

2⁺ The Periodic Table of the Elements

| | | | | | | | | | | | | | | | | | |
|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|-------------------|--------------------|
| 1 H 1.01 | | | | | | | | | | | | | | | | | 2 He 4.00 |
| 3 Li 6.94 | 4 Be 9.01 | | | | | | | | | | | 5 B 10.81 | 6 C 12.01 | 7 N 14.01 | 8 O 16.00 | 9 F 19.00 | 10 Ne 20.18 |
| 11 Na 22.99 | 12 Mg 24.31 | | | | | | | | | | | 13 Al 26.98 | 14 Si 28.09 | 15 P 30.97 | 16 S 32.07 | 17 Cl 35.45 | 18 Ar 39.95 |
| 19 K 39.10 | 20 Ca 40.08 | 21 Sc 44.96 | 22 Ti 47.87 | 23 V 50.94 | 24 Cr 52.00 | 25 Mn 54.94 | 26 Fe 55.85 | 27 Co 58.93 | 28 Ni 58.69 | 29 Cu 63.55 | 30 Zn 65.38 | 31 Ga 69.72 | 32 Ge 72.64 | 33 As 74.92 | 34 Se 78.96 | 35 Br 79.90 | 36 Kr 83.80 |
| 37 Rb 85.47 | 38 Sr 87.62 | 39 Y 88.91 | 40 Zr 91.22 | 41 Nb 92.91 | 42 Mo 95.94 | 43 Tc 98.91 | 44 Ru 101.07 | 45 Rh 102.91 | 46 Pd 106.42 | 47 Ag 107.87 | 48 Cd 112.41 | 49 In 114.82 | 50 Sn 118.71 | 51 Sb 121.76 | 52 Te 127.60 | 53 I 126.90 | 54 Xe 131.29 |
| 55 Cs 132.91 | 56 Ba 137.33 | 57 La 138.91 | 72 Hf 178.49 | 73 Ta 180.95 | 74 W 183.84 | 75 Re 186.21 | 76 Os 190.23 | 77 Ir 192.22 | 78 Pt 195.08 | 79 Au 196.97 | 80 Hg 200.59 | 81 Tl 204.38 | 82 Pb 207.20 | 83 Bi 208.98 | 84 Po 209 | 85 At 210 | 86 Rn 222 |
| 87 Fr 223 | 88 Ra 226 | 89 Ac 227 | 104 Rf 261 | 105 Db 262 | 106 Sg 263 | 107 Bh 264 | 108 Hs 265 | 109 Mt 266 | 110 Ds 267 | 111 Rg 268 | 112 Cn 269 | 113 Nh 270 | 114 Fl 271 | 115 Mc 272 | 116 Lv 273 | 117 Ts 274 | 118 Og 285 |
| 58 Ce 140.12 | 59 Pr 140.91 | 60 Nd 144.24 | 61 Pm (145) | 62 Sm 150.36 | 63 Eu 151.96 | 64 Gd 157.25 | 65 Tb 158.93 | 66 Dy 162.50 | 67 Ho 164.93 | 68 Er 167.26 | 69 Tm 168.93 | 70 Yb 173.04 | 71 Lu 174.97 | | | | |
| 90 Th 232.04 | 91 Pa 231.04 | 92 U 238.03 | 93 Np (237) | 94 Pu (244) | 95 Am (243) | 96 Cm (247) | 97 Bk (247) | 98 Cf (251) | 99 Es (252) | 100 Fm (257) | 101 Md (258) | 102 No (259) | 103 Lr (260) | | | | |

HNO_3
 HClO_3
 HClO_4
 H_2SO_4

$$K_w = [\text{H}^+][\text{OH}^-]$$

↑

$$K_a = 1 \times 10^{-14}$$

Acid: able to donate a H^+

Base: able to accept a H^+

$$\text{pH} = -\log[\text{H}^+]$$

$$\text{pOH} = -\log[\text{OH}^-]$$

↑

1, 2, 3, ...

- a high value of $[\text{H}^+]$ will have a low pH / high pOH
- a high value of $[\text{OH}^-]$ will have a high pH / low pOH

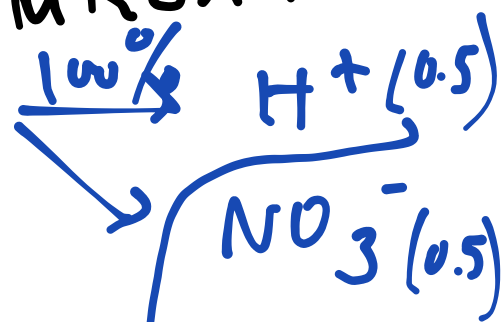
1. What is the pH of a

0.50 M

HNO₃

(strong acid)

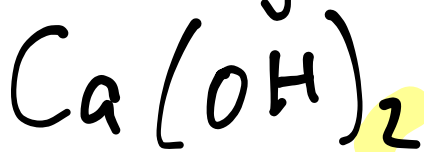
solution?



