A metal surface is illuminated by light of two different wavelengths 248 nm and 310 nm. The maximum speeds of the photoelectrons corresponding to these wavelengths are  $u_1$  and  $u_2$ , respectively. If the ratio  $u_1: u_2 = 2: 1$  and hc = 1240 eV nm, the work function of the metal is nearly [Adv. 2014]

(a) 3.7 eV

(b) 3.2 eV

(c) 2.8 eV

(d) 2.5 eV

ANS

(a) Here, 
$$\frac{hC}{\lambda_1} - \phi = \frac{1}{2} m u_1^2$$
 ...(i)

and 
$$\frac{hC}{\lambda_2} - \phi = \frac{1}{2}mu_2^2$$
 ...(ii)

Dividing equations, (i) by (ii)

$$\frac{hC}{\frac{\lambda_1}{\lambda_1} - \phi} = \frac{u_1^2}{u_2^2} \qquad \therefore \frac{\frac{1240}{248} - \phi}{\frac{1240}{310} - \phi} = \frac{4}{1}$$

$$\therefore \frac{1240}{248} - \phi = \frac{4 \times 1240}{310} - 4\phi \quad \therefore \ \phi = 3.7 \text{ eV}$$

Hence the work function of the metal is nearly,  $\phi = 3.7 \text{ eV}$