magnetic field is :

(*a*) towards south (*b*) towards east (*c*) downward (*d*) upward

Ans. (*d*) upward (For details, see Sample Problem 1 on page 88 of this book).

NCERT Book, Page 233

Q.1. State Flemings left-hand rule.

Ans. See page 87 of this book.

Q.2. What is the principle of an electric motor ?

Ans. See page 89 of this book.

Q.3. What is the role of the split ring in an electric motor ?

Ans. The role of the split ring (called commutator) in an electric motor is to reverse the direction of current flowing through the motor coil after every half rotation of the coil. Due to this reversing of current, the direction of force remains unchanged on the two sides of the coil and hence the coil continues to rotate in the same direction.

NCERT Book, Page 236

Q.1. State different ways to induce current in a coil.

Ans. (*i*) The current can be induced in a coil by rotating it in the magnetic field between the poles of a U-shaped magnet.

(*ii*) The current can be induced in the coil by keeping it stationary and rotating a magnet inside it.

(*iii*) The current can be induced in a coil by changing the current continuously in 'another coil' kept near it.

NCERT Book, Page 237

Q.1. State the principle of an electric generator.

Ans. The electric generator works on the principle that when a straight conductor is moved in a magnetic field, then current is induced in the conductor.

Q.2. Name some sources of direct current.

Ans. Dry cell, Dry cell battery, Car battery, Solar cell and D.C. generator.

Q.3. Which sources produce alternating current ?

Ans. A.C. generators (or Power house generators), Car alternators and Bicycle dynamos.

Q.4. Choose the correct option :

A rectangular coil of copper wires is rotated in a magnetic field. The direction of the induced current changes once in each :

(*a*) two revolutions (*b*) one revolution (*c*) half revolution (*d*) one-fourth revolution

Ans. (*c*) half revolution.

NCERT Book, Page 238

Q.1. Name two safety measures commonly used in electric circuits and appliances.

Ans. See Sample Problem 4 on page 112 of this book.

Q.2. An electric oven of 2 kW power rating is operated in a domestic electric circuit (220 V) that has a current rating of 5 A. What result do you expect ? Explain.

Ans. See Sample Problem 1 on page 111 of this book.

Q.3. What precautions should be taken to avoid the overloading of domestic electric circuits ?

Ans. See Sample Problem 3 on page 112 of this book.

NCERT Book, Pages 240-241

Q.1. Which of the following correctly describes the magnetic field near a long straight wire ?

(*a*) The field consists of straight lines perpendicular to the wire

(*b*) The field consists of straight lines parallel to the wire

(*c*) The field consists of radial lines, originating from the wire

(*d*) The field consists of concentric circles centred on the wire

Ans. (*d*) The field consists of concentric circles centred on the wire.

Q.2. The phenomenon of electromagnetic induction is :

(*a*) the process of charging a body

(*b*) the process of generating magnetic field due to a current passing through a coil

(*c*) producing induced current in a coil due to relative motion between a magnet and the coil

(*d*) the process of rotating a coil of an electric motor

Ans. (*c*) producing induced current in a coil due to relative motion between a magnet and the coil.

Q.3. The device used for producing electric current is called a :

(*a*) generator (*b*) galvanometer (*c*) ammeter (*d*) motor

Ans. (*a*) generator

Q.4. The essential difference between an AC generator and a DC generator is that :

(*a*) AC generator has an electromagnet while a DC generator has permanent magnet

(*b*) DC generator will generate a higher voltage

(*c*) AC generator will generate a higher voltage

(*d*) AC generator has slip rings while the DC generator has a commutator

Ans. (*d*) AC generator has slip rings while the DC generator has a commutator.

Q.5. At the time of short circuit, the current in the circuit :

(*a*) reduces substantially (*b*) does not change

(*c*) increases heavily (*d*) varies continuously

Ans. (*c*) increases heavily.

Q.6. State whether the following statements are true or false :

(*a*) An electric motor converts mechanical energy into electrical energy

(b) An electric generator works on the principle of electromagnetic induction
(c) The field at the centre of a long circular coil carrying current will be parallel straight lines
(d) A wire with a green insulation is usually the live wire of an electric supply

Ans. (a) False (b) True (c) True (d) False

Q.7. List three sources of magnetic fields.

Ans. Magnetic fields can be produced :
(i) by using a permanent magnet
(ii) by passing electric current through a straight wire or a circular coil (solenoid)
(iii) by using an electromagnet

Q.8. How does a solenoid behave like a magnet ? Can you determine the north and south poles of a current carrying solenoid with the help of a bar magnet ? Explain.

Ans. (a) One end of a current-carrying solenoid acts like a north pole (N-pole) and the other end a south pole (S-pole). So, if a current-carrying solenoid is suspended freely by tying a thread in the middle, it will come to rest pointing in the north and south directions (just like a freely suspended bar magnet).

(b) We can determine the north and south poles of a current-carrying solenoid by using a bar magnet. This can be done as follows : We bring the north pole of a bar magnet near both the ends of a freely suspended current-carrying solenoid. The end of solenoid which will be repelled by the north pole of bar magnet and move away from it, will be its north pole. And the end of solenoid which will be attracted by the north pole of the bar magnet and move towards it, will be its south pole.

Q.9. When is the force experienced by a current-carrying conductor placed in a magnetic field largest ?

Ans. The force experienced by a current-carrying conductor placed in a magnetic field is the largest when the current-carrying conductor is perpendicular to the direction of magnetic field.

Q.10. Imagine that you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally from back wall towards the front wall is deflected by a strong magnetic field to your right side. What is the direction of magnetic field ?

Ans. See Sample Problem 2 on page 88 of this book.

Q.11. Draw a labelled diagram of an electric motor. Explain its principle and working. What is the function of a split ring in an electric motor ?

Ans. See page 89 of this book.

Q.12. Name some devices in which electric motors are used.

Ans. Electric motors are used in electric fans, coolers, refrigerators, mixer and grinders, washing machines, water pumps and electric cars.

Q.13. A coil of insulated copper wire is connected to a galvanometer. What will happen if a bar magnet is (i) pushed into the coil (ii) held stationary inside the coil (iii) withdrawn from inside the coil ?

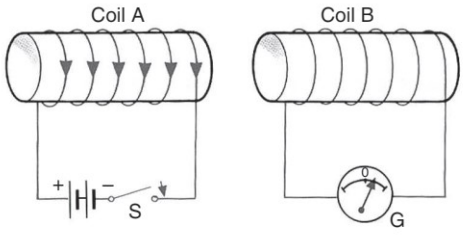
Ans. See Sample Problem 1 on page 102 of this book.

Q.14. Two circular coils A and B are placed close to each other. If the current in the coil A is changed, will some current be induced in the coil B ? Give reason.

Ans. If the current in coil A is 'switched on' or 'switched off', then an electric current is induced in the coil B (see Figure given here). This can be explained as follows :

(i) When we switch on current in coil A, it becomes an electromagnet and produces a magnetic field around coil B. The effect is just the same as pushing a magnet into coil B. So, an induced current flows in coil B for a moment. When the current in coil A becomes steady, its magnetic field also becomes steady and the current in coil B stops.

(ii) When we switch off the current in coil A, then its magnetic field in coil B stops quickly. This effect is just the same as pulling a magnet quickly out of coil B. So, in this case an induced current flows in coil B in the opposite direction.



Q.15. State the rule to determine the direction of a :

(*i*) magnetic field produced around a straight conductor carrying current.

(*ii*) force experienced by a current-carrying straight conductor placed in a magnetic field which is perpendicular to it.

(*iii*) current induced in a straight conductor moving in a magnetic field.

Ans. (*i*) The direction of magnetic field produced around a straight current-carrying conductor is determined by using Maxwell's right hand thumb rule (For statement, see page 76 of this book).

(*ii*) The direction of force experienced by a current-carrying straight conductor placed in a magnetic field is determined by Fleming's left-hand rule (For statement, see page 87 of this book).

(*iii*) The direction of current induced in a straight conductor moving in a magnetic field is determined by Fleming's right-hand rule (For statement, see page 96 of this book).

Q.16. Explain the underlying principle and working of an electric generator by drawing a labelled diagram. What is the function of brushes ?

Ans. See page 98 of this book.

Q.17. When does an electric short circuit occur ?

Ans. An electric short circuit takes place when the live wire and the neutral wire of electricity supply line touch each other directly. This occurs when the plastic insulation of live wire and neutral wire get torn or when there is a fault in the electrical appliance.

Q.18. Why is it necessary to earth metallic appliances ? What is the function of an earth wire ?

Ans. The metal body of an electrical appliance is 'earthed' or connected by means of a metal wire to the earth (which is at zero potential) to avoid the risk of electric shocks. This is because if, by chance, the live wire at the high potential of 220 volts touches the metal case of the electrical appliance, then the current passes from the electrical appliance directly to the earth through the low resistance earth wire. Since the current does not pass through our body, we do not get an electric shock. Thus, the function of an earth wire is to provide an easy passage to the leaking current from an electrical appliance to go into the earth and hence prevent electric shocks to the user of electrical appliance.

Chapter : SOURCES OF ENERGY

NCERT Book, Page 243

Q.1. What is a good source of energy ?

Ans. A good source of energy is one :

(*i*) which would give a large amount of energy per unit mass (or per unit volume)

(*ii*) which is cheap and easily available

(*iii*) which is easy to store and transport

(*iv*) which is safe to handle and use, and

(*v*) which does not cause environmental pollution.

Q.2. What is a good fuel ?

Ans. A good fuel is one :

(*i*) which has a high calorific value,

(*ii*) which has a proper ignition temperature,

(*iii*) which burns without giving out any smoke or harmful gases,

(*iv*) which burns smoothly and does not leave behind much ash after burning, and

(*v*) which is cheap, easily available, easy to handle, safe to transport and convenient to store.

Q.3. If you could use any source of energy for heating your food, which one would you use and why ?

Ans. I would use LPG (cooking gas) for heating food because :

(*i*) LPG has a high calorific value. It gives a lot of heat (per unit mass) on burning.

(*ii*) LPG burns with a smokeless flame and hence does not cause any air pollution.

(*iii*) LPG does not produce any poisonous gases on burning

(*iv*) LPG does not leave behind any ash after burning

NCERT Book, Page 248

Q.1. What are the disadvantages of fossil fuels ?

Ans. Coal, petroleum and natural gas are fossil fuels. The burning of fossil fuels has the following disadvantages :

(*i*) Fossil fuels are non-renewable sources of energy. Once exhausted, fossil fuels will not be available to us in the near future.

