國立雲林科技大學
94學年度碩士班入學招生考試試題

系所：環安系、防災所
科目：微積分

1.Choose the correct answer

(1)(4%)The inequality $a<b$ means $b-a$ is

(A)positive (B)negative (C)zero (D)none

(2)(4%)The distance between the numbers a and b is the number

(A) $a-b$ (B) $b-a$ (C) 0 (D) $|b-a|$

(3)(4%)The sloop of the line tangent to the graph of the function f at the point $(x_0, f(x_0))$, if it exists, is the number

(A) $\lim_{h\to 0}\frac{f(x_0+h)-f(x_0)}{h}$ (B) $\lim_{h\to 0}\frac{f(x_0+h)-f(h)}{h}$ (C) $\lim_{h\to 0}\frac{f(h+x_0)-f(x_0)}{x_0}$

(D) $\lim_{x_0\to 0}\frac{f(h+x_0)-f(x_0)}{x_0}$

(4)(6%)Assum that $\lim_{x\to a} f(x)=L$ exists, for any positive integer $n=1,2,\ldots$

(A) $\lim_{x\to a}[f(x)]^n=L$ (B) $\lim_{x\to a}[f(x)]^n=0$ (C) $\lim_{x\to a}[f(x)]^n=1$

(D) $\lim_{x\to a}[f(x)]^n=L^n$.

(5)(6%)For the polynomial function

$$f(x)=x^4-4x^3+3x^2-5x+3$$

(A) $f'(x)=4x^3-6x^2+12x-5$ (B) $f''(x)=12x^2-6x+24$ (C) $f'''(x)=24x-6$

(D) $f^{(4)}(x)=24$.

(6)(8%)Let f be continuous on $[a,b]$ and suppose C is the only critical number of f in (a,b). Then

(A)if $f'(x)>0$ for all $x\in(a,c)$ and if $f'(x)<0$ for all $x\in(c,b)$, then $f(c)$ is a relative minimum.

(B)if $f'(x)<0$ for all $x\in(a,c)$ and if $f'(x)>0$ for all $x\in(c,b)$, then $f(c)$ is a relative maximum.

(C)if $f'(x)>0$ for all $x\in(a,c)\bigcup(c,b)$, then f is increasing on $[a,b]$.

(D)if $f'(x)>0$ for all $x\in(a,c)\bigcap(c,b)$, then f is decreasing on $[a,b]$.

國立雲林科技大學
94學年度碩士班入學招生考試試題

系所：環安系、防災所
科目：微積分

(7)(8%)Find a solution of the differential equation

$$\frac{dy}{dt} = 2 - ay, a \neq 0$$

(A) $\ln|2-ay| = -at - ac$, C arbitrary constant.

(B) $\ln|ay| = -t - ac$, C arbitrary constant.

(C) $\ln|2-y| = -t - c$, C arbitrary constant.

(D) $\ln|2a-y| = -at - c$, C arbitrary constant.

(8)(10%)The general solution of the differential equation

$$\frac{d^2y}{dt^2} - \frac{dy}{dt} - 2y = 0$$

(A) $y = Ae^{-2t} + Be^{t}$ (B) $y = Ae^{2t} + Be^{-t}$ (C) $y = Ae^{2t} + Be^{t}$

(D) $y = Ae^{-2t} + Be^{-t}$

2. (10%) Find the derivative of $f(x) = x^2 \sin x$.

3. (10%) Evaluate

$$\int_1^1 (x^{4/3} + 4x^{1/3})\,dx$$

4. (10%) Find the absolute extrema of f on [-2, 3] if

$$f(x) = 3x^3 - 6x - 1$$

5. (20%) Find the area of the region bounded by the curve $y = x^2 - 4x$, the x axis, and the lines $x = 1$ and $x = 3$.

國立雲林科技大學
94學年度碩士班入學招生考試試題

系所：環安系、防災所
科目：工程統計

共 8 題，每題 12.5 分。

1. 設隨機變數 X 之機率密度函數(PDF)為

式：$f(X)=\begin{cases} aX^2e^{-\frac{X}{2}}, & X\geq 0 \\ 0, & X<0 \end{cases}$，試求 a 值

2. 一小型鋼琴的水平耐力為具下述機率密度函數(PDF)之隨機變數

$$f(x)=\begin{cases} \frac{3}{500}(x-10)(20-x), & 10\leq x\leq 20 \\ 0, & x<10, x>20 \end{cases}$$ ，求以下諸值：

(1)X 之平均值(mean)
(2)X 之中間值(median)
(3)X 之眾數(mode)
(4)X 之標準值(standard deviation)
(5)X 之變異係數(Coefficient of Variation)
(6)X 之偏態係數(Coefficient of Skewness)

3. 試以動差法(Method of Moment) 證明指數分佈

$f(x)=\lambda e^{-\lambda x}$ 之期望值為：$E(x)=\frac{1}{\lambda}$ ；變異數為：$Var(x)=\frac{1}{\lambda^2}$

4. 某工廠下游某點 A 的每日溶氧濃度 DO 連續記錄 10 天結果如下：

日	1	2	3	4	5	6	7	8	9	10
DO(m^3/L)	53.1	50.9	51.8	49.0	52.4	54.1	51.0	50.4	51.9	51.1

試求平均值 μ 之 95%信賴區間？

5. A communication channel is being monitored by recording the number of errors in a string of 1000 bits. Data for 18 of these strings are given here.

   (Read data left to right, then down.)

   3 1 0 1 3 2 4 1 3 1

   1 1 2 3 3 2 0 2

   (a) Construct a stem-and-leaf plot of the data.

   (b) Find the sample average and sample standard deviation.

   (c) Construct a time series plot of the data. Is there evidence that there was an increase or decrease in the number of errors in a string? Explain.

6. Consider the 18 observations collected on the number of errors in a string of 1000 bits of a communication channel given in the above problem. Based on the description of the random variable and these 20 observations, is a Poisson distribution an appropriate model? Perform a goodness-of fit procedure with α=0.05.

7. A random sample of n = 16 structural elements is tested for compressive strength. We know that the true mean compressive strength is μ = 5000 psi and the standard deviation is σ = 100 psi. Find the probability that the sample mean compressive strength exceeds 4985 psi.

