7. Lenses
Extra Questions

State true or false

1) Power of a lens p = $1/f$

Ans – True

2) A concave lens is a converging lens.

Ans – false

3) A concave lens always forms a virtual image

Ans – True

4) Due to the light sensitive cells in the eye, we get information about the brightness or dimness of the object & the colour of the object

Ans – True

5) A concave lens is used as a magnifying glass

Ans – True

6) The principle focus of convex lens is virtual

Ans – False

7) When an object is placed in front of a concave lens, its image is obtained on the opposite side of the object

Ans – False

8) In compound microscope a real image acts as an object for the eyepiece.

Ans – True

9) In television, we see a continuous picture due to persistence of vision.

Ans – True

10) The rod like cells respond to colours & communicate the presence of colours in the retinal image of the brain

Ans – False

11) Power of lens , p = $1/f$

Ans – True

12) A convex lens is a diverging lens

Ans – False

14) The focal length of concave lens is negative

Ans – False

15) As one grows old ciliary muscles become weak

Ans – True

16) Find odd man out

prism, concave lens, convex lens, mirror

Ans – mirror

17) Explain the term power of accommodation of the eye. OR write a short note on the power of accommodation of the eye.

Ans – **Power of accommodation of the eye :** The eye lens is held in its position by the ciliary muscles. When we look at a nearby object, the ciliary muscles compress the eye lens so that it becomes rounded. Hence, the focal length of the eye lens decreases. Therefore , the image is formed on the retina of the eye and hence the nearby object is seen clearly. When we look at a distant object, the ciliary muscles relax so that the eye lens becomes flat. Hence, the focal length of the eye lens increases. Therefore, the image is formed on the retina of the eye and hence the distant object is seen clearly. This ability of the eye lens to adjust its focal length is called the power of accommodation of the eye.

18) Explain the difference in camera and human eye.

Ans – **Differences :** Cameras come in a variety of sizes and shapes unlike the human eye. Unlike the human eye, a wide variation in exposure time is possible in the case of cameras. The human eye is sensitive in the visible region (red to violet) of the electromagnetic spectrum, while a much wider range of the electromagnetic spectrum, while a much wider range of the electromagnetic spectrum can be covered with cameras designed for specific purposes. In comparison with the human eye, a wider view and range can be covered by a camera. In comparison with the human eye, a wider intensity (of light) range can be covered with a camera. The retina is indispensable in the human eye, while cameras without a photographic film have been designed with the help of

photographic film have been designed with the help of photosensitive materials and are in current use.

19) Simple microscope, compound microscope, telescope, myopia

Ans – Myopia

20) If two lenses with focal lengths – 10 cm and 40 cm respectively are kept in contact with each other, what can you say about the behavior of the combination of the lenses will behave as a concave lens.

Ans – The combination of the lenses will behave as a concave lens.

21) Match the columns

A	B	Ans
i) correction of myopia	Colour of light	Concave lens
ii)correction of hypermetropia	Intensity of light	Convex lens
ii) rod – shaped cells	Concave lens	Intensity of light
iv) cone – shaped cells	Convex lens	Color of light

22)

A	B	Ans
i) opaque	v/u	v/u
ii) transparent	Simple microscope	Simple microscope
iii) magnifying glass	Cornea	Cornea
iv) magnification	Iris	Iris

23) In general, when a ray of light passes through a lens, there occurs a change in its direction of propagation. Why?

Ans – The working of a lens is similar to that of a triangular prism. When a ray of light passes through a lens, it is refracted twice : When entering the lens and when emerging from the lens. There is a change in its direction of propagation every time and as both the changes occur in the same sense, the direction of propagation of the emergent ray is different from that of the incident ray.

24) convex or double convex lens.

Ans – The lens which has two spherical surfaces which are puffed up outwards is called a convex or double convex lens

25) concave lens or double concave lens.

Ans The lens with both surfaces spherical on the inside is called a concave or double concave lens.