(*ii*) The burning of fossil fuels causes a lot of air pollution. This is described below :

(*a*) The burning of fossil fuels produces acidic gases such as sulphur dioxide and nitrogen oxides which cause acid rain. The acid rain damages plants (crops, etc.) , reduces fertility of soil by making it acidic, poses a danger to aquatic life (like fish) by making the water of lakes and rivers acidic, and damages buildings by corroding them slowly.

(*b*) The burning of fossil fuels produces large amount of carbon dioxide gas which goes into air. The presence of increasing amounts of carbon dioxide gas in air is causing increased greenhouse effect leading to excessive heating of the earth. This global warming is harmful for all the life on earth.

(*c*) The burning of fossil fuels (especially coal) produces smoke which pollutes the air. The burning of coal leaves behind a lot of ash. It also puts tiny particles of ash (called fly-ash) into the air causing air pollution.

Q.2. Why are we looking at alternative sources of energy ?

Ans. We are looking at alternative sources of energy mainly due to two reasons :

(*i*) because the fossil fuels and nuclear fuels present in the earth are limited which may not last for long, and

(*ii*) because of the undesirable effects of pollution both from the burning of fossil fuels and from the radioactive wastes of the nuclear power plants.

Q.3. How has the traditional use of wind and water energy been modified for our convenience ?

Ans. (*i*) The traditional use of wind energy has been modified by the improvements in technology to generate electricity through wind-powered generators.

(*ii*) The traditional use of energy of flowing water has been modified by improvements in technology to generate electricity through flowing water-powered generators (by establishing hydropower plants).

NCERT Book, Page 253

Q.1. What kind of mirror–concave, convex or plane–would be best suited for use in a solar cooker ? Why ?

Ans. A concave mirror reflector would be best suited for use in a solar cooker. This is because a concave reflector converges a large amount of sun's heat rays to a small area at its focus due to which a high temperature is produced in its focus area (which is suitable for baking and frying). Such a high temperature cannot be achieved in a solar cooker by using a plane mirror reflector. Convex mirror reflector, being a diverging mirror, cannot be used at all in a solar cooker.

Q.2. What are the limitations of energy that can be obtained from the oceans ?

Ans. The energy from the oceans can be obtained mainly in three forms : Tidal energy, Wave energy and Ocean thermal energy. Some of the important limitations of these forms of energy are as follows :

(*i*) There are very few places around the world where barrages (or dams) can be built to harness tidal energy. Moreover, the rise and fall of water during high and low tides is not enough to generate electricity on a large scale.

(*ii*) The wave energy can be harnessed only at those places where the sea-waves are very strong. The efficiency of power plants based on wave energy is very low. Moreover, the power plants built in oceans or at sea-shores have high cost of installation, corrode easily and need a lot of maintenance.

(*iii*) A temperature difference of 20°C (or more) between the surface water of ocean and deeper water is necessary to harness ocean thermal energy. The efficiency of OTEC power plants which work by utilising ocean thermal energy, is very low. Moreover, it is very expensive to establish OTEC power plants.

Q.3. What is geothermal energy ?

Ans. Geothermal energy is the heat energy from hot rocks present inside the earth. This heat comes from the fission of radioactive materials which are naturally present in these rocks. Geothermal energy is available only at some places in the world. Geothermal energy can be used to produce electricity.

Q.4. What are the advantages of nuclear energy ?

Ans. See page 156 of this book.

NCERT Book, Page 253

Q.1. Can any source of energy be pollution free ? Why or why not ?

Ans. In reality, no source of energy can be said to be pollution free. The use of each and every source of energy disturbs the environment in one way or the other. For example, though the use of a wind generator, solar cooker and solar cells for obtaining energy is pollution free but the processes involved in making the materials for these energy devices must have caused some pollution and damaged the environment in one way or the other.

Q.2. Hydrogen has been used as a rocket fuel. Would you consider it a cleaner fuel than CNG ? Why or why not ?

Ans. See Sample Problem on page 160 of this book.

NCERT Book, Page 254

Q.1. Name two energy sources that you would consider to be renewable. Give reasons for your choices.

Ans. Hydroenergy (Energy from flowing water) and Biomass energy (Energy from biofuels such as wood) are the renewable sources of energy.

(*i*) Hydroenergy is a renewable source of energy because it is supplied by the water cycle in nature (powered by sun's energy) and it will never get exhausted.

(*ii*) Biomass energy contained in wood is a renewable source of energy because if trees are cut from the forest for obtaining wood, then more trees will grow in the forest in due course of time.

Q.2. Give the names of two energy sources that you would consider to be exhaustible. Give reasons for your choices.

Ans. Exhaustible sources of energy means non-renewable sources of energy. Coal and petroleum are the two exhaustible sources of energy (or non-renewable sources of energy). This is due to the following reasons : Coal and petroleum are fossil fuels which were formed in the earth very, very slowly. The coal and petroleum which are present in the earth today have taken millions of years to form and get accumulated. So, if all the coal and petroleum present in earth get exhausted, they cannot be produced quickly in nature. We will not get any coal or petroleum in the near future.

NCERT Book, Pages 254-255

Q.1. A solar water heater cannot be used to get hot water on :

(*a*) a sunny day (*b*) a cloudy day (*c*) a hot day (*d*) a windy day

Ans. (*b*) a cloudy day.

Q.2. Which of the following is not an example of a bio-mass energy source ?

(*a*) wood (*b*) gobar gas (*c*) nuclear energy (*d*) coal

Ans. (*c*) nuclear energy

Q.3. Most of the sources of energy we use represent stored solar energy. Which of the following is not ultimately derived from the sun's energy ?

(*a*) geothermal energy (*b*) wind energy (*c*) fossil fuels (*d*) biomass

Ans. (*a*) geothermal energy

Q.4. Compare and contrast fossil fuels and the sun as direct sources of energy.

Ans. See page 140 of this book.

Q.5. Compare and contrast bio-mass and hydroelectricity as sources of energy.

Ans. See page 146 of this book.

Q.6. What are the limitations of extracting energy from :

(*a*) wind ? (*b*) waves ? (*c*) tides ?

Ans. *(a) Limitations of extracting energy from wind :*

(*i*) Wind generators to produce electricity can be established only at those places where wind blows for the greater part of the year.

(*ii*) The wind speed should be higher than 15 km/h to maintain the required speed of wind turbines for generating electricity.

(*iii*) There should be some back-up facilities like storage cells to take care of energy needs during the period there is no wind.

(*iv*) A large area of land is required for establishing wind energy farms

(*v*) The initial cost of establishing wind energy farms is quite high.

(b) Limitations of extracting energy from waves (or sea-waves) :

(*i*) The wave energy can be harnessed at only those places where the sea-waves are very strong.

(*ii*) The efficiency of power plants based on wave energy is very low.

(*iii*) The power plants built in oceans or at sea-shores have high cost of installation, corrode easily and need a lot of maintenance.

(c) Limitations of extracting energy from tides :

(*i*) There are very few sites around the world which are suitable for building tidal barrages (or tidal dams).

(*ii*) The rise and fall of sea-water during high and low tides is not enough to generate electricity on a large scale.

Q.7. On what basis would you classify energy sources as :

(*a*) renewable and non-renewable ?

(*b*) inexhaustible and exhaustible ?

Are the options given in (*a*) and (*b*) the same ?

Ans. The options given in (*a*) and (*b*) are the same. This is because renewable sources of energy are also known as inexhaustible sources of energy whereas non-renewable sources of energy are also called exhaustible sources of energy.

(*i*) Those sources of energy which are being produced in nature continuously and can be used again and again for ever, are called renewable sources of energy (or inexhaustible sources of energy). These sources of energy will never get exhausted. For example, wood is a renewable source of energy (or inexhaustible source of energy), because if some trees are cut down from forests for obtaining firewood, then more trees will grow in the forest on their own or can be replanted by man. This will ensure continuous supply of wood for obtaining heat energy.

(*ii*) Those sources of energy which have accumulated in the earth over very, very long time of millions of years and cannot be made quickly when used up completely, are called non-renewable sources of energy (or exhaustible sources of energy). These sources of energy will get exhausted sooner or later. For example, coal is a non-renewable source of energy (or exhaustible source of energy) because coal has accumulated in the earth over a very, very long time, and if all the coal gets used up completely, it cannot be produced quickly in nature.

Q.8. What are the qualities of an ideal source of energy ?

Ans. An ideal source of energy has the following qualities :

(*i*) It gives a large amount of energy per unit mass (or per unit volume).

(*ii*) It does not cause any environmental pollution.

(*iii*) It is easy to store and safe to transport

(*iv*) It is safe to handle and use

(*v*) It is cheap and easily available.

Q.9. (*a*) What are the advantages and disadvantages of using a solar cooker ?
(*b*) Are there any places where solar cookers would have limited utility ?

Ans. (*a*) See page 138 of this book.

(*b*) The solar cookers have limited utility at those places which usually remain cloudy and have long winters. An example of such places are hilly areas.

Q.10. (*a*) What are the environmental consequences of the increasing demand for energy ?
(*b*) What steps would you suggest to reduce energy consumption ?

Ans. (*a*) *Some of the environmental consequences of the increasing demand for energy are the following :*

(*i*) The combustion of fossil fuels is producing acid rain and damaging plants (crops), soil, aquatic life and buildings.

(*ii*) The burning of fossil fuels is increasing the amount of greenhouse gas carbon dioxide in the atmosphere leading to global warming.

(*iii*) The cutting down of forest trees (deforestation) for obtaining firewood is causing soil erosion and destroying wildlife.

(*iv*) The construction of hydropower plants is disturbing ecological balance.

(*v*) Nuclear power plants are increasing radioactivity in the environment.

(*b*) *Some of the steps which can be taken to reduce energy consumption are as follows :*

(*i*) Switch off lights, fans, TV and other such electrical appliances when not needed, to save electricity.

(*ii*) Use energy efficient electrical appliances such as compact fluorescent lamps (CFLs) and tube-lights to save electricity.

(*iii*) Good quality stoves should be used to burn fuels like kerosene and LPG so as to obtain maximum heat.

(*iv*) Pressure cookers should be used for cooking food to save fuel.

(*v*) Solar cookers should be used to cook food wherever possible and solar water heaters should be used to get hot water.

(*vi*) Bicycles should be used for short distances instead of scooters, motorcycles and cars so as to save petrol.

Chapter : LIGHT– REFLECTION AND REFRACTION

NCERT Book, Page 168

Q.1. Define the principal focus of a concave mirror.

Ans. The principal focus of a concave mirror is a point on its principal axis to which all the light rays which are parallel and close to the axis, converge after reflection from the concave mirror.

