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## 2. Fluids

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## 2.2. Dispersions

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- Distinction of substances
    - Pure substances
      - Atoms or molecules with **strict stoichiometric ratio**
      - Physical manipulation
        - Only alters state of matter
        - Chemical identity preserved
    - Mixtures
      - Two or more substances
      - Dispersions
        - Mixtures with one substance scattered throughout another substance
        - Further differentiation by **size of particles**
          - Solutions
          - Colloids
          - Suspensions
-

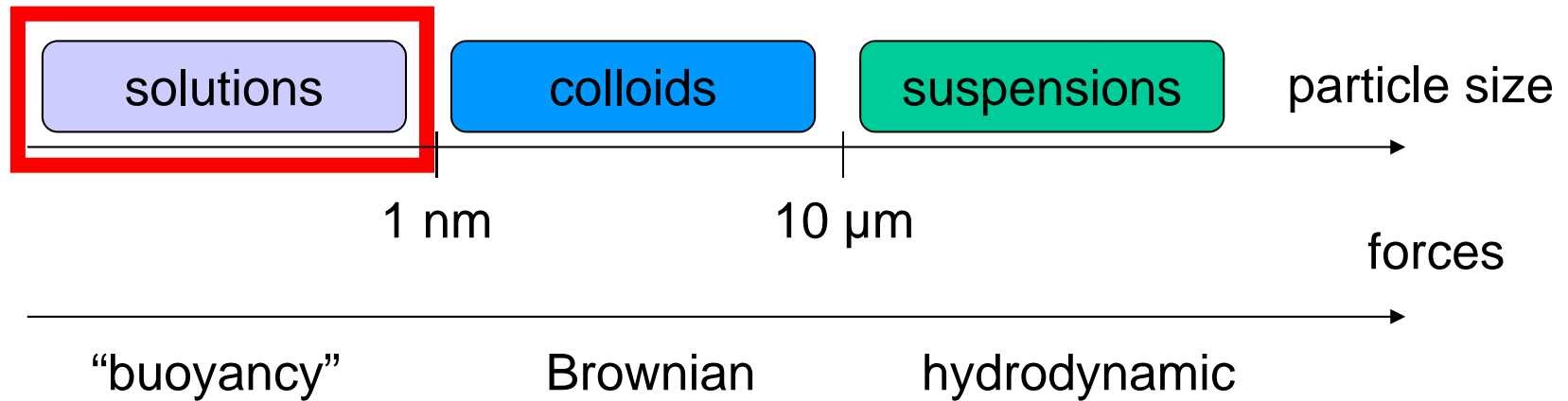
## 2.2. Dispersions

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### 1. Solutions

2. Colloids

3. Suspensions



## 2.2.1. Solutions

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- Solution (also: homogeneous mixture)
  - Dispersion with dissolved particles of ionic or molecular size
  - Homogeneous distribution of particles
  - Commonly liquid, but also gas and solid

- Molar concentration (molarity)

$$c = \frac{N}{N_A V} = \frac{n}{V}$$

$N$  = number of solved molecules  
 $V$  = carrier volume

- Molality

$$c_m = \frac{n}{m}$$

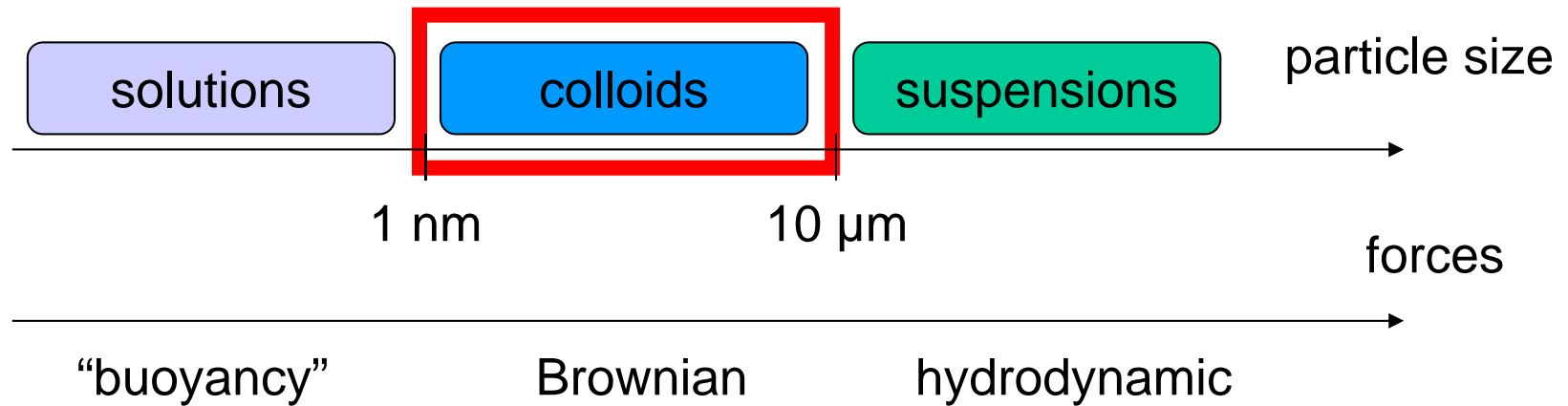
$n$  = moles of solute  
 $m$  = solvent mass

- Example: air
    - Solution of oxygen and nitrogen
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## 2.2. Dispersions

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1. Solutions
- 2. Colloids**
3. Suspensions



## 2.2.2. Colloids

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- Colloid (also: colloidal system, colloidal solution, coll. dispersion)
    - Dispersion
      - Tiny dispersed (not solved) particles (1 nm -10  $\mu\text{m}$ )
    - Colloidal particles pass through
      - Filters
      - Not through semi-permeable membranes
        - Original definition by Thomas Graham
    - Heterogeneous mixture
    - Typically two-phase
    - Both phases
      - Solid or liquid
      - Only one gaseous
    - Incessant bombardment of molecules sufficient to keep colloidal particles in suspension
      - Brownian motion
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## 2.2.2. Colloids

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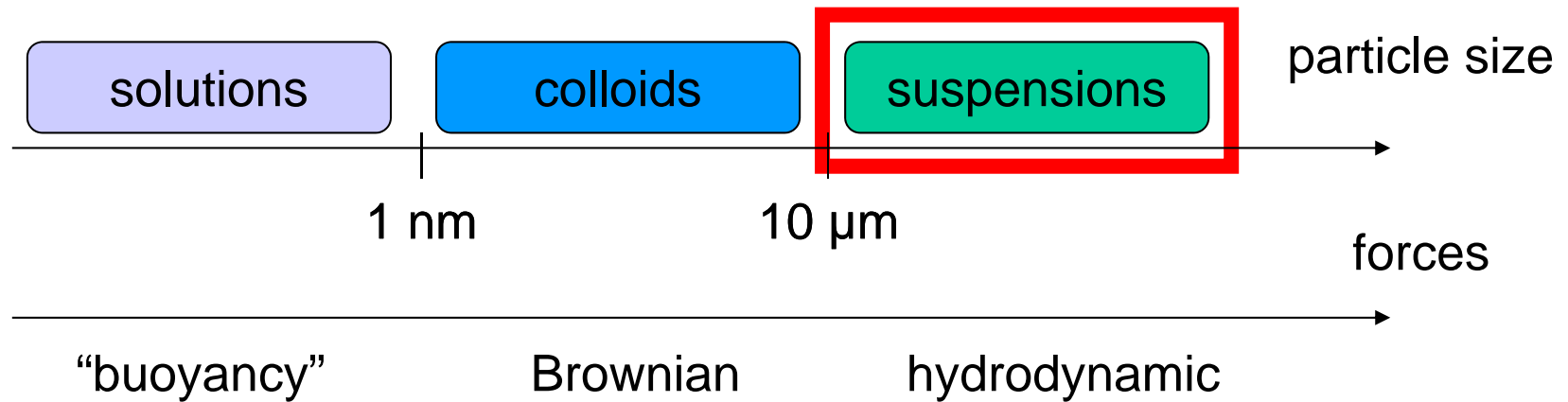
- Colloid (also: colloidal system, colloidal solution, coll. dispersion)
    - Reversible
      - Generation and dissociation of colloidal particles
    - Irreversible
      - Suspended material is stable
    - Types
      - Aerosols
        - Either solid or liquid suspended in gas
        - E.g. smoke, fog and smog
      - Emulsions
        - Heterogeneous liquid-liquid mixture
        - E.g. milk: fat droplets in aqueous solution
      - Sols
        - Solid particles in liquid
      - Gels
        - Liquid with particles dispersed or arranged in network throughout gel
        - Viscous enough to behave more or less like solid
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## 2.2. Dispersions

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1. Solutions
2. Colloids
3. **Suspensions**



## 2.2.3. Suspensions

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- Suspension
    - Particles larger than those of colloids ( $>10\ \mu\text{m}$ )
    - Suspension particles observable with ordinary microscope
    - Can be purified by filters
    - Particles precipitate
      - If solution remains undisturbed
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