26) centre of curvature (c)

Ans The centers of spheres whose parts form surfaces of the lens are called center of curvatures of the lenses A lens with both surfaces spherical has two centers of curvature c1 & c2

27) Radius of curvature (R)

Ans – The radii (R_1 & R_2) of the spheres whose parts form surfaces of the lenses are called the radii of curvature of the lens.

28) Principle axis

Ans – The imaginary line passing through both centers of curvature is called the principle axis of the lens

29) Optical centre(o)

Ans – The point inside a lens on the principal axis, through which light rays pass without changing their path is called the optical centers of a lens.

30) Simple microscope

Ans – A convex lens with small focal length produces a virtual, erect & bigger of an object. Such lens is called simple microscope or magnifying lens.

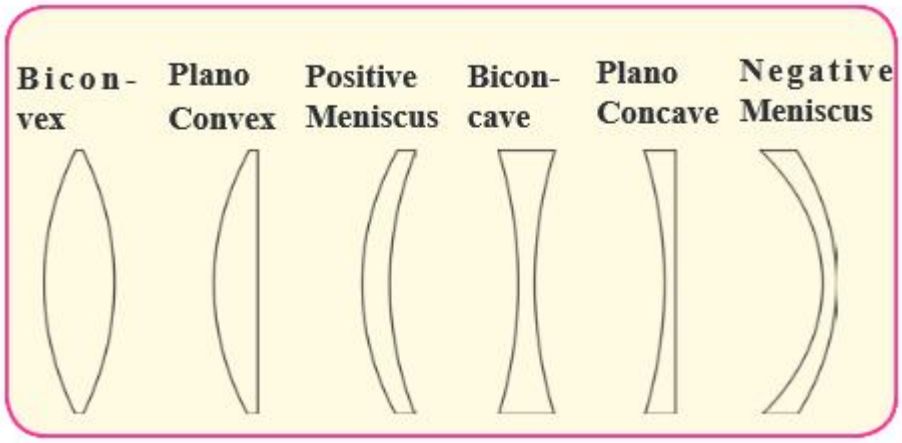
31) Principal focus (F)

Ans – When light ray parallel to the principal axis are incident on a convex lens, they coverage to a point on the principal axis. This point is called the principal foci of the convex lens

32) How a lens different from mirror?

Ans – The different between mirrors & lens lies in how light reflects when false over their surface when light interacts with any surface, mainly two things happen, reflection & refraction. The main difference between mirror & lens is that image forms by reflection, as the light falls on a mirror, In lens, the image is formed by refraction.

33) Draw neat labelled diagrams. Types of lenses (2 marks)



7.2 Types of lenses

Ans

34) How do we perceive different colours?

Ans – We perceive colour when the different wavelength composing white light are selectively interfered with by matter (absorbed, reflected, refracted, scattered, or diffracted)on their way to our eyes, or when a non – white distribution of light has been emitted

35) what is the power of lens ? what is its SI unit? (2 marks)

Ans – The capacity of a lens to coverage or diverge incident rays is called its power (P) The power of a lens depends on its focal length.

power is the inverse of its focal length (f) ; f is expressed in meters

The unit of the power of a lens is dioptre(D)

