Quiz 4—Water Quality

CENG 340–Introduction to Environmental Engineering

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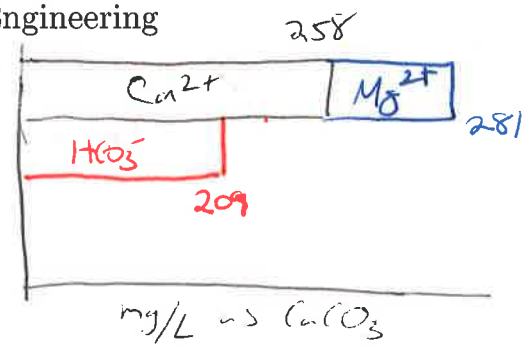

Name:

1. Given the following analysis of a raw(untreated) water:

Chemical	mg/L as chemical	$\frac{\text{EW* as } CaCO_3}{\text{EW* as ion}}$	mg/L as $CaCO_3$
CO_2	8.8	2.27	20
Ca^{2+}	103	2.5	258
Mg^{2+}	5.5	4.12	23
Na^+	16	2.18	35
HCO_3^-	255	0.82	209
SO_4^{2-}	49	1.04	51
Cl^-	37	1.41	52

*EW stands for equivalent weight

(a) *(2 points)* Report the the total hardness, carbonate hardness, and non-carbonate hardness in units of mg/L as $CaCO_3$.

Total Hardness = $[Ca^{2+}] + [Mg^{2+}] = 258 + 23 =$ 281 mg/L as $CaCO_3$

Carbonate Hardness = $[HCO_3^-] =$ 209 mg/L, as $CaCO_3$

Non-carbonate Hardness = TH − CH = 281 − 209 = 72 mg/L as $CaCO_3$

(b) *(2 points)* Determine how much lime (in units of mg/L as $CaCO_3$) must be added to remove calcium.

Lime = $[CO_2]$ + $[Ca^{2+}]$ that is CH = $[CO_2] + [HCO_3^-] = 20 + 209 =$ 229 mg/L as $CaCO_3$

* All carbonate hardness is in the form of Ca^{2+}

(c) *(1 points)* After softening with the amount of lime calculated in (b), what is the remaining hardness of the water.

Remaining Hardness = NCH = 72 mg/L as $CaCO_3$

2. *(2 point)* **Short Answer:** Name one water contaminant (or class of water contaminants) that poses a threat to human health, and state its associated health concern.

cholera → pathogen → death

trihalomethanes → cancer

Manganese → Parkinson Disease (according to the NY Times)

3. *(3 points)* **Multiple Choice:** One or more answers may be correct in the following question:

Turbidity

(a) is higher in groundwater than in lakes.

(b) is used as an indicator of synthetic organic materials.

(c) is used as an indicator of the presence of pathogenic microorganisms.

(d) is used as an indicator of heavy metals.

(e) can be removed by lime precipitation followed by sedimentation.

(f) is regulated by the Safe Drinking Water Act.