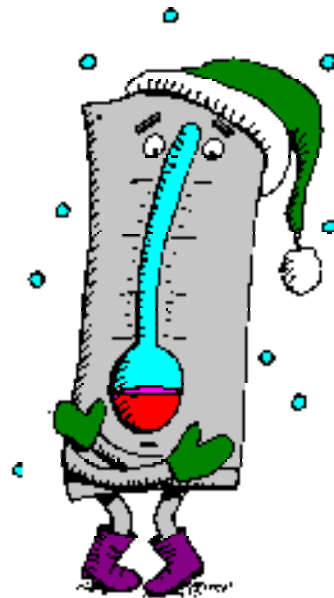


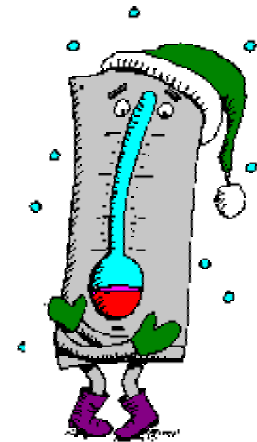
# Wat is de koudste kou?



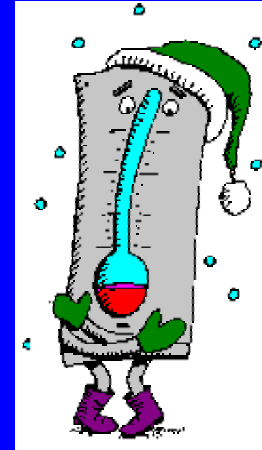


# Wat is de koudste kou?

- Warm, koud, thermometers
  - De wereld van de gassen  
temperatuur en volume
- ➔ de koudste kou!
- Hoe maak je koude?
  - Koude proefjes!



