

PME 3222 – MECÂNICA DOS FLUIDOS PARA ENGENHARIA CIVIL

AULA 2.2

ESTÁTICA DOS FLUIDOS.

Pressão em um Ponto. Variação de Pressão. Equação Fundamental da Estática dos Fluidos. Pressões na Atmosfera, atmosfera -padrão. Manometria. Medidores de Pressão. Forças de Pressão sobre Áreas Planas.

[Cap. 2–Munson]

[Ap. N°10].

CONCEITO DE TENSÃO E DEFINIÇÃO DE PRESSÃO

FORÇA / ÁREA=TENSÃO

- TENSÃO NORMAL DE COMPRESSÃO (ou simplesmente pressão)
- TENSÃO NORMAL DE TRAÇÃO
- TENSÃO TANGENCIAL DE CISALHAMENTO

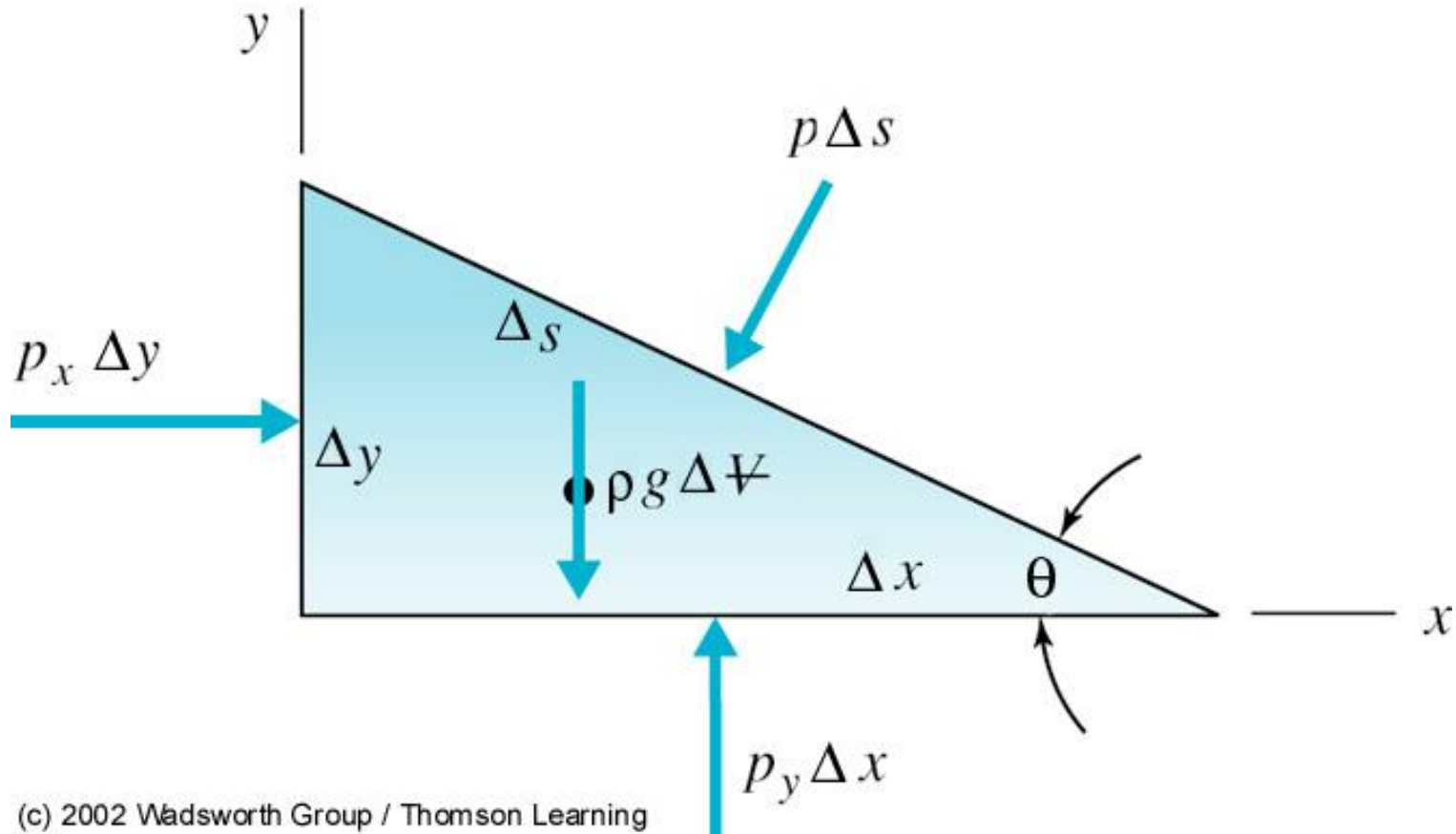
PRESSÃO É UMA GRANDEZA ESCALAR

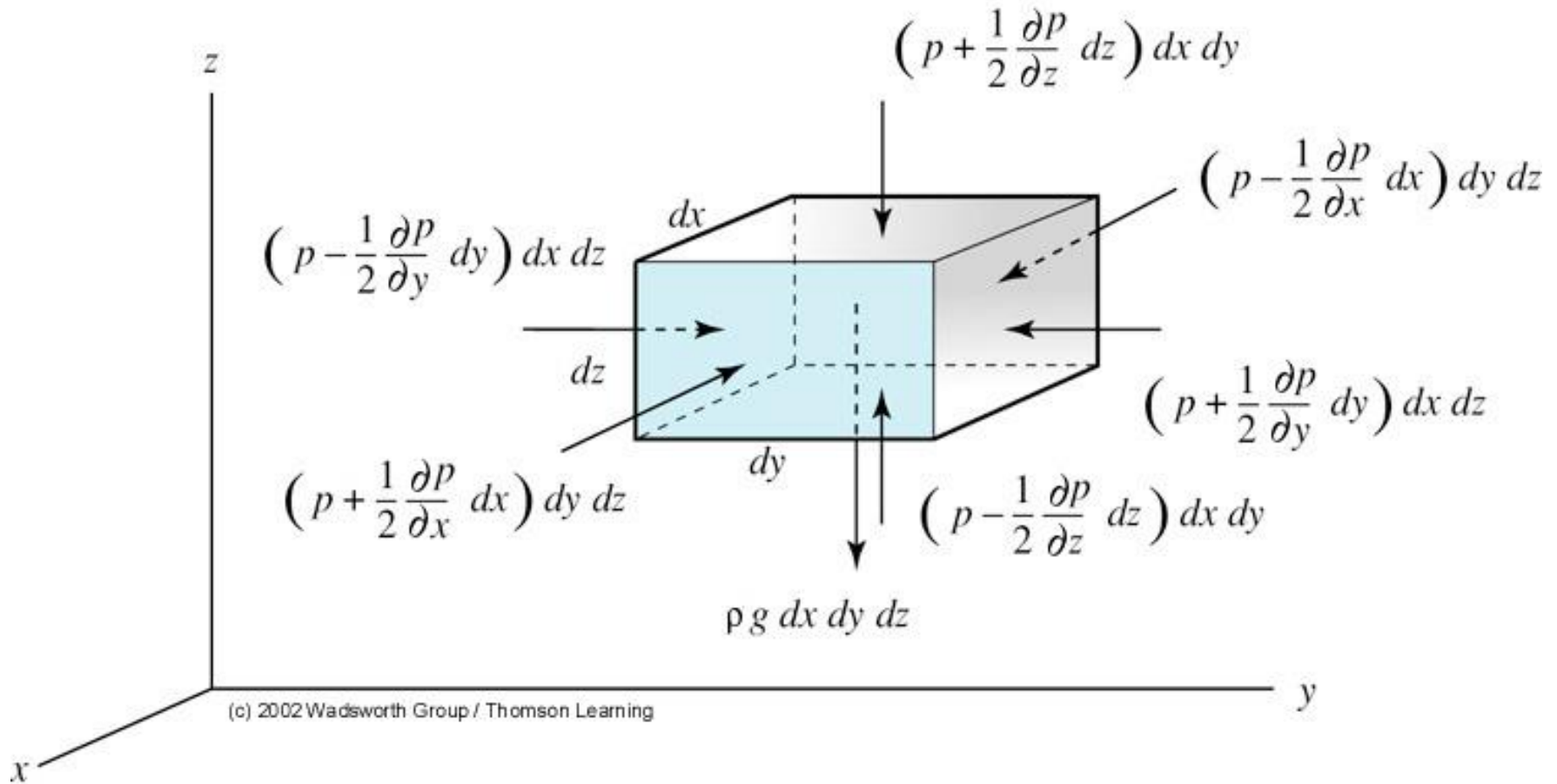
- Fluido em repouso:
- Fluido em movimento:

$$p_x = p_y = p_z$$

$$p_x \neq p_y \neq p_z$$

Pressure at a point in a fluid





Forces acting on a infinitesimal element that is at rest in the xyz -reference frame. The reference frame may be accelerating or rotating.

