BRILLIANT PUBLIC SCHOOL, SITAMARHI

(Affiliated up to +2 level to C.B.S.E., New Delhi)

X Physics Chapter Notes

Session: 2014-15

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Class X: Physics
Chapter 10: Light- Reflection and Refraction

Points to remember

Key learnings:

1. When light falls on a body, it may be absorbed, may be transmitted or light may come back to the same medium.

2. Reflection of a light means light waves are neither transmitted nor absorbed but are deflected from the surface of the medium back into the same medium.

3. Laws of Reflection:

First law of reflection: The incident ray, the normal to the surface at the point of incidence and the reflected ray, all lie in the same plane.

Second law of reflection: The angle of incidence is equal to the angle of reflection.

4. Real image is obtained when the rays of light after reflection, actually converge at a point. It can be obtained on the screen and can be seen with the eye.

5. Virtual image forms when rays of light do not actually meet, but appear to meet when produced backwards. It cannot be obtained on the screen.

6. Characteristics of the image formed by the plane mirror:
   i. The image formed by a plane mirror is always virtual and erect.
   ii. Size of image = Size of object and the image is laterally inverted.

iii. The image formed by the plane mirror is as far behind the mirror as the object is in front.

7. Lateral Inversion: The phenomenon due to which the right side of the object appears as left and the left side of the object appears as right. That is the image is inverted sideways.

8. A spherical mirror whose reflecting surface is curved outwards and polished on the inner spherical surface is convex mirror.

9. A spherical mirror whose reflecting surface is curved inwards and polished on the outer spherical surface is concave mirror.

10. Concave mirror mostly forms real images, which can be received on the screen.

11. Convex mirror forms virtual images, which cannot be received on the screen.

12. Differentiating between a plane mirror, a concave mirror and a convex mirror, without touching them:
i) If the image formed is erect and is of same size as in reality then it is a plane mirror.

ii) If the image formed is still erect but smaller in size then it is a convex mirror.

iii) If the image is erect but magnified when mirror is close to the object then it is a concave mirror.

13. Solar concentrators use huge concave mirrors to focus large amounts of solar energy thereby producing high temperature conditions in a solar power plant.

14. Concave mirrors are used as shaving and make up mirrors.

15. The centre of the reflecting surface of a spherical mirror is a point called the pole of the mirror and usually represented by P.

16. The horizontal line passing through the centre of curvature and pole of the spherical mirror is known as Principal axis.

17. The centre of curvature of a spherical mirror is the centre of the hollow sphere of glass, of which the spherical mirror is a part and usually represented by C.

18. The radius of curvature of a spherical mirror is the radius of the hollow sphere of glass, of which the spherical mirror is a part and usually represented by R.

19. The diameter of the reflecting surface that is twice the radius is called its aperture.

20. Radius of curvature (R) = 2 $\times$ focal length (f)

21. Rules for ray diagram-

i. The path of the reflected light ray depends upon how the incident ray is oriented with respect to the principal axis.

ii. A ray of light parallel to the principal axis, after reflection pass through the principal focus.

iii. A ray of light passing through the principal focus of a mirror becomes parallel to the principal axis of the mirror, on reflection

iv. A ray of light incident obliquely towards the pole of mirror is reflected obliquely as per the laws of reflection

v. A ray of light passing through centre of curvature of a mirror is reflected back along the same path

22. Image formation by a concave mirror for different positions of the object

Position of object	Position of image	Size of image	Nature of image
At infinity	At focus F	Highly diminished, point – sized	Real and inverted
Beyond C	Between F and C	Diminished	Real and inverted
At C	At C	Same size	Real and inverted
Between C and F	Beyond C	Enlarge	Real and inverted
At F	At infinity	Highly enlarged	Real and inverted
Between P and F	Behind mirror	Enlarged	Virtual and erect

23. Nature, position and relative size of the image formed by a convex mirror:

Position of object	Position of image	Size of image	Nature of image
At infinity	At focus F behind the mirror	Highly diminished, point	Virtual and erect

		sized	
Between infinity and pole of the mirror	Between P and F behind the mirror	Diminished	Virtual and erect

24. The ratio of the height of the image to the height of the object is known as the magnification.

25. Magnification is positive for virtual image and negative for real image.

26. The phenomenon of change in the path of light from one medium to another is called refraction of light.

27. The angle formed between the incident ray and the normal is called angle of incidence and the angle formed between the refracted ray and the normal is called angle of refraction.

28. The cause of refraction is the change in the speed of light as it goes from one medium to another medium.

29. Larger the difference in speeds of light, the greater will be the angle of bending and vice-versa.

30. When a ray of light passes from a rarer medium to a denser medium, it bends towards the normal. Also, the angle of incidence is greater than the angle of refraction.