Q.2. The radius of curvature of a spherical mirror is 20 cm. What is its focal length ?

Ans. See Sample Problem on page 178 of this book.

Q.3. Name a mirror that can give an erect and enlarged image of an object.

Ans. Concave mirror.

Q.4. Why do we prefer a convex mirror as a rear-view mirror in vehicles ?

Ans. We prefer a convex mirror as a rear-view mirror in vehicles because of the following reasons :

(*i*) A convex mirror always produces an erect image (right side up image) of the objects.

(*ii*) The image formed in a convex mirror is highly diminished or much smaller than the object, due to which a convex mirror gives a wide field of view (of the traffic behind).

NCERT Book, Page 171

Q.1. Find the focal length of a convex mirror whose radius of curvature is 32 cm.

Ans. $$\text{Focal length} = \frac{\text{Radius of curvature}}{2}$$

or $$f = \frac{R}{2}$$

$$f = \frac{32}{2}\text{ cm}$$

$$f = 16\text{ cm}$$

Thus, the focal length of convex mirror is 16 centimetres.

Q.2. A concave mirror produces three times magnified (enlarged) real image of an object placed at 10 cm in front of it. Where is the image located ?

Ans. See Sample Problem 3 on page 197 of this book.

NCERT Book, Page 176

Q.1. A ray of light travelling in air enters obliquely into water. Does the light ray bend towards the normal or away from the normal ? Why ?

Ans. When a ray of light travelling in air enters obliquely into water, it bends towards the normal. This is because water is optically denser (than air) due to which the speed of light waves decreases on entering water, making the light bend towards the normal.

Q.2. Light enters from air to glass having refractive index 1.50. What is the speed of light in the glass ? The speed of light in vacuum is 3×10^8 m s^{-1}.

Ans. See Sample Problem on page 225 of this book.

Q. 3. Find out from Table on page 225 the medium having highest optical density. Also find the medium with lowest optical density.

Ans. (*a*) The medium having highest refractive index has the highest optical density. Since diamond has the highest refractive index (2.42), therefore, diamond has the highest optical density.

(*b*) The medium having lowest refractive index has the lowest optical density. Since air has the lowest refractive index (1.0003), therefore, air has the lowest optical density.

Q.4. You are given kerosene, turpentine and water. In which of these the light travels fastest ? Use the information given in Table on page 225.

Ans. The light travels fastest in that medium which has the lowest refractive index. Now, the refractive index of

kerosene is 1.44, the refractive index of turpentine is 1.47 whereas the refractive index of water is 1.33. Here water has the lowest refractive index (of 1.33), so light travels fastest in water.

Q.5. The refractive index of diamond is 2.42. What is the meaning of this statement ?

Ans. By saying that the refractive index of diamond is 2.42, we mean that the ratio of speed of light in air (or vacuum) to the speed of light in diamond is equal to 2.42.

NCERT Book, Page 184

Q.1. Define 1 dioptre of power of a lens.

Ans. 1 dioptre is the power of a lens whose focal length is 1 metre.

Q.2. A convex lens forms a real and inverted image of a needle at a distance of 50 cm from it. Where is the needle placed in front of the convex lens if the image is equal in size to the object ? Also find the power of the lens.

Ans. See Sample Problem 7 on page 259 of this book.

Q.3. Find the power of a concave lens of focal length 2 m.

Ans. The focal length of a concave lens is considered negative and hence written with a minus sign.

So, Focal length of concave lens, $f = -2$ m (or –2 metres)

Now, $\text{Power, } P = \dfrac{1}{f(\text{in metres})}$

or $P = \dfrac{1}{-2}$

Thus, Power, $P = -0.5$ dioptre (or, – 0.5 D)

NCERT Book, Pages 185-186

Q.1. Which one of the following materials cannot be used to make a lens ?

(a) water (b) glass (c) plastic (d) clay

Ans. (*d*) clay.

Q.2. The image formed by a concave mirror is observed to be virtual, erect and larger than the object. Where should be the position of the object ?

(a) between the principal focus and the centre of curvature

(b) at the centre of curvature

(c) beyond the centre of curvature

(d) between the pole of the mirror and its principal focus.

Ans. (*d*) between the pole of the mirror and its principal focus

Q.3. Where should an object be placed in front of a convex lens to get a real image of the size of the object ?

(a) at the principal focus of the lens

(b) at twice the focal length

(c) at infinity

(d) between the optical centre of the lens and its principal focus

Ans. (*b*) at twice the focal length.

Q.4. A spherical mirror and a thin spherical lens each have a focal length of, –15 cm. The mirror and the lens are likely to be :

(a) both concave

(b) both convex

(c) the mirror is concave and the lens is convex

(d) the mirror is convex but the lens is concave

Ans. (*a*) both concave.

Q.5. No matter how far you stand from a mirror, your image appears erect. The mirror is likely to be :

(a) plane (b) concave (c) convex (d) either plane or convex

Ans. (*d*) either plane or convex

Q.6. Which of the following lenses would you prefer to use while reading small letters found in a dictionary ?
(*a*) A convex lens of focal length 50 cm
(*b*) A concave lens of focal length 50 cm
(*c*) A convex lens of focal length 5 cm
(*d*) A concave lens of focal length 5 cm

Ans. (*c*) A convex lens of focal length 5 cm

Q.7. We wish to obtain an erect image of an object using a concave mirror of focal length 15 cm. What should be the range of distance of the object from the mirror ? What is the nature of the image ? Is the image larger or smaller than the object ? Draw a ray diagram to show the image formation in this case.

Ans. See Sample Problem 1 on page 187 of this book.

Q.8. Name the type of mirror used in the following situations :
(*a*) Headlights of a car
(*b*) Side/rear view mirror of a vehicle
(*c*) Solar furnace
Support your answer with reason.

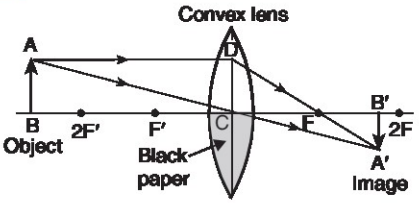
Ans. (*a*) A concave mirror is used in the headlights of a car. This is because when, a lighted bulb is placed at the focus of the concave reflector, then the concave reflector produces a powerful beam of parallel light rays. This beam of light helps us to see things up to a considerable distance in the darkness of night.

(*b*) A convex mirror is used as side-view mirror (or rear-view mirror) in a vehicle. This is because (*i*) a convex mirror always produces an erect image of the objects, and (*ii*) the image formed in a convex mirror is highly diminished due to which a convex mirror gives a wide field of view (of the traffic behind).

(*c*) A concave mirror is used in a solar furnace. This is because when the solar furnace is placed at the focus of a large concave reflector, then the concave reflector converges and focuses the sun's heat rays on the furnace due to which the solar furnace gets very hot.

Q.9. One half of a convex lens is covered with a black paper. Will this lens produce a complete image of the object ? Verify your answer experimentally. Explain your observations.

Ans. The convex lens half covered with a black paper will produce a complete image of an object (as shown in the Figure alongside). We can verify this by obtaining the image of a tree (or a window) on a screen by using this half covered convex lens. The full image of an object is produced by this convex lens (which is half covered with a black paper) because light rays can still pass through its optical centre (as shown in Figure given here).



Q.10. An object 5 cm in length is held 25 cm away from a converging lens of focal length 10 cm. Draw the ray diagram and find the position, size and nature of the image formed.

Ans. A converging lens means a convex lens. Now, first of all we will find the position of image by calculating the image distance v.

Here, Object distance, $u = -25$ cm (It is to the left of lens)
Image distance, $v = ?$ (To be calculated)
And, Focal length, $f = +10$ cm (It is a converging lens or convex lens)

Now, putting these values in the lens formula :

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

We get :

$$\frac{1}{v} - \frac{1}{-25} = \frac{1}{10}$$

$$\frac{1}{v} + \frac{1}{25} = \frac{1}{10}$$

$$\frac{1}{v} = \frac{1}{10} - \frac{1}{25}$$

$$\frac{1}{v} = \frac{5-2}{50}$$

$$\frac{1}{v} = \frac{3}{50}$$

$$v = +\frac{50}{3}$$

$$v = +16.67 \text{ cm}$$

Thus, the position of image is at a distance of 16.67 cm from the lens. The plus sign for image distance shows that the image is formed on the right side of lens (or behind the lens) and that the nature of image is real and inverted.

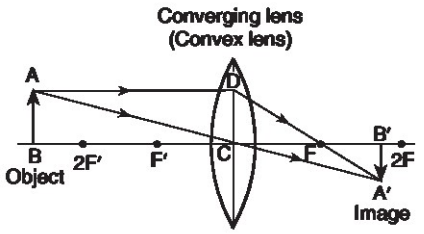
Let us calculate the magnification now. For a lens :

$$\text{Magnification, } m = \frac{v}{u}$$

$$m = \frac{16.67}{-25}$$

$$m = -0.66$$

We will now calculate the size of image h_2 by knowing the size of object h_1 and value of m.



$$\text{Now, } m = \frac{h_2}{h_1}$$

$$\text{So, } -0.66 = \frac{h_2}{5}$$

$$h_2 = -0.66 \times 5$$

$$h_2 = -3.3 \text{ cm}$$

Thus, the size of image is 3.3 cm. The negative sign of the size of image shows that the image is inverted.

Q.11. A concave lens of focal length 15 cm forms an image 10 cm from the lens. How far is the object from the lens ? Draw the ray diagram.

Ans. In this question, we have to calculate the object distance u.

Here, Object distance, u = ? (To be calculated)

Image distance, $v = -10$ cm (To the left of concave lens)

And, Focal length, $f = -15$ cm (It is a concave lens)

Now, putting these values in the lens formula :

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

We get :

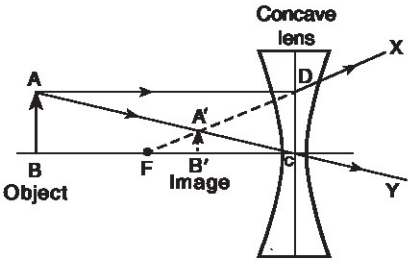
$$\frac{1}{-10} - \frac{1}{u} = \frac{1}{-15}$$

$$-\frac{1}{u} = -\frac{1}{15} + \frac{1}{10}$$

$$-\frac{1}{u} = \frac{-2+3}{30}$$

$$-\frac{1}{u} = \frac{1}{30}$$

Object distance, $u = -30$ cm



Thus, the object is placed at a distance of 30 cm from the concave lens. The minus sign with object distance shows that the object is on its left side.