8. The thickness of a plastic film (in mils) on a substrate material is thought to be influenced by the temperature at which the coating is applied. A completely randomized experiment is carried out. Ten substrates are coated at 125°F, resulting in a sample mean coating thickness of x_1 = 103 and a sample standard deviation of s_1= 10. Another 15 substrates are coated at 150°F, for which x_2 = 100 and s_2= 15 are observed. It was originally suspected that raising the temperature would reduce mean coating thickness. Do the data support this claim? Use α =0.01 and assume that the two population standard deviations are not equal.

國立雲林科技大學
94學年度碩士班入學招生考試試題

系所：環安系、防災所
科目：工程統計

$$\Phi(z) = P(Z \le z) = \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} e^{\frac{-u^2}{2}} du$$

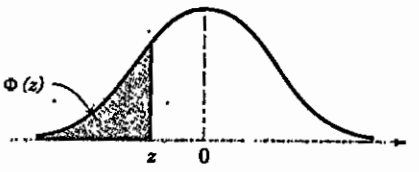


Table I Cumulative Standard Normal Distribution

	−0.09	−0.08	−0.07	−0.06	−0.05	−0.04	−0.03	−0.02	−0.01	−0.00
−3.9	0.000033	0.000034	0.000036	0.000037	0.000039	0.000041	0.000042	0.000044	0.000046	0.000048
−3.8	0.000050	0.000052	0.000054	0.000057	0.000059	0.000062	0.000064	0.000067	0.000069	0.000072
−3.7	0.000075	0.000078	0.000082	0.000085	0.000088	0.000092	0.000096	0.000100	0.000104	0.000108
−3.6	0.000112	0.000117	0.000121	0.000126	0.000131	0.000136	0.000142	0.000147	0.000153	0.000159
−3.5	0.000165	0.000172	0.000179	0.000185	0.000193	0.000200	0.000208	0.000216	0.000224	0.000233
−3.4	0.000242	0.000251	0.000260	0.000270	0.000280	0.000291	0.000302	0.000313	0.000325	0.000337
−3.3	0.000350	0.000362	0.000376	0.000390	0.000404	0.000419	0.000434	0.000450	0.000467	0.000483
−3.2	0.000501	0.000519	0.000538	0.000557	0.000577	0.000598	0.000619	0.000641	0.000664	0.000687
−3.1	0.000711	0.000736	0.000762	0.000789	0.000816	0.000845	0.000874	0.000904	0.000935	0.000968
−3.0	0.001001	0.001035	0.001070	0.001107	0.001144	0.001183	0.001223	0.001264	0.001306	0.001350
−2.9	0.001395	0.001441	0.001489	0.001538	0.001589	0.001641	0.001695	0.001750	0.001807	0.001866
−2.8	0.001926	0.001988	0.002052	0.002118	0.002186	0.002256	0.002327	0.002401	0.002477	0.002555
−2.7	0.002635	0.002718	0.002803	0.002890	0.002980	0.003072	0.003167	0.003264	0.003364	0.003467
−2.6	0.003573	0.003681	0.003793	0.003907	0.004025	0.004145	0.004269	0.004396	0.004527	0.004661
−2.5	0.004799	0.004940	0.005085	0.005234	0.005386	0.005543	0.005703	0.005868	0.006037	0.006210
−2.4	0.006387	0.006569	0.006756	0.006947	0.007143	0.007344	0.007549	0.007760	0.007976	0.008198
−2.3	0.008424	0.008656	0.008894	0.009137	0.009387	0.009642	0.009903	0.010170	0.010444	0.010724
−2.2	0.011011	0.011304	0.011604	0.011911	0.012224	0.012545	0.012874	0.013209	0.013553	0.013903
−2.1	0.014262	0.014629	0.015003	0.015386	0.015778	0.016177	0.016586	0.017003	0.017429	0.017864
−2.0	0.018309	0.018763	0.019226	0.019699	0.020182	0.020675	0.021178	0.021692	0.022216	0.022750
−1.9	0.023295	0.023852	0.024419	0.024998	0.025588	0.026190	0.026803	0.027429	0.028067	0.028717
−1.8	0.029379	0.030054	0.030742	0.031443	0.032157	0.032884	0.033625	0.034379	0.035148	0.035930
−1.7	0.036727	0.037538	0.038364	0.039204	0.040059	0.040929	0.041815	0.042716	0.043633	0.044565
−1.6	0.045514	0.046479	0.047460	0.048457	0.049471	0.050503	0.051551	0.052616	0.053699	0.054799
−1.5	0.055917	0.057053	0.058208	0.059380	0.060571	0.061780	0.063008	0.064256	0.065522	0.066807
−1.4	0.068112	0.069437	0.070781	0.072145	0.073529	0.074934	0.076359	0.077804	0.079270	0.080757
−1.3	0.082264	0.083793	0.085343	0.086915	0.088508	0.090123	0.091759	0.093418	0.095098	0.096801
−1.2	0.098525	0.100273	0.102042	0.103835	0.105650	0.107488	0.109349	0.111233	0.113140	0.115070
−1.1	0.117023	0.119000	0.121001	0.123024	0.125072	0.127143	0.129238	0.131357	0.133500	0.135666
−1.0	0.137857	0.140071	0.142310	0.144572	0.146859	0.149170	0.151505	0.153864	0.156248	0.158655
−0.9	0.161087	0.163543	0.166023	0.168528	0.171056	0.173609	0.176185	0.178786	0.181411	0.184060
−0.8	0.186733	0.189430	0.192150	0.194894	0.197662	0.200454	0.203269	0.206108	0.208970	0.211855
−0.7	0.214764	0.217695	0.220650	0.223627	0.226627	0.229650	0.232695	0.235762	0.238852	0.241964
−0.6	0.245097	0.248252	0.251429	0.254627	0.257846	0.261086	0.264347	0.267629	0.270931	0.274253
−0.5	0.277595	0.280957	0.284339	0.287740	0.291160	0.294599	0.298056	0.301532	0.305026	0.308538
−0.4	0.312067	0.315614	0.319178	0.322758	0.326355	0.329969	0.333598	0.337243	0.340903	0.344578
−0.3	0.348268	0.351973	0.355691	0.359424	0.363169	0.366928	0.370700	0.374484	0.378281	0.382089
−0.2	0.385908	0.389739	0.393580	0.397432	0.401294	0.405165	0.409046	0.412936	0.416834	0.420740
−0.1	0.424655	0.428576	0.432505	0.436441	0.440382	0.444330	0.448283	0.452242	0.456205	0.460172
0.0	0.464144	0.468119	0.472097	0.476078	0.480061	0.484047	0.488033	0.492022	0.496011	0.500000

