

Groundwater with Darcy and Bernoulli

<https://www.youtube.com/user/MartinRHendriks/videos>



Henry Darcy (1803-1858)



Daniel Bernoulli (1700-1782)

Importance of groundwater

- effluent seepage
- agriculture (crops)
- drinking water
- industry
- biodiversity

Groundwater needs to be protected from pollution and over-exploitation.



Groundwater with Bernoulli

<https://www.youtube.com/user/MartinRHendriks/videos>

By law of nature, water flows from a higher to a lower

A. elevation

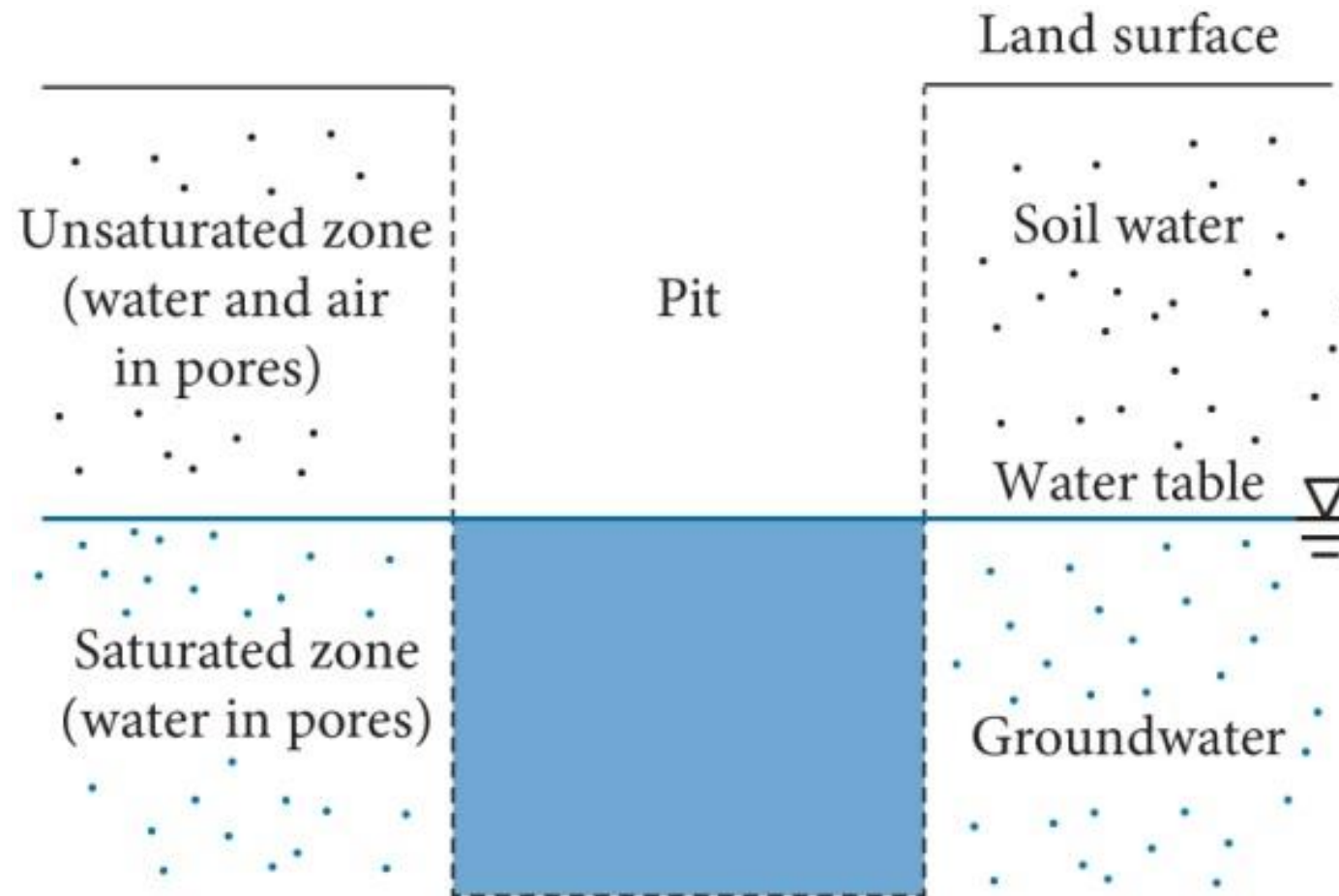
B. energy

C. pressure

D. All of the above options are true

Water table

<https://www.youtube.com/user/MartinRHendriks/videos>



Model between two glass plates

<https://www.youtube.com/user/MartinRHendriks/videos>



^

75 cm high
⇒ 80 m

v

By law of nature, water flows from a higher to a lower ENERGY!

