

元智大學 107 學年度 碩士班 招生試題卷

系(所)別：化學工程與材料 組別：不分組
科學學系碩士班

科目：普通物理

用紙第 / 頁共 / 頁

●可使用現行『國家考試電子計算器規格標準』規定第二類之計算機

Problems:

1. Why is the boiling point of water in a high mountain lower than 100°C ? (5 %)
2. How many degrees of freedom for a diatomic molecule undergoing a temperature ranged 100 k to 800 k? (5 %)
3. Determine the energy consumption as a 10 kg ice was experienced from -200°C to 200°C . (5 %)
4. There 4 processes in thermodynamic, Adiabatic, Isothermal, Isochoric, and Isobaric. Please briefly describe distinguishing feature of these 4 processes. Please calculate the Work and Heat for these 4 processes. (10 %)
5. Briefly describe the (1) Coulomb's Law and (2) Gauss's Law, including the formula and physical meaning. (3) What the difference between the Coulomb's Law and Gauss's Law, (5 %)
6. What are the (1) electric polarization and (2) electric dipole. (3) What is the different between them? (5 %)
7. What are (1) Charge, and (2) the basic magnitudes of a proton? (5 %)
8. For the lightning rod, the sphere shape one easily attract spark, but not for the thinner case. If you are an engineer, how do you design the lightning rod? Please use the electric field to explain this question. (5 %)
9. Use a simple figure to shortly describe the electric force, electric field, and electric flux. And please describe their physical meaning. (5 %)
10. Illustrate the relationships between the electric potential energy and electric potential according the Coulomb's Law. (10 %)
11. According to the wet cell in Fig. 1, (a) Please briefly illuminate how the cell work, including who donate the electron, who accept the electron, and what the product is. (5 %) (2) What the ideal battery mean? And why the wet cell is an ideal battery. (5 %)
12. Please see the Fig. 2. If the each battery, capacitor, and resistor have terminal potential $\mathcal{E} = 1.5\text{ V}$, capacitance $C = 9.0\text{ }\mu\text{F}$, and resistance $R = 12\text{ }\Omega$, respectively. Please use an Equivalent Circuit to instead the Fig. 2. (10%)
13. According to Fig. 3A and 3B, the two conductive plates were connected to batteries with terminal potential \mathcal{E} . Then a dielectric material with the dielectric constant K was inserted between the two plates. However, the battery still connects to plates in Fig. 3A after inserting the dielectric material. But in Fig. 3B, the battery was removed before inserting the dielectric material. (a) Please briefly discuss why the energy reserved in Fig. 3A is more than that in Fig. 3B. (8 %) (b) There is a typo in this figure, where is it? (2 %)
14. Please briefly discuss the relationship between conductivity and operation temperature if the materials are conductor, semiconductor, and insulator. (10%)

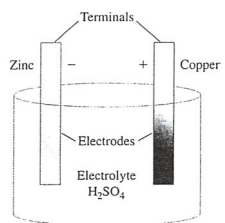


Fig.1. Wet cell

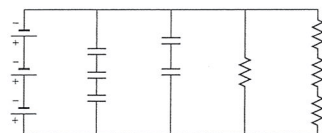


Fig. 2. Batteries, capacitors, and resistors form a network.

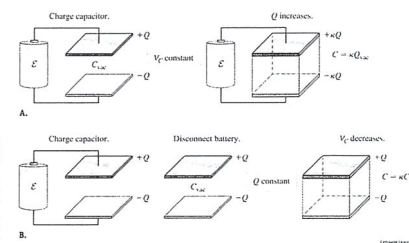


Fig. 3.