EQUAÇÃO BÁSICA DO CAMPO DE PRESSÃO

$$-\overrightarrow{\text{grad}} p - \gamma \cdot \vec{k} = \rho \cdot \vec{a}$$

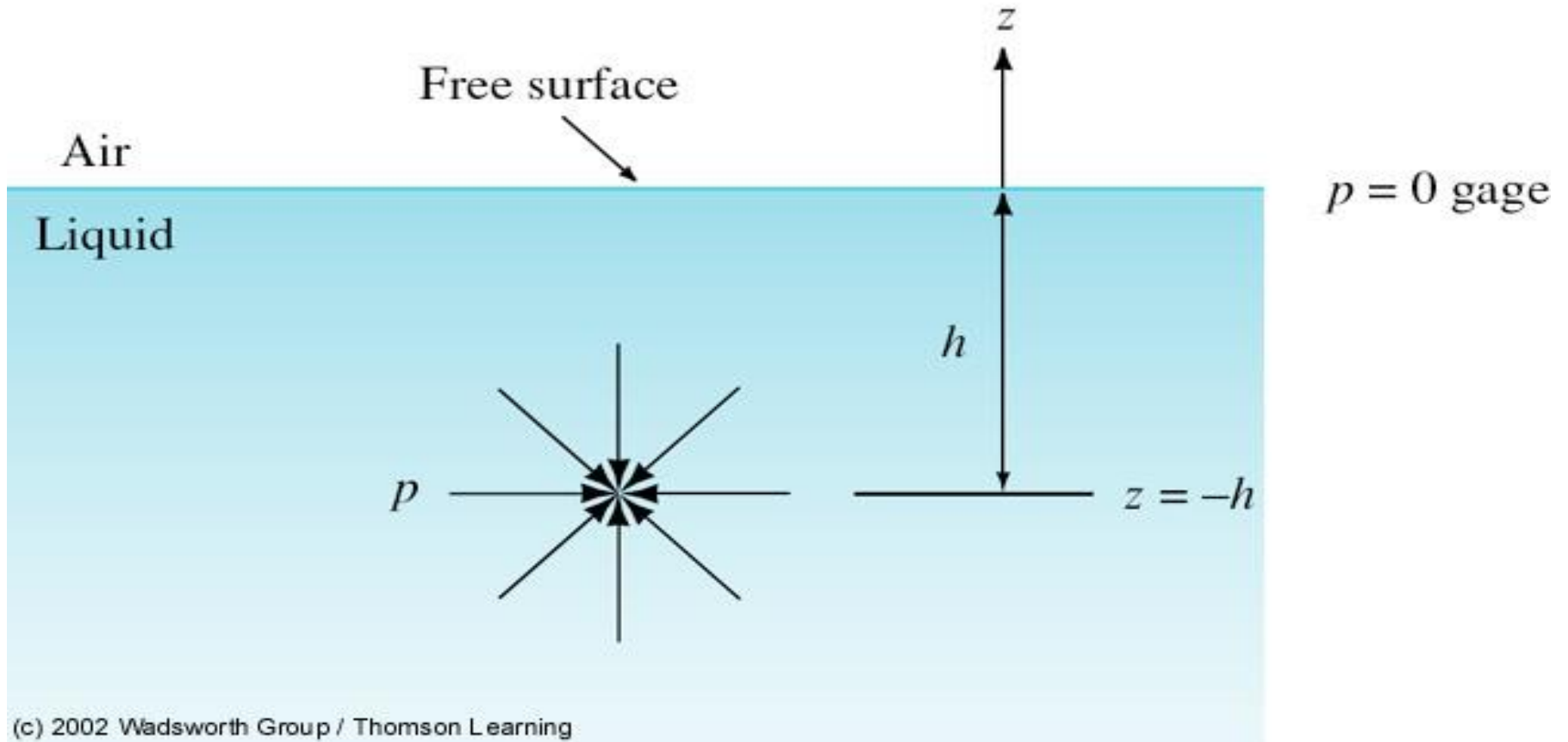
EQUAÇÃO FUNDAMENTAL DA ESTÁTICA DOS FLUIDOS

$$-\overrightarrow{\text{grad}} p - \gamma \cdot \vec{k} = 0$$

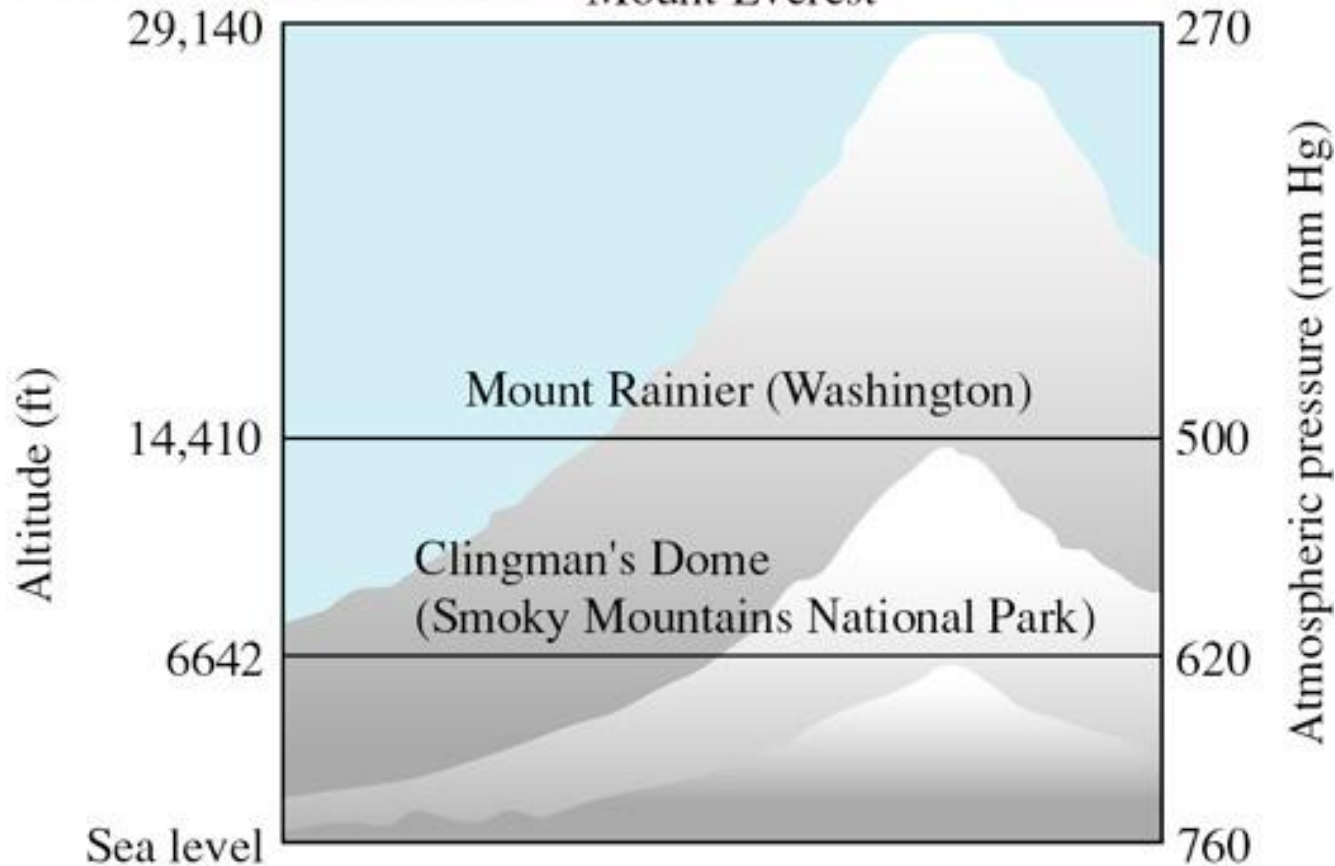
VARIAÇÃO DE PRESSÃO NUM FLUIDO EM REPOUSO

$$\frac{\partial p}{\partial z} = -\gamma$$

Pressure below a free surface.



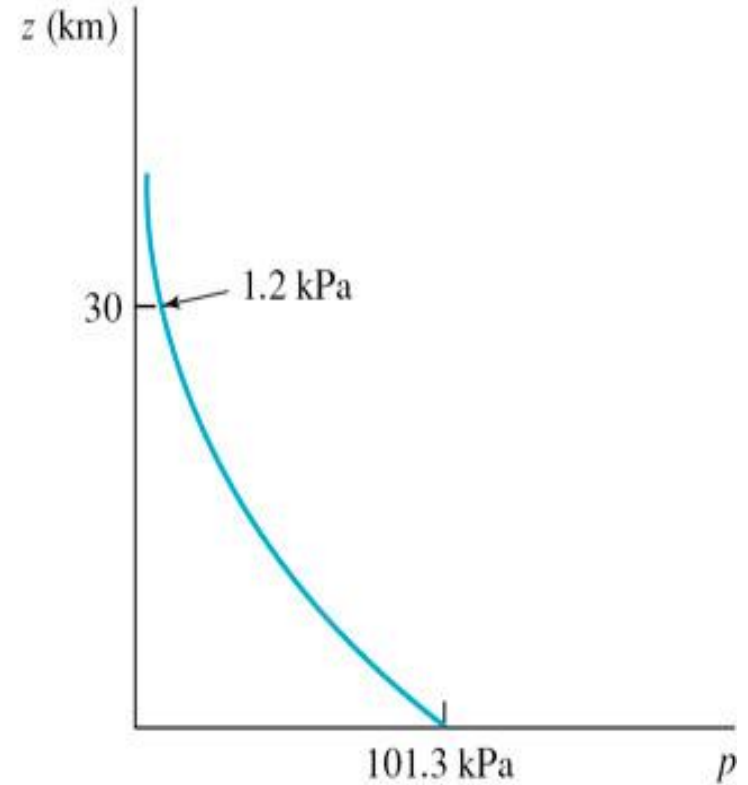
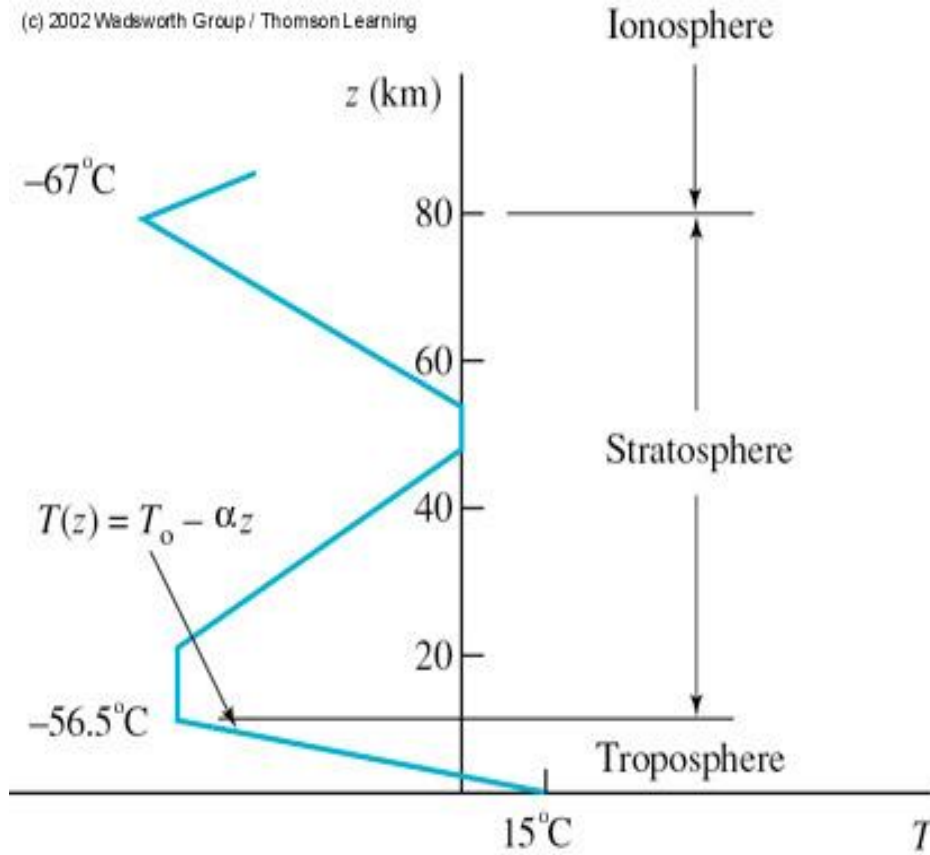
Mount Everest



Atmospheric Pressure and Altitude - A column of air from the outer atmosphere to a given point on Earth contains gases that exert a force equal to 14.7 lb on each square inch. This pressure is 1 atm or 760 mm Hg. At a higher altitude the pressure is less because the mass of the column of air from the outer atmosphere to that point is less. Examples of pressure on three mountains are given.

