

Answer on Question#40906, Physics, Other

Question:

To be dimensionally consistent, force $[ML/T^2]$, pressure $[M/LT^2]$, and length $[L]$ must be related as follows.

- A) force = pressure² × length²
- B) force = pressure² × length
- C) force = pressure × length²
- D) force = pressure × length

Answer:

Force equals:

$$F = p^a l^b$$

where a and b – some numbers; p, l – pressure and length

Then dimension of force equals:

$$[F] = \left(\frac{M}{LT^2}\right)^a L^b = M^a L^{b-a} T^{-2a} = \frac{ML}{T^2}$$

Therefore:

$$\begin{cases} a = 1 \\ b - a = 1 \\ -2a = -2 \end{cases}$$

or $a = 1, b = 1 + 1 = 2$

$$F = pl^2$$

Answer: C) force = pressure × length²