Q.12. An object is placed at a distance of 10 cm from a convex mirror of focal length 15 cm. Find the position and nature of the image.

Ans. We can find the position of image by calculating the image distance, v.

Here, Object distance, $u = -10$ cm (To the left of mirror)
Image distance, $v = ?$ (To be calculated)
And, Focal length, $f = +15$ cm (It is a convex mirror)
Putting these values in the mirror formula :

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

We get :

$$\frac{1}{v} + \frac{1}{-10} = \frac{1}{15}$$

$$\frac{1}{v} - \frac{1}{10} = \frac{1}{15}$$

$$\frac{1}{v} = \frac{1}{15} + \frac{1}{10}$$

$$\frac{1}{v} = \frac{2+3}{30}$$

$$\frac{1}{v} = \frac{5}{30}$$

$$\frac{1}{v} = \frac{1}{6}$$

So, Image distance, $v = +6$ cm
Thus, the position of image is at a distance of 6 cm from the convex mirror on its right side (behind the mirror). Since the image is formed behind the convex mirror, therefore, the nature of image is virtual and erect.

Q.13. The magnification produced by a plane mirror is +1. What does this mean ?

Ans. See Sample Problem 4 on page 197 of this book.

Q.14. An object 5.0 cm in length is placed at a distance of 20 cm in front of a convex mirror of radius of curvature 30 cm. Find the position of the image, its nature and size.

Ans. Here, Object distance, $u = -20$ cm (To the left of mirror)
Image distance, $v = ?$ (To be calculated)
Radius of curvature, $R = +30$ cm (It is a convex mirror)

So, Focal length, $f = \frac{R}{2} = \frac{30}{2} = +15$ cm

Now, putting these values of u and f in the mirror formula :

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

We get :

$$\frac{1}{v} + \frac{1}{-20} = \frac{1}{15}$$

$$\frac{1}{v} - \frac{1}{20} = \frac{1}{15}$$

$$\frac{1}{v} = \frac{1}{15} + \frac{1}{20}$$

$$\frac{1}{v} = \frac{4+3}{60}$$

$$\frac{1}{v} = \frac{7}{60}$$

$$v = \frac{60}{7}$$

or

$$v = +8.57 \text{ cm}$$

Thus, the position of image is 8.57 cm behind the mirror (on its right side). Since the image is formed behind the convex mirror, therefore, the nature of image is virtual and erect.

Now, For a mirror, Magnification, $m = -\frac{v}{u}$

So, $m = -\frac{+8.57}{-20}$

$m = +0.42$

Also, $\text{Magnification} = \frac{\text{height of image}}{\text{height of object}}$

or $m = \frac{h_2}{h_1}$

So, $+0.42 = \frac{h_2}{5.0}$

$h_2 = 0.42 \times 5.0$

Height of image, $h_2 = 2.1$ cm

Thus, the size of image is 2.1 cm.

Q.15. An object of size 7.0 cm is placed at 27 cm in front of a concave mirror of focal length 18 cm. At what distance from the mirror should a screen be placed so that a sharp focussed image can be obtained ? Find the size and nature of the image.

Ans. Here, Object distance, $u = -27$ cm (To the left side of mirror)

Image distance, $v = ?$ (To be calculated)

Focal length, $f = -18$ cm (It is a concave mirror)

Height of object, $h_1 = 7.0$ cm

And, Height of image, $h_2 = ?$ (To be calculated)

Now, For a mirror : $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

So, $\frac{1}{v} + \frac{1}{-27} = \frac{1}{-18}$

$\frac{1}{v} - \frac{1}{27} = -\frac{1}{18}$

$\frac{1}{v} = -\frac{1}{18} + \frac{1}{27}$

$\frac{1}{v} = \frac{-3+2}{54}$

$\frac{1}{v} = -\frac{1}{54}$

Image distance, $v = -54$ cm

Since the image distance is minus 54 cm, therefore, the screen should be placed at a distance of 54 cm in front of the concave mirror (on its left side). The nature of image obtained on the screen is real and inverted.

Also, For a mirror, $\frac{h_2}{h_1} = -\frac{v}{u}$

So, $\frac{h_2}{7.0} = -\frac{-54}{-27}$

$\frac{h_2}{7.0} = -2$

$h_2 = -2 \times 7.0$

Height of image, $h_2 = -14.0$ cm

Thus, the size of image is 14.0 cm.

Q.16. Find the focal length of a lens of power, –2.0 D. What type of lens is this ?

Ans. The power of this lens has a negative sign (or minus sign), so this is a concave lens. Now,

$$\text{Power, } P = \frac{1}{f(\text{in metres})} \qquad (f = \text{focal length})$$

So, $$-2.0 = \frac{1}{f}$$

And, $$f = -\frac{1}{2.0}\ \text{m}$$

Or $$f = -\frac{1}{2.0} \times 100\ \text{cm}$$

So, Focal length of lens, $f = -50$ cm

Q.17. A doctor has prescribed a corrective lens of power + 1.5 D. Find the focal length of the lens. Is the prescribed lens diverging or converging ?

Ans. The power of this lens is positive (with a plus sign), therefore, this is a convex lens or converging lens. Now,

$$\text{Power, } P = \frac{1}{f(\text{in metres})}$$

So, $$+1.5 = \frac{1}{f}$$

or $$f = \frac{1}{+1.5}\ \text{m}$$

$$f = +\frac{1}{1.5} \times 100\ \text{cm}$$

So, Focal length of lens, $f = +66.7$ cm

Chapter : THE HUMAN EYE AND THE COLOURFUL WORLD

NCERT Book, Page 190

Q.1. What is meant by the power of accommodation of the eye ?

Ans. The ability of an eye to focus the distant objects as well as the nearby objects on the retina by changing the focal length (or converging power) of its lens is called accommodation.

Q.2. A person with a myopic eye cannot see objects beyond 1.2 m distinctly. What should be the type of the corrective lens used to restore proper vision ?

Ans. The proper vision of a myopic eye can be restored by using concave lens of suitable power.

Q.3. What are the far point and near point of the human eye with normal vision ?

Ans. The far point of human eye with normal vision is at infinity and the near point is at a distance of 25 centimetres from the eye.

Q.4. A student has difficulty in reading the blackboard while sitting in the last row. What could be the defect the child is suffering from ? How can it be corrected ?

Ans. Since the child cannot see the distant objects (like blackboard writing) clearly, he is suffering from the defect of vision (or defect of eye) called 'myopia' or 'short-sightedness'. Myopia can be corrected by using spectacles containing concave lenses of suitable power.

NCERT Book, Pages 197-198

Q.1. The human eye can focus objects at different distances by adjusting the focal length of the eye-lens. This is due to :

(*a*) presbyopia **(*b*) accommodation** **(*c*) near-sightedness** **(*d*) far-sightedness**

Ans. (*b*) accommodation

Q.2. The human eye forms the image of an object at its :

(*a*) cornea **(*b*) iris** **(*c*) pupil** **(*d*) retina**

Ans. (*d*) retina

Q.3. The least distance of distinct vision for a young adult with normal vision is about :

(*a*) 25 m **(*b*) 2.5 cm** **(*c*) 25 cm** **(*d*) 2.5 m**

Ans. (*c*) 25 cm

Q.4. The change in focal length of an eye-lens is caused by the action of the :

(*a*) pupil **(*b*) retina** **(*c*) ciliary muscles** **(*d*) iris**

Ans. (*c*) ciliary muscles

Q.5. A person needs a lens of power, –5.5 dioptres for correcting his distant vision. For correcting his near vision, he needs a lens of power +1.5 dioptres. What is the focal length of the lens required for correcting (*i*) distant vision, and (*ii*) near vision ?

Ans. (*i*) *For distant vision* : Power of lens, $P = -5.5$ D

Now, Power, $P = \dfrac{1}{f \text{ (in metres)}}$ (where f = focal length)

So, $-5.5 = \dfrac{1}{f}$

And, $f = \dfrac{1}{-5.5}$ m

Or, $f = -\dfrac{1}{5.5} \times 100$ cm

So, Focal length, $f = -18.18$ cm (or –18.2 cm)

Thus, the focal length of lens required for correcting distant vision is, –18.2 cm. Minus sign of focal length tells us that it is a concave lens.

(*ii*) *For near vision* : Power of lens, $P = +1.5$ D

Now, Power, $P = \dfrac{1}{f(\text{in metres})}$

So, $+1.5 = \dfrac{1}{f}$

And, $f = \dfrac{1}{+1.5}$ m

Or, $f = +\dfrac{1}{1.5} \times 100$ cm

So, Focal length, $f = +66.66$ cm (or + 66.7 cm)

Thus, the focal length of lens required for correcting near vision is + 66.7 cm. Plus sign of focal length tells us that it is a convex lens.

Q.6. The far point of a myopic person is 80 cm in front of the eye. What is the nature and power of the lens required to correct the problem ?

Ans. See Sample Problem on page 275 of this book.

Q.7. (*a*) Make a diagram to show how hypermetropia is corrected.

(*b*) The near point of a hypermetropic eye is 1 m. What is the power of the lens required to correct this defect ? Assume that the near point of the normal eye is 25 cm.

Ans. (*a*) See Figure 13(*c*) on page 276 of this book.

(*b*) See Sample Problem on page 277 of this book.

Q.8. Why is a normal eye not able to see clearly the objects placed closer than 25 cm ?

Ans. A normal eye can see nearby objects because the ciliary muscles make the eye-lens more convex (or thick) thereby increasing its converging power. This increased converging power of eye-lens can make a normal eye see objects clearly only when placed up to 25 cm from the eye. However, when objects are placed closer than 25 cm, then the ciliary muscles cannot make the eye-lens more convex to increase its converging power further so as to focus them sharply on the retina. Due to this, such objects are not seen clearly. In other words, a normal eye is not able to see clearly the objects placed closer than 25 cm because all its power of accommodation (or ability to increase converging power of eye-lens by making it more convex) has already been exhausted.

Q.9. What happens to the image distance in the eye when we increase the distance of an object from the eye ?

Ans. See Sample Problem on page 269 of this book.

Q.10. Why do stars twinkle ?

Ans. See page 290 of this book.

Q.11. Explain why the planets do not twinkle.

Ans. See page 291 of this book.

Q.12. Why does the sun appear reddish in the morning ?

Ans. See page 296 of this book.

Q.13. Why does the sky appear dark instead of blue to an astronaut ?

Ans. This is because in outer space, there is no atmosphere to scatter sunlight. Since there is no scattering of blue component of white sunlight which can reach the eyes of an astronaut in outer space, therefore, the sky appears dark to the astronaut, instead of blue.