Standard atmosphere

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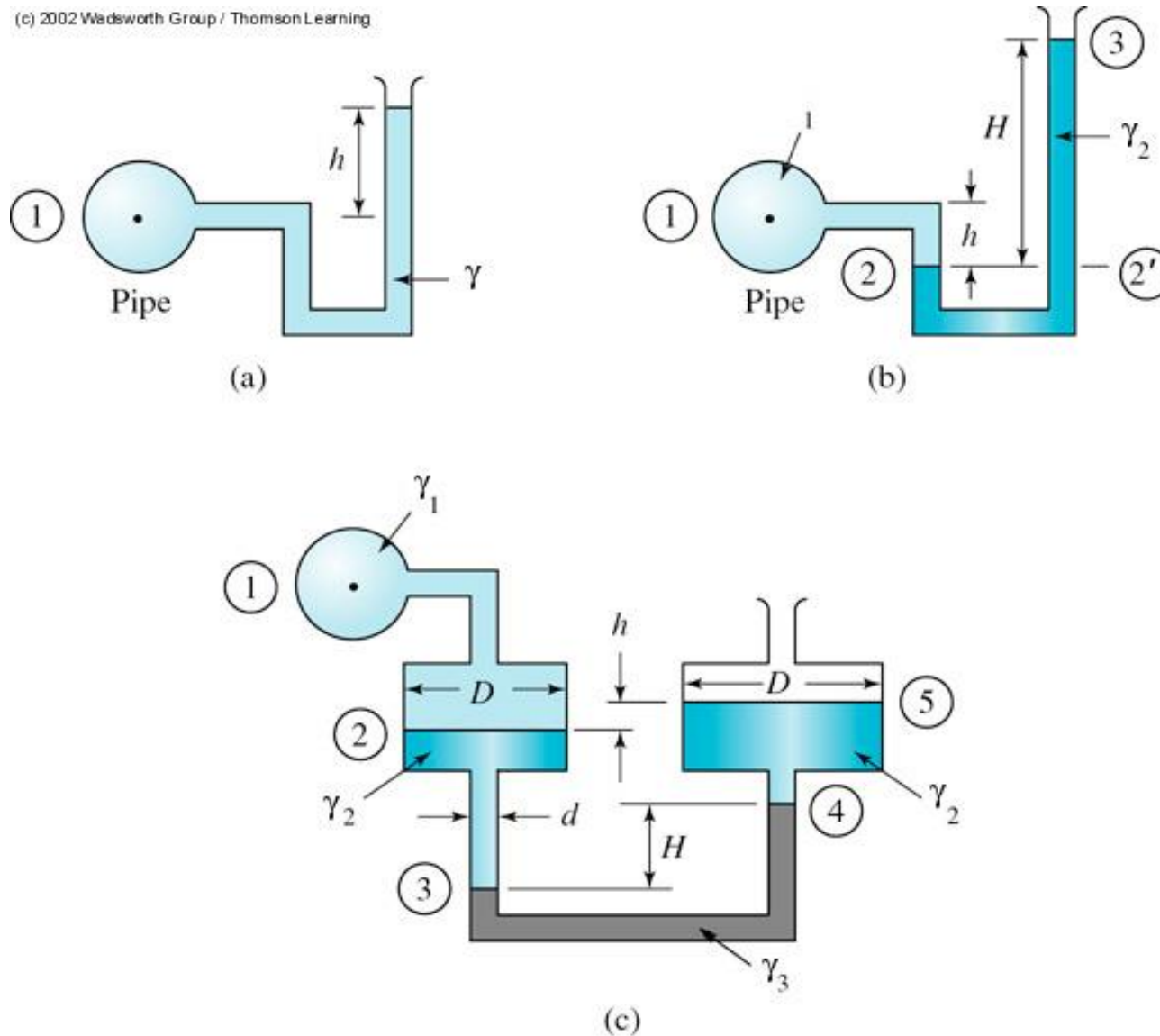
MEDIDORES DE PRESSÃO