(answer B)

<

1.5 m wide ⇒ 13 km

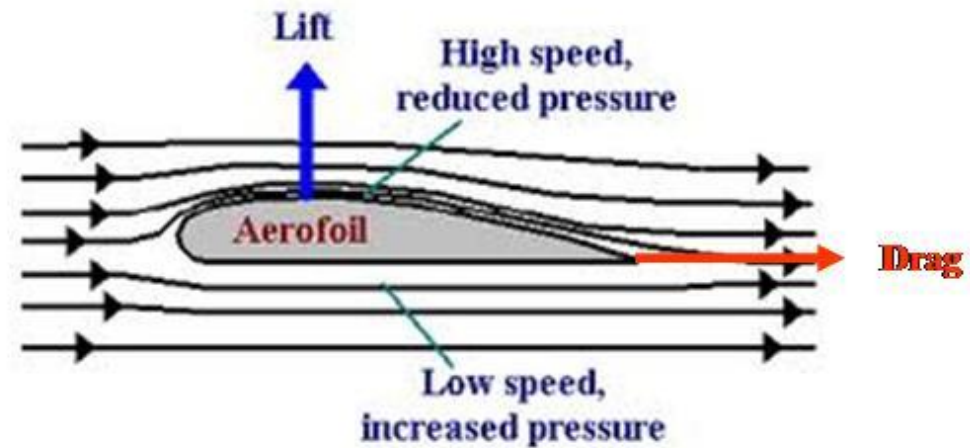
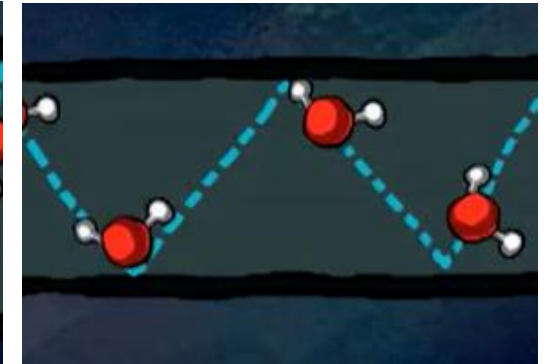
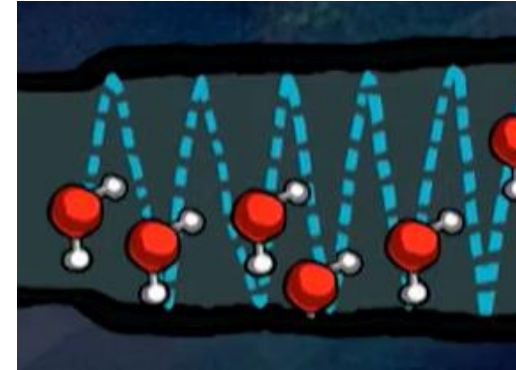
>

Daniel Bernoulli (1700-1782)

<https://www.youtube.com/user/MartinRHendriks/videos>



Source: Wikipedia



<https://www.skybrary.aero/articles/bernoullis-principle>

Leonhard Euler (1707-1783)