# 1. Warm Koud Thermometers





# Warm en koud

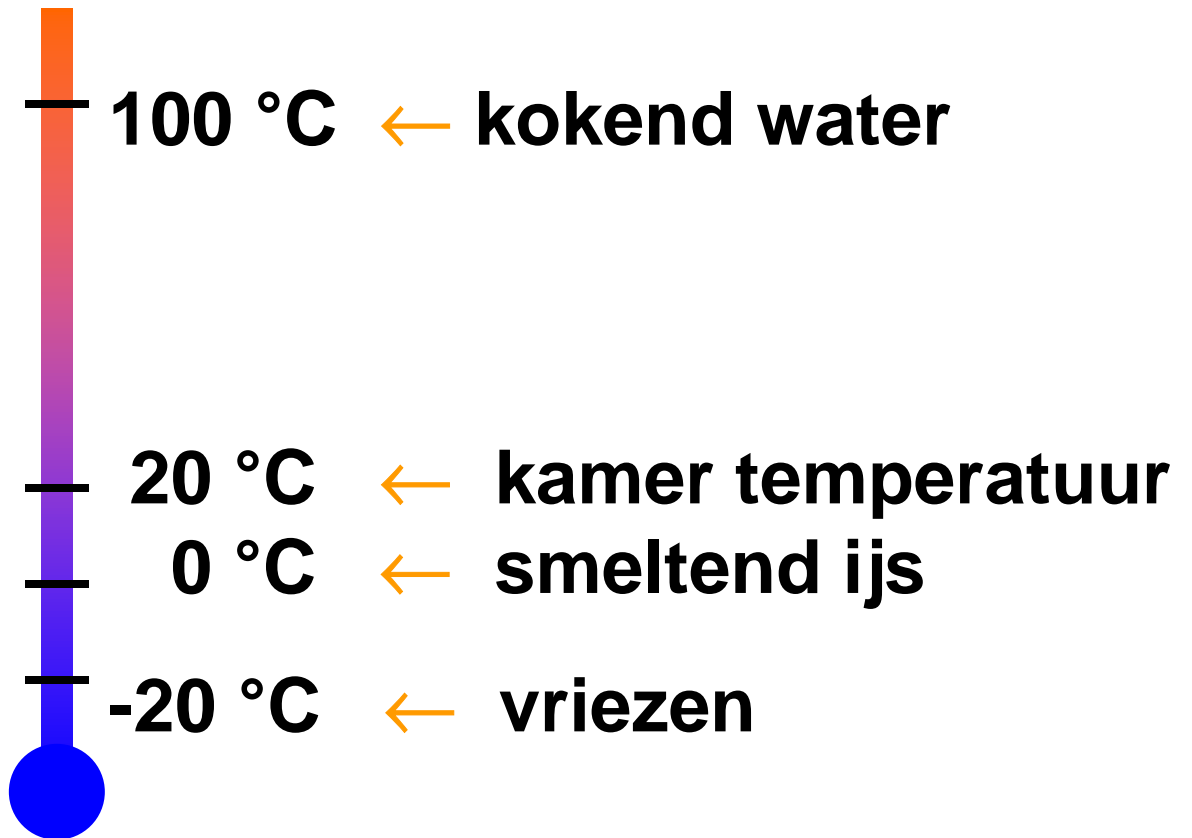


# Hoe meet je warm of koud?



# Hoe meet je warm of koud?

## Thermometer



# Celsius en Celsie



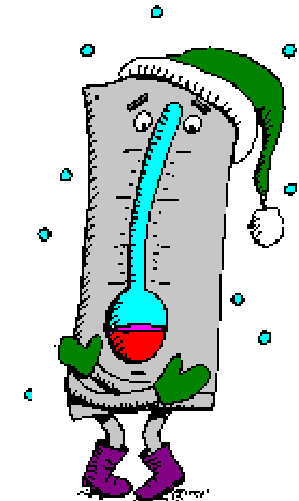
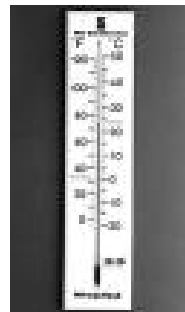
**A. Celsius**  
1701-1744



