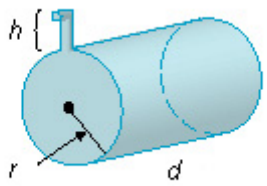
Applications to work done by a force

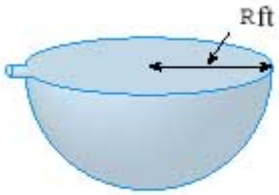
1. The linear density of a 15 m long rod is $22.5/\sqrt{x+1}$ kg/m, where x is measured in meters from one end of the rod. Find the mass of the rod? (ans: 9)
2. An aquarium 3 m long, 6 m wide, and 1 m deep is full of water. Find the work (in J) needed to pump half of the water out of the aquarium. (Use the facts that the density of water is $1000\ \text{kg/m}^3$ and $g \approx 9.8.$) (Ans: 22050)
3. A force of 10 lb is required to hold a spring stretched 4 in. beyond its natural length. How much work (in inches-pound) is done in stretching it from its natural length to 9 in. beyond its natural length? (Ans: 405/4)
4. If 432 J of work are needed to stretch a spring from 8 cm to 14 cm and another 580 J are needed to stretch it from 14 cm to 19 cm, what is the natural length of the spring? (Ans: 2)
5. If 132 J of work are needed to stretch a spring from 9 cm to 12 cm and another 588 J are needed to stretch it from 12 cm to 19 cm, what is the natural length of the spring? (Ans: 5cm)
6. A heavy rope, 40 ft long, weighs 0.8 lb/ft and hangs over the edge of a building 110 ft high. How much work is done in pulling the rope to the top of the building?(Ans: 640 ft-lb)
7. A tank is full of water. Find the work required to pump the water out of the outlet. Round the answer to the nearest thousand (Ans: W = 2,463,000 J)



h = 2 m , r = 2 m , d = 5 m

8. A spring has a natural length of 22 cm. If a force of 15 N is required to keep it stretched to a length of 32 cm, how much work is required to stretch it from 22 cm to 40 cm? (Ans: 2.43 J)
9. If 90 J of work are needed to stretch a spring from 8 cm to 13 cm and another 294 J are needed to stretch it from 13 cm to 20 cm, what is the natural length of the spring? (Ans: 6 cm)
10. A bucket that weighs 5 lb and a rope of negligible weight are used to draw water from a well that is 70 ft deep. The bucket starts with 50 lb of water and is pulled up at a rate of 10 ft/s, but water leaks out of a hole in the bucket at a rate of 0.5 lb/s. Find the work done in pulling the bucket to the top of the well. (Ans: 3,727.5 ft-lb)

11. The tank shown is full of water. Given that water weighs 62.5 lb/ft^3 and R = 7, find the work required to pump the water out of the tank. (Ans: . 117,859 ft-lb)



hemisphere

12. A heavy rope, 20 ft long, weighs 0.6 lb/ft and hangs over the edge of a building 100 ft high. How much work is done in pulling the rope to the top of the building? (Ans: 120 ft-lb)