Piezômetro

Barômetro

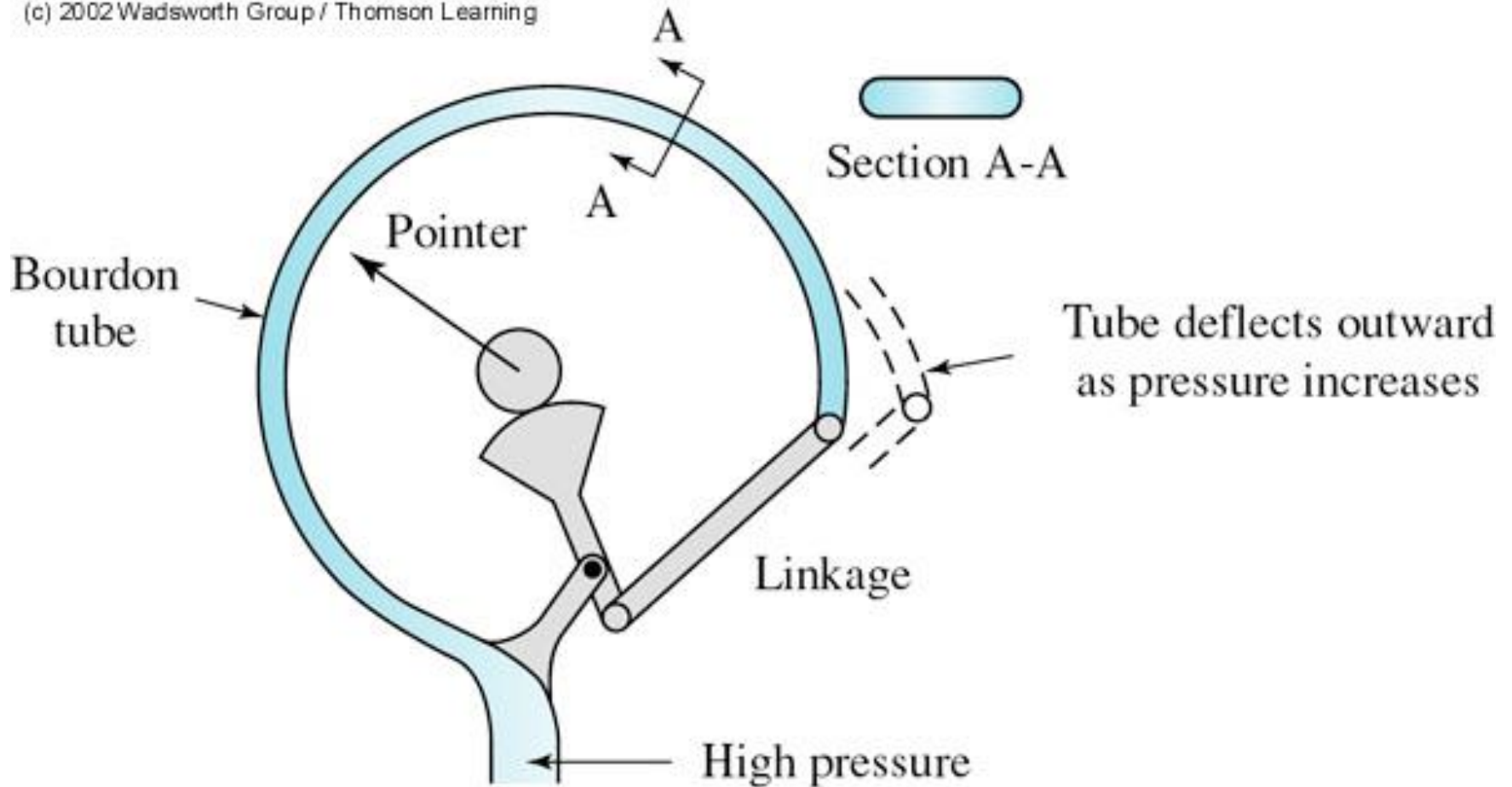
Manômetro em U com líquido manométrico

Manômetro metálico ou de Bourdon

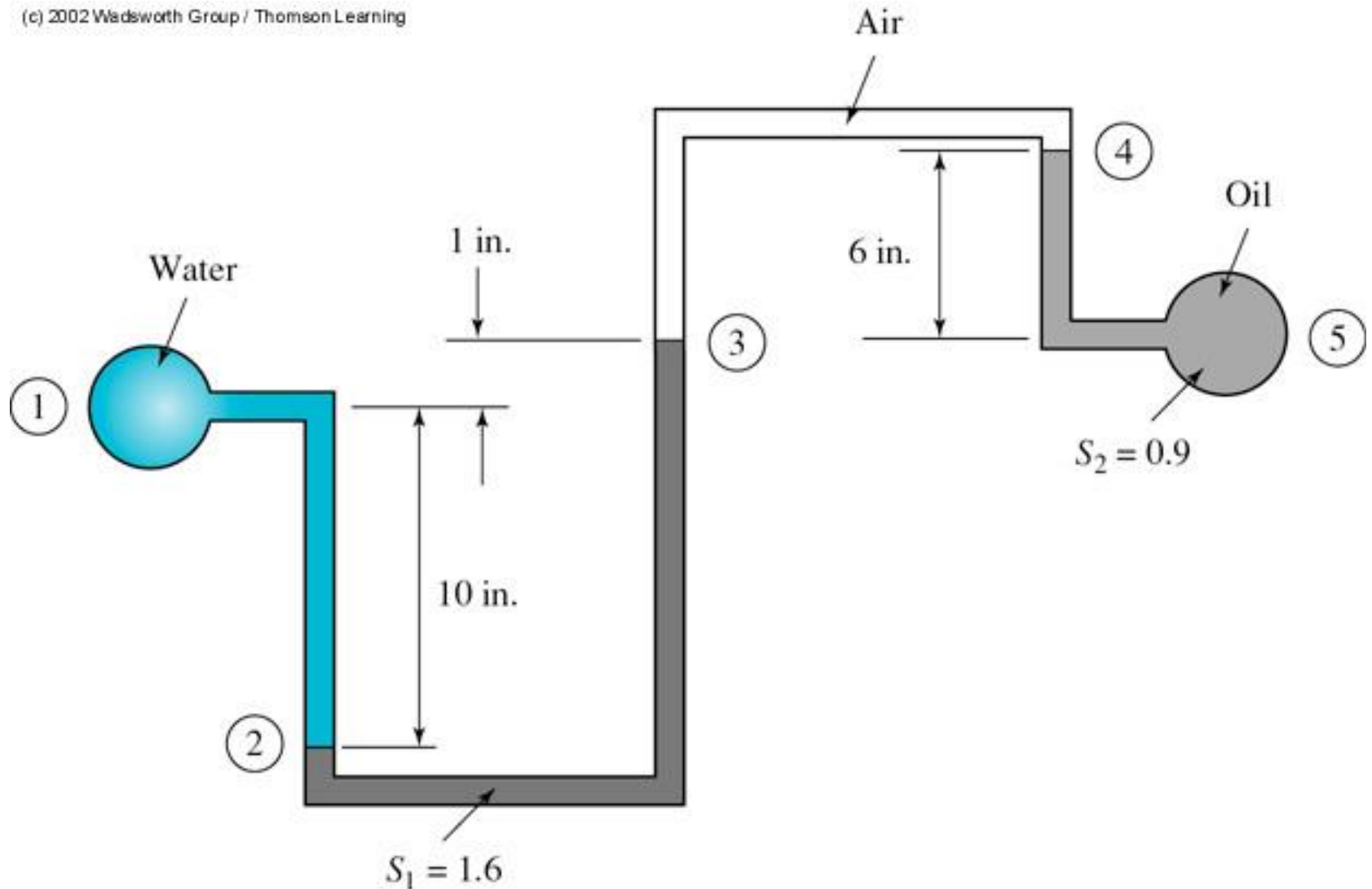


Manometers

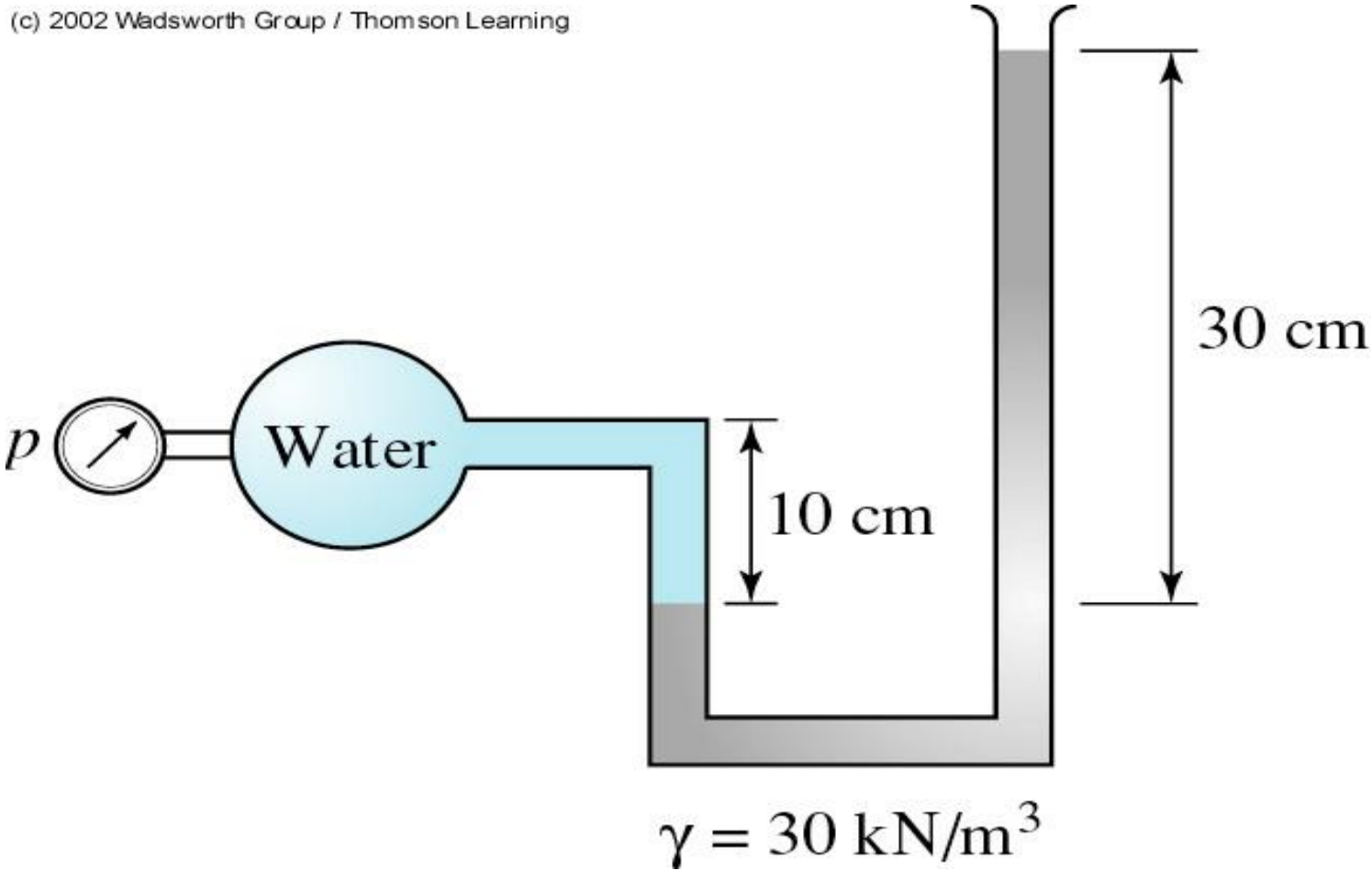
- (a) U-tube manometer (small pressures);
- (b) U-tube manometer (large pressures);
- (c) micromanometer (very small pressure changes).

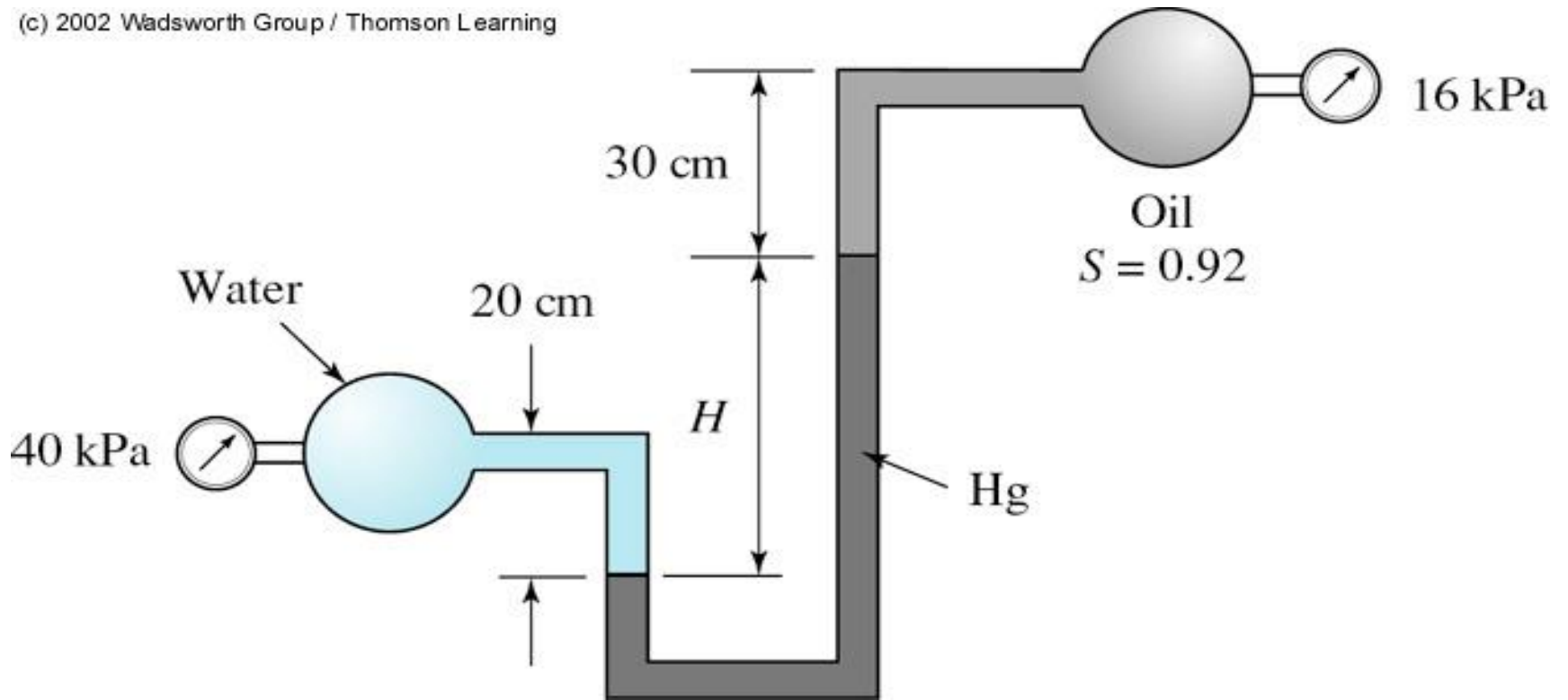


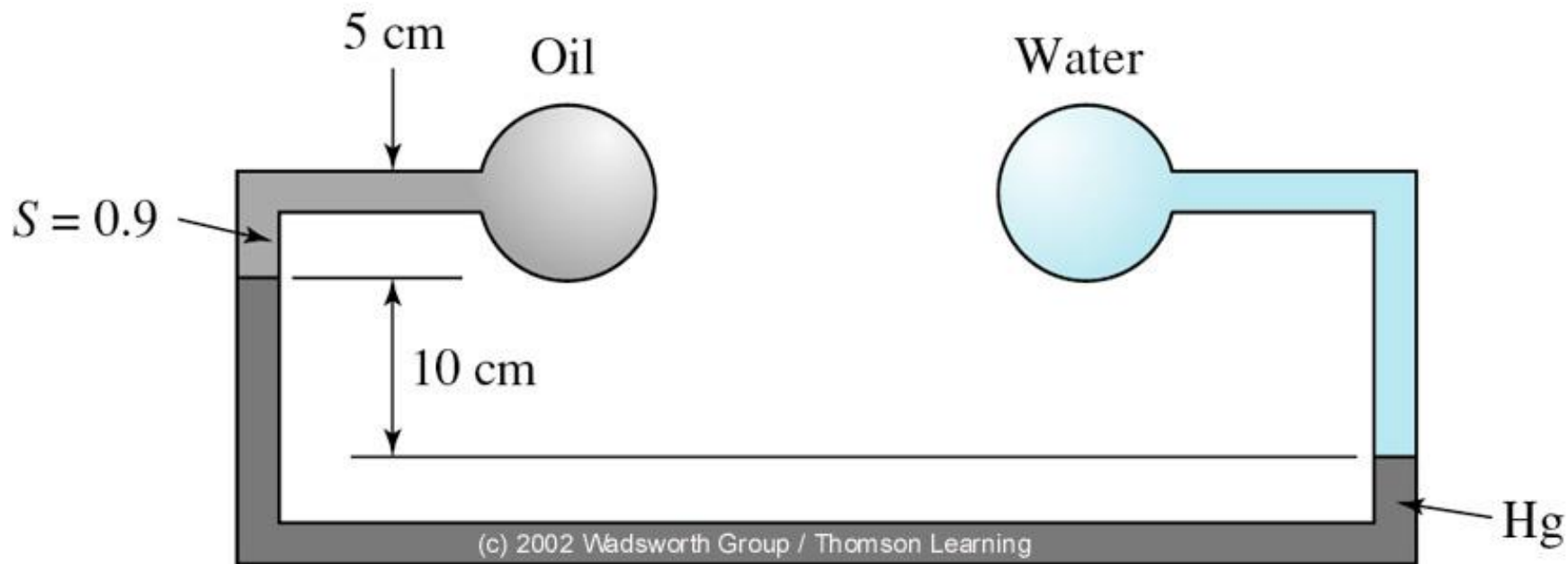
Bourdon tube pressure gage.

