



Question 9. 21. The Marina trench is located in the Pacific Ocean, and at one place it is nearly eleven km beneath the surface of water. The water pressure at the bottom of the trench is about 1.1×10^8 Pa. A steel ball of initial volume 0.32 m^3 is dropped into the ocean and falls to the bottom of the trench. What is the change in the volume of the ball when it reaches to the bottom?

Answer:

Given, $P = 1.1 \times 10^8$ Pa, $V = 0.32 \text{ m}^3$, $K = 1.6 \times 10^{11} \text{ Nm}^{-2}$

Bulk modulus for steel = $1.6 \times 10^{11} \text{ Nm}^{-2}$

Using relation,
$$K = \frac{P}{\frac{\Delta V}{V}} = \frac{PV}{\Delta V}$$

or,
$$\Delta V = \frac{PV}{K}$$

$$\Rightarrow \Delta V = \frac{1.1 \times 10^8 \times 0.32}{1.6 \times 10^{11}} \text{ m}^3$$
$$= 2.2 \times 10^{-4} \text{ m}^3.$$

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