31. When a ray of light passes from a denser medium to a rarer medium, it bends away from the normal. Also, the angle of incidence is less than the angle of refraction

32. Laws of refraction:

The first law of refraction: The incident ray, the refracted ray and the normal at the point of incidence all lie in the same plane.

Second law of refraction: The ratio of the sine of angle of incidence in the first medium to the sine of angle of refraction in the second medium is a constant for a given pair of medium and for a given wavelength of light.

$$n = \frac{\sin i}{\sin r}$$

where n is a constant known as refractive index of the second medium with respect to the first medium. This law is also called as Snell's Law

33. The phenomenon of change in path of light in going from one medium to another is called refraction of light.

34. The ratio of speed of light in vacuum to the speed of light in a medium is called the refractive index of the medium. It has no unit.

35. When a ray of light traveling from a rarer to a denser medium slows down and bends towards the normal.

36. When it travels from a denser medium to a rarer medium, it speeds up and bends away from the normal.

37. The shifting of emergent ray sideways from the direction of original incident ray is called lateral displacement or lateral shift

38. The extend of the lateral shift depends on

- the angle of incidence,
- the thickness of slab, and
- Refractive index of the glass slab

39. Lateral displacement is produced during refraction through a glass slab and not through a glass prism.

40. The angle through which a ray of light deviates on passing through a prism is called the angle of deviation.

41. Convex lens is thicker at the middle than at the edges.

42. Concave lens is thicker at the edges than at the middle.

43. Convex lens converge the rays of light while concave lens diverges.

44. As the object moves towards the optical centre of convex lens, the image moves away from the optical centre except when the object is placed between focus and optical centre of the lens.

45. As the object moves towards the optical centre of the convex lens, the size of image increases and it's highly enlarged when object is at focus.

46. Power of a lens is the reciprocal of its focal length. The SI unit of power of a lens is Dioptre.

Top Formulae

Mirror Formula:

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

Magnification produced by mirror:

$$m = \frac{\text{Height of the image (h')}}{\text{Height of the object (h)}}$$

Snell's law of refraction:

If I is the angle of incidence and r is the angle of refraction, then,

$$\frac{\sin i}{\sin r} = \text{constant}$$

The refractive index of medium 2 with respect to medium 1

$$n_{21} = \frac{\text{Speed of light in medium 1}}{\text{Speed of light in medium 2}} = \frac{v_1}{v_2}$$

The refractive index of medium 1 with respect to medium 2

$$n_{12} = \frac{\text{Speed of light in medium 2}}{\text{Speed of light in medium 1}} = \frac{v_2}{v_1}$$

Absolute refractive index:

$$n_m = \frac{\text{Speed of light in air}}{\text{Speed of light in the medium}} = \frac{c}{v}$$

Lens Formula:

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

Magnification produced by lens:

$$m = \frac{\text{Height of the Image}}{\text{Height of the Image}} = \frac{h'}{h}$$

Magnification (m) = h'/ h = v/ u

The power p of a lens of focal length f:

$$P = \frac{1}{f}$$

Class X: Science
Chapter 11: The Human Eye and the Colorful World

Points to remember

Key Learnings:

1. Human eye is a valuable sense organ. Its various parts and the respective functions include:

Eye part	Eye function
Cornea	Protective layer of eye
Eye lens	Refracts the light so as to form the image on retina
Retina	Behaves as the screen on which the image is formed
Pupil	Controls the intensity of light entering the eye
Ciliary's muscles	Adjust the thickness of the lens

2. The farthest point up to which the eye can see clearly is called the far point of the eye.

3. The distance of the closest point from the eye that can be seen clearly without accommodation is known as least distance of distinct vision.

4. The ability of the eye to observe distinctly the objects situated at widely different distances from the eye is called power of accommodation.

5. The smallest distance, at which the eye can see objects clearly without strain, is called the near point of the eye or the least distance of distinct vision. For a young adult with normal vision, it is about 25 cm.

6. In myopia distant objects are not clearly visible. It is corrected by using concave lens.

7. In hypermetropia nearby objects are not clearly visible. It is corrected by using convex lens.

8. Presbyopia arises due to weakening of ciliary muscles in old age. It can be corrected by using bi-focal lenses.

9. The phenomenon of splitting of white light into its constituent seven colors on passing through a glass prism is called dispersion of light.

10. Different colors undergo different deviations on passing through prism.

11. If a second identical prism is placed in an inverted position with respect to the first prism, all the seven colors recombine to form white light.

12. Atmospheric refraction is the phenomenon of bending of light on passing through earth's atmosphere.

13. As we move above the surface of earth, density of air goes on decreasing.

14. Light traveling from rarer to denser layers always bends towards the normal.

15. Stars twinkle on account of atmospheric refraction.

16. Sun appears to rise 2 minutes earlier and set 2 minutes later due to atmospheric refraction.

17. The phenomenon in which a part of the light incident on a particle is redirected in different directions is called scattering of light.

