SHARJAH INDIAN SCHOOL

Grade x notes - The human eye & the colourful world.

POWER OF ACCOMMODATION.

The ability of the eye lens to adjust its focal length and hence to see both nearby and faraway objects is called accommodation.

Near point or least distance of distinct vision.

The minimum distance at which objects can be seen most distinctly without strain is called the least distance of distinct vision. For normal vision it is at 25 cm.

Far point. The farthest point upto which the eye can see objects clearly is called far point of the eye. It is infinity for a normal eye.

Q. What is cataract? How can it be corrected?

Sometimes the crystalline lens of people at old age becomes milky and cloudy. This condition is called cataract. This causes partial or complete loss of vision. It is possible to restore vision through cataract surgery.

Defects of vision and their correction.

1. The three common refractive defects of vision are, 1. Myopia 2. Hypermetropia and 3. presbyopia.

I Myopia / nearsightedness - It is the defect of vision by which one can see nearby objects clearly but cannot see faraway objects clearly.

Causes. (i) excessive curvature of the eye lens or (ii) elongation of the eyeball.

Correction - by using a concave lens of suitable power.

Fig 11.2 page 189.

II Hypermetropia / farsightedness :- It is the defect of vision by which one can see faraway objects clearly but cannot see nearby objects clearly.

Causes. (i) The focal length of the eye lens is too long or (ii) the eye ball has become too small.

Correction using a convex lens of appropriate power.

Ray diagrams page 190 Fig 11.3.

Presbyopia - The power of accommodation of the eye decreases with ageing. For most people the near point gradually recedes away. They find it difficult to see nearby objects comfortably and distinctly. This defect is called presbyopia.

Causes. - gradual weakening of ciliary muscles and diminishing flexibility of eye lens. Sometimes a person may suffer from both myopia and hypermetropia. Such people require bifocal lenses.

Refraction of light through a prism - Refer text -

Dispersion - The phenomenon of splitting up of white light into its seven component colours by a glass prism is called dispersion.

Reason - The speed of different colours is different in glass. Hence these colours of light bend through different angles with respect to the incident ray as they pass through the prism.

The band of colours thus obtained is called spectrum. The colour which deviates most is violet and the colour which deviates least is red.

To obtain white light from the spectrum, let it pass through a second identical

prism in an inverted position with respect to the first prism as shown. Fig. 11.6.

Q Explain the formation of rainbow.

Rainbow is caused by the dispersion of sunlight by tiny water droplets present in the atmosphere. The rays of light entering the water droplets get refract, disperse and reflect totally and internally and finally refract again when it comes out of the raindrop. Due to these different colours reach an observers eye and we see the rainbow. diagram 11.8.

Atmospheric refraction.

Atmosphere consists of different layers of air at different temperatures. The hot air has less refractive index than that of cool air. Hence a ray of light entering the earths atmosphere refracts. This phenomenon is called atmospheric refraction. This causes many **natural phenomena.**

Q. Why do stars twinkle?

It is due to atmospheric refraction. The stars are very distant objects. Hence can be considered as point sized sources of light. Due to atmospheric refraction the path of a ray of light coming from a star changes which causes a change in the amount of light entering an observers eye, causing twinkling effect.

Q. Planets donot twinkle. Why?

Planets are much closer to the earth. and is considered as an extended source of light. A planet can be considered as a collection

of large number of point sized sources of light. The total variation in the amount of light entering our eye from all the individual point sized sources will average out to zero nullifying twinkling effect. Fig. 11.9 (194.)

Q. The sun is visible to us about 2 min before actual sunrise and about 2 min after sunset. Why?

It is due to atmospheric refraction. By actual sunrise we mean the actual crossing of the horizon by the sun. Due to atmospheric refraction, the rays from the sun bends and reaches an observers eye eventhough it is below the horizon. This forms an image of the sun and we see the sun above horizon and sun is visible to us before the actual sunrise. Fig. 11.10.

Scattering

When light strikes fine particles, it gets reflected diffusely by these particles. This phenomenon is called scattering. Scattering of light makes the particles visible.

The colour of scattered light depends on the size of the scattering particles. Very fine particles scatter mainly blue light while particles of larger size scatter light of longer wavelengths. If the size of the scattering particles is large enough, then the scattered light may even appear white.

Q. Why is the colour of the clear sky blue?

The molecules of air and other fine particles in the atmosphere have size smaller than the wavelength of visible light.

These particles are more effective in scattering blue light. The scattered blue light enters our eyes. This is why sky is blue in colour.

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

At high altitudes there are no atmospheric particles to scatter light. That is why the sky appear as dark at high altitudes.

Q. Danger signals are red in colour. why?

Red colour is least scattered by fog or smoke. Red colour being longer wavelength can travel longer distance without being scattered. This is why danger signals are red in colour.

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

During Sunset and sunrise, rays from the sun passes through larger distance in the atmosphere before reaching an observers eye. Easily scattered shorter wavelengths colours such as blue is scattered and lost near the horizon. So the colour that reaches our eyes is the longer wavelengths (red, orange etc). This gives rise to reddish appearance of the Sun.