The Human Eye and the Colourful World

87. In which of the following two cases the focal length of the eye lens will be more:
(a) When ciliary muscles of a normal eye is most relaxed.
(b) When ciliary muscles of a normal eye is in most contracted state. Explain with reason.

2012/2015 [2 Marks]

(a) ● Focal length of the eye lens will be more when ciliary muscles is most relaxed.
● It is because in this state, eye lens becomes thinner, hence its focal length increases.
(b) Focal length of the eye lens will be least when ciliary muscles are in their most contracted state. It is because in this state, eye lens become thicker, hence its focal length decreases.

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88. (a) Mention the role of crystalline lens in the human eye.
(b) How does the focal length of the eye lens change when we shift looking from nearby object to a distant object?

2014/2015 [3 Marks]

(a) The crystalline lens provides the finer adjustment of focal length required to focus objects at different distance on the retina.
(b) When we look at a nearby object, the ciliary muscles contract. This increases thecurvature of the eye lens and hence, its focal length decreases. However, when we seedistant object, ciliary muscle relaxes. This causes decrease in curvature of the eye lens.Thus, its focal length increases in order to clearly see a distant object.

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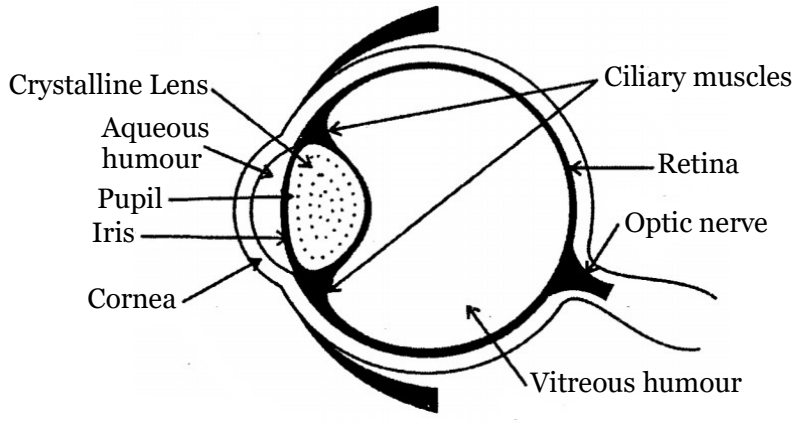
89. Draw a diagram of human eye. Label the following parts and give their functions:
pupil, eye lens, ciliary muscles, retina.

2013/2015 [5 Marks]



Functions of the human eye:
(i) **Pupil:** The pupil regulates and controls the amount of light entering in the eyes.
(ii) **Eye lens:** Human eye lens is a crystalline convex lens on which image forms.
(iii) **Ciliary muscles:** They help in adjusting the focal length of eye lens.
(iv) **Retina:** Retina is a light sensitive surface of the eye where the real image is formed.

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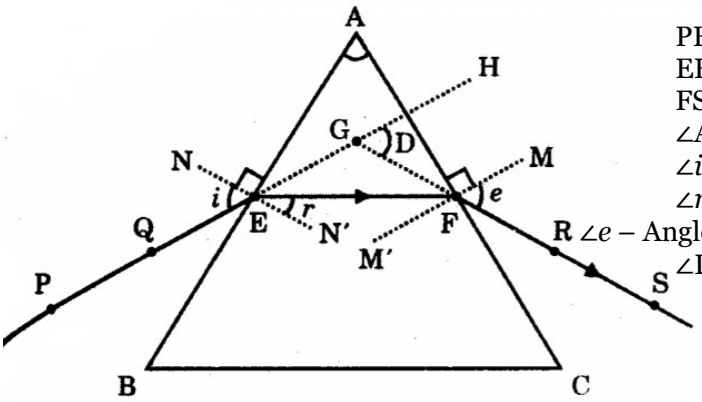
90. Make a well labelled diagram showing refraction of light through a glass prism and of the following:
(a) Incident ray (b) Emergent ray (c) Refracted ray
(d) Angle of refraction (e) Angle of incidence (f) Angle of deviation
(g) Angle of emergence (h) Angle of prism

2011/ 2012/2014 [2 Marks]



PE – Incident ray
EF – Refracted ray
FS – Emergent ray
∠A – Angle of prism
∠i – Angle of incidence
∠r – Angle of refraction
∠e – Angle of emergence
∠D – Angle of deviation

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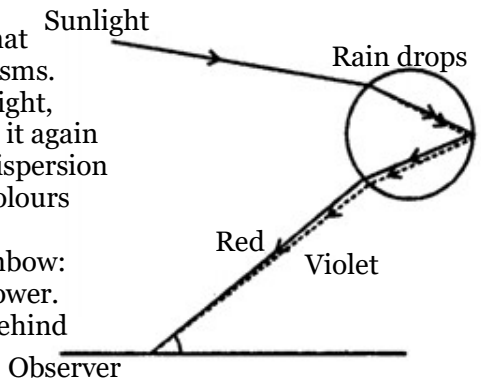
91. Draw a labelled ray diagram to show the formation of rainbow in the sky giving brief explanation of the phenomena involved in each stage. List two conditions necessary to observe a rainbow.

2014 [5 Marks]

We see rainbow after a rain shower. It is always formed in a direction opposite to that of the Sun. The water droplets acts like prisms. they refract and disperse the incident sunlight, then reflect it externally and finally refract it again when it comes out of the droplet. Due to dispersion of light and external reflection, different colours reaches our eyes.
Two conditions necessary to observe a rainbow:
(1) It is seen in the sky only after a rain shower.
(2) The position of sun should be always behind the observer.



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92. (a) If a person wears lens of power – 6D for distant vision and for correcting his near vison he needs a lens of +2D. Determine the focal length of the lenses in both the case.
(b) Give reason for the following natural phenomenon:
(i) Stars appear raised in the sky.

2012/2015 [5 Marks]

(a) ● Power = -6 D

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

$f = \frac{-1}{6D} = -0.166$ m

● Power = 2D

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

$2D = \frac{1}{f}$

f = 0.5 m

(b) (iii) The starlight, on entering the earth's atmosphere undergoes refraction continuously before it reaches the earth. The atmospheric refraction occurs in medium gradually changes refractive index. Since the atmosphere bends starlight towards the normal, the apparent position of star is slightly higher than actual position.

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93. Why does the sun appear reddish at sunrise? Explain with the help of a diagram.

2014/2015 [3 Marks]

For answer to the question "Why does the sun appear redish at sunrise", refer to question number 24.