**Celsie**



# Thermometers



# Koude op aarde

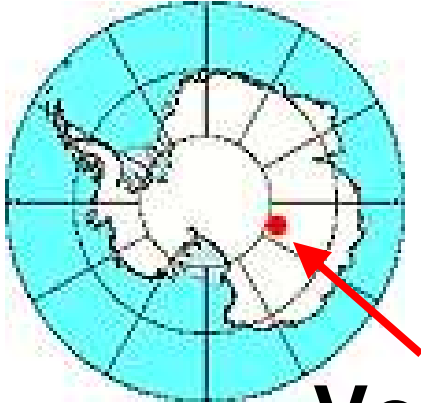


**noordpool**

**zuidpool**



# Koudst op aarde



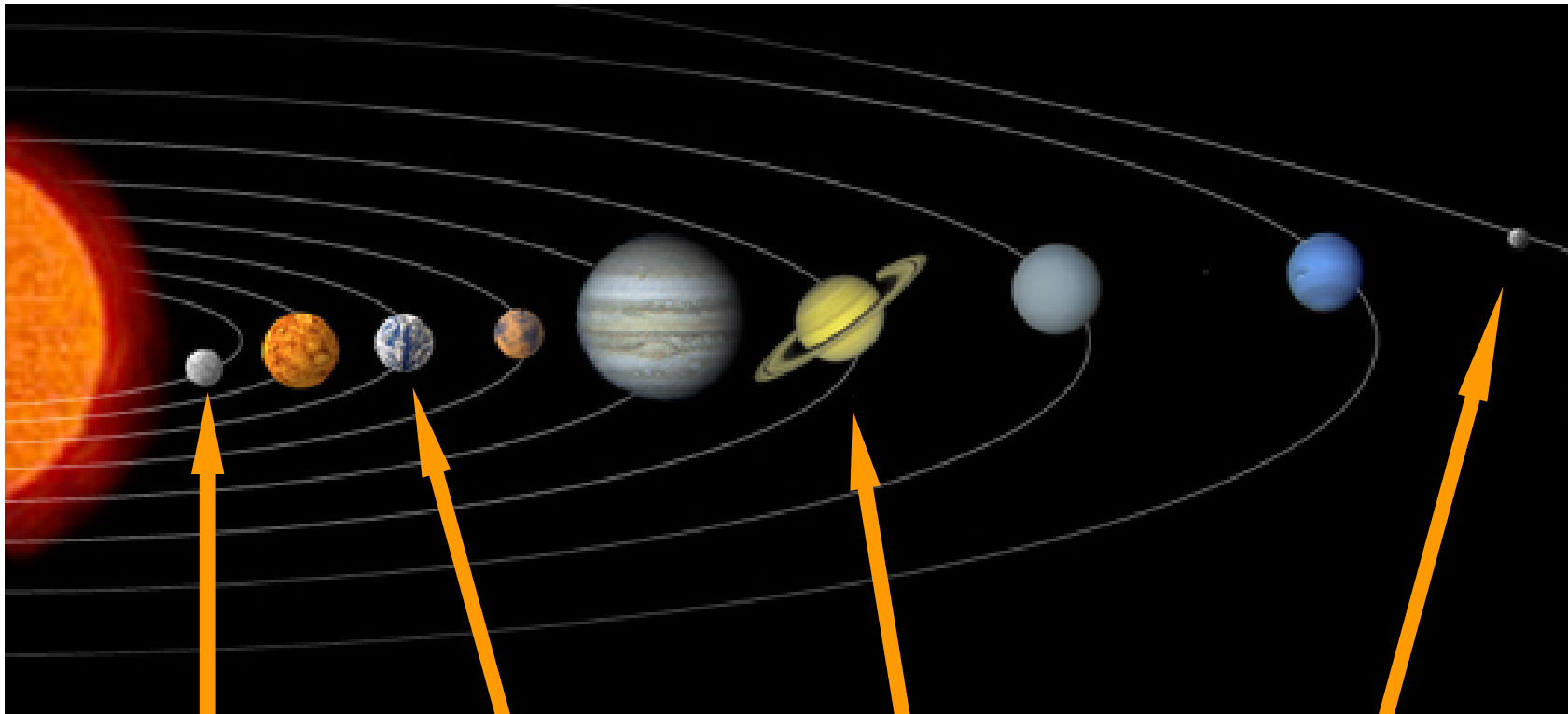
zuidpool Vostok



-89,2°C

21 juli 1983

# Koudst in ons zonnestelsel



mercurius  
350 °C

aarde  
22 °C

uranus  
