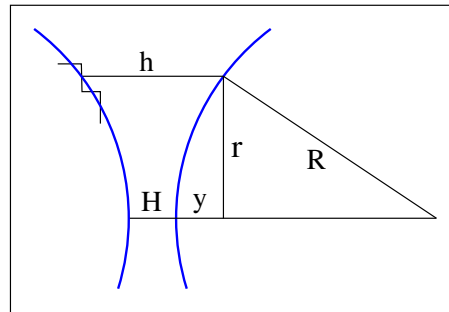


[pex24] Adhesive force between spherical colloids (Derjaguin approx.)

Use the result, $u(h) = -A_H/12\pi h^2$, for the adhesive energy per unit area between parallel flat colloidal surfaces from [pex23] as the starting point for the calculation of the adhesive energy, $U(H)$, between two spherical colloids of radius R at a distance H between nearest points. The Derjaguin approximation assumes $H \ll R$ and replaces the spherical surfaces in the vicinity of the nearest points by two staircases of rings with radius r and width dr . Each pair of rings with equal radius is treated as a pair of flat surfaces subject to an adhesive force per area equal to that derived in [pex23]. Adding up the forces for all such pairs of rings yields the total force, $F(H)$, between the spherical colloids, from which the adhesive interaction potential, $U(H)$, can be inferred directly. Show that the Derjaguin approximation predicts

$$U(H) = -\frac{A_H R}{12H}.$$



Solution: