國立成功大學

110學年度碩士班招生考試試題

編　號：139

系　所：環境工程學系

科　目：衛生工程

日　期：0202

節　次：第 1 節

備　註：可使用計算機

編號： 139　　國立成功大學 110 學年度碩士班招生考試試題

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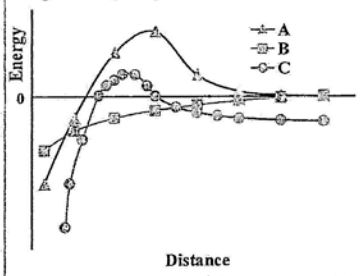
※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Answer the following questions or explain the terms.

(1) Taiwan is experiencing a draught due to the lack of rainfall in the summer. In a meeting, if the General Manager of Taiwan Water Corporation, the Minister of Agriculture, and the Director General of the Industrial Development Bureau are negotiating for the usage of water resources. Who should be given the priority? (5%)

(2) How does the colloidal suspended solid concentration affect the dosage (劑量) of coagulant? (5%)

(3) What are the typical inter-particle force(s) that are involved in colloidal suspended solids? Given the net inter-particle interaction energy for three suspended solid samples below, which one is most difficult to coagulate? (10%)

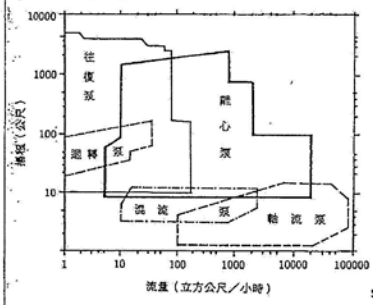


(4) Describe sedimentation types and their characteristics. Which type is involved in sludge dewatering? (5%)

(5) What are the disinfection product(s) that can form if free chlorine and ozone are used as the disinfectants respectively? How to minimize their formation? (10%)

(6) Describe "crown corrosion" and lists at least two methods to minimize it. (5%)

(7) Given the pump characteristics below, which one would you choose to pump clean water to the distribution system? (5%)



Source: 駱 and 楊、駱國、2012

(8) Write the reaction equations if soda-lime chemical precipitation methods are used to remove hardness (Ca^{2+} and Mg^{2+}) from water. (5%)

2. Runoff drainage areas are given in the map below. Assume inlet time is 10 min and the flow velocity in pipes is 1 m/s. Use $I = 4830/(t + 25)$ (mm/h) to find the maximum flows in pipe 1-3, pipe 2-3, pipe 3-4.(15%)

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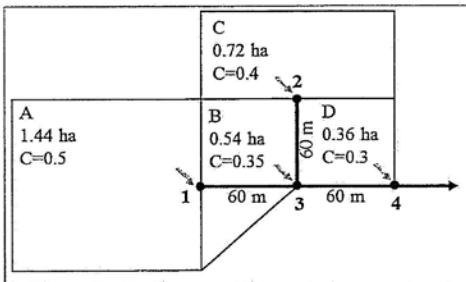

3. If a well of radius r_w = 0.2 m produces water at a rate Q = 1500 m^3/day from a confined aquifer with T = 600 m^2/day and S = 0.0004, determine the drawdown after 1 year of pumping at a radius of 1 km. (10%)

u	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
$\times 1$	0.219	0.049	0.013	0.0038	0.0011	0.00036	0.000038	0.000012	0.000012
$\times 10^{-1}$	1.82	1.22	0.91	0.70	0.56	0.45	0.37	0.31	0.26
$\times 10^{-2}$	4.04	3.35	2.96	2.68	2.47	2.30	2.15	2.03	1.92
$\times 10^{-3}$	6.33	5.64	5.23	4.95	4.73	4.54	4.39	4.26	4.14
$\times 10^{-4}$	8.63	7.94	7.53	7.25	7.02	6.84	6.69	6.55	6.44
$\times 10^{-5}$	10.94	10.24	9.84	9.55	9.33	9.14	8.99	8.86	8.74
$\times 10^{-6}$	13.24	12.55	12.14	11.85	11.63	11.45	11.29	11.16	11.04
$\times 10^{-7}$	15.54	14.85	14.44	14.15	13.93	13.75	13.60	13.46	13.34
$\times 10^{-8}$	17.84	17.15	16.74	16.46	16.23	16.05	15.90	15.76	15.65
$\times 10^{-9}$	20.15	19.45	19.05	18.76	18.54	18.35	18.20	18.07	17.95
$\times 10^{-10}$	22.45	21.76	21.35	21.06	20.84	20.66	20.50	20.37	20.25
$\times 10^{-11}$	24.75	24.06	23.65	23.36	23.14	22.96	22.81	22.67	22.55
$\times 10^{-12}$	27.05	26.36	25.96	25.67	25.44	25.26	25.11	24.97	24.86
$\times 10^{-13}$	29.36	28.66	28.26	27.97	27.75	27.56	27.41	27.28	27.16
$\times 10^{-14}$	31.66	30.97	30.56	30.27	30.05	29.87	29.71	29.58	29.46
$\times 10^{-15}$	33.96	33.27	32.86	32.58	32.35	32.17	32.02	31.88	31.76

Source: After L. K. Wenzel, "Methods for Determining Permeability of Water Bearing Materials with Special Reference to Discharging Well Methods," U.S. Geological Survey, Water-Supply Paper 887, Washington, DC, 1942.

4. Assume that a 2-log removal of pathogens in raw water requires a c·t value of 2 mg/L·min, try to determine the size of disinfection chamber, given the residual chlorine level of 0.5 mg/L and a flow rate of 4 m^3/min. (10%)

5. Calculate the initial head loss through a dual-media filter consisting of a 0.2-m layer of uniform anthracite with a grain diameter of 1.0 mm and a 0.2-m layer of uniform sand with a grain size of 0.5 mm at a surface filtration rate of 2.71 L/m^2·s. The porosity of both media is 0.42, the sphericity for the anthracite is 0.73 and the sphericity for the sand is 0.91. Water temperature is 10°C (kinematic viscosity = 1.306×10^{-6} m^2/s) (15%)

$$\frac{h}{L} = \frac{k\mu}{\rho g}\frac{(1-\varepsilon)^2}{\varepsilon^3}\left(\frac{6}{\Psi d}\right)^2 V$$

$$= \frac{36k\nu}{g}\frac{(1-\varepsilon)^2 V}{\varepsilon^3 \Psi^2 d^2}$$

, where $k = 5$.