Value Based Questions
(with Answers)
FIRST TERM

Q.1. Raman is a student of class X. Raman's mother was making tea in an old electric kettle having metal case. She switched on the power supply to the electric kettle. When Raman's mother touched the metal case of working electric kettle unknowingly, she got a severe electric shock. Raman put off the main switch quickly. After removing the kettle plug from socket, Raman found that the connecting cord was torn where it touched the metal case of the kettle. He also found that though the red and black wires of connecting cord were firmly connected to the two lower terminals of the power plug but the green wire of cord was not connected to the upper terminal of the plug. Raman replaced the torn connecting cord and also connected the three wires of cord firmly to the power plug terminals.

(*a*) Why did Raman put off the main switch quickly ?

(*b*) What name is given to (*i*) red wire (*ii*) black wire, and (*iii*) green wire, of the connecting cord ?

(*c*) Which wire, red, black or green, touched the metal case of electric kettle when Raman's mother got electric shock ?

(*d*) Which safety device was not working in electric kettle circuit which could have prevented the electric shock ?

(*e*) What values are displayed by Raman in this incident ?

Ans. (*a*) Raman put off the main switch to cut off the electricity supply to faulty electric kettle so as to save his mother.

(*b*) (*i*) Red wire is live wire (*ii*) Black wire is neutral wire, and (*iii*) Green wire is earth wire.

(*c*) Red wire (or live wire) which is at a high potential of 220 volts was touching the metal case of electric kettle.

(*d*) Earth wire.

(*e*) The values displayed by Raman are (*i*) Presence of mind (in putting off the main switch) (*ii*) Concern for mother (to save her life) (*iii*) Knowledge of household electric wiring, and (*iv*) Application of knowledge (in daily life situations).

Q.2. Vikalp's father had constructed a new room in their house. An electrician was called in to do the electric wiring. The electrician was asked to do wiring for two fans, two bulbs, a light socket and a power socket. Vikalp studies in tenth standard. Just when the electrician had completed the wiring, Vikalp returned home from school. Vikalp wanted to check the wiring by using all the switches and sockets. Vikalp found that the two fans and two sockets worked properly, each having a separate switch but there was a problem in the working of bulbs. Both the bulbs could be switched on and switched off with the same switch. Vikalp explained the mistake in wiring to electrician and then two separate switches were provided for the two bulbs.

(*a*) In what way were the two fans and two sockets connected in the household circuit by the electrician ?

(*b*) What mistake was made by electrician in connecting the two bulbs in the circuit ?

(*c*) In addition to the problem of not being able to be switched on and switched off independently, what other problem could be observed easily in the working of two electric bulbs, if the mistake had not been corrected ?

(*d*) What values were displayed by Vikalp during this incident ?

Ans. (*a*) The two fans and two sockets were connected correctly in parallel circuits.

(*b*) The two electric bulbs were connected wrongly in series in the circuit.

(*c*) The two electric bulbs would glow less brightly when connected in series because they would not get the same voltage of 220 volts of the mains supply line.

(*d*) Vikalp showed the values of (*i*) Curiosity to check whether things worked properly or not (*ii*) Knowledge of household wiring, and (*iii*) Application of knowledge.

Q.3. Rahul went to an electronics shop to get his father's old radio set repaired. The radio mechanic required resistances of 1.5 Ω and 10 Ω to repair the radio set properly but he had only a large number of 3 Ω resistors. The radio mechanic made many attempts but could not get the right combinations of 3 Ω resistors to obtain 1.5 Ω and 10 Ω resistances. Rahul had studied combination of resistors in class X. Rahul thought for a while and then joined some 3 Ω resistors in two different ways to obtain the required resistances.

(*a*) How did Rahul obtain 1.5 Ω resistance by joining a number of 3 Ω resistors ?

(*b*) How many 3 Ω resistors were combined together to obtain 1.5 Ω resistance ?

(*c*) How did Rahul obtain 10 Ω resistance by joining a number of 3 Ω resistors ?

(*d*) How many 3 Ω resistors were combined together by Rahul to obtain 10 Ω resistance ?

(e) What values are shown by Rahul in this episode ?

Ans. (a) In order to obtain 1.5 Ω resistance, Rahul first combined three 3 Ω resistors in parallel to obtain a resistance of 1 Ω. He then connected six 3 Ω resistors in parallel to obtain a resistance of 0.5 Ω. These two parallel combinations were then connected in series to obtain a resistance of 1 + 0.5 = 1.5 Ω (see Figure 1)

(b) Nine 3 Ω resistors.

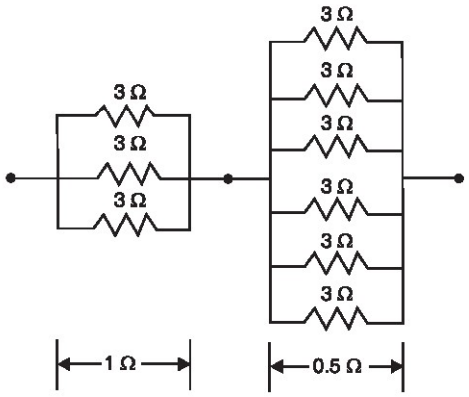


Figure 1.

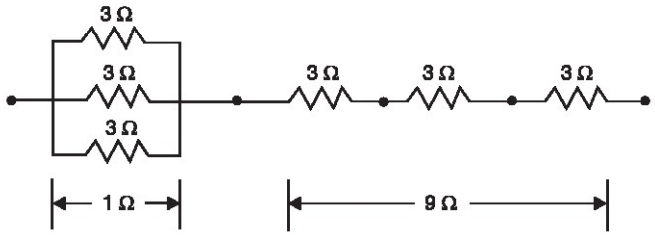


Figure 2.

(c) In order to obtain 10 Ω resistance, Rahul first connected three 3 Ω resistors in parallel to obtain a resistance of 1 Ω. He then connected three 3 Ω resistors in series to get a resultant resistance of 9 Ω. The parallel combination and series combination were then connected in series to obtain a final resistance of 1 + 9 = 10 Ω (see Figure 2).

(d) Six 3 Ω resistors.

(e) Rahul showed the values of (*i*) Knowledge of combination of resistors (*ii*) Application of knowledge, and (*iii*) Desire to help others.

Q.4. Aslam is a welder by profession who was working at Mohan's house. After making a 'railing' by using electric welding with naked eyes, Aslam was using a grinder on it to smoothen the welding joints. Just then some particle fell into Aslam's eye. He started crying with pain. Mohan hired an auto and took him to an eye hospital. In the hospital, doctor used a device connected to two electric wires to remove the particle from Aslam's eye. Aslam asked Mohan what had fallen into his eye and what device was used by the doctor to remove that particle from the eye. Being a science student of class X, Mohan explained everything to Aslam and asked him to be careful in future.

(a) What could be the particle which fell into Aslam's eye ?

(b) What device was used by the doctor to remove the particle and how it worked ?

(c) What precautions should be observed by Aslam while doing electric welding and grinding work ?

(d) What values are shown by Mohan during this episode ?

Ans. (a) An iron particle fell into Aslam's eye while using the grinder on iron railing.

(b) The doctor used an electromagnet to remove the tiny iron particle from Aslam's eye. Electromagnet is a powerful magnet and the iron particle in the eye is strongly attracted by the electromagnet, sticks to the electromagnet and gets removed.

(c) Aslam should use some device to protect his eyes while doing electric welding or using a grinder. Such an eye-protecting device can be welding helmet, hand held shield or welding goggles.

(d) Mohan showed the values of (*i*) Ability to handle a serious situation with calmness, and (*ii*) Desire to help others (by rushing Aslam to an eye hospital).

Q.5. Rajan constructed a small house. He used good quality and well insulated copper wires for wiring. He also used good quality switches, sockets and plugs. Rajan, however, had a very old room heater. On one winter night, Rajan was sleeping in a closed room with his family with the room heater switched on. During sleep, Rajan felt suffocated and woke up to see the room heater on fire. Rajan's son Arvind got up quickly and put off the main switch. Arvind also made a telephone call to Fire Brigade. The Fire Brigade men reached quickly and extinguished fire in the room. Rajan and his family thanked the firemen.

(a) What was the cause of fire in Rajan's house ?

(b) Name the safety device which was missing in the electric wiring of Rajan's house ?

(c) How could the above device prevent fire in Rajan's house ?

(d) What values are displayed by Arvind in this whole incident ?

Ans. (a) The cause of fire in Rajan's house was short-circuiting (due to the working of an old room heater having connecting cord with torn insulation, etc.).

(*b*) Electric fuse is the safety device which was missing in the wiring of Rajan's house.

(*c*) During short-circuiting, when the live wire and neutral wire touch each other directly, then the resistance of the circuit formed becomes very low due to which too much current passes through the household circuit (including the thin fuse wire). When too much current passes through fuse wire, the fuse wire gets heated too much, melts and breaks, cutting off the electricity supply in the household circuit. This prevents the electric fire in the house.

(*d*) The values displayed by Arvind in this incident are (*i*) General awareness (that electric fire can be prevented from spreading by putting off the main switch), and (*ii*) Presence of mind (in calling the Fire Brigade to extinguish fire).

Q.6. Vaibhav had gone to his uncle's home in a foreign country where the domestic electric supply is D.C. (Direct Current). An electrician was working in his uncle's kitchen who was trying to find out the location of electric wiring in a particular wall for further electrical work. Failing to do so, the electrician recommended the breaking of substantial portion of the kitchen wall. Vaibhav told his uncle that he could locate the position of current-carrying wires in the kitchen wall without breaking the kitchen wall. In order to do this, Vaibhav purchased a small device from the market and moved it slowly over the whole kitchen wall. After about ten minutes, Vaibhav could locate the position of all the current-carrying wires in this kitchen wall. His uncle was happy that now only a small portion of the kitchen wall will have to be dismantled.

(*a*) What was the small device purchased by Vaibhav ?

(*b*) What was noticed by Vaibhav when this device was moved slowly over the current-carrying wires embedded in the wall ?

(*c*) What name was given to the effect which helped Vaibhav to locate the concealed current-carrying wires in the wall ?

(*d*) Name the Scientist who discovered the above effect.

(*e*) What values are shown by Vaibhav in this episode ?

Ans. (*a*) Vaibhav purchased a plotting compass.

(*b*) When Vaibhav moved the plotting compass over the wall slowly, the compass needle was deflected from its usual north-south position whenever compass came over the current-carrying wires.

(*c*) Magnetic effect of electric current.