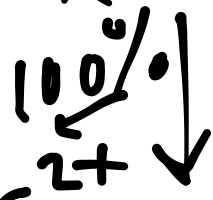
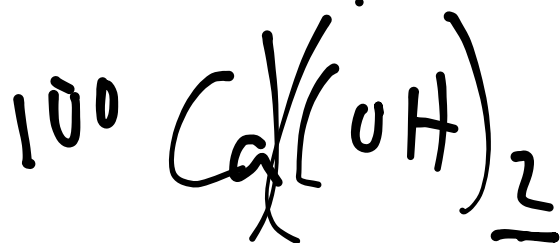
$$\text{pH} = -\log [\text{H}^+]$$
$$= -\log (0.50 \text{ M})$$

$$\text{pH} = 0.30$$

2. What is the hydrogen ion concentration of a 0.30 M calcium hydroxide solution?



Strong Base



$$K_w = [H^+] [OH^-]$$

$$24.0 \text{ } OH^-$$
$$200 \text{ } OH^-$$

$$\frac{1 \times 10^{-14}}{(0.30 \times 2)} = \frac{[H^+] (0.30 \times 2)}{(0.30 \times 2)}$$

$$[H^+] = \frac{(1 \text{ } EE - 14)}{(0.30 \times 2)}$$
$$= \boxed{1.67 \times 10^{-14} \text{ M}}$$

$$pOH = -\log [OH^-]$$

$$= -\log (0.30 \times 2)$$

$$= 0.2218 \dots$$

$$pH = 14 - pOH$$

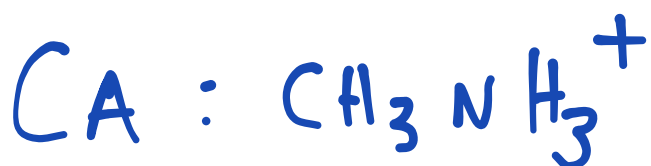
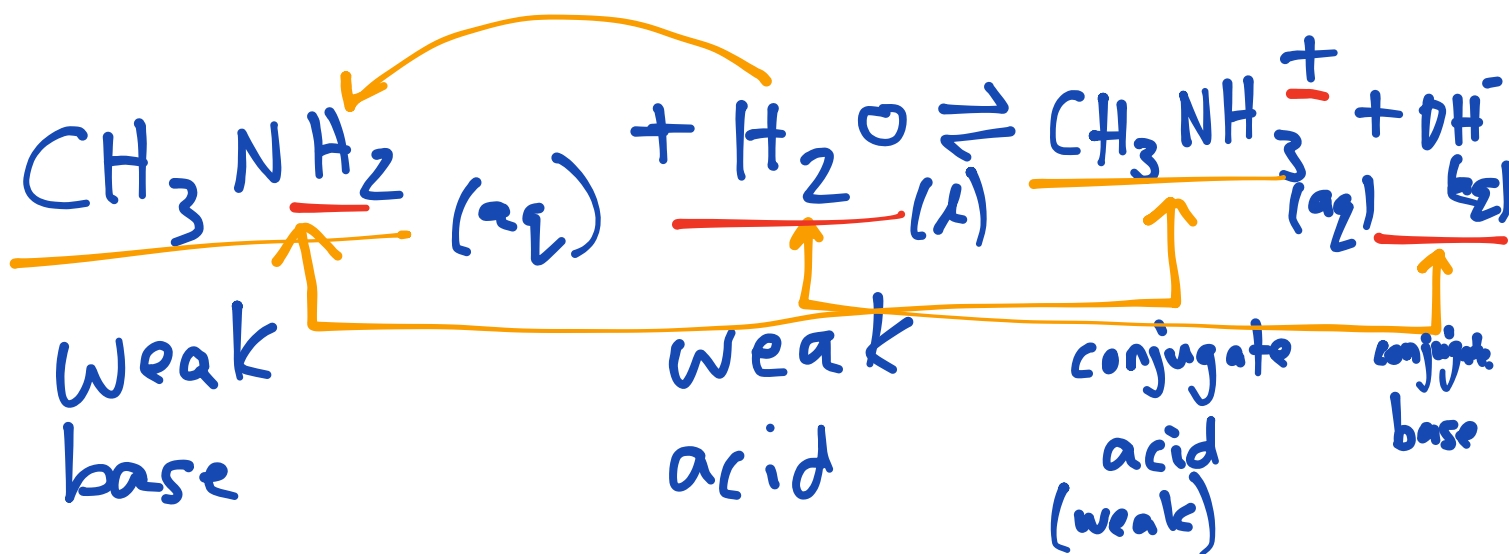
$$pH = 14 - 0.2218 \quad [H^+] = 10^{-pH}$$