$$P = \frac{1}{f(m)}$$

$$1 \text{ dioptre} = \frac{1}{1 \text{ m}}$$

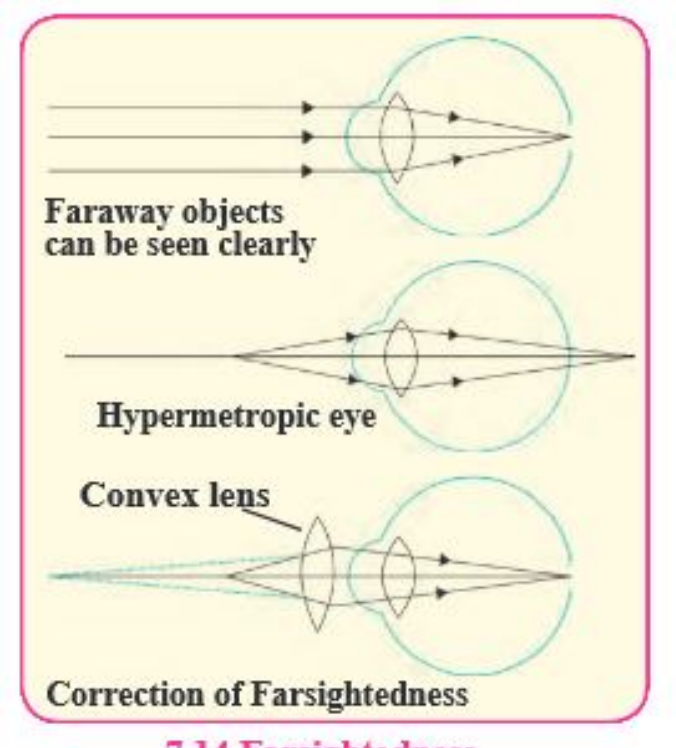
36) Write short note on farsightedness

Ans – In this defect the human eye can see distant objects clearly but cannot see nearby objects distinctly. This means that the near point of the eye is no longer at 25 cm but shifts further away.

There are two reasons for farsightedness.

1. curvature of the cornea & the eye lens decreases so that, the converging power of the lens become less.

2. Due to the flatter of the dye ball the distance between the lens & retina decreases this defect can be corrected by using a convex lens with proper focal length. This lens coverages the incident rays before they reach the lens. The lens then coverages them to form the image on the retina.



7.14 Farsightedness

37) Write short note on presbyopia (2 marks)

Ans – This defect occurs because of old age. In this the people suffer from near sightedness as well as farsightedness. In such a case bifocal lenses are required to correct the defect. In such lenses, the upper part is concave lens and corrects nearsightedness. while the lower parts is convex lens which corrects the farsightedness.

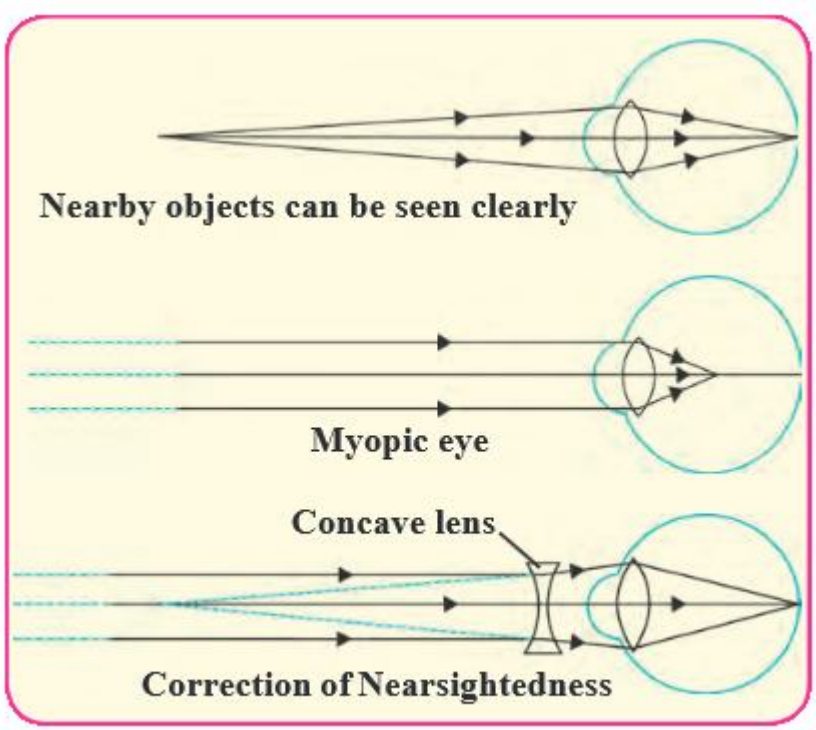
38) Write a short note on nearsightedness (4 marks)

Ans – In this case, the eye can see nearby objects clearly, but the distant objects appear indistinct. This means that the far point of the eye is not at infinity but shifts closer to the eye. There are two reasons for this defect.

1. The curvature of the cornea and the eye lens increases the muscles near the lens cannot relax so that the converging power of the lens remains large.