(*d*) Oersted.

(*e*) The values shown by Vaibhav are (*i*) Knowledge of scientific facts (that even a concealed current- carrying wire in a wall can create magnetic field around it and deflect compass needle), and (*ii*) Application of knowledge in everyday situations.

Q.7. Farid was given two thin wires X and Y in the science laboratory. The teacher asked Farid to find out (by performing suitable activities) which wire was 'fuse wire' and which one a 'nichrome wire'. Farid was given batteries of 3 V and 12 V, and some copper connecting wires alongwith crocodile clips. The teacher had himself performed this activity earlier and knew that the batteries of 3 V and 12 V were appropriate for this activity. The teacher also advised Farid to put off fan while performing the activites and take necessary precautions to avoid burns. Farid performed the activities and concluded that wire X is nichrome wire whereas wire Y is the fuse wire.

(*a*) Describe briefly the activity which Farid could have performed to conclude that wire X is nichrome wire.

(*b*) Describe briefly the activity which Farid could have performed to conclude that wire Y is fuse wire.

(*c*) Why did teacher advise Farid to switch off the fan during these activities ?

(*d*) What values are shown by Farid in performing these activities ?

Ans. (*a*) Farid first connected the wire X in series circuit with 3 V battery. He found that the wire got heated and became dull red. Farid then connected wire X in series circuit with 12 V battery. He found that wire X got heated too much and started glowing bright red. This showed that wire X is like the heating element of an electric heater and hence made of nichrome.

(*b*) Farid now connected the wire Y in series circuit with 3 V battery. The wire got heated a little but did not glow. Farid then connected wire Y in series circuit with 12 V battery. He found that wire Y got heated too much, melted and broke into two pieces. Now, when a thin wire gets heated too much and breaks on passing excessive electric current, it behaves like a fuse wire. So, wire Y is the fuse wire.

(*c*) The teacher advised Farid to switch off the fan while performing these activities because the fan's air could cool the hot wires due to which the fuse wire will not get heated to its melting point and hence not break.

(*d*) The values shown by Farid in performing these activities are (*i*) Knowledge of the heating effect of electric current and working of fuse, and (*ii*) Ability to apply knowledge in real life situations.

Q.8. Mr. Dogra lives in a very old house. The electric wiring in this house was done more than 50 years ago. Mr. Dogra purchased an air conditioner recently. One day Mr. Dogra was sitting in a closed room with all his family members with air conditioner switched on. A geyser was also working on the same socket as the air conditioner. Suddenly, everyone in the room heard a little explosion and saw that the electric wires in the air conditioner socket had caught fire. Mr. Dogra was so shocked that he did not know what to do. Mr. Dogra's son Rajesh who is studying in Class X rushed out of the room and put off the main switch quickly. Before Mr. Dogra could call the Fire Brigade, Rajesh extinguished the fire with the help of a fire extinguisher which he had made in the school. An electrician was called. When he checked the main fuse, he found that someone had put a thick copper wire in the main fuse instead of a proper fuse wire. The electrician changed the whole wiring of the house by using good quality wires and fixed a proper fuse wire in the main fuse. He also made separate circuit for geyser and provided separate fuses for all the circuits.

(*a*) Why did the electric wires catch fire ?

(*b*) What is the condition of using an air conditioner and a geyser on the same socket known as ?

(*c*) Why did the fuse not blow off ?

(*d*) What would you recommend in place of old porcelain fuse holders in the house to protect the wiring more efficiently ?

(*e*) What values are displayed by Mr. Dogra's son Rajesh in this whole episode ?

Ans. (*a*) The wires caught fire due to overheating caused by the excessive current passing through them when two appliances, air conditioner and geyser, which draw heavy current were used on the same socket.

(*b*) This condition is called overloading.

(*c*) The fuse did not blow off because a thick copper wire had been used as a fuse wire in the fuse box which did not get heated too much, did not melt and hence did not break to cut off the electric supply.

(*d*) The old porcelain fuse holders should be replaced by MCBs (Miniature Circuit Breakers). And an additional MCB should be put in the air conditioner circuit alongwith its socket.

(*e*) The values displayed by Mr. Dogra's son Rajesh are (*i*) Presence of mind (in switching off the main switch to cut off electricity supply and prevent fire from spreading), and (*ii*) Concern for the family (to protect them by extinguishing the fire).

Q.9. Vinod went to his ancestral village alongwith his father during the summer holidays. He found that the women of the village still used dried cow-dung cakes (*uple*) as the fuel to cook food and for other heating purposes. One day Vinod went to *Panchayat* meeting in the village which is attended by all the village elders and requested them to instal '*Gobar* gas plant' in the village and use cow-dung in it to produce *gobar* gas, instead of burning cow-dung cakes directly. He explained the advantages of using *gobar* gas as a fuel instead of cow-dung cakes. Every one liked the idea and thanked Vinod for guidance.

(*a*) State two disadvantages of using dried cow-dung cakes as a fuel for cooking food.

(*b*) State two advantages of using *gobar* gas as a fuel for cooking food.

(*c*) What values are displayed by Vinod in this whole episode ?

Ans. (*a*) (*i*) Burning of dried cow-dung cakes as fuel produces a lot of smoke which causes air pollution in the house and damages the health of all the family members, especially women and children.

(*ii*) The burning of dried cow-dung cakes as fuel destroys the important plant nutrients (like nitrogen and phosphorus) present in them which could otherwise be used to increase the fertility of soil in the fields.

(*b*) (*i*) *Gobar* gas burns without producing any smoke and hence does not cause any air pollution. This ensures good health for village people, especially women and children (who spend most of their time inside the house).

(*ii*) The cow-dung slurry left behind after the extraction of *gobar* gas still contains the plant nutrients (like nitrogen and phosphorus) which can be used as a manure in fields to increase the fertility of soil.

(*c*) The values displayed by Vinod are (*i*) General awareness (or knowledge) of the alternative sources of energy (such as *gobar* gas), and (*ii*) Concern about the environment and health of village people (exemplified by his desire to reduce air pollution).

Q.10. Dinesh is a student of 10th standard. He went to a remote area of Rajasthan for trekking with his friends. Dinesh found that it was a sparsely inhabited area. He was surprised to know that there was still no electricity in this area. The people used kerosene oil lamps to light up their homes at night and there were no street lights. The children also had to study with kerosene lamps at night. The village farmers used diesel to run irrigation pumps. Actually, there were no power transmission lines which could bring electricity to this remote area. Dinesh was really disturbed by the living conditions of the people in this part of Rajasthan. One day Dinesh gathered all the people of village in the village school. He told them that if they put pressure on their area MLAs and MP for making available the required funds, then he could tell them about the devices to light up their homes and streets at night, play radio and television

and also run irrigation pumps with electricity without there being power transmission lines. All the people agreed and Dinesh described them the devices to get electricity in their area in detail. The village people were very happy to know this and soon they got electricity in their area.

(*a*) What was the device described by Dinesh to the village people to obtain electricity locally ?
(*b*) What source of energy is made use of in this device to obtain electricity ?
(*c*) Why do you think this device is more appropriate for an area like Rajasthan ?
(*d*) What is the name of the single unit of this device ?
(*e*) What values are shown by Dinesh in this incident ?

Ans. (*a*) Solar panels.
(*b*) Solar energy (Sun's energy or Sunlight energy).
(*c*) Because Rajasthan gets a lot of sunshine throughout the year.
(*d*) Solar cell.
(*e*) The values shown by Dinesh in this incident are (*i*) General awareness (knowledge) about the alternative sources of energy (here solar energy) (*ii*) Concern for the environment to improve it (by reducing air pollution), and (*iii*) Desire to help people improve their life (by providing electricity).

Q.11. Simranjit studies in tenth class in a school. There are fifty students in his class. Most of the students come to the school by school buses but four students (including Simranjit) live in an area where school buses do not ply. These four students come to school by separate cars driven by their parents and also go back by separate cars. One day their science teacher was teaching the chapter on sources of energy. He told the students that the fossil fuels are limited in nature and we should make efforts to conserve them by reducing their consumption. Hearing this, an idea came to Simranjit's mind which he shared with the three classmates who live in the same area. All these students liked the idea. These students talked to their parents, and even the parents liked the idea.

(*a*) What could be the idea mooted by Simranjit ?
(*b*) Why was this idea mooted ?
(*c*) How did this idea help the environment ?
(*d*) How did this idea help the individual parents ?
(*e*) What values are displayed by Simranjit in mooting this idea ?

Ans. (*a*) The idea mooted by Simranjit was that since four of them come to school from the same area, they should form a 'car pool' in which four of them come and go by one car, turn by turn.
(*b*) The idea of 'car pool' was mooted to conserve (or save) petrol fuel (which comes from a fossil fuel petroleum) because it is non-renewable and present in limited quantity in earth.
(*c*) The idea of 'car pool' helped the environment by decreasing air pollution because less fuel (like petrol) is burned in one car daily (than four cars).
(*d*) The idea of 'car pool' helped the individual parents by providing them more spare time for doing other work (because only one of the parents had to do the duty of taking all the four students to school and bring them back. The other three parents are free on this day).
(*e*) The values displayed by Simranjit in mooting the idea of 'car pool' are (*i*) To conserve (or save) the non-renewable and fast depleting fossil fuel petroleum (so that it could last for as long as possible) (*ii*) To reduce air pollution caused by the excessive burning of petroleum fuels, and (*iii*) Strengthening the bonds of friendship among classmates (by travelling together in one car daily).

Q.12. Mr. Firoze is a retired man who lives in a big house. He has recently replaced all the filament-type bulbs in his house by CFLs. His wife and children have a habit of keeping the lights and fans on (even when there is no one in the room) but Mr. Firoze keeps on going to every room periodically to switch them off. A few days back Mr. Firoze had purchased a device which can cook rice and *dal* without using any usual fuel. He has also installed an equipment on the roof of his house to obtain hot water. Mr. Firoze uses bicycle for short distances like going to nearby market, instead of scooter or car.

(*a*) What is CFL ? Why has Mr. Firoze replaced all the filament-type bulbs in his big house by CFLs ?
(*b*) Why does Mr. Firoze keep switching off lights and fans when no one is in the rooms ?
(*c*) Name the device which Mr. Firoze has purchased to cook rice and *dal* without using any usual fuel ?
(*d*) Name the equipment which Mr. Firoze has installed on the house-roof to obtain hot water ?
(*e*) Why does Mr. Firoze use bicycle for going through short distances ?
(*f*) What values are displayed by Mr. Firoze by all the above actions ?

