

Derivations In Physics Class 11 Cbse Pdf 111

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#### IMPORTANT DERIVATIONS

### (3 marks derivations)

#### 1. Derive the mirror formula for concave mirror.

Let, P = pole and F=principal focus. Object AB is place beyond C and the real image formed by it is A'B' between F and C.

From similar triangles A'B'C and ABC

$$\frac{AB}{A'B'} = \frac{BC}{B'C} \dots (1)$$

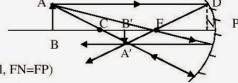
From similar triangles A'B'F and DNF

$$\frac{DN}{A'B'} = \frac{FN}{B'F}$$
 or  $\frac{AB}{A'B'} = \frac{FN}{B'F}$  .... (2)

From (1) and (2)

$$\frac{BC}{B'C} = \frac{FN}{B'F} = \frac{FP}{B'F}$$

 $\frac{BC}{BIC} = \frac{FN}{BIF} = \frac{FP}{BIF}$   $\frac{PB-PC}{PC-PBI} = \frac{FP}{PB'-PF}$  (: the aperture is small, FN=FP)



Using sign convention, the above equation can be written as

$$\frac{-u-(2f)}{-2f-(-v)} = \frac{-f}{-v-(-f)}$$

Or, 
$$2f^2 - vf = -uf + uv + 2f^2 - 2fv$$

Or, 
$$f v + u f = u v$$

Dividing both sides by uvf, we get

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$
 which is the required formula.

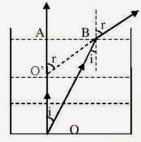
### 2. Show that refractive index = real depth/apparent depth.

'O' is the object lying at the bottom of a tank containing water. O' is its virtual image.

From Snell's law, 
$${}^{w}n_{a} = \frac{\sin i}{\sin r} = \frac{AB/BO}{AB/BO} = \frac{BO'}{BO}$$

Since the aperture of the eye is very small, the two rays from A and B will enter the eye, only if B lies very close to A. Then, BO'~AO' and BO~AO.

$$\therefore \quad {}^{a}n_{w} = 1 / {}^{w}n_{a} = \frac{AO}{AO'} = \frac{\text{Real depth}}{\text{Apparent depth}}$$



### 3. Derive the relation between critical angle and refractive index of the medium.

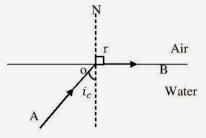
When a ray of light passes through denser (water to a rarer (air) medium, then, according to Snell's law.

when, 
$$i = i_e$$
,  $r = 90^\circ$ 

when,  $i = i_e$ ,  $r = 90^\circ$ 

$$w n_a = \frac{\sin i}{\sin r} = \frac{\sin i_c}{\sin 90^\circ} = \sin i_c$$

Or, 
$$a n_w = \frac{1}{\sin i_c}$$
\*\* In general,  $n = \frac{1}{\sin i_c}$ 



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