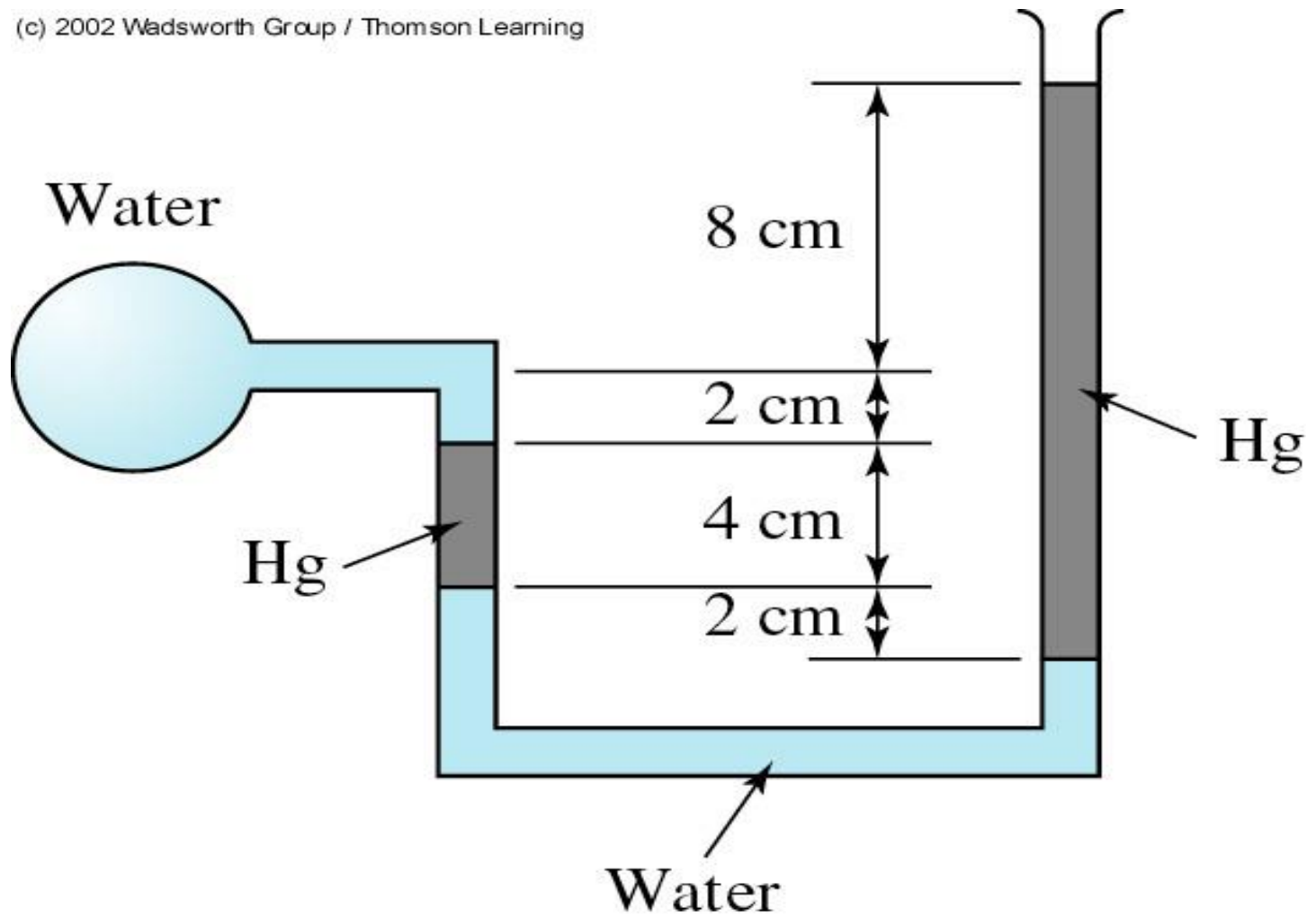


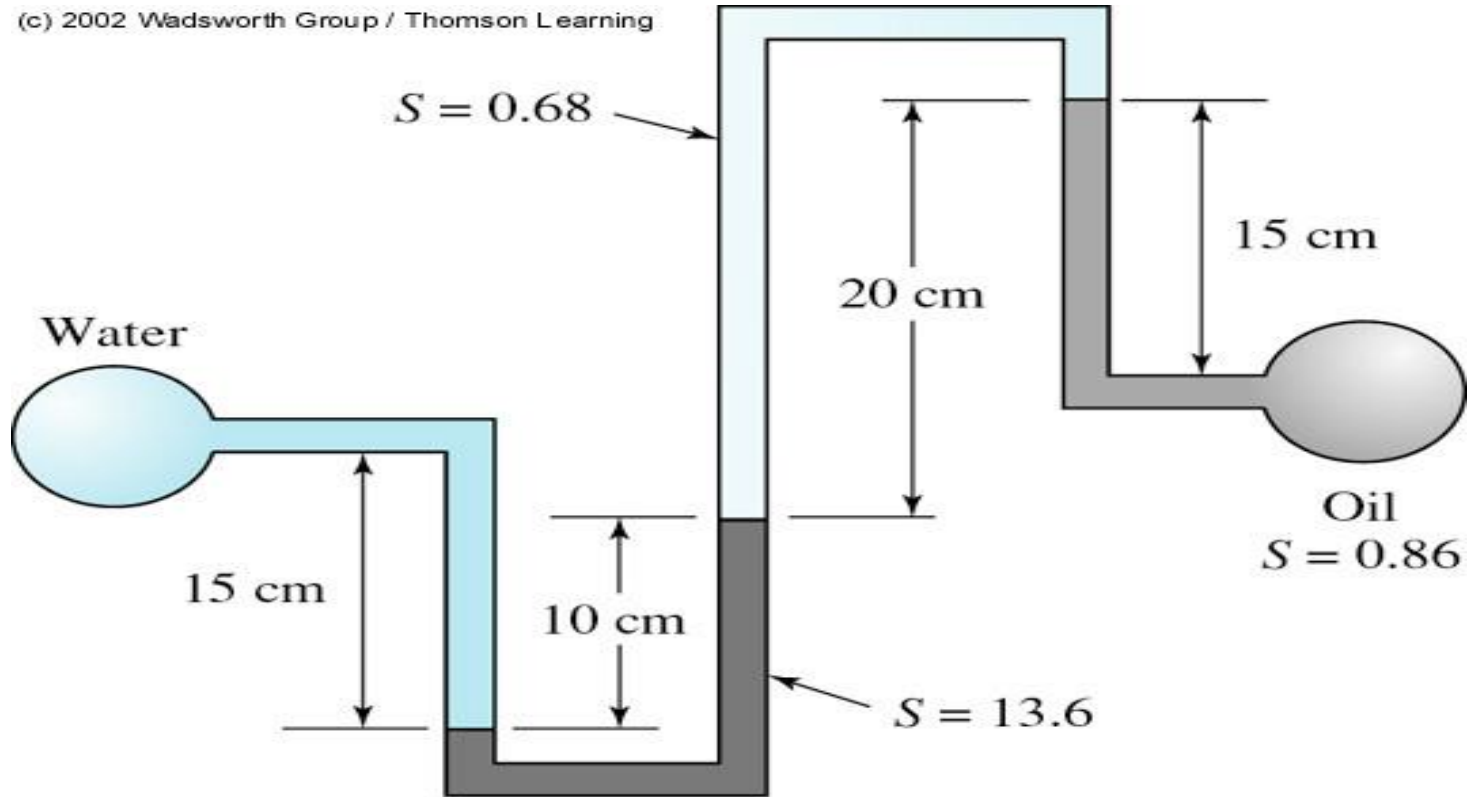
Exemplos de exercícios: slides 12 a 22.