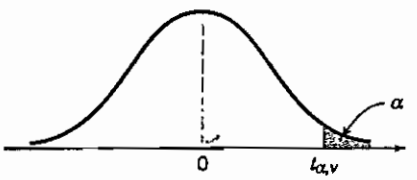


Table II Percentage Points $t_{\alpha,\nu}$ of the t Distribution

ν \ α	.40	.25	.10	.05	.025	.01	.005	.0025	.001	.0005
1	.325	1.000	3.078	6.314	12.706	31.821	63.657	127.32	318.31	636.62
2	.289	.816	1.886	2.920	4.303	6.965	9.925	14.089	23.326	31.598
3	.277	.765	1.638	2.353	3.182	4.541	5.841	7.453	10.213	12.924
4	.271	.741	1.533	2.132	2.776	3.747	4.604	5.598	7.173	8.610
5	.267	.727	1.476	2.015	2.571	3.365	4.032	4.773	5.893	6.869
6	.265	.718	1.440	1.943	2.447	3.143	3.707	4.317	5.208	5.959
7	.263	.711	1.415	1.895	2.365	2.998	3.499	4.029	4.785	5.408
8	.262	.706	1.397	1.860	2.306	2.896	3.355	3.833	4.501	5.041
9	.261	.703	1.383	1.833	2.262	2.821	3.250	3.690	4.297	4.781
10	.260	.700	1.372	1.812	2.228	2.764	3.169	3.581	4.144	4.587
11	.260	.697	1.363	1.796	2.201	2.718	3.106	3.497	4.025	4.437
12	.259	.695	1.356	1.782	2.179	2.681	3.055	3.428	3.930	4.318
13	.259	.694	1.350	1.771	2.160	2.650	3.012	3.372	3.852	4.221
14	.258	.692	1.345	1.761	2.145	2.624	2.977	3.326	3.787	4.140
15	.258	.691	1.341	1.753	2.131	2.602	2.947	3.286	3.733	4.073
16	.258	.690	1.337	1.746	2.120	2.583	2.921	3.252	3.686	4.015
17	.257	.689	1.333	1.740	2.110	2.567	2.898	3.222	3.646	3.965
18	.257	.688	1.330	1.734	2.101	2.552	2.878	3.197	3.610	3.922
19	.257	.688	1.328	1.729	2.093	2.539	2.861	3.174	3.579	3.883
20	.257	.687	1.325	1.725	2.086	2.528	2.845	3.153	3.552	3.850
21	.257	.686	1.323	1.721	2.080	2.518	2.831	3.135	3.527	3.819
22	.256	.686	1.321	1.717	2.074	2.508	2.819	3.119	3.505	3.792
23	.256	.685	1.319	1.714	2.069	2.500	2.807	3.104	3.485	3.767
24	.256	.685	1.318	1.711	2.064	2.492	2.797	3.091	3.467	3.745
25	.256	.684	1.316	1.708	2.060	2.485	2.787	3.078	3.450	3.725
26	.256	.684	1.315	1.706	2.056	2.479	2.779	3.067	3.435	3.707
27	.256	.684	1.314	1.703	2.052	2.473	2.771	3.057	3.421	3.690
28	.256	.683	1.313	1.701	2.048	2.467	2.763	3.047	3.408	3.674
29	.256	.683	1.311	1.699	2.045	2.462	2.756	3.038	3.396	3.659
30	.256	.683	1.310	1.697	2.042	2.457	2.750	3.030	3.385	3.646
40	.255	.681	1.303	1.684	2.021	2.423	2.704	2.971	3.307	3.551
60	.254	.679	1.296	1.671	2.000	2.390	2.660	2.915	3.232	3.460
120	.254	.677	1.289	1.658	1.980	2.358	2.617	2.860	3.160	3.373
∞	.253	.674	1.282	1.645	1.960	2.326	2.576	2.807	3.090	3.291

ν = degrees of freedom.

國立雲林科技大學
94學年度碩士班入學招生考試試題

系所：環安系、防災所
科目：工程統計

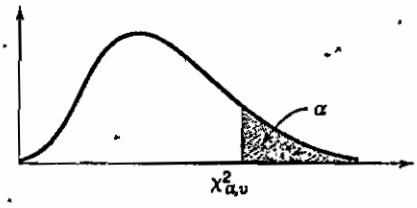


Table III Percentage Points $\chi^2_{\alpha,\nu}$ of the Chi-Square Distribution

ν	.995	.990	.975	.950	.900	.500	.100	.050	.025	.010	.005
1	.00+	.00+	.00+	.00+	.02	.45	2.71	3.84	5.02	6.63	7.88
2	.01	.02	.05	.10	.21	1.39	4.61	5.99	7.38	9.21	10.60
3	.07	.11	.22	.35	.58	2.37	6.25	7.81	9.35	11.34	12.84
4	.21	.30	.48	.71	1.06	3.36	7.78	9.49	11.14	13.28	14.86
5	.41	.55	.83	1.15	1.61	4.35	9.24	11.07	12.83	15.09	16.75
6	.68	.87	1.24	1.64	2.20	5.35	10.65	12.59	14.45	16.81	18.55
7	.99	1.24	1.69	2.17	2.83	6.35	12.02	14.07	16.01	18.48	20.28
8	1.34	1.65	2.18	2.73	3.49	7.34	13.36	15.51	17.53	20.09	21.96
9	1.73	2.09	2.70	3.33	4.17	8.34	14.68	16.92	19.02	21.67	23.59
10	2.16	2.56	3.25	3.94	4.87	9.34	15.99	18.31	20.48	23.21	25.19
11	2.60	3.05	3.82	4.57	5.58	10.34	17.28	19.68	21.92	24.72	26.76
12	3.07	3.57	4.40	5.23	6.30	11.34	18.55	21.03	23.34	26.22	28.30
13	3.57	4.11	5.01	5.89	7.04	12.34	19.81	22.36	24.74	27.69	29.82
14	4.07	4.66	5.63	6.57	7.79	13.34	21.06	23.68	26.12	29.14	31.32
15	4.60	5.23	6.27	7.26	8.55	14.34	22.31	25.00	27.49	30.58	32.80
16	5.14	5.81	6.91	7.96	9.31	15.34	23.54	26.30	28.85	32.00	34.27
17	5.70	6.41	7.56	8.67	10.09	16.34	24.77	27.59	30.19	33.41	35.72
18	6.26	7.01	8.23	9.39	10.87	17.34	25.99	28.87	31.53	34.81	37.16
19	6.84	7.63	8.91	10.12	11.65	18.34	27.20	30.14	32.85	36.19	38.58
20	7.43	8.26	9.59	10.85	12.44	19.34	28.41	31.41	34.17	37.57	40.00
21	8.03	8.90	10.28	11.59	13.24	20.34	29.62	32.67	35.48	38.93	41.40
22	8.64	9.54	10.98	12.34	14.04	21.34	30.81	33.92	36.78	40.29	42.80
23	9.26	10.20	11.69	13.09	14.85	22.34	32.01	35.17	38.08	41.64	44.18
24	9.89	10.86	12.40	13.85	15.66	23.34	33.20	36.42	39.36	42.98	45.56
25	10.52	11.52	13.12	14.61	16.47	24.34	34.28	37.65	40.65	44.31	46.93
26	11.16	12.20	13.84	15.38	17.29	25.34	35.56	38.89	41.92	45.64	48.29
27	11.81	12.88	14.57	16.15	18.11	26.34	36.74	40.11	43.19	46.96	49.65
28	12.46	13.57	15.31	16.93	18.94	27.34	37.92	41.34	44.46	48.28	50.99
29	13.12	14.26	16.05	17.71	19.77	28.34	39.09	42.56	45.72	49.59	52.34
30	13.79	14.95	16.79	18.49	20.60	29.34	40.26	43.77	46.98	50.89	53.67
40	20.71	22.16	24.43	26.51	29.05	39.34	51.81	55.76	59.34	63.69	66.77
50	27.99	29.71	32.36	34.76	37.69	49.33	63.17	67.50	71.42	76.15	79.49
60	35.53	37.48	40.48	43.19	46.46	59.33	74.40	79.08	83.30	88.38	91.95
70	43.28	45.44	48.76	51.74	55.33	69.33	85.53	90.53	95.02	100.42	104.22
80	51.17	53.54	57.15	60.39	64.28	79.33	96.58	101.88	106.63	112.33	116.32
90	59.20	61.75	65.65	69.13	73.29	89.33	107.57	113.14	118.14	124.12	128.30
100	67.33	70.06	74.22	77.93	82.36	99.33	118.50	124.34	129.56	135.81	140.17

ν = degrees of freedom.

國立雲林科技大學
94 學年度碩士班入學招生考試試題

系所：環安系、防災所
科目：流體力學

1. (10 %) Calculate the difference in pressure between points A and B in Fig. 1 and express it as $P_B - P_A$.

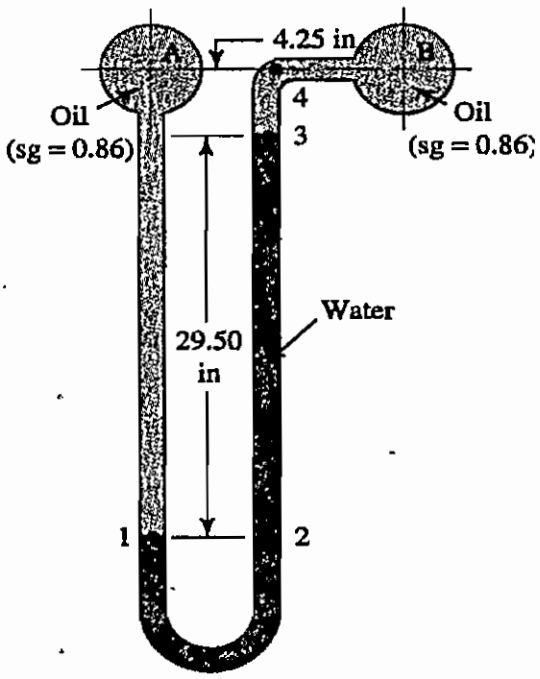


Fig. 1

國立雲林科技大學
94 學年度碩士班入學招生考試試題

系所：環安系、防災所
科目：流體力學

2. (10 %) A dam (Fig. 2) has a parabolic shape $z/z_0 = (x/x_0)^2$ as show in Fig. E2.7a, with $x_0 = 10$ ft and $z_0 = 24$ ft. The fluid is water, $\gamma = 62.4$ lbf/ft^3, and atmospheric pressure may be omitted. Computer the forces F_H and F_V on the dam and their line of action. The width of the dam is 50 ft.

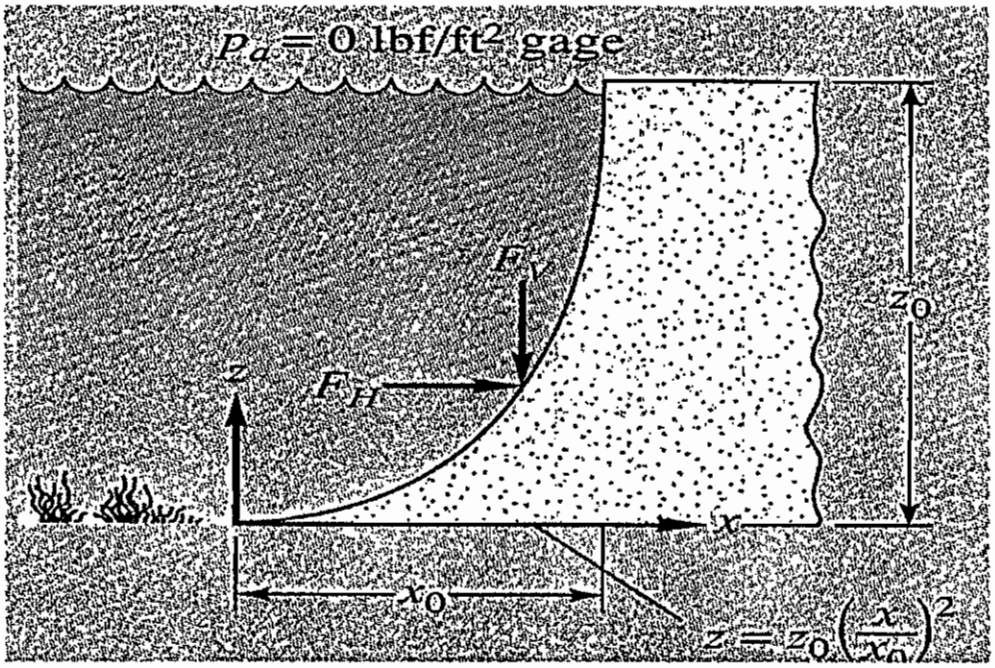


Fig. 2

3. (10 %) Determine if the flow is laminar or turbulent if water at 70℃ flows in a 1-in Type K copper tube ($\nu = 4.11\times10^{-7}$ m^2/s, D = 0.02527 m and A = 5.017×10^{-4} m^2) with a flow rate of 285 L/min.