2. The eyeball elongates so that the distance between the lens and the retina increase.

This defect can be corrected by using spectacles with concaves lens of proper focal length of proper focal length this lens diverges the incident rays and these diverged rays can be converged by the lens in the eye to form the image on the retina. The focal length of concave lens is negative. so a lens with negative power is required for correcting nearsightedness. The power of the lens is different for different eyes depending on the magnitude of their nearsightedness.



7.13 Nearsightedness

39) Give the applications of concave lens

Ans – a) medical equipment's, scanner, CD player – These instruments use laser light. for proper working of these equipment's concave lenses are used.

b) The peep hole in door. This is a small safety device which helps us see a large area outside the door. The uses one or more concave lenses

c) spectacles concave lenses are used in spectacles to correct nearsightedness.

d) torch – concave lens is used to spread widely the light produced by a small bulb inside a torch.

e) camera, telescope & microscope these instruments mainly use convex lenses. to get good quality images a concave lens is used in front of the eyepiece or inside.

40) Give the application of convex lens (5 marks)

Ans – a) simple microscope – A convex lens with small focal length produces a virtual, erect & bigger image of an object as shown in figure such a lens is called simple microscope. one can get a 20 times larger image of an object using such microscopes these are used for watch repair, testing precious gems & finding their defects

b) compound microscope.

simple microscope is used to observe small sized objects but minute object like blood cells cell of plants & animals & minute living beings like bacteria cannot be magnified sufficiently by simple microscope, compound microscopes are used to study objects. It is used to observe Bactria, viruses, cells & microorganisms etc.

c) Telescope – A combination of two convex lens is used in telescope. Telescope are used to observe astronomical sources like starts & the plants are called astronomical telescope

d) optical instruments

convex lenses are used in various other optical instruments like camera, projector, spectrograph etc.

e) spectacles

convex lens are used in spectacles for correcting farsightedness.

41) Distinguish between the following convex lens & concave lens. (3 marks)

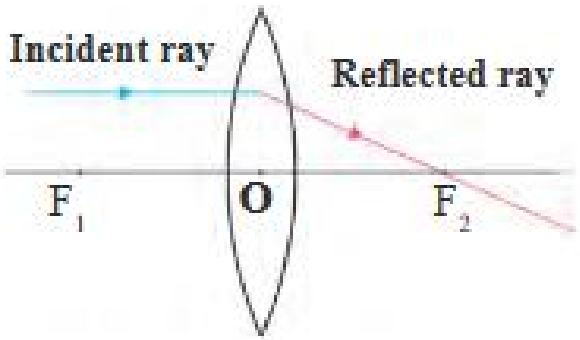
Convex lens	Concave lens
The lens which has two spherical surfaces puffed outwards is called convex	The lens with both the surfaces spherical on inside is called concave lens.
It is thicker in the middle than at the edges	It is thicker at the middle than in the middles glass.
These are called converging lens.	These lens are called diverging lens.
It can form a magnified, diminished or the same sized image.	It can form only a diminished image
Image formed by convex lens are real & act virtual	Image formed by concave lens are always virtual.
These are used to correct hypermetropia	These are used to correct to myopia

42) Simple microscope & compound microscope (3 marks)

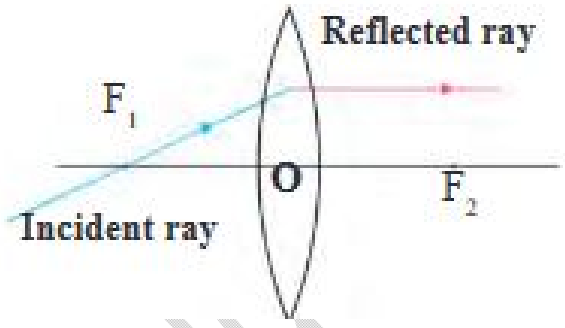
Simple Microscope	Compound Microscope
1) In simple microscope, only one convex lens is used.	1) In compound microscope, two convex lenses objective & eye place are used.
2) In this case. the object is placed within the focal length of convex lens.	2) In this case, the object is placed beyond the focal length of the objective lens.
3) Its magnifying power is much less than that of a compound microscope	3) Its magnifying power is much greater than that of a simple microscope
4) It is used to observe minute parts of a watch, to read words in small prints etc.	4) It is used to observe blood corpuscles, plant & animal cells etc.

