

11.2 (a) Water contains 50 mg/l of calcium ion and 15 mg/l of magnesium ion. Express the hardness as mg/l of CaCO<sub>3</sub>. (b) Alkalinity in water consists of 150 mg/l of bicarbonate ion and 15 mg/l of carbonate ion. Express the alkalinity in units of mg/l of CaCO<sub>3</sub>.

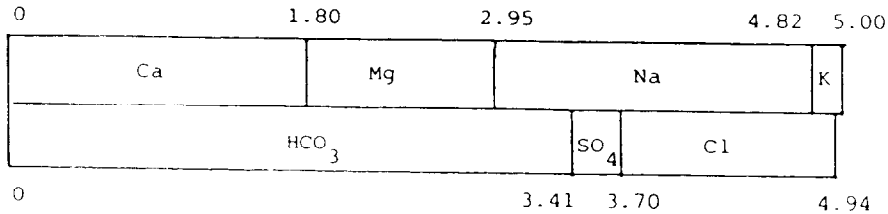
11.2 (a) Total hardness =  $50 \frac{50}{20} + 15 \frac{50}{12.2} = 186 \text{ mg/l}$

(b) Total alkalinity =  $150 \frac{50}{61} + 15 \frac{50}{30} = 146 \text{ mg/l}$

11.3 Draw a milliequivalent per liter bar graph and list the hypothetical combinations for the following analysis of a soft water:

Ca<sup>2+</sup> = 36 mg/l      HCO<sub>3</sub><sup>-</sup> = 208 mg/l  
Mg<sup>2+</sup> = 14 mg/l      SO<sub>4</sub><sup>2-</sup> = 14 mg/l  
Na<sup>+</sup> = 43 mg/l      Cl<sup>-</sup> = 44 mg/l  
K<sup>+</sup> = 7 mg/l

Component	mg/l	EW	meq/l
Ca <sup>2+</sup>	36	20.0	1.80
Mg <sup>2+</sup>	14	12.2	1.15
Na <sup>+</sup>	43	23.0	1.87
K <sup>+</sup>	7	39.1	0.18
HCO <sub>3</sub> <sup>-</sup>	208	61.0	3.41
SO <sub>4</sub> <sup>2-</sup>	14	48.0	0.29
Cl <sup>-</sup>	44	35.5	1.24



1.80 Ca(HCO<sub>3</sub>)<sub>2</sub>; 1.15 Mg(HCO<sub>3</sub>)<sub>2</sub>; 0.46 NaHCO<sub>3</sub>  
0.29 Na<sub>2</sub>SO<sub>4</sub>; 1.12 NaCl; 0.15 KCl