國立雲林科技大學
94 學年度碩士班入學招生考試試題

系所：環安系、防災所
科目：流體力學

4. (20 %) The venture meter shown in Fig. 3 carries water at 60℃. The specific gravity of the gage fluid in the manometer is 1.25. Calculate the velocity of flow at section A and the volume flow rate of water. The areas for the 200 mm and 300 mm diameter sections are 3.142×10^{-2} m^2 and 7.069×10^{-2} m^2.

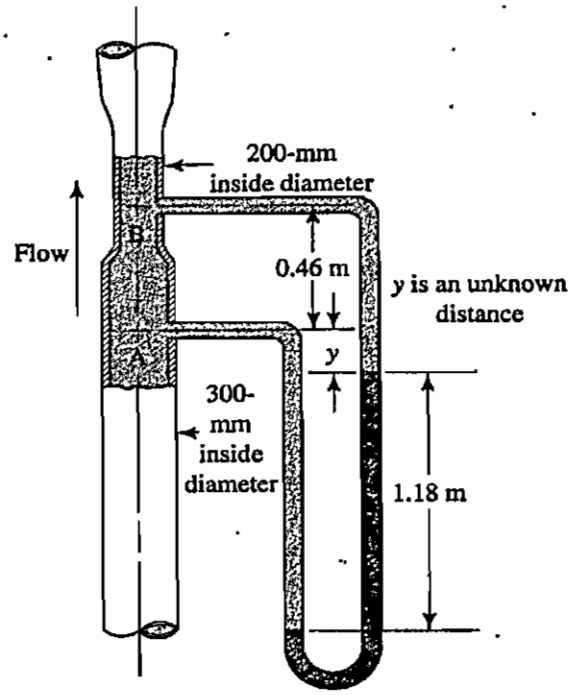


Fig. 3

國立雲林科技大學
94學年度碩士班入學招生考試試題

系所：環安系、防災所
科目：流體力學

5. (10%) Water at 10℃ is flowing at a rate of 115 L/min through the fluid motor shown in Fig. 4. The pressure at A is 700 kPa and the pressure at B is 125 kPa. It is estimated that due to friction in the piping there is an energy loss of 4 N · m/N of water flowing. Calculate the power delivered to the fluid motor by the water.

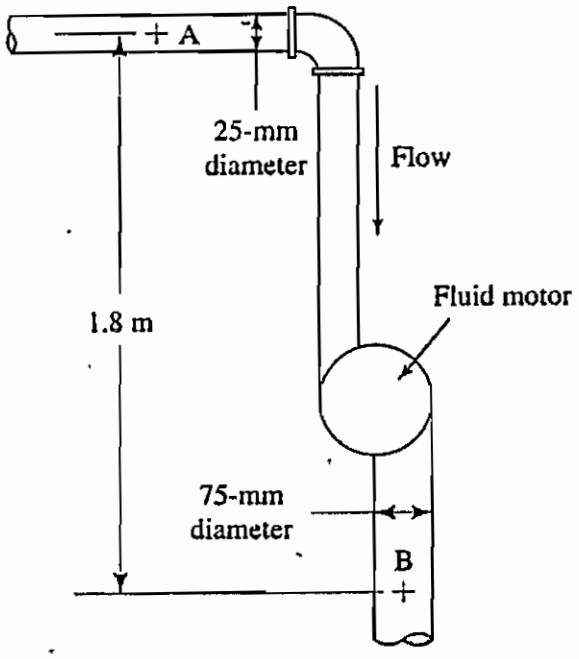


Fig. 4

6. (10%) Fig. 5 shows a jet of water with a velocity v_1 striking a vane that is moving with a velocity v_0. Determine the forces exerted by the vane on the water if $v_1 = 20$ m/s and $v_0 = 8$ m/s, the jet is 50 mm in diameter.

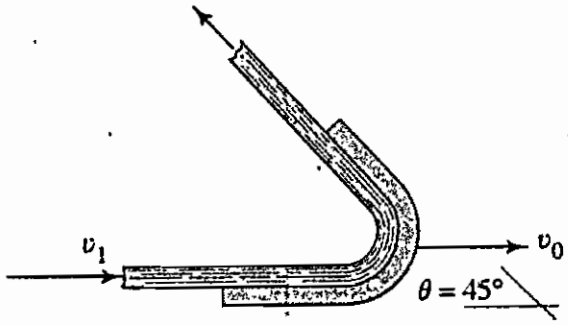


Fig. 5

國立雲林科技大學
94學年度碩士班入學招生考試試題

系所：環安系、防災所
科目：流體力學

7. (10%) Water is flowing in an open channel (Fig. 6) at a depth of 2 m and a velocity of 3 m/s. It then flows down a contracting chute into another channel where the depth is 1 m and the velocity is 10 m/s. Assuming frictionless flow, determine the difference in elevation of the channel floors.

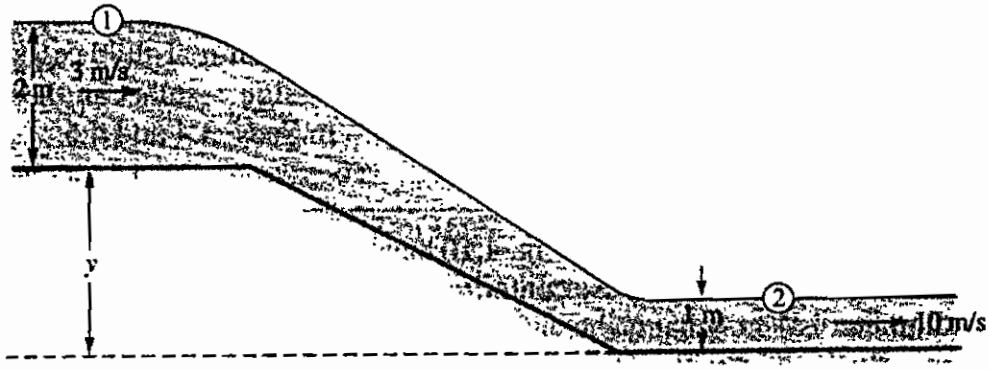


Fig. 6

8. (10%) For laminar flow conditions, what size pipe will deliver 0.0057 m^3/s of medium fuel oil at 4℃ (kinematic viscosity of the fluid $\nu = 6.09\times10^{-6}\ m^2/s$)

9. (10%) Water is to flow at a rate of 30 m^3/s in the concrete channel shown in Fig. 7. Find the vertical drop of the channel bottom per kilometer of length.