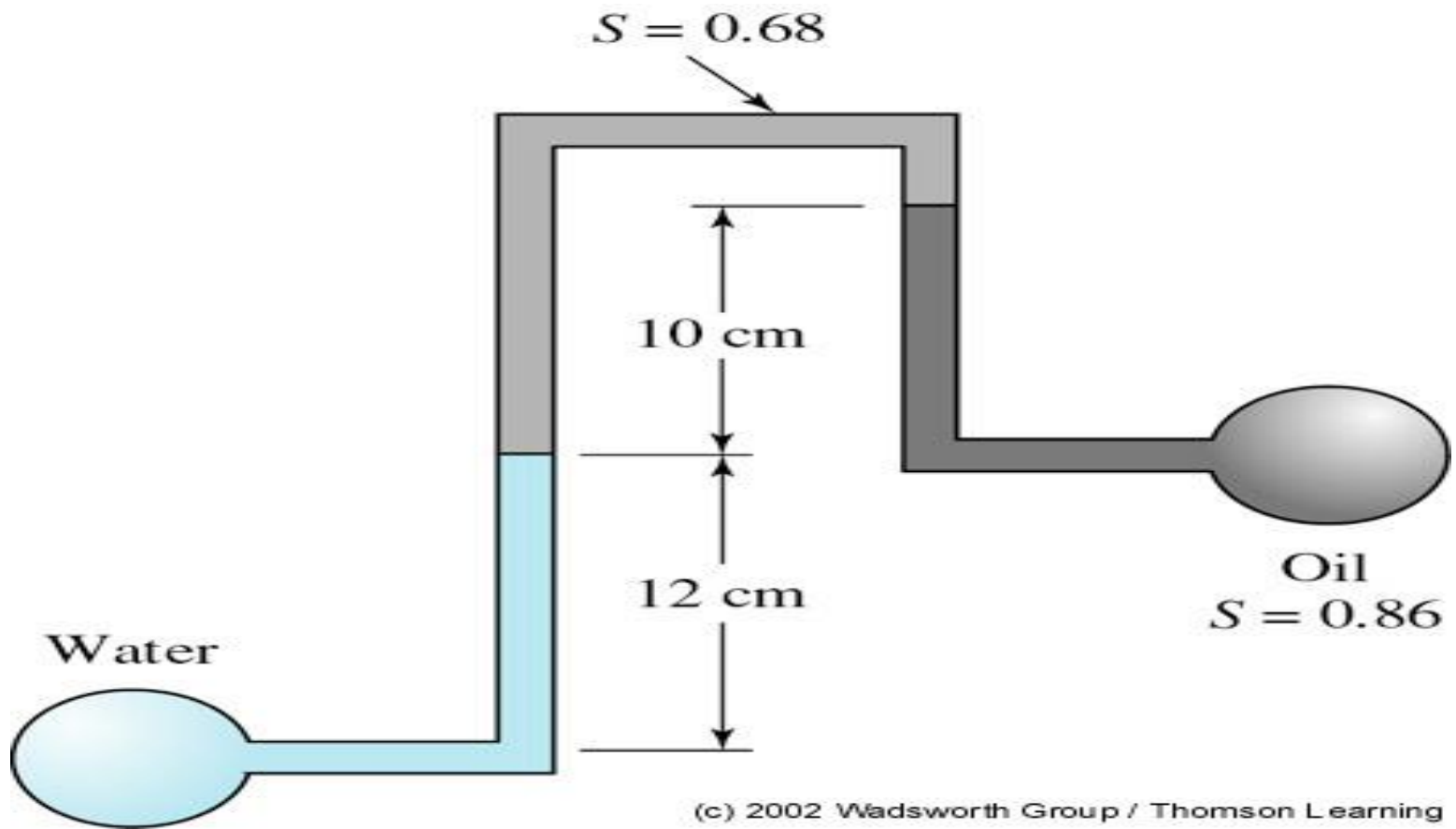




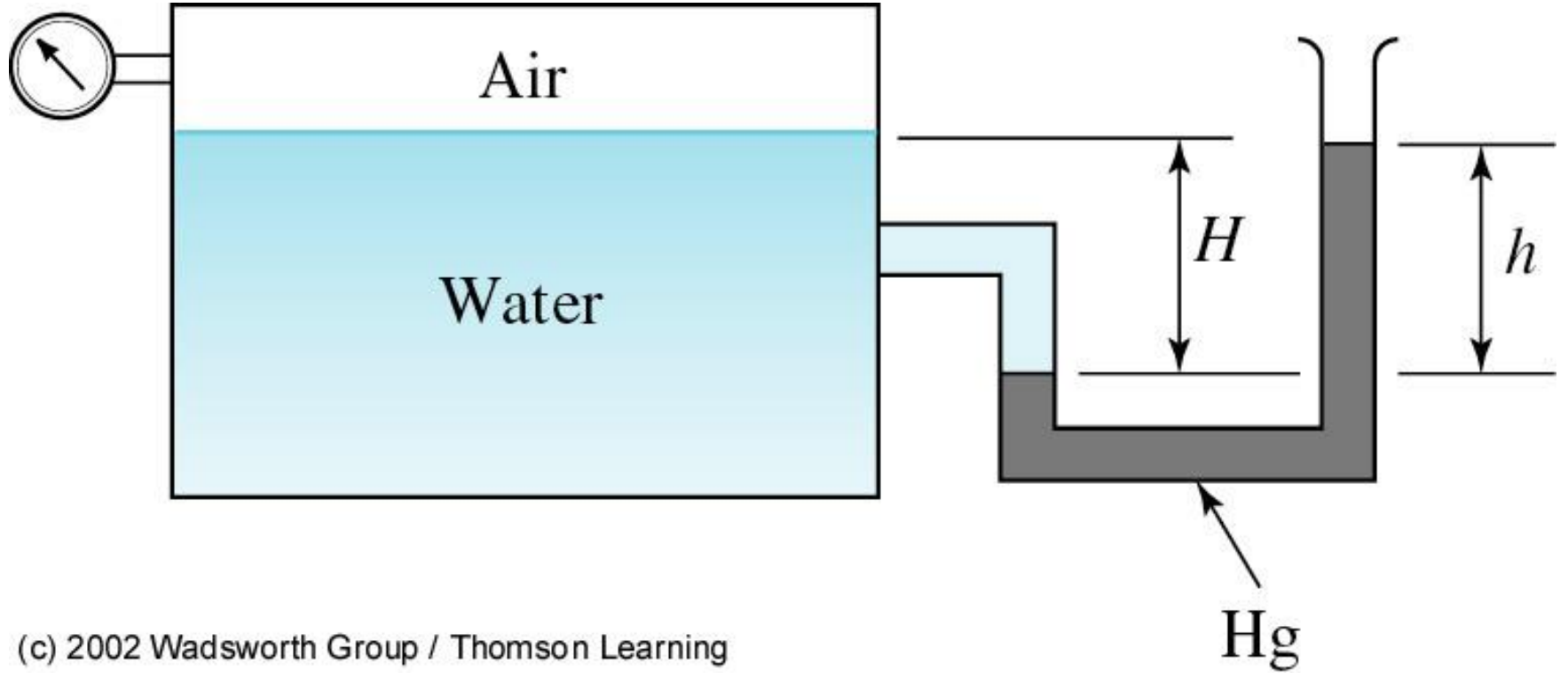




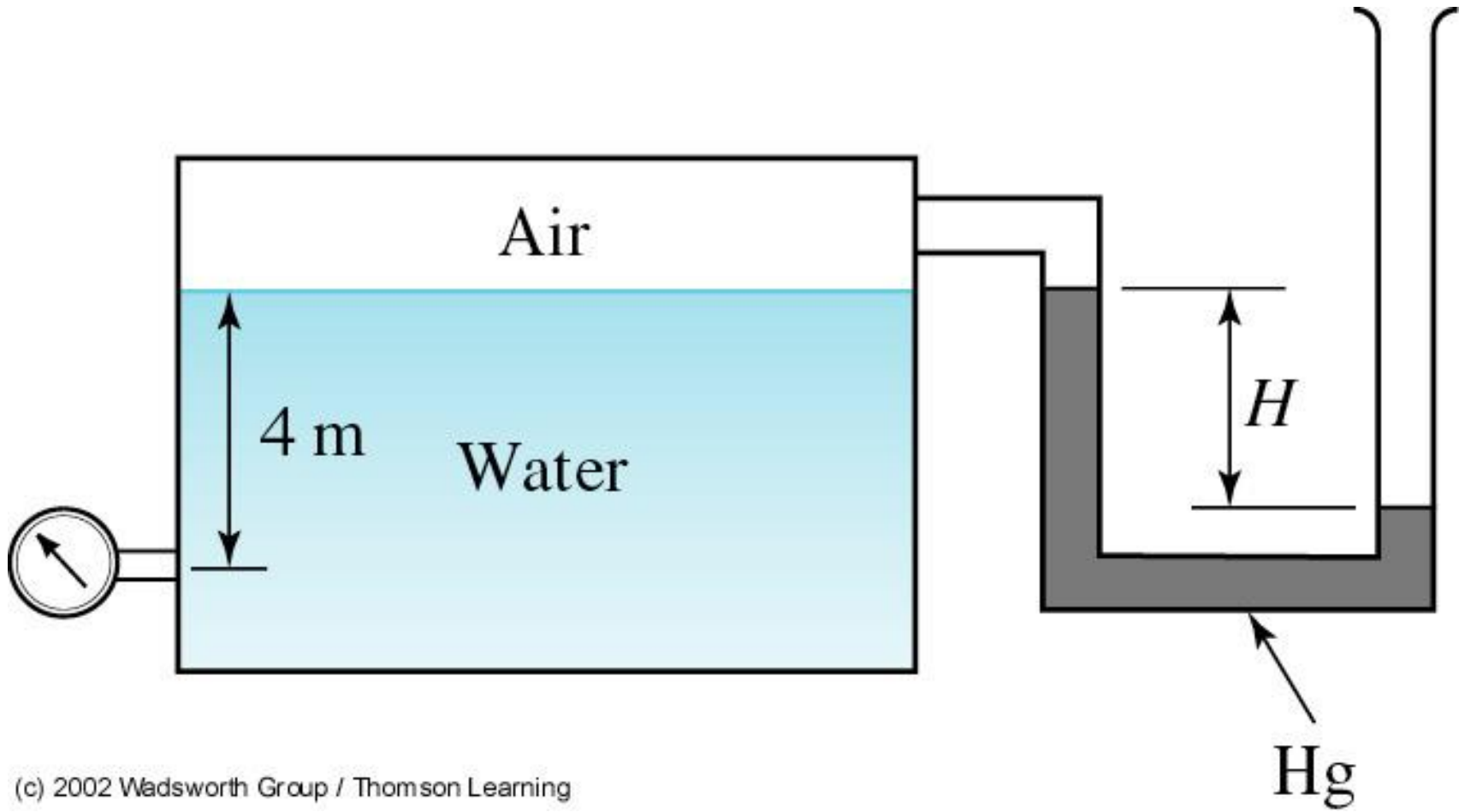




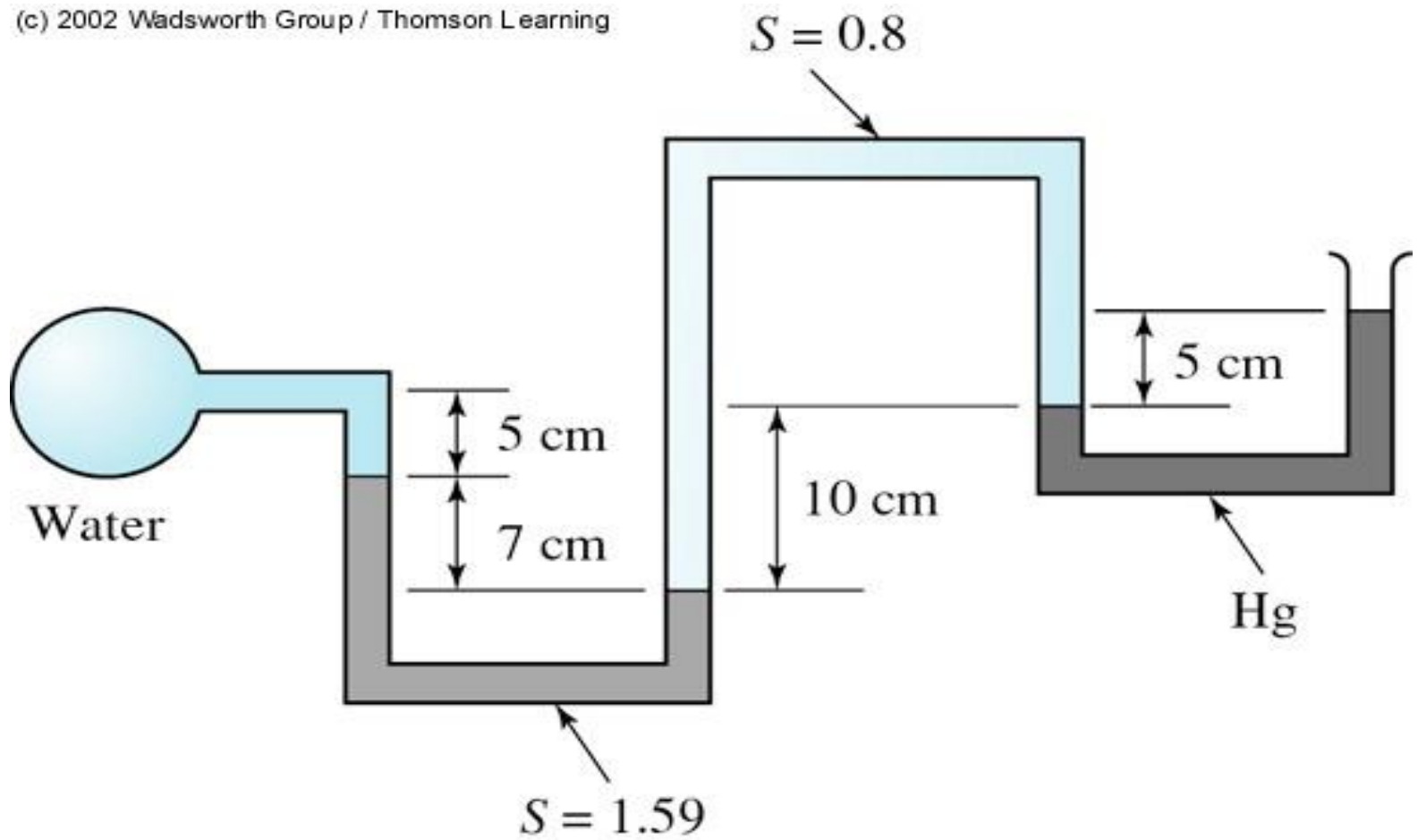
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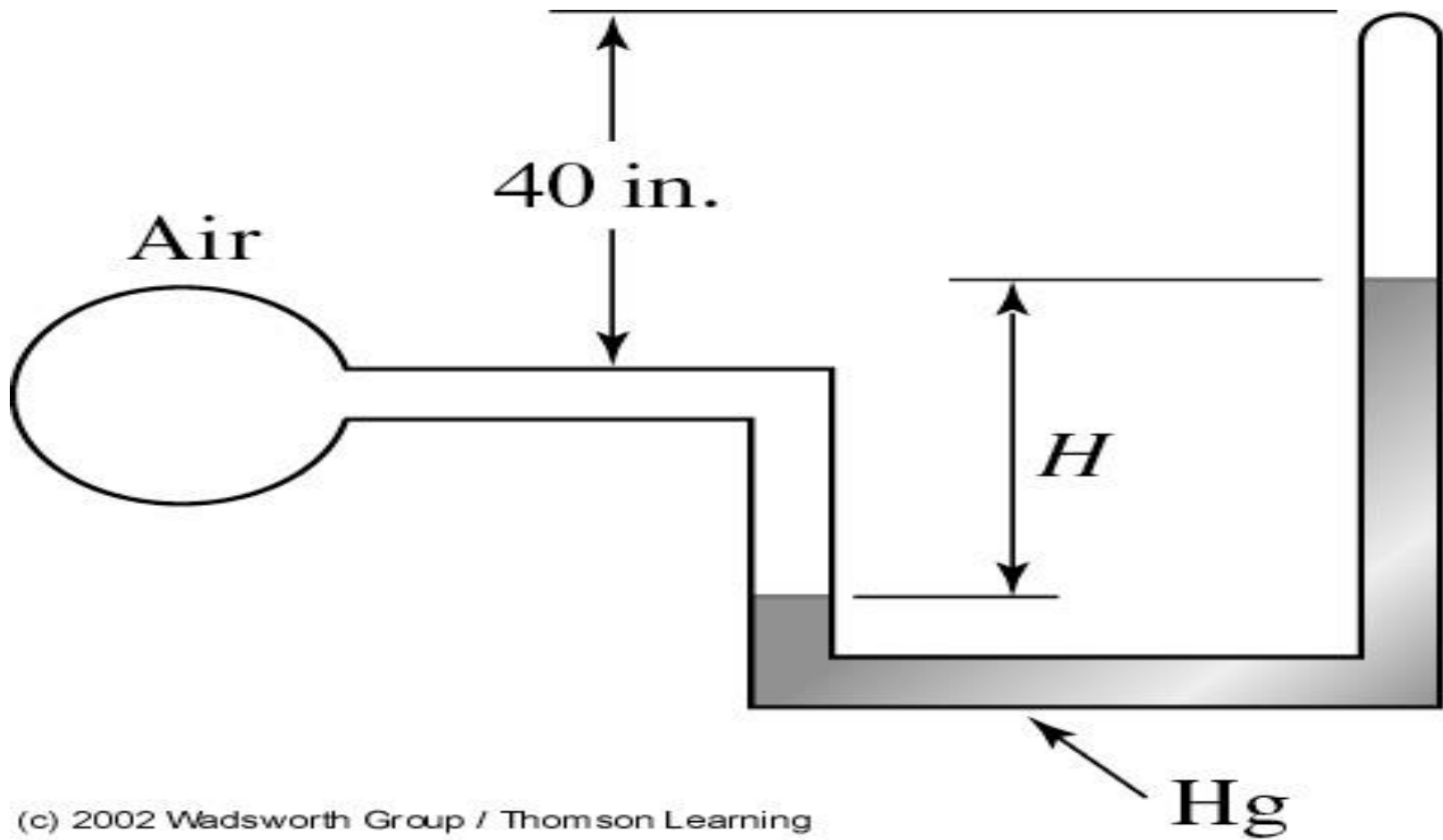