-180 °C

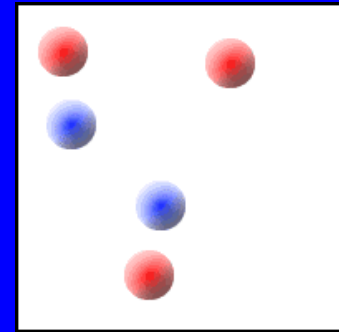
pluto  
-220 °C



# Koudst in de ruimte

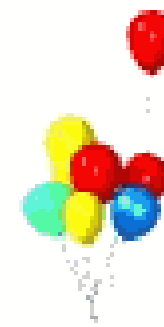
**-270 °C**

## 2. De wereld van de gassen





# Welke gassen ken je?



# Meer gassen

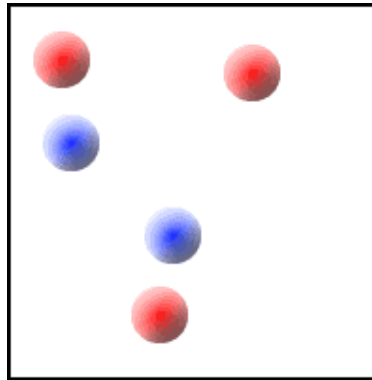


# Wat gebeurt met een gas als de temperatuur verandert?



Temperatuur ↑ volume ↑

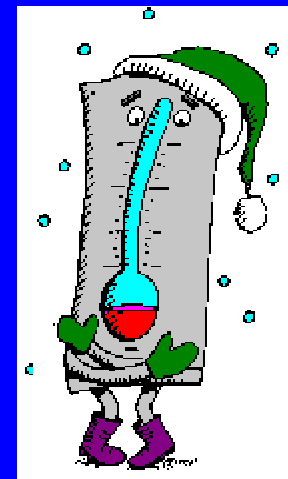
bij vaste druk



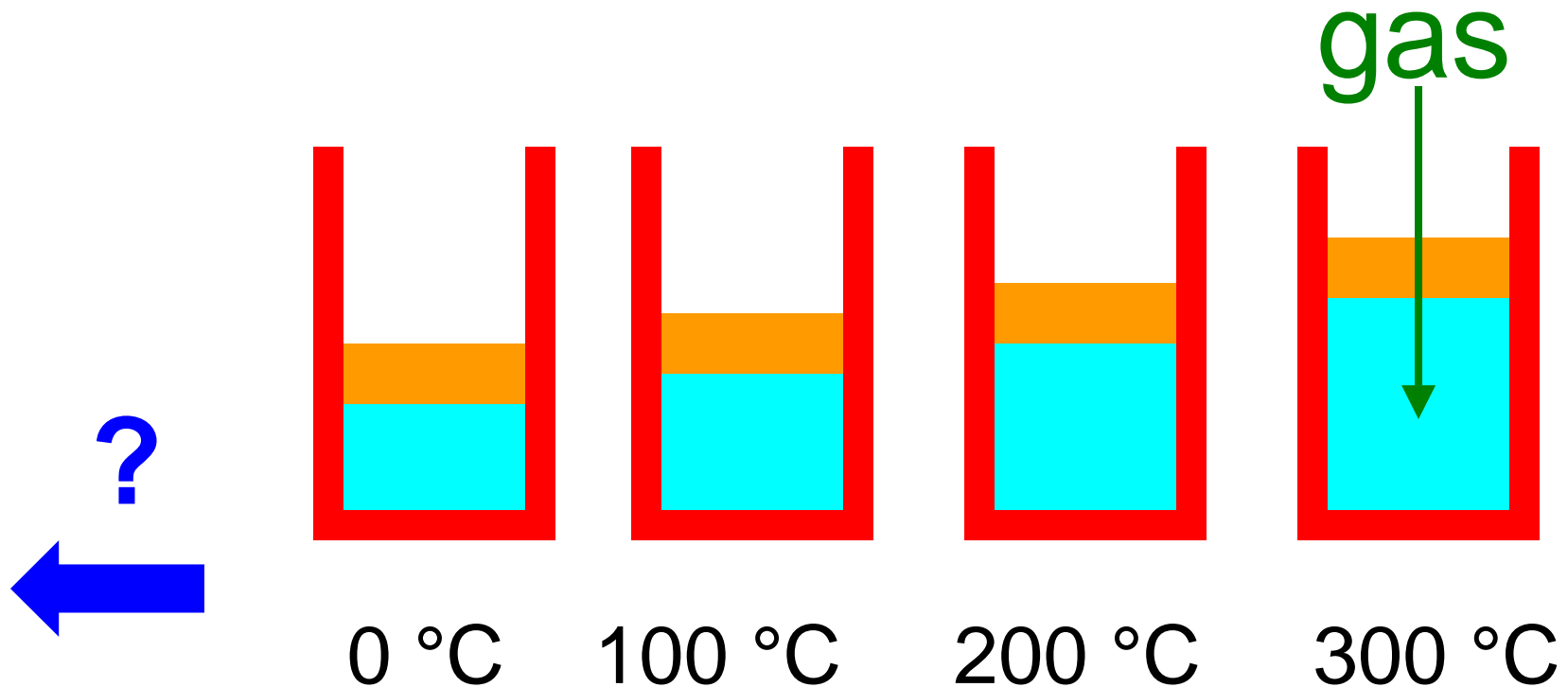
Temperatuur ↑ volume ↑

Temperatuur is beweging

# 3. De koudste kou !



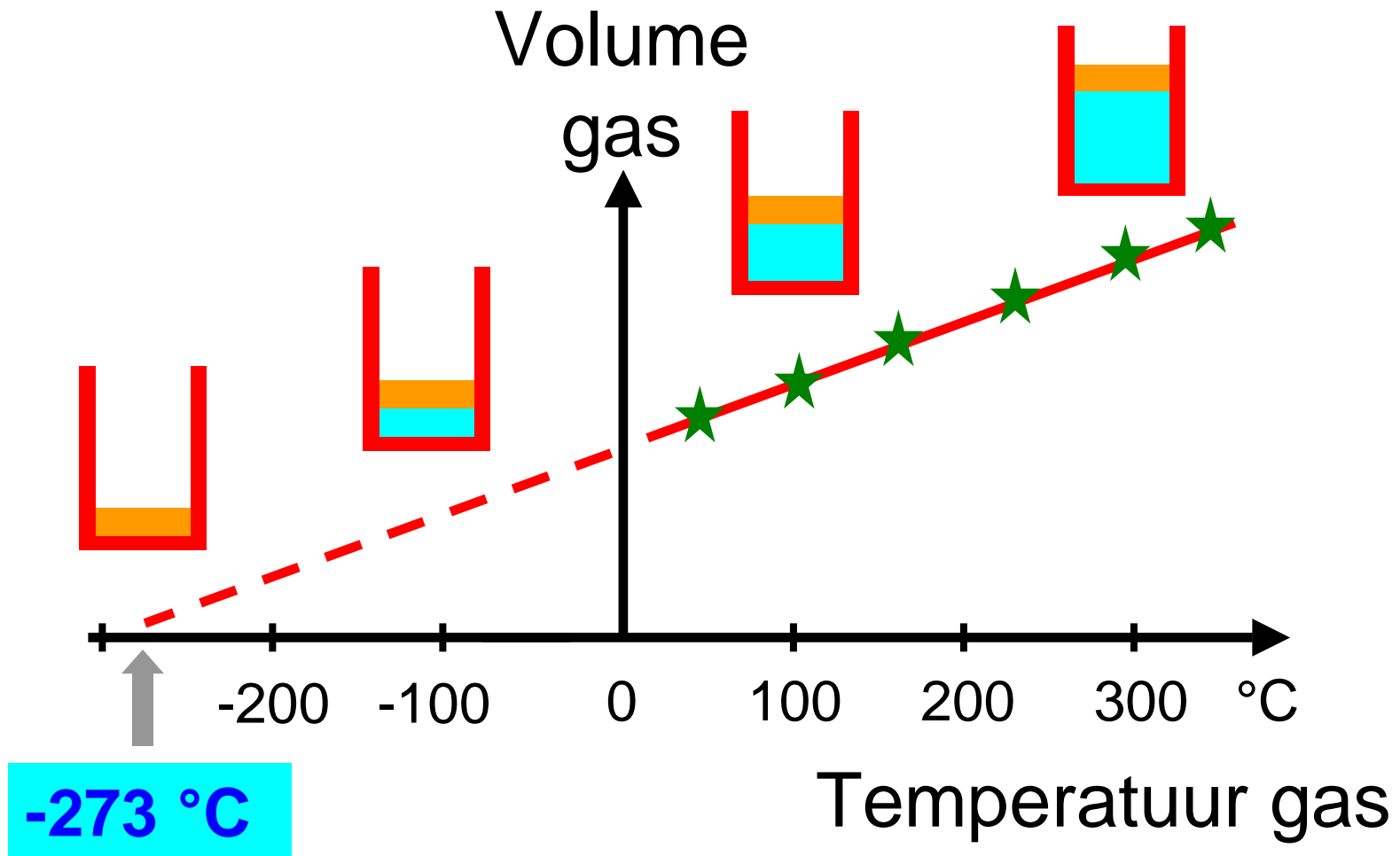