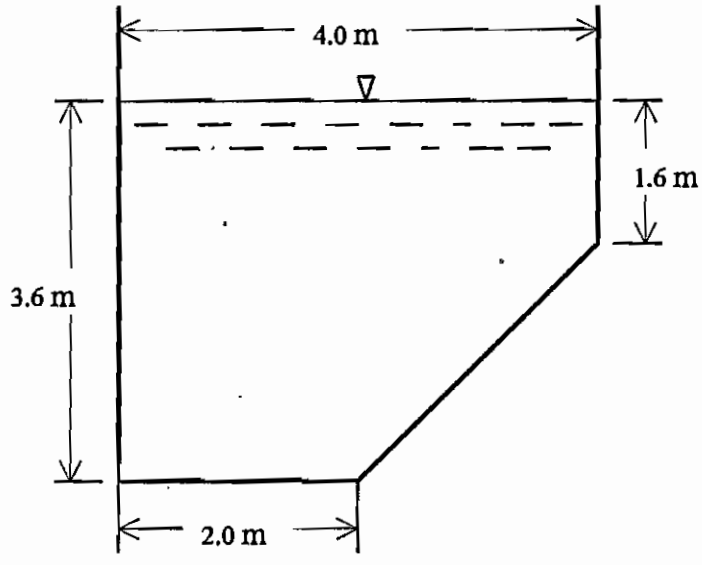


Fig. 7

國立雲林科技大學

94學年度碩士班入學招生考試試題

系所：環安系、防災所

科目：工程靜力學

1. 將數量 300 lb·s 和 52 slug/ft^3 轉換爲適當之 SI 單位？（10 %）

2. 試求圖 1 中之力 F 表示爲卡氏向量(Cartesian Vectors)。(10 %)

3. 將 8 kg 之吊燈以圖 2 中所示之方式懸吊，試求繩索 AC 的長度。（彈簧 AB 的原長 $l'_{AB} = 0.4\,m$，彈簧常數 k_{AB}=300 N/m）(10%)

4. 試求圖 3 中作用於軸承上之等效合力大小及作用位置。（10 %）

5. 如圖 4 桿 AB 承受 200N 之力，試求球窩頭 A 之反作用力及繩索 BD 與 BE 之張力。(10 %)

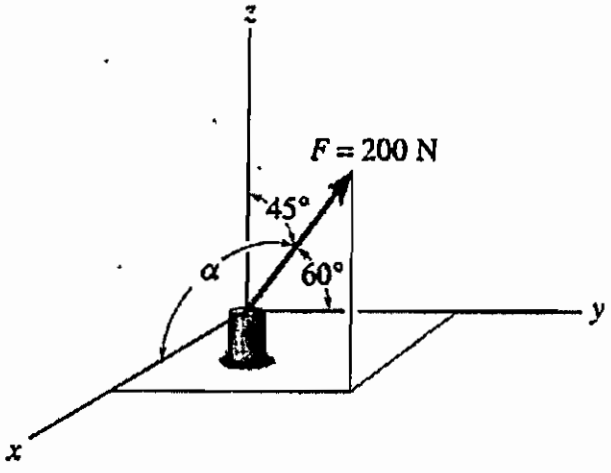


圖 1 (第 2 題)

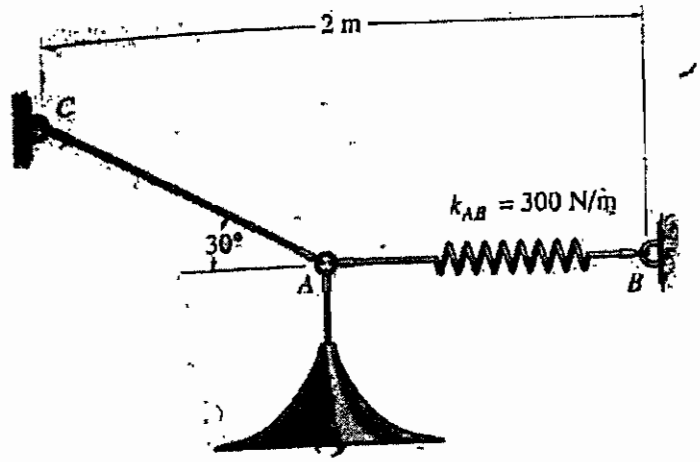


圖 2 (第 3 題)

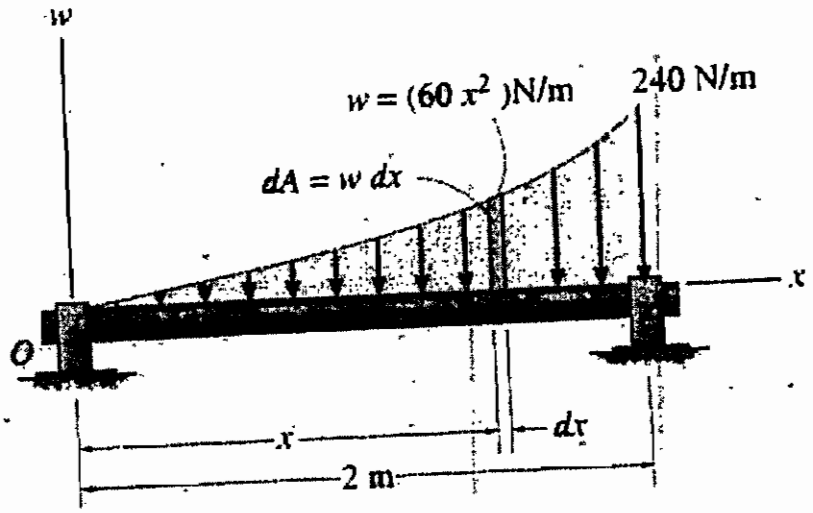


圖 3 (第 4 題)