18. Very small particles scatter lights of shorter wavelengths better than longer wavelengths.

19. The scattering of longer wavelengths of light increases as the size of the particles increases.

20. Larger particles scatter lights of all wavelengths equally well.

Class X: Physics
Chapter 3: Electricity

Chapter Notes

Key Learnings:

1. Electric current is the rate of flow of charge.

2. Battery provides the driving force required to move the charges along the wire from one terminal to another.

3. The constant voltage difference between the two terminals of the wire maintains the constant electric current through the wire.

4. Electric current is measured in terms of amperes where

1 ampere = 1 coulomb / second

5. Voltage is measured in terms of volt where

1 volt = 1 joule /coulomb

6. Resistance is a property that resists the flow of electrons in a conductor. It controls the magnitude of the current. The SI unit of resistance is ohm (Ω).

7. Resistivity is defined as the resistance offered by a cube of the material of side 1 m when the current flows perpendicular to the opposite faces of the cube.

8. Ohm's law: The potential difference across the ends of a resistor is directly proportional to the current through it, provided its temperature remains the same.

9. The resistance of a conductor depends directly on its length, inversely on its area of cross – section, and also on the material of the conductor.

10. In Series combination of resistors:
- The current flowing through each resistor is the same
- The potential difference across the ends of the series combination is distributed across the resistors
- The equivalent resistance is greater than the greatest resistance in the combination.

11. In Parallel combination of resistors:
- The potential difference across each resistor is same and is equal to the potential difference across the combination.

- The main current divides itself and a different current flow through each resistor.
- The equivalent resistance is lesser than the least of all the resistances.

12. The effect of heating current due to which heat is produced in a wire when current is passed through it is called heating effect of current.

13. Electric power is the rate at which electrical energy is produced or consumed in an electric circuit.

14. The unit of power is watt (W). One watt of power is consumed when 1 A of current flows at a potential difference of 1 V.

15. The commercial unit of electric energy is kilowatt hour (kW h), commonly known a 'unit'.

Top Formulae:

1. The current I through the cross – section of a conductor is

$$I = \frac{Q}{t}$$

Where Q is net charge flowing across the cross – section of a conductor in time t.

2. Potential difference (V) between two points = work done (W)/ Charge (Q)

$$V = W/ Q$$

3. Ohm's law: V = I R

4. The equivalent resistance in series circuit is the sum of the individual resistances -

$$R = R_1 + R_2 + R_3$$

5. The equivalent resistance of a parallel circuit containing resistances R_1, R_2, R_3 is given as

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

6. The electric power P is given by

$$P = VI$$

Or $$P = I^2R = V^2/ R$$

7. The electrical energy dissipated in a resistor is given by $W = V \times I \times t$

8. Joule's law of heating; $H = I^2Rt$

9. 1 kW h = 3, 600, 000 J = 3.6×10^6 J

Class X: Science
Chapter 13: Magnetic Effects of Electric Current
Chapter Notes

Key Learnings:

1. A compass needle behaves as a small magnet. Its one end pointing towards north is called a north pole, and the other end pointing towards south, is called a south pole.

2. The space around a magnet in which the force of attraction and repulsion due to the magnet can be detected is called the magnetic field.

3. A field line is path along which a hypothetical free north pole would tend to move. The direction of the magnetic filed at a point is given by the direction that a north pole placed at that point would take. Field lines are shown closer together where the magnetic filed is greater.

4. The magnetic field lines around a straight conductor carrying current are concentric circles.

5. The direction of magnetic field is given by Right Hand Thumb Rule.

6. The magnetic field inside a solenoid is similar to that of a bar magnet.

7. A current-carrying conductor when placed in a magnetic field experiences a force.

8. Fleming's left-hand rule gives the direction of magnetic force acting on a conductor.

9. An electromagnet consists of a core of soft iron wrapped around with a coil of insulated copper wire.

10. An electric motor is a device that converts electric energy into mechanical energy and it works on the principle of force experienced by a current carrying conductor in a magnetic field.

11. The phenomenon in which an electric current is induced in a circuit because of a changing magnetic field is called electromagnetic induction.

12. The magnetic field may change due to a relative motion between the coil and a magnet placed near to the coil. If the coil is placed near to a current carrying conductor, the magnetic field may change either due to a change in the current through the conductor or due to the relative motion between the coil and conductor.

13. Fleming's right hand rule is used to find the direction of induced current.

14. Electric generators are based on the principle of electromagnetic induction and converts mechanical energy into electrical energy.

15. In our houses we receive AC electric power of 220 V with a frequency of 50 Hz.

16. One of the wires in the electricity wiring of houses is with red insulation, called live wire. The other one is of black insulation, which is a neutral wire. The third is the earth wire that has green insulation and this is connected to a metallic body deep inside earth.