Ans. (*a*) CFL stands for Compact Fluorescent Lamp. Mr. Firoze has replaced all the filament-type bulbs by CFLs to save electricity (or electrical energy) because CFLs consume much less electricity as compared to the traditional filament-type bulbs.
(*b*) Mr. Firoze keeps switching off lights and fans when no one is in the rooms to save electricity by preventing its wastage.
(*c*) Solar cooker.

(*d*) Solar water heater.

(*e*) Mr. Firoze uses bicycle for short distances to save petrol (which is used in scooter or car). Cycling also keeps him physically fit.

(*f*) The values displayed by Mr. Firoze by all his actions are (*i*) Conservation (or saving) of fossil fuels like coal and natural gas (which are used to produce electricity), LPG (which is used to cook food or heat water), petroleum (which gives petrol to run cars and scooters), and (*ii*) Concern for the environment to keep it pollution free (because burning of less fossil fuels produces less air pollution).

SECOND TERM

Q.13. Benny's mother was finding it difficult to cook food in the kitchen because there was no light in the kitchen due to a power cut. She complained about this to Benny. Benny took a big plane mirror from the house and made it stand in sunshine (outside the house) in such a way that sun's rays falling on it were diverted into the kitchen. This arrangement provided sufficient light in the kitchen due to which Benny's mother could finish her work in the kitchen comfortably.

(*a*) Which phenomenon of light is made use of by Benny in this case ?

(*b*) Benny's mother could also cook rice and *dal* by using a device kept in sunshine outside the kitchen in which a plane mirror is used as a reflector. Name the device.

(*c*) State four characteristics of images formed by a plane mirror.

(*d*) What values (or qualities) are displayed by Benny in this episode ?

Ans. (*a*) Benny makes use of the phenomenon of reflection of light from a plane mirror.

(*b*) Solar cooker.

(*c*) The image formed by a plane mirror is (*i*) virtual and erect (*ii*) same size as the object (*iii*) same distance behind the mirror as the object is in front of the mirror (*iv*) laterally inverted (or sideways reversed).

(*d*) The values (or qualities) displayed by Benny in this episode are (*i*) Awareness (or knowledge) about the reflection of light (*ii*) Ability to apply knowledge in real life situations, when needed, and (*iii*) Desire to help his mother.

Q.14. Sanjay was going to his office in his car. While driving his car, Sanjay saw a man behind him on a motorcycle through his rear-view mirror. A woman was also sitting behind the man on the motorcycle. Through his rear-view mirror, Sanjay noticed that the saree of the woman was almost touching the spokes of motorcycle wheel. He signalled the motorcyclist to stop and alerted the woman. She tied her saree properly and thanked Sanjay for the alert.

(*a*) What kind of mirror is used by Sanjay as rear-view mirror ?

(*b*) State two characteristics of the image formed by such a rear-view mirror ?

(*c*) What could have happened if Sanjay had not alerted the woman sitting at the back of motorcycle ?

(*d*) What values are displayed by Sanjay in this incident ?

Ans. (*a*) Convex mirror.

(*b*) The characteristics of the image formed by rear-view mirror (which is a convex mirror), are (*i*) virtual and erect, and (*ii*) diminished (smaller than the object).

(*c*) If Sanjay had not alerted the woman sitting at the back of motorcycle, then her saree could get entangled in the spokes of moving motorcycle wheel and cause a serious accident.

(*d*) The values displayed by Sanjay in this incident are (*i*) Vigilant (because he kept careful watch for possible danger around him) (*ii*) Concern about others (here he was concerned about the safety of the woman), and (*iii*) Responsible citizen (because he stopped the motorcycle and alerted the woman about impending danger to her life).

Q.15. Manoj is a twelve year old boy. He obtained a lens from one of his friends. Manoj held the lens towards the sun and started looking at the sun through it. On seeing this, Manoj's elder brother ran towards him and snatched away the lens from him. The brother firmly told Manoj not to do it again.

(*a*) What could be the nature of the lens ?

(*b*) Why did the brother snatch the lens from Manoj ?

(*c*) What could have happened to Manoj if his brother had not snatched away the lens from him ? Explain.

(*d*) What values are shown by Manoj's brother ?

Ans. (*a*) It is convex lens (which is a converging lens).

(*b*) The brother snatched away the convex lens from Manoj because looking at the sun through convex lens could damage the eyes of Manoj.

(*c*) Convex lens is a converging lens. It could converge (or concentrate) a lot of sun's rays or sun's energy into Manoj's eyes. This energy could damage the delicate retina of eyes and even make him blind.

(*d*) The values shown by Manoj's brother are (*i*) Awareness (having knowledge) of the properties of convex lens, and (*ii*) Concern for the eyes of his brother Manoj.

Q.16. Anahat is an eight year old girl who has just begun to learn swimming. At the moment she is in the swimming pool. Suddenly, Anahat finds that her earring has fallen into the water. It appears to her that the earring has not gone too deep. So, she begins to go further into swimming pool to retrieve her earring. Her trainer, who has been watching her movements, does not allow Anahat to go further and pulls her out of the swimming pool quickly.

(*a*) Why does it appear to Anahat that her earring has not gone too deep in water ? Name the phenomenon involved.

(*b*) Why does the trainer not allow Anahat to go further in the swimming pool ?

(*c*) Give one example of the effect of phenomenon involved in the above episode in which a glass slab is used.

(*d*) What values does the trainer show in the above episode ?

Ans. (*a*) The phenomenon involved is refraction of light. Due to refraction of light coming out through the water of swimming pool into air, the bottom of swimming pool appears raised. In other words, the swimming pool appears to be less deep to Anahat than it really is. Due to this, Anahat thinks that her earring has not gone too deep in water and tries to retrieve it.

(*b*) The trainer does not allow Anahat to go further in the swimming pool because the water there is much deeper than it appears to be and there is a risk of drowning

(*c*) Due to refraction of light, when a glass slab is placed over some printed matter, the letters appear to be raised when viewed from top.

(*d*) The trainer shows the values of (*i*) Sense of duty (*ii*) Presence of mind (*iii*) Concern for the safety of children, and (*iv*) Timely action.

Q.17. Seema's father Mr. Soni runs a cosmetics and perfumes shop in a crowded market place. Mr. Soni usually complains at home that there is lot of 'shop-lifting' in his shop which was causing loss to him. Seema used to hear such complaints of her father. One day Seema went to the market and purchased two big mirrors of a special kind. She then went to her father's shop and fixed the two big mirrors at two strategic positions inside the shop. Mr. Soni found that after the installation of these mirrors, the shop-lifting almost stopped. He was very happy and thanked Seema for making this possible.

(*a*) What type of mirrors were fixed by Seema in the shop ?

(*b*) How did these mirrors help in preventing shop-lifting ?

(*c*) What special name is given to such mirrors which help prevent shop-lifting ?

(*d*) Can you give one example of another use of such mirrors ?

(*e*) What values are exhibited by Seema in this episode ?

Ans. (*a*) Convex mirrors.

(*b*) Mr. Soni could see the virtual, erect and diminished images of the customers by looking at the two big convex mirrors. In this way, Mr. Soni was able to keep a watch on most of the customers present in the shop (with the help of these two big convex mirrors) and hence the shop-lifting almost stopped.

(*c*) Shop security mirrors.

(*d*) Convex mirrors are used as rear-view mirrors in vehicles such as cars, buses, trucks, motorcycles and scooters, etc.

(*e*) The values exhibited by Seema are (*i*) Knowledge about various types of mirrors (*ii*) Application of knowledge in everyday situations, and (*iii*) Desire to solve her father's problem.

Q.18. It was a bright, sunny day in the morning when the classes started in the school. Suddenly dark clouds appeared in the sky. Due to this the classroom became quite dark. The teacher asked a student to switch on all the lights in the classroom.

(*a*) Why did the teacher ask for all the lights to be switched on ?

(*b*) What was the size of the pupil of the eyes of the students :

(*i*) before the clouds appeared ?

(*ii*) when classroom became quite dark ?

(*iii*) when the lights were switched on ?

(*c*) In which of the above mentioned three situations, the students will feel glare in their eyes and why ?

(*d*) What values are exhibited by the teacher in this case ?

Ans. (*a*) The teacher asked all the lights in the classroom to be switched on because seeing the blackboard writing in dim light put a lot of strain on the eyes of the students.

(*b*) (*i*) Before the clouds appeared, there was sufficient light in the classroom due to which the size of pupil of eyes was small.

(*ii*) When classroom became quite dark, the light was dim, due to which the size of pupil of eyes was very large.

(*iii*) When the lights were switched on, the light was bright and hence the size of pupil of eyes became

small again.

(*c*) The students will feel glare in their eyes when the lights are switched on in the dark classroom. This is because the size of pupil of eye is large in the dark room. So, when lights are switched on, then suddenly too much light enters the eyes (due to large size of pupil) causing the glare in the eyes.

(*d*) The values exhibited by the teacher are (*i*) General awareness or Knowledge (that it is necessary to study in sufficient light to keep the eyes healthy, and (*ii*) Concern for the students (that studying in dim light can harm the eyes of students).

Q.19. Mr. Vinay's 65 year old mother is complaining about blurred vision in both the eyes due to which she cannot see things clearly. Mr. Vinay took his mother to an eye hospital. The doctor examined the eyes of his mother carefully and concluded that she has a medical condition which could not be corrected by using any type of spectacle lenses and it required surgery. The mother's eyes were operated upon and she could see properly once again.

(*a*) What could be the defect in the eyes of Mr. Vinay's mother ?

(*b*) What has happened to the eye lens during this defect ?

(*c*) What is done during surgical operation of eyes to restore the correct vision ?

(*d*) What would happen if eye surgery of a person having this defect is not done ?

(*e*) What values are shown by Mr. Vinay in this episode ?

Ans. (*a*) The defect in the eyes of Mr. Vinay's mother is known as cataract.

(*b*) During the development of cataract, a membrane is gradually formed over both the eye-lenses making the eye-lenses cloudy. This makes the vision blurred.

(*c*) During surgical operation, the cloudy eye-lenses are removed from the eyes and suitable artificial lenses are inserted in their place.

(*d*) If the eye surgery of a person having cataract is not done then the vision of this person will go on becoming more and more blurred, and ultimately the person would not be able to see anything at all.

(*e*) Mr. Vinay shows the values of (*i*) Awareness or knowledge (that eye-defects can be cured by eye-specialist doctors) (*ii*) Desire to mitigate the sufferings of others (here mother), and (*iii*) Sense of responsibility (towards old mother).