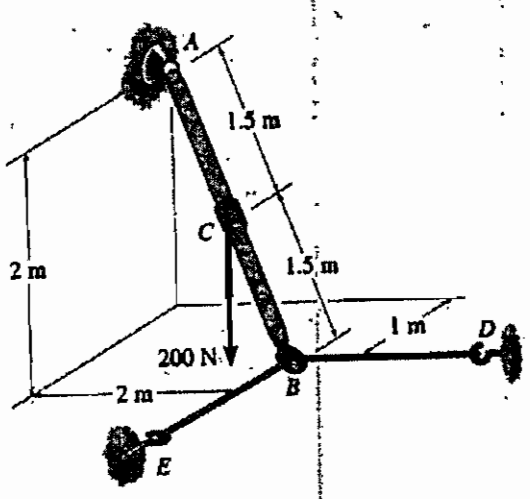
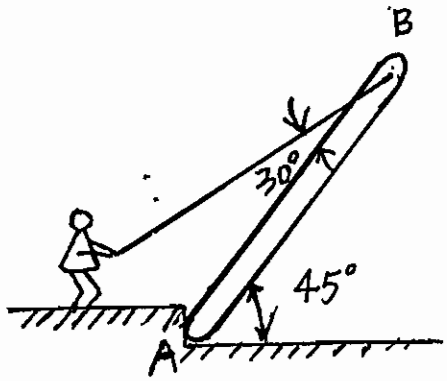


圖 4 (第 5 題)

國立雲林科技大學
94學年度碩士班入學招生考試試題

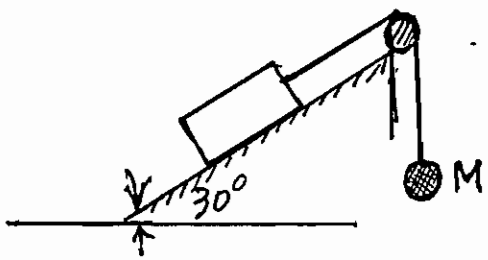
系所：環安系、防災所
科目：工程靜力學

6. 如右圖，一人欲以一繩索豎立--根質量 30 kg，長 5 m 的樑，試求繩子張力及點 A 處之反力。(10%)

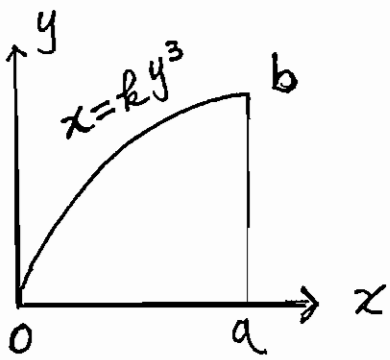


7. 已知 $F = 8i - 4j + 2k$ N，且 F 的作用線通過點 A (-2, 4, 3)m，試求
(a) F 對原點 O 所生之力矩。
(b) F 對原座標(4, 1,-3)m 的 P 點所生之力矩。
(10%)

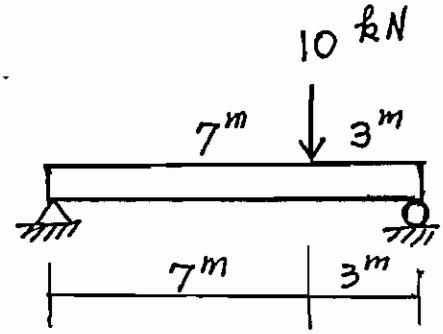
8. 100 kg 之物體置於一傾斜度 $\theta=30^\circ$ 之粗糙面上， 如右圖所示， 已知接觸面的靜磨擦係數爲 0.3，試求質量 M 之可能範圍，使得 100 kg 之物體既不向上移動，亦不滑下此斜面。(10%)



9. 求由曲線下 $x = ky^3$ 自 x= 0 到 x=a 間面積之形心位置。 (10%)



10. 一簡支樑受到 10 kN 之集中負荷，求剪力及彎矩之分佈。(10%)



國立雲林科技大學
94學年度碩士班入學招生考試試題

系所：環安系
科目：環境化學及環境微生物

一、選擇題(每題2分)

1.(　)在氮素循環過程中，氨態氮在有氧條件下，經何種微生物作用氧化成硝態氮？①脫硝菌；②硝化菌；③反硝化菌；④以上皆非。

2.(　)下列物質的分解速度由快而慢排列，以何者為正確？a. 澱粉；b. 纖維素；c. 半纖維素：①abc；②acb；③cab；④bca。

3.(　)在一個深度達40公尺的淡水湖泊中，在冬季時底泥中生活的微生物屬於哪一種：①需氧型微生物；②厭氧型微生物；③酵母菌；④以上皆有。

4.(　)在水體中，90%的微生物屬於：①革蘭氏陽性；②革蘭氏中性；③革蘭氏陰性；④以上皆非。

5.(　)由真菌和藻類共生組成的地衣，其中真菌負責提供藻類需要的：①醣類；②無機養料；③有機養料；④蛋白質。

二、問答題

1..在植物與微生物中醣的轉換一般以溶質形式存在，但在根瘤共生系統與菌根中，有哪三種主要形式的碳水化合物可被根圈微生物所利用？(6分)

2..如果我們在實驗室培養採自土壤的微生物，在培養基中添加微生物可能需要的有機物，然後放入二氧化碳培養箱中培養24小時，溫度維持30℃。請問：最後會長出哪些類別的微生物菌落？我們可以使用哪些工具和方法來驗證？(8分)

3..堆肥原本即為亞洲國家長久使用的一種廢棄物處理技術。請問：堆肥是利用哪一類型的微生物？可將廢棄物中的有機物轉化為哪一種物質(終產物)？此項技術可應用在哪些類別的廢棄物？在農業及園藝上的用途為何？(8分)

4..當微生物遇到一物質需要以不同或額外的酵素、代謝途徑或環境狀況將其分解時，馴化(**Acclimation**)則成為生物處理之必要程序。馴化所需的時間則因物質結構、植種來源和環境現況之不同而有從幾小時到幾個月之差異。而造成時間延遲的可能原因為何？(8分)

三、解釋名詞(每題2分)

1..Decomposer：
2..Assimilataive capacity：
3.. Denitrification：
4..Oxygen sag curve：
5..Eutrophication：