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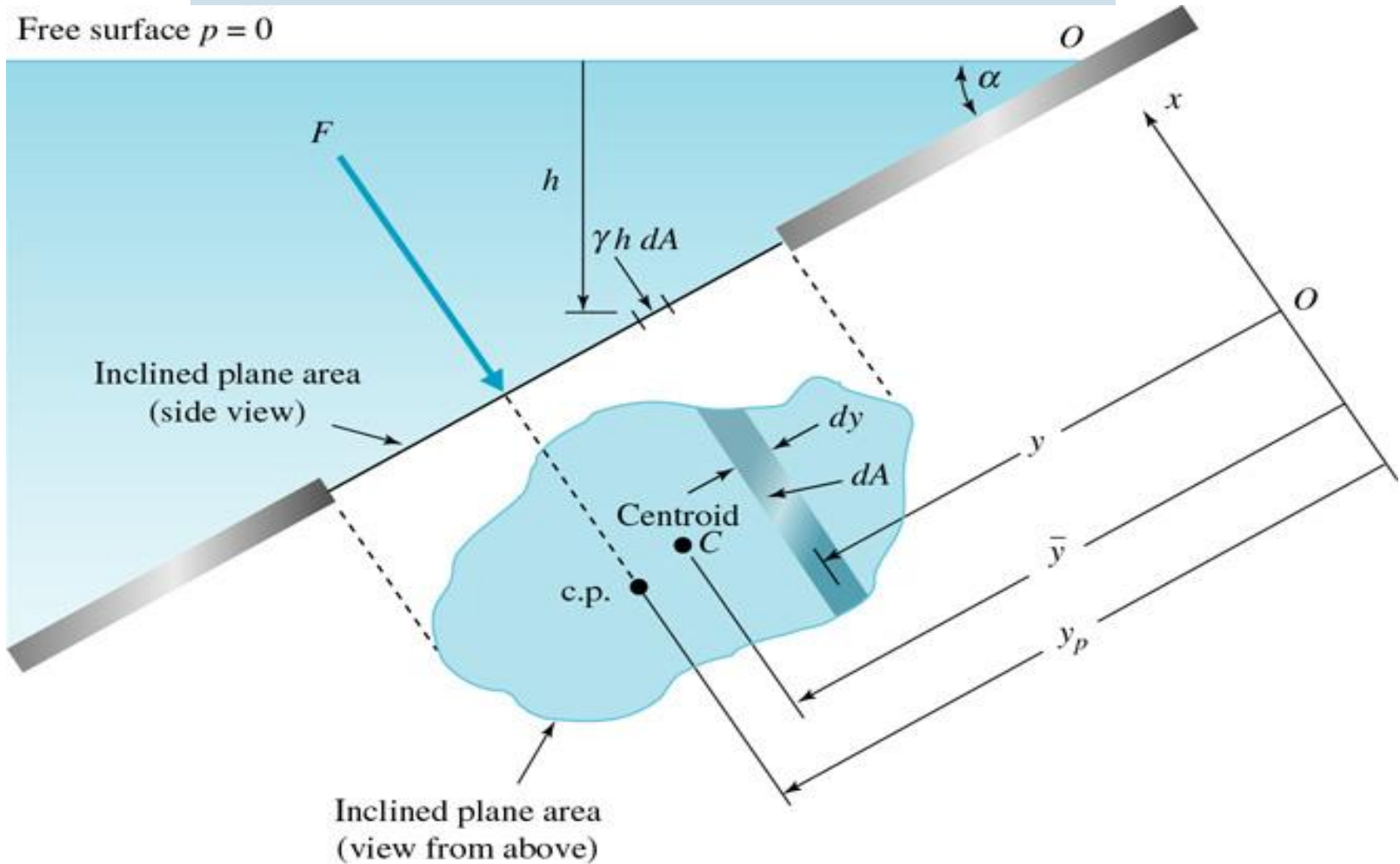




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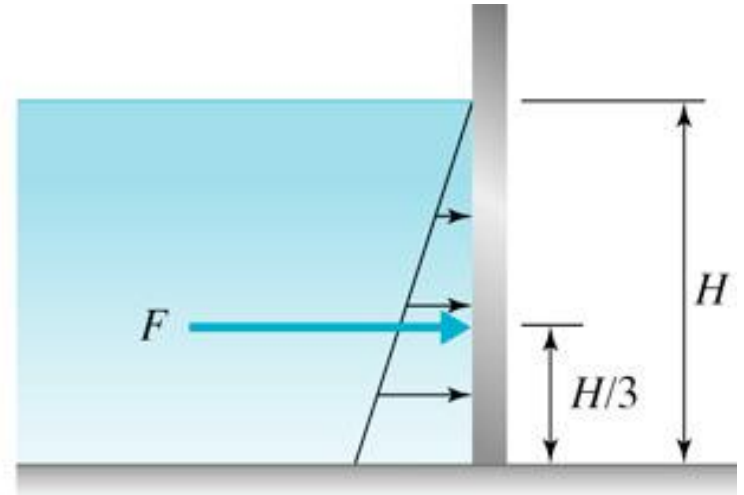
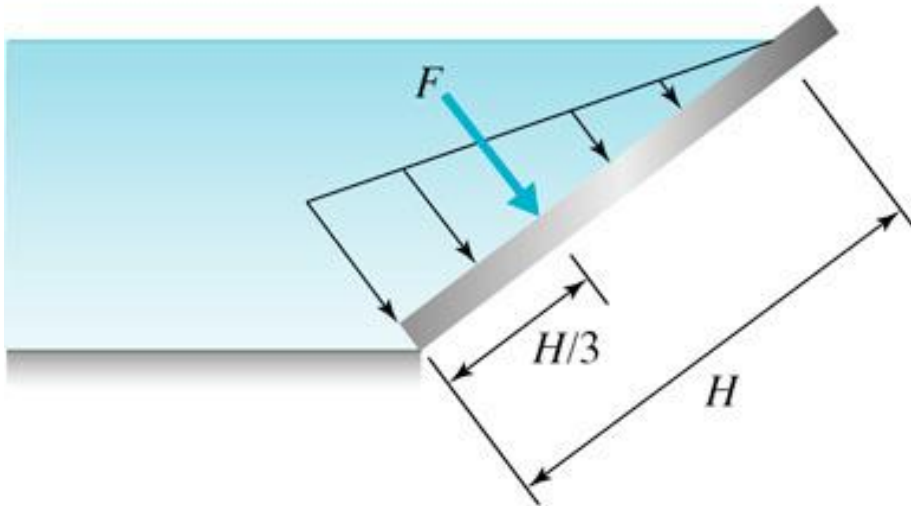
Force on an inclined plane area.

