46.47 The flow of a centrifugal pump developing $150ft$ of head is reduced from $500gpm$ to $300gpm$. After the speed reduction, what is the head added by the pump?

A. $32ft$

B. $54ft$

C. $90ft$

D. $250ft$

Refer to the Pump Affinity Laws. For a change in speed, the change in volume flow rate is proportional to the change in speed. Calculate the ratio of the new speed to the old speed.

$$\frac{N_2}{N_1} = \frac{Q_2}{Q_1} = \frac{300gpm}{500gpm} = 0.6$$

The change in head is a function of the *square* of the change in speed. Calculate the new head after the speed change.

$$\frac{h_2}{h_1} = \left(\frac{N_2}{N_1}\right)^2$$

$$h_2 = h_1\left(\frac{N_2}{N_1}\right)^2 = (150ft)(0.6)^2 = 54ft$$

Answer B

46.48 A manometer uses mercury to measure the pressure inside a gas storage tank. One end of the manometer is open to the atmosphere. The height of the column of mercury is $18in$. What is the pressure inside the tank?

A. $9psia$

B. $18psia$

C. $24psia$

D. $37psia$

Refer to the Commonly Used Equivalents, taking note of the relationship between inches of mercury and psi.

$$1in\,of\,mercury = 0.491psi$$

Since the manometer is open to the atmosphere on one side, the height of the column of mercury measures the gauge pressure only. The absolute pressure must account for atmospheric pressure which is exerted on the open manometer in addition to the mercury. Determine the pressure of the column of mercury and add $14.7psi$ for the atmosphere.

$$P_g = (18in)\,(0.491psi) = 8.84psig$$

$$P_a = 8.84psig + 14.7psi = 23.5psia$$

Answer C