Acid
Arrhenius Rule
definition
dissolve in water
ionizes ⇒ H⁺
acidic properties
分类
basicity
max. no. of ionizable H atoms in an acid molecule
monobasic — CH₃COOH (CH₃COOH ⇌ CH₃COO⁻ + H⁺), HCl (HCl → H⁺ + Cl⁻)
dibasic — H₂SO₄ (H₂SO₄ → 2H⁺ + SO₄²⁻)
tribasic — H₃PO₄ (H₃PO₄ ⇌ 3H⁺ + PO₄³⁻)
conc. / dilute
completely ionize?
acid reactivity 不同 — reaction 不一样
diluting conc. acid — qualitatively, quantatively
两个原因不同
strong / weak
completely ionize? (is ionization reversible?)
(strong: HCl, H₂SO₄, HNO₃ | weak: everything else)
differentiate — chemical — reaction rate; physical — pH paper, electrical conductivity
organic / mineral
mineral — HCl, H₂SO₄ ...
organic — CH₃COOH, citric acid ...
Concentration
Density — 单位: g cm⁻³
受物质不同的影响
Molarity — 单位: M / mol dm⁻³
算法: mole / volume — mol, dm³
不会因物质不同而有影响 (算的是 mol, 不是重量)
of H⁺
pH
[H⁺] > [OH⁻] → acidic
[H⁺] = [OH⁻] → neutral
[H⁺] < [OH⁻] → alkaline
没单位
算法: −log[H⁺]
受acid的 ① basicity ② concentration ③ strength 影响
standard solutions
direct weighing method
diluting method
primary standards
known conc.
solute may lose/gain mass as it reacts while weighing
need to find actual conc. by
double standardisation
Titration
Direct titration
Back titration
insoluble, volatile, slow rxn
indicator
litmus
methyl orange
phenolphthalein
universal indicator
burette
pipette
known conc.
known volume
conical flask
Acid Reactions
w/ base
Alkali
dissolve in water
ionizes / dissociate
OH⁻
(真正 react 的 H⁺)
conc. 与 dilute acid reaction 一样, 只是 rate 不同
HX + M₂O → M⁺X⁻ + H₂O (neutralization)
HX + MOH → M⁺X⁻ + H₂O
HX + M₂CO₃ → M⁺X⁻ + H₂O + CO₂
HX + MHCO₃
HX + M₂SO₃ → M⁺X⁻ + H₂O + SO₂
NH₄⁺X⁻ + M₂O → M⁺X⁻ + H₂O + NH₃
NH₄⁺X⁻ + MOH
As an dehydrator agent
X⁺Y⁻ · nH₂O → (conc. H₂SO₄) XY + nH₂O
C₆H₁₂O₆ → (conc. H₂SO₄) 6C + 6H₂O
alcohol → (conc. H₂SO₄) alkene + H₂O
when heated H₂O(l) → H₂O(g) ⇒ white flames
☆ only H₂SO₄(l)
i.e. H₂SO₄(l) is hygroscopic (吸水)
conc. H₂SO₄ exposed in air
time
dilute H₂SO₄
w/ R.A.s
(redox)
(O.A.) acid half equ.
HCl (conc. 与 dilute HCl 一样) — 2H⁺ → H₂
dilute H₂SO₄ — 2H⁺ → H₂
very dilute HNO₃ — 2H⁺ → H₂
conc. H₂SO₄(l) — H₂SO₄ → SO₂
dilute HNO₃ — NO₃⁻ → NO
conc. HNO₃ — NO₃⁻ → NO₂
R.A. ①: metals (M → Mⁿ⁺)
HCl, dilute H₂SO₄, very dilute HNO₃ ⇒ K → Pb
conc. H₂SO₄, dilute HNO₃, conc. HNO₃ ⇒ all metals
R.A. ②: non-metals (C → CO₂) (S → SO₂)
R.A. ③: ions (Fe²⁺ → Fe³⁺)
conc. HNO₃ — 不肯定 (未教)
conc. H₂SO₄ — ✓
Redox reactions
Transfer of electrons
R.A. → O.A.
Balancing redox equ.
四部曲
1 欠O加水
2 欠H加H⁺
3 平衡电荷 (加电子)
4 左右两边的LCM加埋
HALF EQU.
FULL EQU.
判断有没有reaction?
看reaction是 ① 弱→强 (x) ② 强→弱 (✓)
① Cu + H₂SO₄ ⇸ CuSO₄ + H₂
② Fe + H₂SO₄ → FeSO₄ + H₂
Reactivity series
water
steam
dilute acid