43) State the rules to draw ray diagrams of images obtained by convex lenses (4 marks)

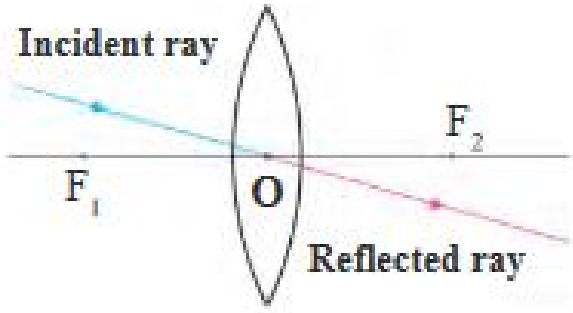
Ans – Rule 1 : When the incident ray is parallel to the principal axis, the refracted ray passes through the principal focus



Rule 2: when incident ray passes through the principal focus, the refracted ray is parallel to the principal axis.



Rule3: when incident ray passes through the optical centre of the lens. it passes without changing its direction



44) What is magnification? write down the formula (3 marks)

Ans – The magnification due to a lens is the ratio of the height of the image (h2) to the height of the object (h_1)

$$\text{magnification} = \frac{\text{height of the image}}{\text{height of the object}}$$

i. e $m = \frac{h2}{h1}$……..1)

The magnification due to lens is also related to the distance of the object (u) & that of the image (v) from the lens.

$$\text{magnification} = \frac{\text{height of the image}}{\text{height of the object}}$$

i. e $m = \frac{v}{u}$……..2)

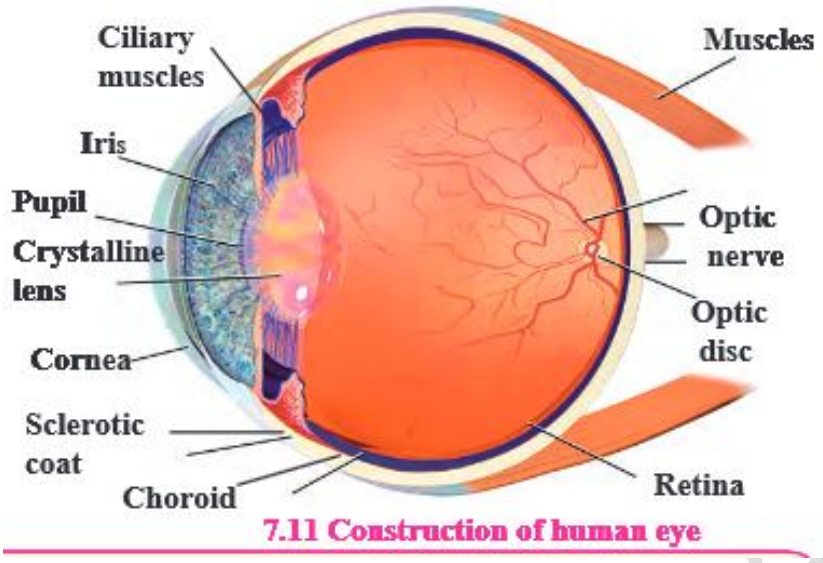
45) Explain the various parts of human eye & their working.

Ans – cornea: There is a very thin transparent cover (membrane) on human eye. This is called cornea light enters the eye through it. Maximum amount of incident light is refracted inside the eye at the outer surface of the cornea. Iris: There is a dark fleshy screen behind the cornea. This is called iris. The colour of iris is different for different people.

pupil: There is a small hole of having diameter at the centre of the iris which is called pupil. The pupil controls the amount of light entering the eye.