$$= 13.778 \quad [H^+] = 10^{-13.778}$$

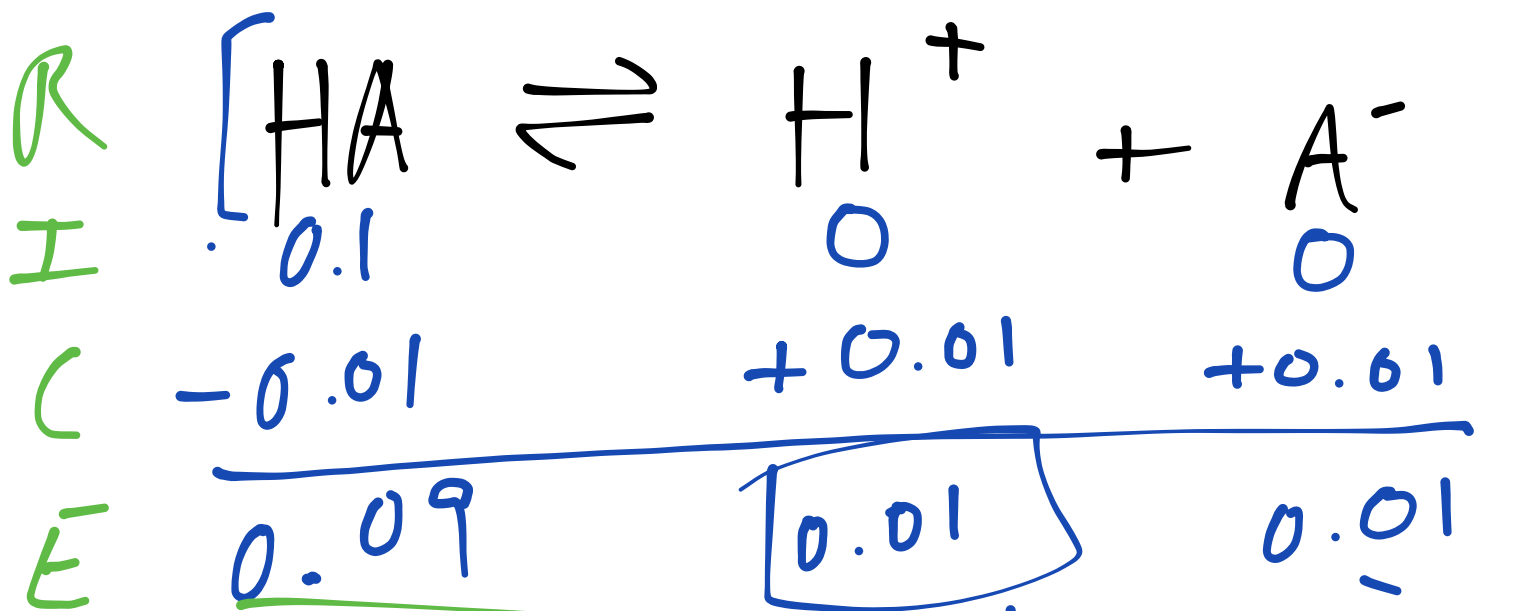
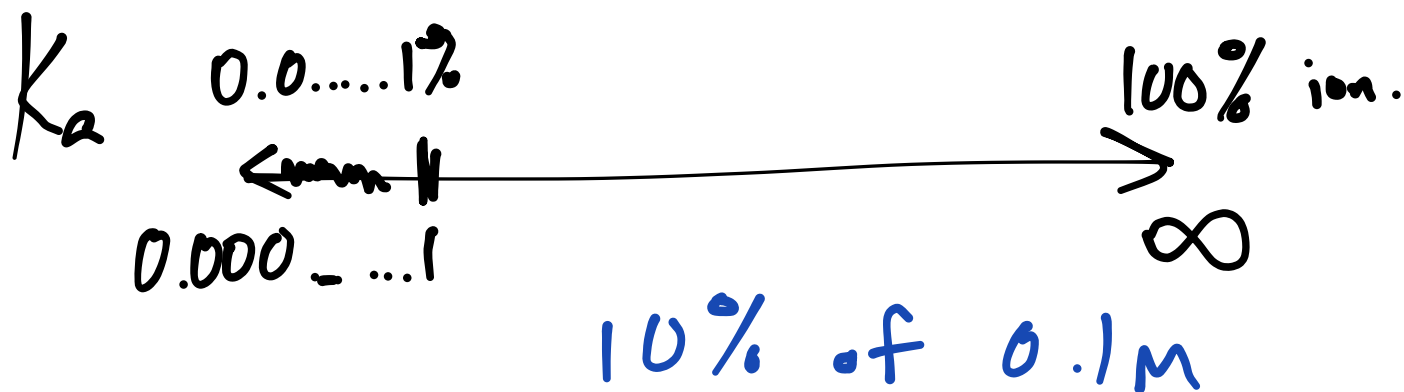
$$= 1.67 \times 10^{-14} \text{ M}$$

$$[OH^-] = 10^{-pOH}$$

3. You place 0.15 moles of methylamine into 1L water.
 What is the conjugate acid & conjugate base?



4. Consider a weak acid "HA" with a % ionization equal to 10% at a 0.1M concentration. What is K_a ?



$$\underline{K_a} = \frac{[H^+][A^-]}{[HA]}$$

$$K_a = \frac{(0.01)(0.01)}{(0.09)}$$

$$K_a = 0.00111\dots$$

$$K_a = 1.11 \times 10^{-3}$$