Free surface $p = 0$



Force on a plane area with top edge in a free surface.

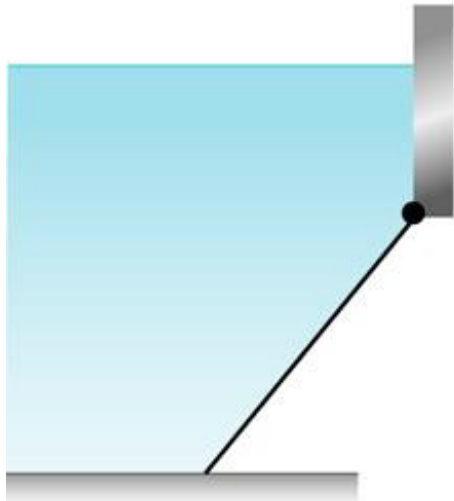
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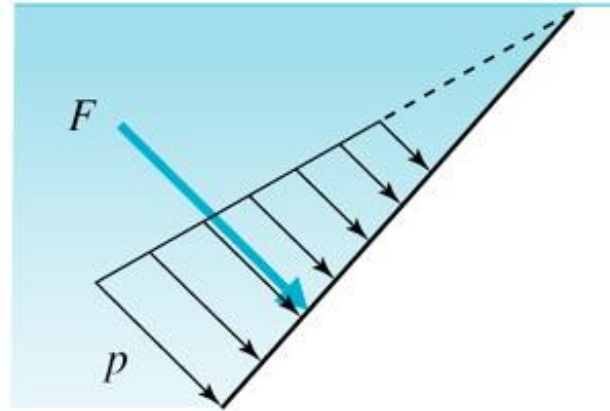
Exemplos de exercícios: slides 24 a 28

Pressure prism: (a) rectangular area; (b) pressure distribution on the area; (c) pressure prism.

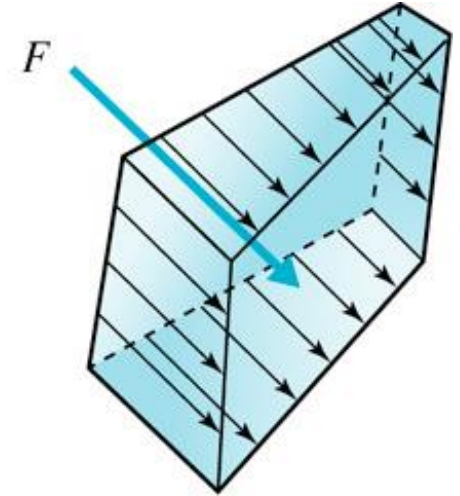
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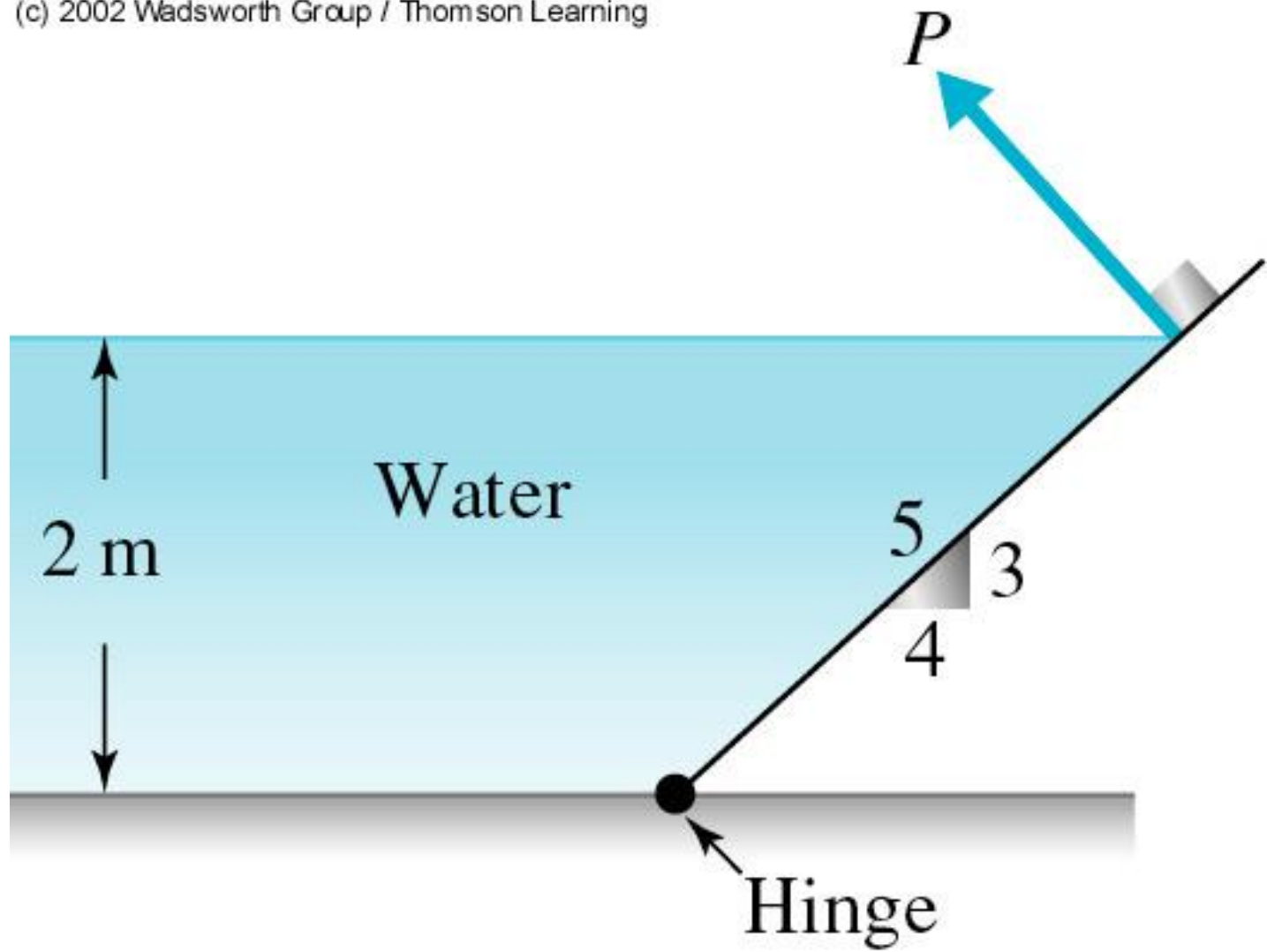
(a)



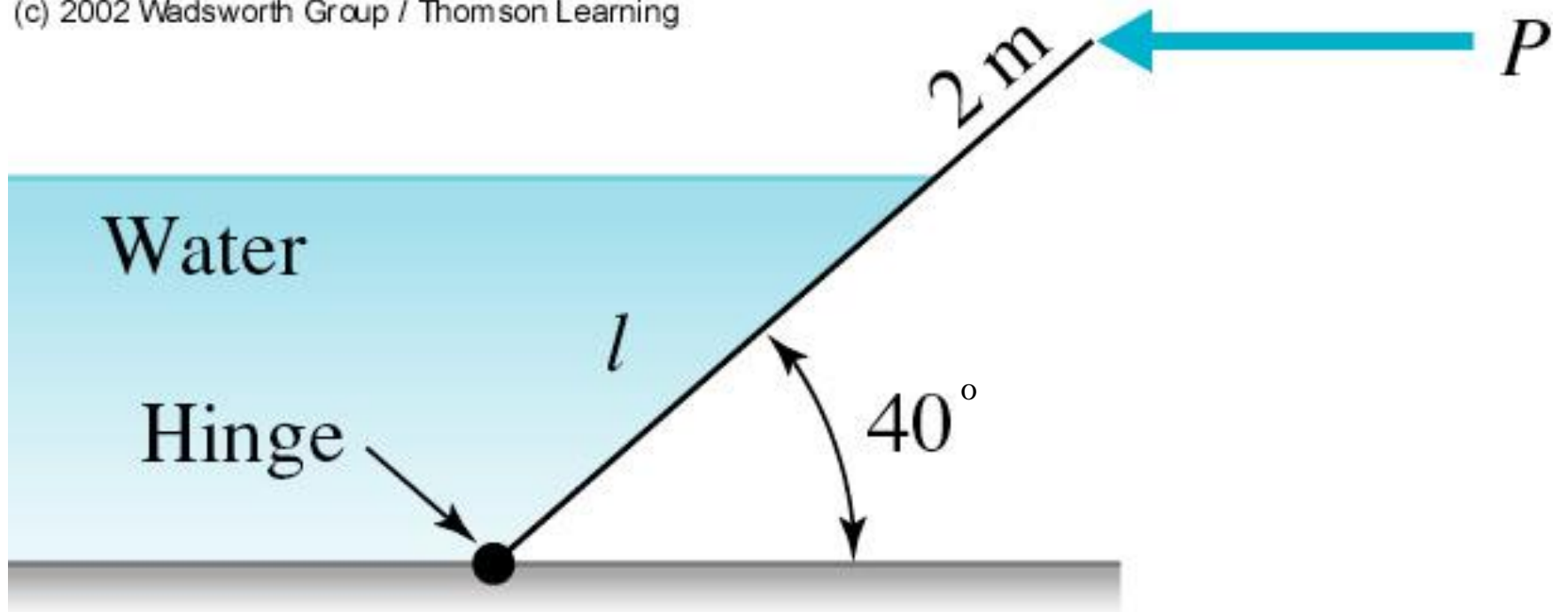
(b)



(c)



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