Retina: It is a screen which is made up of light sensitive cells & These cells get executed when light falls on them & generate electric signals. These signals are conveyed to the brain through optic nerve later the brain analyses these signals

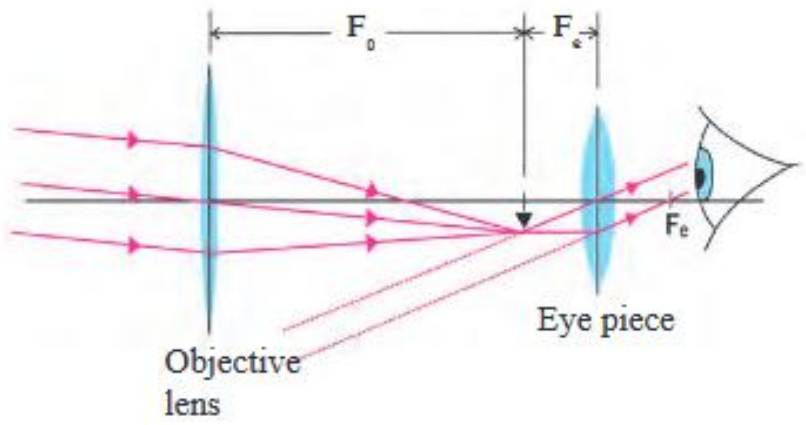
& convert them in such a way that we perceive the objects as they actually are .



7.11 Construction of human eye

46) Explain Refracting telescope (4 marks)

Ans – In refracting telescope, the image is formed by the objective acts as object for the eyepiece which forms a final image.



objective lens has larger diameter & larges focal length because of which maximum amount of light coming from the distant object can be collected.

on the other hand the size of the eyepiece is smaller & focal length is also less. Both the lenses are fitted inside a metallic tube in such a way that the distance between them can be changed. The principal axes of both the lenses are along the same straight line. Generally using the same objective but different eyepiece different magnification can be obtained.

47) doctors has prescribed a lens having power + 1.5D what will be the focal length of the lens ? what is the type of the lens and what must be the defect of vision?

Ans – sol: Given powers of the lens = + 1.5 D

$$\text{focal length} = \frac{1}{\text{power of the lens}}$$

$$= \frac{1}{+\ 1.5\ \text{D}}$$

$$= 0.67\ \text{m}$$

Focal length of the lens is +0.67m. convex lens is the type of the lens hypermetropia

48) 5 cm high object is placed at a distance of 25 cm from a converging lens of focal length of 10 cm determine the position, size and type of the image

Ans – given : converging lens (convex lens)

F = 10 cm, h_1 = 5 cm u = - 25 cm, v = ?, h_2 = ?

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

$$\therefore \frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{10} + \frac{1}{-25}$$

$$= \frac{1}{10} - \frac{1}{25} = \frac{25-10}{250} = \frac{15}{250}$$

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

$$\therefore v = \frac{50}{3} = 16.67 \text{ cm}$$

Their image is real. It is formed at 25 cm from the lens and on the other side of the lens relative to the objects.

ii) $\frac{h2}{h1} = \frac{v}{u}$

$$\therefore h_2 = h_1 \left(\frac{v}{u}\right)$$

$$\therefore h_2 = 5\text{cm} \times \frac{16.67 \text{ cm}}{-25 \text{ cm}} = \frac{16.67}{-5}$$

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

The negative sign indicates that the image is inverted. It is formed below the principle axis

The height of the image, h_2 = + 3.3 cm

49) A convex lens of the focal length 20 cm what is its power?

Ans – given f = 20 cm = $\frac{20}{100}$ = 0.2 cm

$$p = \frac{1}{F \text{ (inm)}}$$

$$\therefore\ p = \frac{1}{0.2} = \frac{1 \times 10}{2} = +0.5\ D$$

DNS – The power of the convex lens is +5.D

50) A thin lens has focal length of – 10 cm what is the power of the lens and what is its nature?

Ans –0given: f = 10 cm = $\frac{-10}{100} = -0.1\ m$

$$p = \frac{1}{f\ (\text{in m})}$$

$$\therefore p = \frac{1}{-0.1} = \frac{-1 \times 10}{1} = -10D$$

$$\therefore p = -10 \text{diopters}$$

Ans:- the power of the lens is -10D the negative sign indicates that it is a diverging lens or a concave lens