King Saud University **CE 442 Water & Wastewater Treatment**
College of Engineering **1st Semester 1425-1426H / 2004-2005G**
Civil Engineering Department **Section: 1026, Dr. W. Zahid**

First Mid-term Exam

Part One (close book). Time allowed: 40 minutes

Student Name: …….
Student Number: …….

Question One (20%)

Answer with true (T) or false (F):

( ) (1) Water turbidity is a direct quantitative measurement of suspended solids.

( ) (2) The conductivity of distilled water is more than that of tap water.

( ) (3) For water with pH of about 8.3-8.5, the predominant alkalinity species present is HCO_3^-.

( ) (4) Unlike ammonium ion (NH_4^+), ammonia (NH_3) is very toxic to aquatic life.

( ) (5) The excessive growth of algae and green plants in water bodies is due to the presence of excessive levels of nutrients, mainly nitrogen and phosphorus.

( ) (6) Consumption of drinking water containing high levels of nitrite causes blue-baby disease for infants less than 6 month old.

( ) (7) Diseases transmitted by water are almost of intestinal (enteric) origin.

( ) (8) For sanitary wastewater, COD is usually less than BOD.

( ) (9) Groundwaters are usually free of pathogens and turbidity.

( ) (10) The design capacity of water treatment plants is usually based on the maximum hourly demand.

( ) (11) Water coagulation is a chemical process involving slow mixing of a chemical coagulant with water.

( ) (12) Water of suspended particles of different sizes is easier to coagulate than water of uniformly sized particles.

( ) (13) Addition of alum (aluminum sulfate) to water increases water alkalinity.

( ) (14) The presence of iron and manganese in water contribute to water hardness.

( ) (15) In the excess-lime softening process, excess lime is added for the removal of calcium.

( ) (16) True color of water is caused by suspended solids.

( ) (17) Highly alkaline water often has a high pH and generally contains high levels of dissolved solids.

( ) (18) Selection of water treatment processes depends only on the type of water source.

( ) (19) About 80% of the domestic water use is for toilet flushing and bathing.

( ) (20) A sand medium with an effective size of 4.0 mm has 10% of its particles (by weight) less than this size.

Question Two (25%)

(A) Briefly define the following:

1- Biochemical Oxygen Demand (BOD_5) (5%):

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2- Water Alkalinity (5%)

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3- Water Hardness (5%)

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(B) Explain the importance of the jar test in coagulation/flocculation operations (5%)

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(C) What are the main advantages of dual-media anthracite-sand filters as compared to single-medium sand filters? (5%)

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First Mid-term Exam

Part Two (aid sheet is provided). Time allowed: One Hour

Student Name: …….
Student Number: …….

Question One (12%)

Fill in the blanks in the following table:

Ion or compound	Atomic weight or molecular weight (g/mol)	Equivalent weight (g/eq.)	mg/L	Molarity (mol/L)	meq/L	mg/L as $CaCO_3$
Na^+	23		23			
HCO_3^{--}	61					122
Fe^{+++}	56				9.3	

Question Two (10%)

In a BOD determination, 6 mL of wastewater containing no oxygen are mixed with 294 mL of dilution water containing 8.6 mg/L of dissolved oxygen. After a 5-day incubation at 20 ^oC, the dissolved oxygen content of the mixture is 5.4 mg/L . Calculate the BOD_5 of the wastewater. If the reaction rate constant (K_e) = 0.23 day^{-1}, what is the ultimate BOD?

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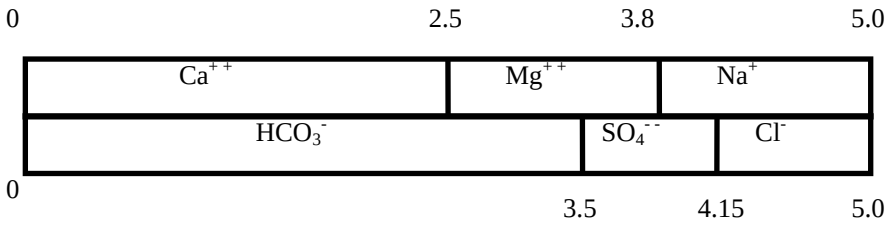
Question Three (15%)

The meq/L bar graph of well water is shown below. Determine:
(a) Total hardness and alkalinity in mg/L as $CaCO_3$.
(b) The softening chemicals (mg/L) required to remove the carbonate hardness.
(c) The final hardness of the treated water.



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Question Four (10%)

Determine the diameters of two circular settling tanks, not over 3.0 m deep, to settle 6500 m^3/day of water provided that the overflow rate should not exceed 30 m^3/m^2.day and the detention time should be at least 2.0 hours.

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Question Five (8%)

Multiple-tube fermentation analyses of well water gave the following results. Determine the total coliform and fecal coliform densities (MPN) and their ranges at the 95% confidence level.

Sample portion (mL)	Number of positive tubes out of five	
	total coliform test	fecal coliform test
10	5	2
1	5	1
0.1	2	0
0.01	1	0
0.001	0	0

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