<https://www.youtube.com/user/MartinRHendriks/videos>



Source: Wikipedia

$$\frac{1}{2} m v^2 + m g z + p V = \text{constant}$$

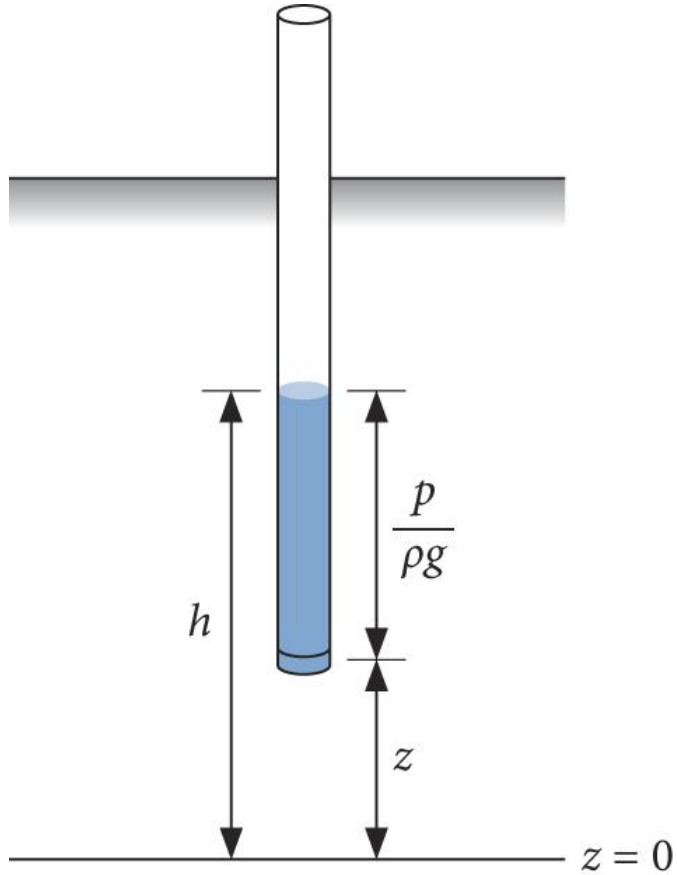
$$m g z + p V = \text{constant}$$

$$\rho g z + p = \text{constant}$$

$$z + \frac{p}{\rho g} = \text{constant}$$

Bernoulli's law for groundwater

<https://www.youtube.com/user/MartinRHendriks/videos>



piezometer

$$h = z + \frac{p}{\rho g}$$

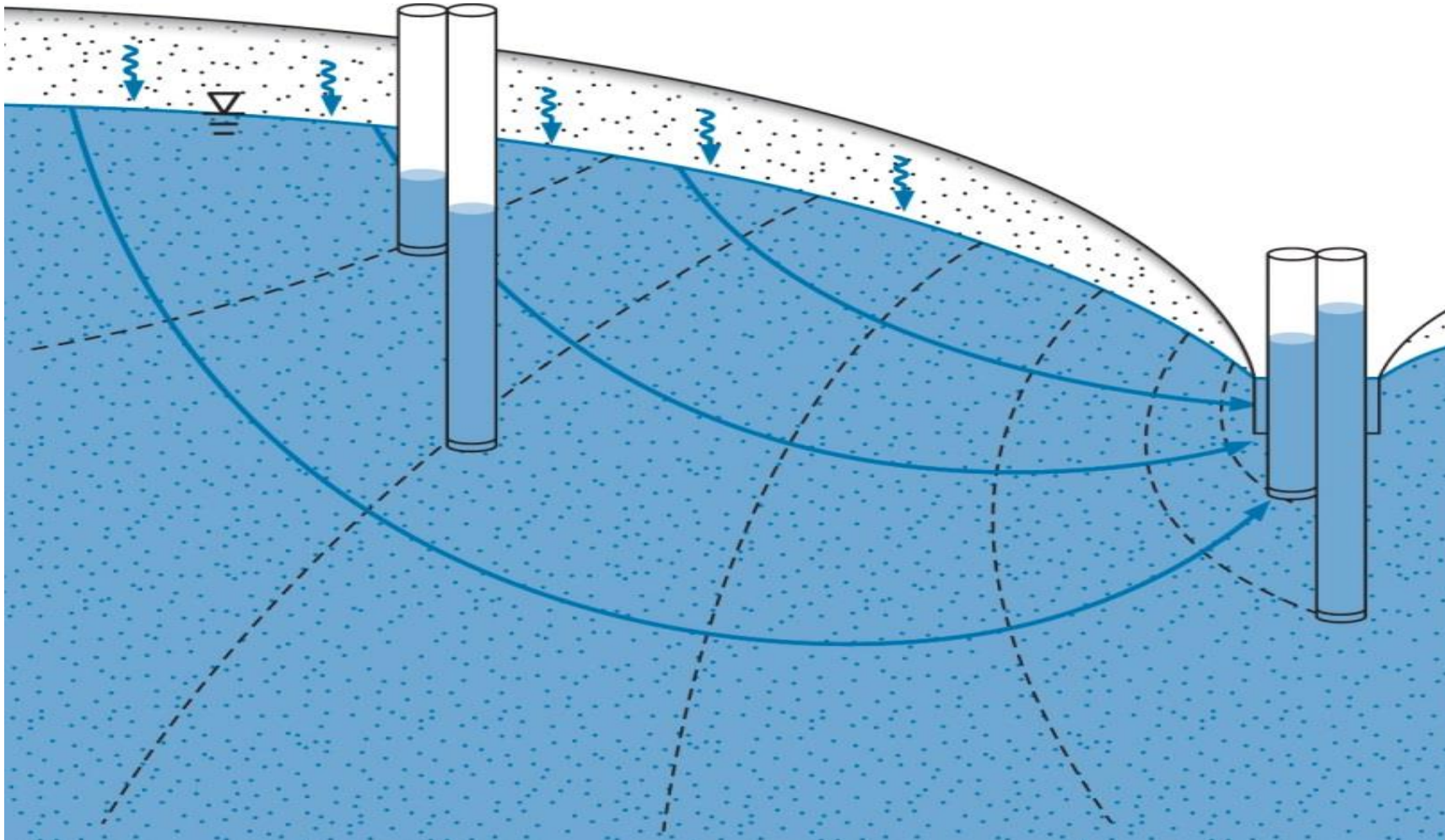
h = hydraulic head (m)

z = elevation head (m)

$\frac{p}{\rho g}$ = pressure head (m)

Unconfined groundwater

<https://www.youtube.com/user/MartinRHendriks/videos>



Groundwater flow is in the direction of the lower hydraulic head!