Q.20. Vasantha is a domestic help (or maid) working at Mrs. Sharma's home. One day Vasantha complained to Mrs. Sharma that she had difficulty in reading the letter which she had received from her parents. Mrs. Sharma, realising that Vasantha had an eye defect, took her to an eye-specialist doctor. The doctor tested her eyes carefully and told Vasantha to wear spectacles containing certain type of lenses having specified power. Mrs. Sharma bought the required spectacles for Vasantha. By wearing these spectacles, Vasantha could read and write easily. She was very happy and thanked Mrs. Sharma.

(*a*) What could be the eye-defect Vasantha was suffering from ?

(*b*) What could be the two possible reasons responsible for her eye-defect.

(*c*) What type of lenses do you think doctor recommended for Vasantha's spectacles ? Why ?

(*d*) Do you think Vasantha has to wear the spectacles all the time ? Give reason for your answer.

(*e*) What values are displayed by Mrs. Sharma in this episode ?

Ans. (*a*) Vasantha was suffering from an eye defect called hypermetropia (long-sightedness or far-sightedness) in which a person cannot see the nearby things clearly (though he or she can see the distant things clearly).

(*b*) (*i*) Low converging power of eye lens (because of eye lens being less convex or less thick).
(*ii*) Eye-ball being too short (because of which the distance of retina from the eye lens is less than normal).

(*c*) The doctor recommended convex lenses for the spectacles of Vasantha. This is because convex lenses are converging lenses which will increase the converging power of the convex eye lenses.

(*d*) No, Vasantha does not have to wear these spectacles all the time. She has to wear these spectacles only while reading, writing, sewing, etc. (because only her near vision is defective).

(*e*) Mrs. Sharma displayed the values of (*i*) Awareness, which means having knowledge of a situation or facts (because she knew that Vasantha's eye defect can be rectified by using spectacles) (*ii*) Concern for others (to mitigate their suffering), and (*iii*) Kindness and generosity (because Mrs. Sharma bought spectacles for Vasantha by spending her own money).

Q.21. There was some construction work going on in the neighbourhood of Amar Singh. One day when Amar Singh came back from his office, he saw his ten year old son standing near the welder and looking at the electric welding being done with great curiosity. Amar Singh grabbed his son by the arm and brought him inside the house quickly. He firmly told his son not to look at electric welding being done again because it is extremely harmful. Amar Singh then went out and scolded the welder for allowing a child to stand near him and watch the electric welding being done. The welder said 'sorry' to Amar Singh for the lapse on his part.

(*a*) Why did Amar Singh bring his son inside the house quickly ?

(b) What harm could have been done to the child by staring at the electric welding and why ?
(c) Name a natural luminous object which can do the same damage when looked at straight with naked eyes for a considerable time.
(d) What other harm could have been done to the child by standing near the welder when electric welding was being done ?
(e) What values are exhibited by Amar Singh in this episode ?

Ans. (a) Amar Singh brought his son inside the house quickly to protect his son from damage to his eyes and possible burns.
(b) Electric welding produces enormously bright light. This extremely bright light could have damaged the retina of the eye.
(c) The sun is also an extremely bright object in the sky which can damage the retina of eyes if looked at straight with naked eyes for a considerable time.
(d) The electric welding produces sparks which fly off in all directions. The extremely hot sparks of electric welding could cause burns on the body of the child standing nearby.
(e) Amar Singh exhibited the values of (*i*) Awareness (that electric welding can damage the eyes and also cause burns) (*ii*) Concern for his son (to protect his eyes and prevent burns), and (*iii*) Teach lesson to wrong doer (by scolding the welder).

Q.22. Sunny Dayal is a car driver working for Mr. Khanna. One day Sunny Dayal complained that he had difficulty in driving car because he could not see the distant traffic (cars, buses, scooters, motorcycles and people) clearly though he could see the nearby things clearly. Mr. Khanna took Sunny Dayal to an eye hospital. The eye-specialist doctor checked and tested his eyes with various machines and gave him the name and power of lenses to be worn as spectacles. Mr. Khanna paid for the required spectacles for the driver. By wearing these spectacles, the driver could now see even the distant vehicles and people on the road clearly. He thanked Mr. Khanna for this.
(a) Name the eye defect Sunny Dayal is suffering from.
(b) What could be the two possible reasons for his eye defect ?
(c) What type of lenses do you think have been recommended for Sunny Dayal's spectacles and why ?
(d) Do you think Sunny Dayal has to wear these spectacles all the time ? Give reasons for your answer.
(e) What could have been the risk if Mr. Khanna had not taken Sunny Dayal to eye specialist doctor for the correction of vision by wearing spectacles ?
(f) What values (or qualities) are displayed by Mr. Khanna ?

Ans. (a) Myopia (Short-sightedenss or Near-sightedness).
(b) (*i*) One reason for this eye defect is the high converging power of eye lens (because of eye lens being too convex or too thick).
(*ii*) Another reason for this eye defect is that the eyeball may be too long (because of which the distance of retina from the eye lens is more than normal).
(c) The doctor recommended concave lenses for the spectacles of Sunny Dayal. This is because concave lenses are diverging lenses which will decrease the converging power of convex eye lenses.
(d) No, Sunny Dayal has not to wear these spectacles when reading or writing. This is because Sunny Dayal's near vision is normal. He can see the nearby objects clearly even with naked eyes.
(e) If Sunny Dayal had not worn spectacles to correct his myopic vision, then the risk was that he could have caused a car accident (because without spectacles he could not see distant vehicles and people clearly).
(f) Mr. Khanna displayed the values of (*i*) General awareness (that eye-defect can usually be corrected by wearing spectacles containing suitable lenses) (*ii*) Concern for others (because he wanted to mitigate or remove the suffering of driver) (*iii*) Concern for self and family (because he wanted to protect himself and his family from car accidents), and (*iv*) Kindness or Generosity (because he spent his own money in the hospital and for buying spectacles, which the driver could not afford).

Q.23. A social worker was addressing people at an eye donation camp organised in a colony. He said that there are millions of blind people in our country who cannot see at all. The eyesight of most of these blind people can be restored if we donate our eyes by making a pledge in writing to the eye bank that, after our death, our eyes should be removed and given to the blind people. He said, in this way we can pass on the priceless gift of vision to our blind brothers and sisters to light up their dark world, without losing anything. By listening to the social worker, many people (including some students) filled up the pledge forms to donate their eyes, after death.
(a) Within how much time of the death of a person, his donated eyes must be removed and preserved so as to remain good for transplantation ?
(b) What happens to those donated eyes which are not good for transplantation ?
(c) Can a person having AIDS disease donate eyes ?

(*d*) Can a person having diabetes disease donate eyes ?
(*e*) How many blind people can get eyesight if ten persons donate their eyes ?
(*f*) What values of social worker are exhibited by his address ?

Ans. (*a*) The eyes must be removed within 4 to 6 hours of a person's death.
(*b*) Those donated eyes which are not good for transplantation are used for doing research and for teaching purposes in medical colleges.
(*c*) No
(*d*) Yes
(*e*) One person donates two eyes, so ten persons donate $2 \times 10 = 20$ eyes. These 20 eyes can give eyesight to 20 blind persons (each blind person getting one eye).
(*f*) The social worker exhibits values of (*i*) Awareness (about the donation of eyes) (*ii*) Concern for blind people (that they get eyesight to see this beautiful world), and (*iii*) Motivational skill (to get the people pledge for eye donation).

Q.24. Pavni's mother had just washed all the white clothes. She was telling her friend that the whiteness of white clothes was decreasing with every wash and even new white clothes appeared to be like old ones after a few washings. Pavni, who is a student of class 10, was listening to her mother's complaint. Pavni then went to the market and purchased a particular 'dye'. She asked her mother to dissolve a little of this dye in a bucketful of water and soak the washed white clothes in the solution of dye for some time. Pavni's mother did the same. After sometime, the clothes were taken out of the bucket, rinsed well and spread on clothes line for drying. Pavni's mother observed that the whiteness of washed white clothes had increased a lot after applying a little of the dye. Pavni's mother did not know why on applying a little of a certain dye to washed white clothes, their whiteness had increased manifolds. Pavni explained everything to her mother.
(*a*) What could be the 'dye' applied by Pavni's mother to the washed white clothes by dissolving in water ?
(*b*) Why does the application of this dye make the washed white clothes look even more white (or shining white) ? Explain.
(*c*) What values are displayed by Pavni in this episode ?

Ans. (*a*) The dye applied by Pavni's mother to the washed white clothes is 'blue' ('blue colour' or '*neel*').
(*b*) The white sunlight is a mixture of seven coloured lights; violet, indigo, blue, green, yellow, orange and red (which is called spectrum). Now, when the white sunlight consisting of seven different colours comes down through the atmosphere, then some of its blue colour is scattered by air molecules present in the atmosphere (causing the blue colour of the sky). In this way, the white sunlight becomes somewhat deficient in blue colour. When this sunlight (having deficiency of blue colour) falls on washed white clothes to which 'blue colour' (or *neel*) has been applied, then the deficiency of blue colour in white sunlight is made up. The white sunlight reflected from the washed white clothes now has all the colours of the spectrum in the right proportions and this makes the white clothes appear extremely white.
(*c*) Pavni displayed the values of (*i*) Knowledge of scientific facts (such as composition of sunlight, spectrum and scattering of light) (*ii*) Application of knowledge in real life situations (such as to make washed white clothes look more white), and (*iii*) Desire to help mother by solving her problem.

Q.25. Sona was standing outside her house in the afternoon enjoying the light drizzle after the heavy rain. Suddenly she saw a rainbow in the sky. Sona called out her father and asked him what a rainbow is and how it is formed. Sona's father told her that rainbow is an arch of seven colours visible in the sky which is produced by the splitting of white sunlight by tiny raindrops in the atmosphere. He also told Sona that a similar phenomenon can also be observed in a science laboratory by passing white light through a transparent object.
(*a*) What is the name of the phenomenon which produces rainbow ?
(*b*) Name the seven colours of the rainbow. Which of them deviates the most ?
(*c*) When the rainbow is formed, state whether the sun is shining in the sky or not.
(*d*) Name the transparent object which can be used to observe the phenomenon similar to a rainbow in the science laboratory.
(*e*) What values are displayed by Sona's father ?

Ans. (*a*) Dispersion of light.
(*b*) Violet, Indigo, Blue, Green, Yellow, Orange and Red. The violet colour deviates the most.
(*c*) Yes, the sun is shining in the sky.
(*d*) Glass prism.
(*e*) The values displayed by Sona's father are (*i*) Understanding of scientific facts (such as the dispersion of light), and (*ii*) Desire to impart knowledge to his daughter.