17. The potential difference between live wire and neutral wire is 220 V.

18. Third wire in the wiring is used as a safety measure to ensure that any leakage of current to a metallic body does not give any server shock to a user.

19. Fuse is the most important safety device used for protecting the circuits due to short circuiting or overloading of the circuits.

Class X: Physics
Chapter 14: Source s of Energy

Key Learning:

1. A windmill is a simple machine that works with the energy of the wind. The windmill can be used to run a pump to draw water from the ground. It can also be used to run a flour mill to grind grain.
2. The moving water also possesses kinetic energy. The water – wheel is a device used for obtaining energy from flowing water.
3. The energy of naturally flowing water in high rivers is generally stored behind dams as potential energy and then further used to generate electricity. The electricity produced by using the energy of flowing water is known as hydro – electric power. The most important advantage of water energy is that like wind energy, it does not cause any pollution.
4. Renewable sources of energy: The renewable sources of energy are those sources which are being produced continuously in nature and are inexhaustible. The important examples of renewable source of energy are: wood, falling water, geothermal power, sun, wind,, tides, gobar gas etc.

   The renewable source are also known as non – conventional sources of energy.
5. The non – renewable sources are those sources which got accumulated in nature over a long time and can't be quickly replaced when they get exhausted. The important examples of non – renewable sources of energy are: Coal, natural gas, petroleum, uranium, etc. The non – renewable sources are also known as conventional sources of energy.
6. The energy radiated by the sun is called solar energy. It is interesting to note that the solar energy recovered on the earth in one day is about 50, 000 times more than the total energy consumed by all the nations of the world in one year.
7. There are two limitations of solar energy:
   a. The solar energy that reaches the earth is in a very diffused form

b. The solar energy is not uniformly available at all the time and all the places.

8. Any device that gets heated by the sun's energy is called a solar heating device. Such a device helps in collecting as much solar energy as possible. It is done by using a black pointed surface, a glass sheet cover and a reflector.

9. A solar cooker is a heating device which is used to cook food by utilizing the energy radiated by the sun. A solar heater is used to heat water by utilizing the energy radiated by the sun. The solar power plants are used to produce electricity by using the solar energy. The solar cells are used to convert solar energy directly into electrical energy. The solar cells are made from semi- conductor elements like silicon and germanium.

10. The oceans act as a storehouse of solar heat energy. Because the oceans covers almost 71% collector of solar heat energy. The energy collector of solar heat energy. The energy from the oceans is available in different forms. They are:
    a. Ocean Thermal Energy (OTE)
    b. Sea – waves energy
    c. Tidal energy
    d. Energy from salinity gradient in seas
    e. Energy from sea – vegetation
    f. Energy from the nuclear fusion of deuterium that is present in oceans

11. There is always some significant temperature difference between the water 'at the surface of ocean' and 'at deeper levels'. This temperature difference is even upto 2°C at enable the flow of heat. The energy available as a result of difference in the temperature water at the surface of the ocean and at deeper levels is known as ocean thermal energy. It is also abbreviated as OTE.

12. The rise of ocean water as a result of moon's attraction is called 'high tide and the fall of water is called 'low tide'. The rise and fall of tidal

waves takes place twice in a day. This gives rise to enormous movement of water between high tides and low a tides and is an excellent source of energy in many coastal areas of the world. The tidal energy can also be harnessed by constructing some tidal barrier or tidal dam.

13. Fuels are substances which are used for producing heat energy. Fuels are sued for producing electricity.
14. The waste material of plants and animals are called biomass. When plants and animal die, their biomass can be used as fuel.
15. The remains of plant and animals buried under the earth millions of years ago are known as fossils. These fossils are excellent fuels and are called fossil fuels. The common examples of fusil fuels are coal, petroleum and natural gas.
16. Petroleum is a mixture of several hydrocarbons with traces of salt, rock particles and water.
17. Fuels used directly to produce heat are called primary fuels and fuels derived from primary fuels are known as secondary fuels.
18. The nuclear reactor (commonly known as atomic reactor or atomic pile) is a specially designed furnace for carrying out the controlled fission of a radioactive material line U – 235 for producing atomic power. The heat energy produced from fission reactions is ultimately converted into electricity.
19. Nuclear fuel is the fissionable material used in the nuclear reactor for producing energy by the process of fission. The nuclear fuel used is enriched which slows down the speed of neutrons so as to cause the fission of uranium 235 effectively. Heavy water is an important moderator.
20. The process in which an unstable nucleus of a heavy atom (like U – 235) splits up into two medium - sized nuclei with the liberation of an enormous amount of energy is called nuclear fission.

$_{92}U^{235} + {}_{0}n^{1} \rightarrow {}_{56}Ba^{141} + {}_{56}Kr^{92} + 3({}_{0}n^{1}) + \text{energy}$