國立雲林科技大學
94學年度碩士班入學招生考試試題

系所：環安系
科目：環境化學及環境微生物

四、名詞解釋（每小題 2 分，共計 10 分）

1. Tyndall effect
2. Common ion effect
3. Nuclear fission
4. isoelectric point
5. photochemical smog

五、問答題（每題 10 分，共計 20 分）

1. 碳水化合物依其結構可分為哪三大類？並舉例之。
2. 敘述含磷、含氟農藥對於環境的影響。

六、計算（每題 10 分，共計 20 分）

1. 若 1 公升 1N H_2SO_4 和 1 公升 1N NaOH 混合，試計算溶液升高的溫度。並判斷該反應為放熱反應或吸熱反應。各物質之 $\triangle H^\circ_{298}$ 如下：$SO_{4(aq)}$ ＝－907.5 kJ/mol；$Na^+_{(aq)}$＝－239.7 kJ/mol；$OH^-_{(aq)}$＝－230.0 kJ/mol；$H_2O_{(lq)}$ ＝－285.9 kJ/mol。
2. 試計算 $CH_{4(g)}$ 之總燃燒熱和淨燃燒熱。各物質之 $\triangle H^\circ_{298}$ 如下：$H_2O_{(lq)}$ ＝－285.9 kJ/mol；$H_2O_{(g)}$ ＝－241.8 kJ/mol；$CH_{4(g)}$ ＝－74.85 kJ/mol；$CO_{2(g)}$ ＝－393.5 kJ/mol。

國立雲林科技大學
94學年度碩士班入學招生考試試題

系所：環安系
科目：物理及化學

一、選擇題 (每題4分)

1. Consider a 4 kg object moving initial at 2 m/s on a horizontal surface that has negligible friction. Find the work required to double the speed of the object?
(a)8.0 J (b)16.0 J (c)24.0J (d)32.0 J
2. A train move due east at 4 m/s along a level, straight track. A girl on the train rolls a ball along the floor with a speed of 2 m/s relative to train. The ball is launched toward a point directly across the aisle from south to north. Find the velocity of the ball in the earth's frame of reference.(a)3.87 m/s (b)4.47 m/s (c)5.25 m/s (d)5.60 m/s
3. A certain diving pool has the dimension 15m×30m. When the pool is filled with the water to a constant depth of h = 10 m, what total force does the water exert on the bottom? (a)1.8×10^6 kg (b)2.4×10^6 kg (c)4.5×10^6 kg (d)6.0×10^6 kg
4. Find the total radiated power emitted from the surface of a thin copper sheet, 20cm×40cm, at a temperature of 600 ℃. The emissivity of copper is 0.60, and the Stefan's constant $\sigma = 5.67\times10^{-8}$ W/(m^2K^4). (a)1980 W (b)2340 W (c)3160 W (d)4320 W
5. What is the entropy change when 2 kg of ice at 0℃ melt to water at 0℃? The latent heat of freezing of ice is $L = 3.34\times10^5$ J/kg. (a)2.45×10^3 J/K (b)3.15×10^3 J/K (c)4.26×10^3 J/K (d)5.76×10^3 J/K.
6. Large quantities of ammonia are used to prepare nitric acid. The first step consists of catalytic oxidation of ammonia to nitric oxide, NO. What is the standard enthalpy change (ΔH) for this reaction?
$4\,NH_3(g) + 5\,O_2 \longrightarrow 4\,NO(g) + 6\,H_2O(g)$
【ΔHf: NH_3, -45.9; NO, 90.3; O_2, 0; H_2O, -241.8 KJ/mole】
(a)+906 KJ (b) +90.6 KJ (c) -906 KJ (d) -90.6 KJ (e) none of above answers.
7. Which of the following molecules or ions are linear?
(a) SeF_2 (b) $CHCl_3$ (c) SeF_4 (d) SnF_6^{-2} (e) none of above answers.
8. Sulfuryl chloride, $SOCl_2$, is a colorless, corrosive liquid whose vapor decomposes in a first-order reaction to sulfur dioxide and chlorine. At 320℃, the rate constant is 2.20×10^{-5}/sec How long would it take for 75% of the $SOCl_2$ to decompose?
(a) 17.5 hr (b) 8.75 hr (c) 13.75 hr (d) 7.75hr (e) none of above answers.

國立雲林科技大學
94學年度碩士班入學招生考試試題

系所：環安系
科目：物理及化學

9. Calculate the standard emf (E^0_{cell}) of the following voltaic cell at 25℃ using standard potentials. Al(s)/Al^{+3}(aq)//Fe^{+2}(aq)/Fe (s) 【E^0_{Al+3} = -1.66V;E^0_{Fe+2} = -0.41V】
(a) -2.07V (b) -1.25V (c) 2.07 V (d) 1.25V (e) none of above answer.

10. Calculate the solubility (in g/L) of calcium fluoride, CaF2 (MW=78.1g/mol), in water from the solubility product constant (3.4×10^{-11})?
(a) 1.6×10^{-1} g/L (b) 1.6×10^{-2} g/L (c) 2.5×10^{-1} g/L (d) 2.5×10^{-2} g/L (e) none of above answers

二、 計算題 (每題 10 分)

1. One end of a Hooker's-law spring (k = 80 N/m) is held fixed while we apply an external force to the free end, stretching it from $x_0 = 0$ to $x_1 = 4$ cm. (a) Find the work done by the external force. (b)Find the additional work done in stretching the spring further from $x_1 = 4$ cm to $x_2 = 7$ cm.
2. A steel piano wire 1.12 m ling has a cross-sectional area of $6\times10^{-3}cm^2$, when under a tension of 115 N, Young's modulus $Y = 20.6 \times 10^{10}$ N/m^2, how much does it stretch(mm)?
3. One end of a copper rod is in thermal contact with a reservoir at $T_2 = 500$ K and the other end is in thermal contact with a reservoir at $T_1 = 300$ K. If 8000 J is conducted from one end to the other, with no change in the temperature distribution along the rod, find (a) the entropy change of each reservoir, (b) the entropy change of the universe.
4. Estimate the pH of natural rainwater assuming that the only substance affecting it is CO_2 that is absorbed from the atmosphere. Assume that the concentration of CO_2 is 360 ppm, and the temperature and pressure are 25℃ and 1 atm. 【$(H^+)(HCO3^-)/(CO2_{aq}) = K_1 = 4.47\times10^{-7}$ mol/L】
5. A solution is prepared to be 0.15 M acetic acid, CH_3COOH and 0.30 M sodium acetate, CH_3COONa. What is the pH of this solution at 25℃? 【Ka for acetic acid is 1.7×10^{-5}】
6. (a) Predict the following compounds in order of increasing acidity:
Water, p-methylphenol, Acetic Acid, p-bromophenol, Acetone
(b) Give the explanations for your answer of question (a).