745.

Problem 51.8 (RHK)

We have to find the value of the quantum number for a hydrogen atom that has an orbital radius of 847 pm.

Solution:

The radii of the stationary states of hydrogen atom are given by the equation

$$r_n = n^2 a_0, \ n = 1, 2, 3...$$

Bohr radius $a_0 = \dfrac{4\pi\varepsilon_0 h^2}{me^2} = 52.92$ pm.

Therefore, the shell with orbital radius of 847 pm will correspond to principal quantum number n given by the equation

$$52.92 \times n^2 = 847,$$

or

$$n^2 = \frac{847}{52.92} = 16.00,$$

and

$$n = 4 \ .$$