University of California at Berkeley Department of Civil and Env. Eng

Spring Semester, 2008

Name of the Student_____

CE 241

HOMEWORK 1

Question 1

a) What are the two basic raw materials used for the manufacture of portland cement?

b) Which of the four major compounds contributes most to the strength development during the first few weeks of hydration?

c) What type of cement (I to V) would one use in (a) cold-weather construction, (b) a dam, (c) sewer tank For each cement indicate its principle characteristics.

Question 2

I) Define *hydraulic* cement and give one example of a *non-hydraulic* cement.

II) Give two advantages and two disadvantages of having cements with high C_3A content.

III) In the older times the cement raw materials were transported by water ("wetprocess"). Explain why this method is not used anymore.

Question 3

I) The architecture wants to build a concrete structure that has a lighter shades of gray. Which cement should you use?

Cement A: C3S=50 %, C2S= 25 %, C3A = 5%, C4AF = 20%

Cement B: C3S= 55%, C2S = 25%, C3A = 10%, C4AF = 10%

II) Describe the hydration reaction that generates the most heat. (3 points)

III) Describe Type IV cement. Why is it not available in the market anymore?

Question 4

I) A portland cement has the following composition: 60% C3S, 15% C2S, 13% C3A, 12% C4AF:

a) will the cement give high early strength?

b) Will the cement generate high heat of hydration?

c) In what type of construction you should **not** use this type of cement?

Question 5 (Midterm question 2003)

I) Compare the properties of C-S-H, ettringite and CH and their roles in determining the properties of hardened cement paste.

II) A cement paste after 63% hydration had a porosity of 15%. Compute the original water-to-cement ratio.

Question 6 (midterm 2005)

I) What will happen if not enough gypsum is added to the cement?

II) You're the manager of a cement plant and observed that the construction market is demanding a cement that gives high-early ages. Your boss does not allow you to change the proportions of the cement compounds but, other than that, she will support any other change that you suggest. What should you do to stay competitive in the market?

III) Assume that you were able to keep your job as the manager of the cement plant. Your geologist suggests to use raw materials that do not contain iron nor aluminum so the cement will not have C3A nor C4AF. Is this a good idea?