# Temperatuur ↓ dan volume ↓



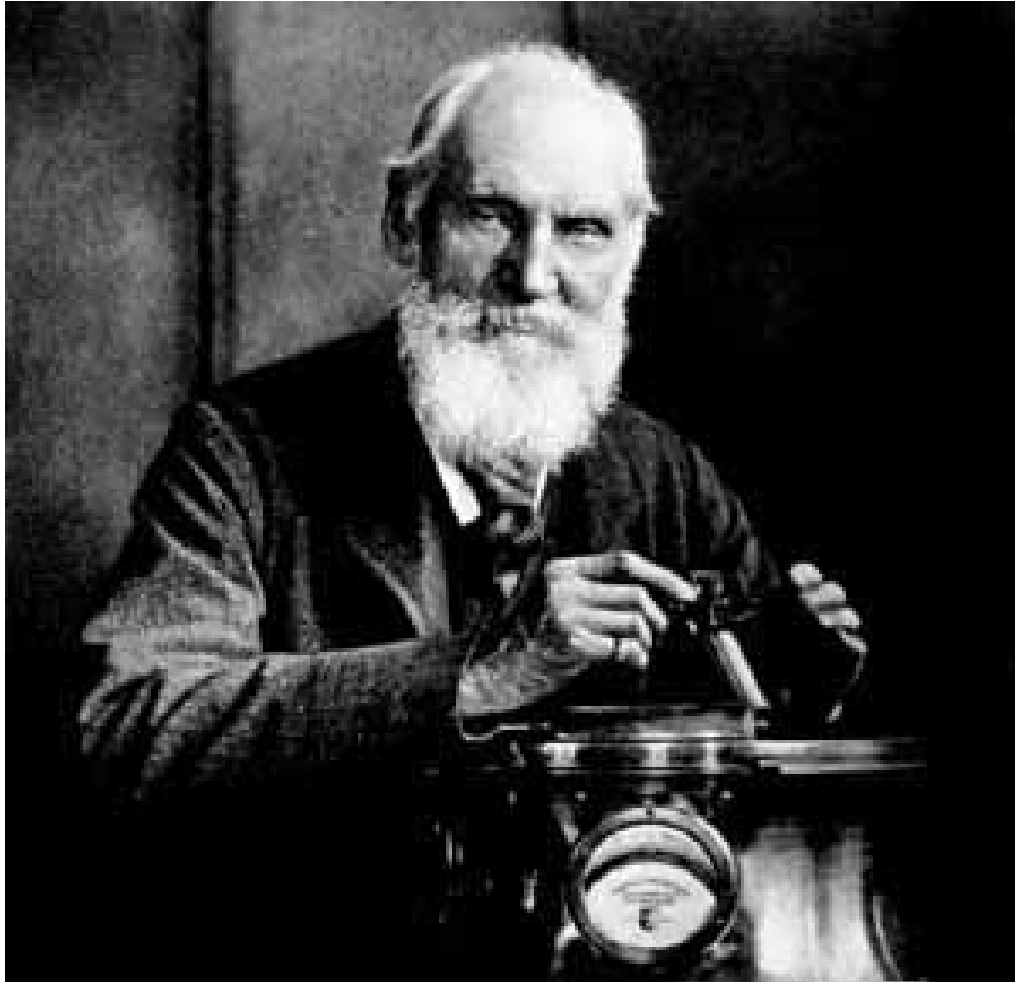
J. Gay-Lusac 1778-1850



# De laagste temperatuur

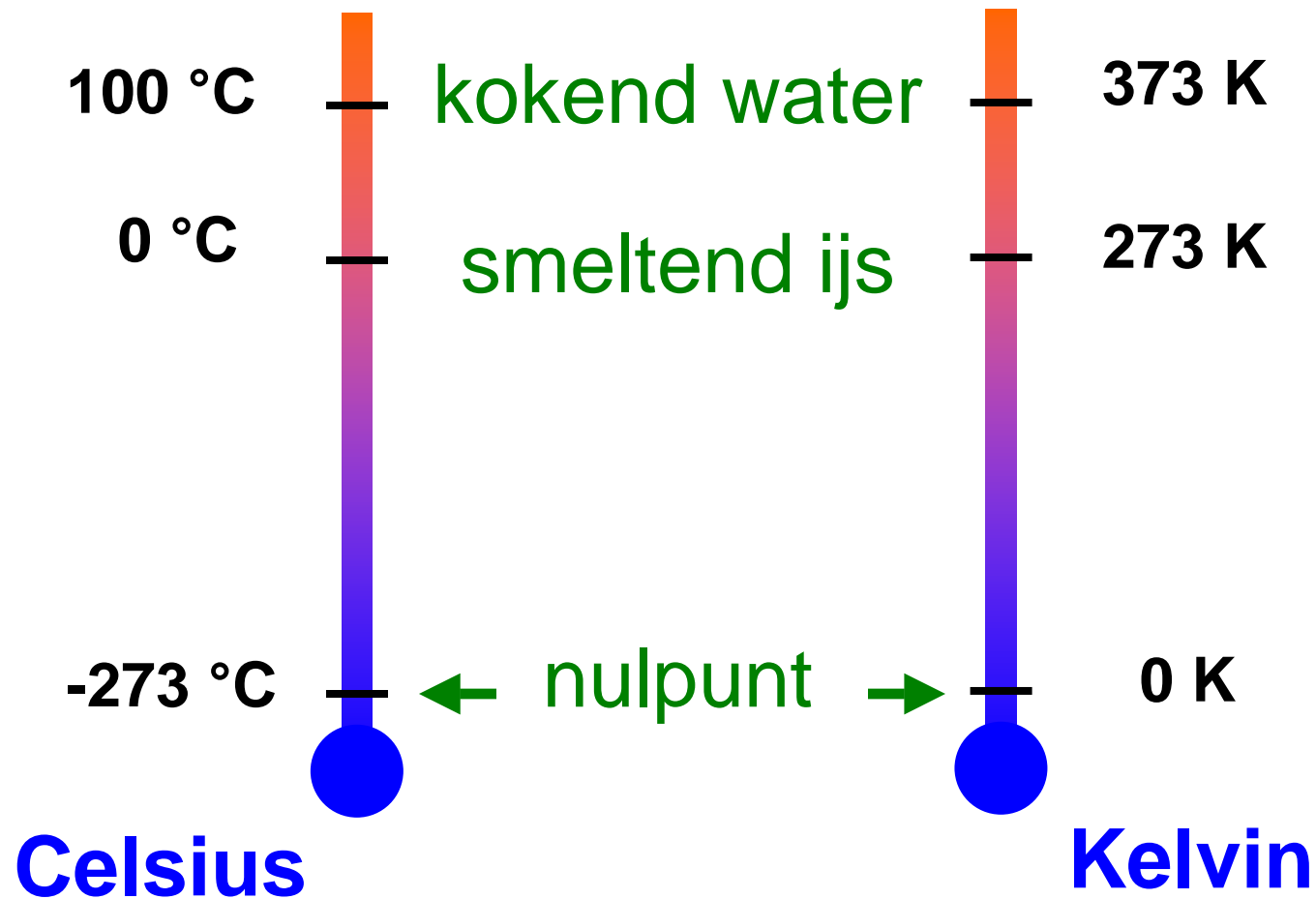


# Kelvin

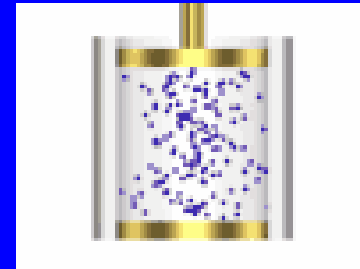


**Lord Kelvin**  
(William Thomson)  
**1824-1907**

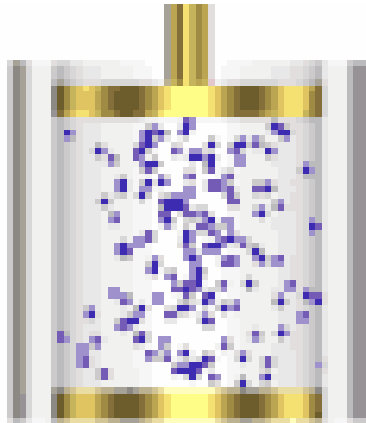
**-273 °Celsius = 0 Kelvin**



# 4. Hoe maak je koude?



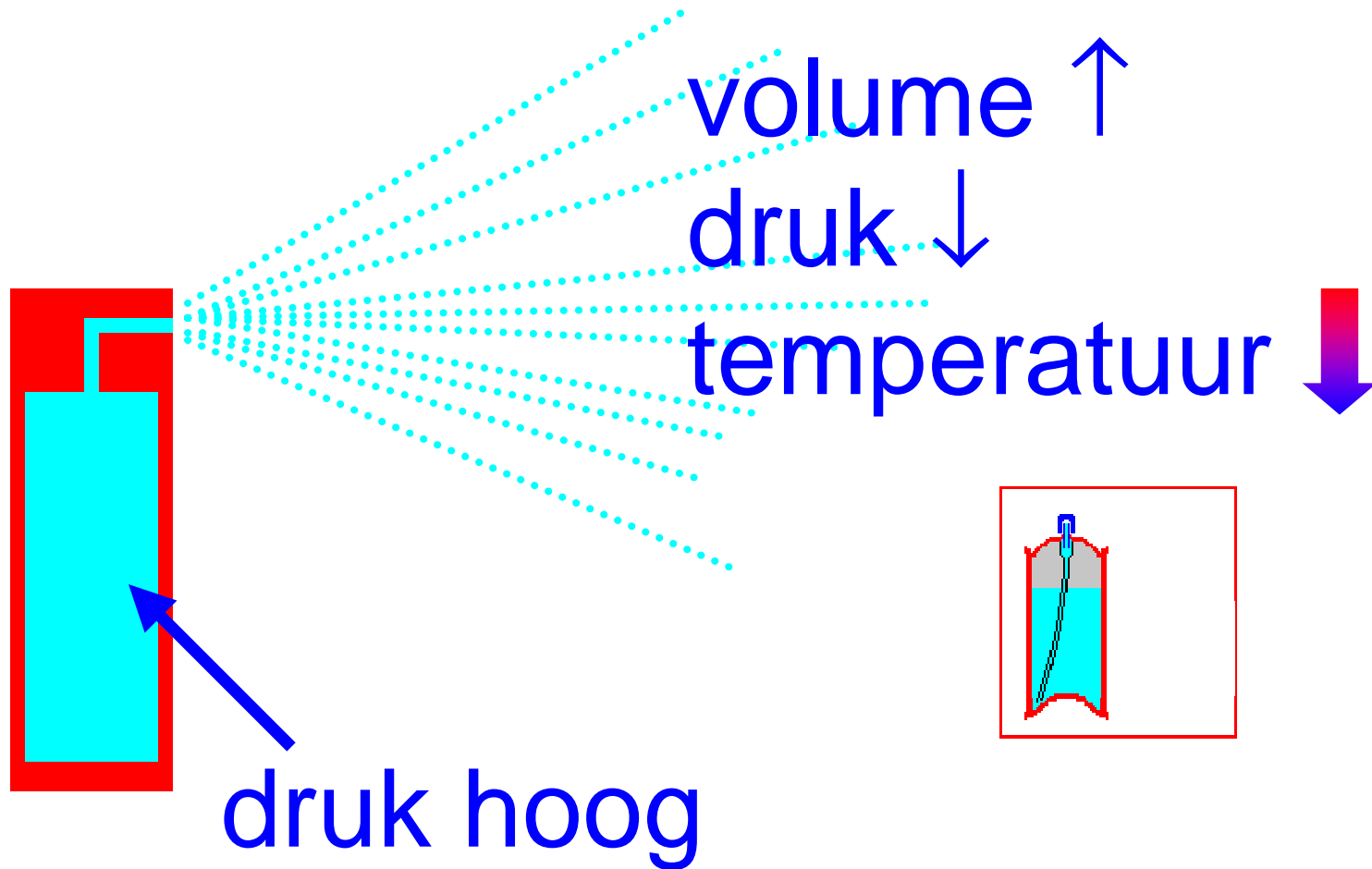
# De zuiger in de cylinder



druk ↓ volume ↑  
temperatuur ↓

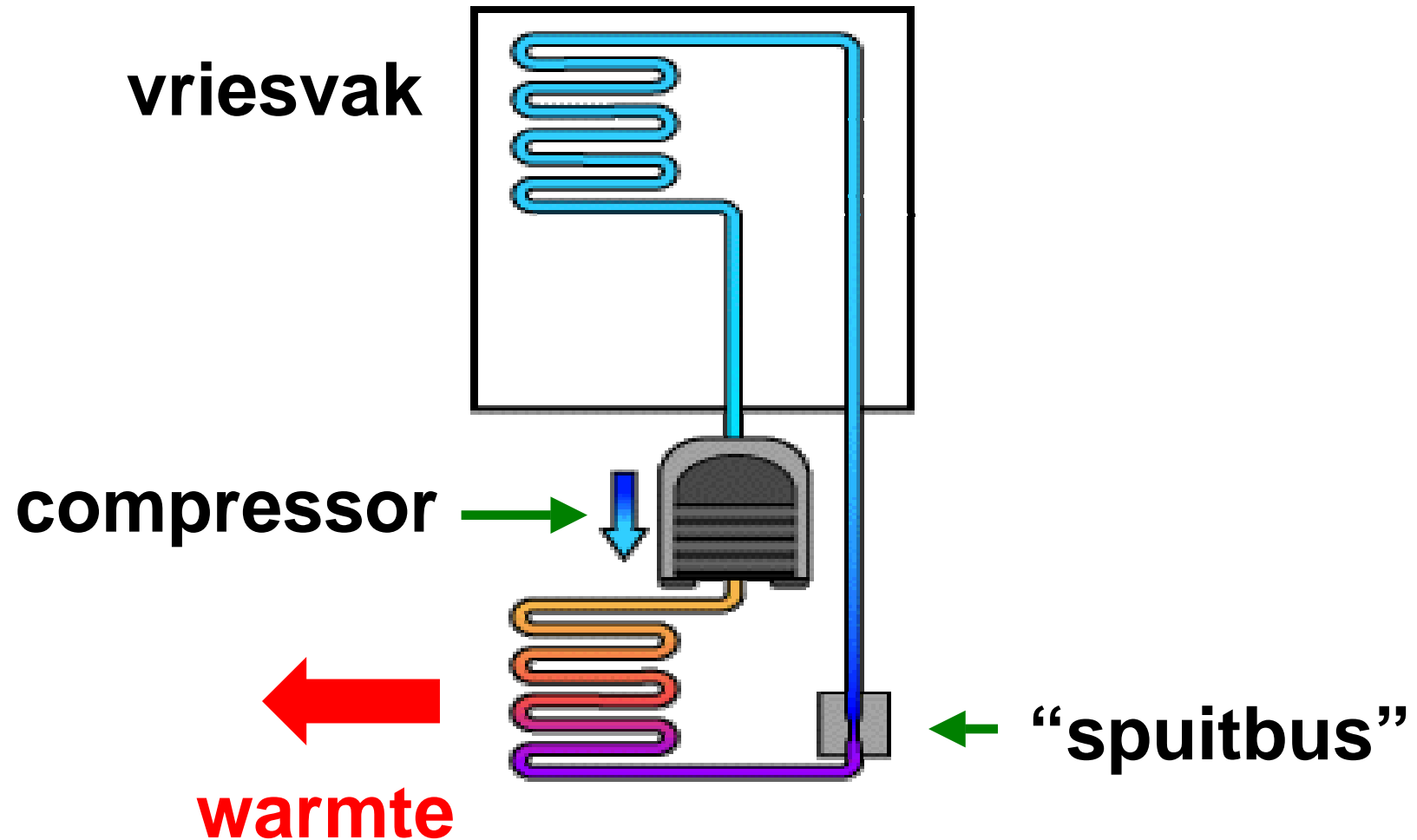
druk ↑ volume ↓  
temperatuur ↑

# Spuitbus





# De koelkast



# Hele koude toepassingen



# 5. Koude proefjes!



# Koude proefjes



Bron: Chemistry Learning Center  
Universiteit Illinois



# Is de koudste kou al gemaakt?



wereldrecord



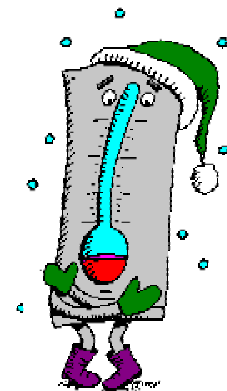
1 K ?

0,001 K ?

0,000 001 K ?

0,000 000 001 K ?

0,000 000 000 1 K !



Universiteit Helsinki, Finland, 2000

# Bedankt!

