

所別： 材料工程研究所 組別： 不分組 科目： 普化

注意 不准 一般計算器 工程用計算器，考試時間總計：100 分鐘。試題共 2 頁，第 1 頁

1. Explain the meaning of the following: (10 %)
(a) Hydrogen bonding; (b) London dispersion force; (c) Ionic bonding
(d) Standard Temperature and Pressure (S.T.P.)
2. Give the Lewis structure for each of the following (20%)
(a) HF ; (b) NH₃ ; (c) CF₄ ; (d) NO⁺
3. (1) How many protons and neutrons are contained in the nucleus of each of following atoms? Assuming each atom is uncharged, how many electrons are present? (10 %)
(a) ${}_{94}^{244}\text{Pu}$ (b) ${}_{95}^{241}\text{Am}$ (c) ${}_{89}^{227}\text{Ac}$ (d) ${}_{55}^{133}\text{Cs}$ (e) ${}_{77}^{193}\text{Ir}$
4. For the following ions , indicate whether electrons must be *gained* or *lost* from the parent neutral atom ,and *how many* electrons must be gained or lost. (10 %)
(a) O²⁻ ; (b) P³⁻ ; (c) Cr³⁺; (d) Rb⁺
5. For the following pairs of ions , use the concept that a chemical compound must have a charge of zero to predict the formula of the simplest compound that the ions are most likely to form. (10 %)
(a) Cr³⁺ and S²⁻; (b) Ca²⁺ and P³⁻; (c) Al³⁺ and O²⁻; (d) Li⁺ and N³⁻
6. Classify each of the following reactions in as many ways as possible. (10 %)
(a) $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g})$
(b) $2\text{Al}(\text{s}) + 3\text{Cl}_2(\text{g}) \rightarrow 2\text{AlCl}_3(\text{s})$
(c) $\text{BaCl}_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{NaCl}(\text{aq})$
(d) $2\text{Cs}(\text{s}) + \text{Br}_2(\text{l}) \rightarrow 2\text{CsBr}(\text{s})$
(e) $\text{KOH}(\text{aq}) + \text{HCl}(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{KCl}(\text{aq})$
7. For each of the following reactions, complete and balance the equation, indicating clearly which product is the precipitate. (20 %)
(a) $\text{KNO}_3(\text{aq}) + \text{BaCl}_2(\text{aq}) \rightarrow$
(b) $\text{Na}_2\text{SO}_4(\text{aq}) + \text{Pb}(\text{NO}_3)_2(\text{aq}) \rightarrow$
(c) $\text{KOH}(\text{aq}) + \text{Fe}(\text{NO}_3)_3(\text{aq}) \rightarrow$
(d) $\text{NaS}(\text{aq}) + \text{Cu}(\text{NO}_3)_2(\text{aq}) \rightarrow$

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8. Mixtures of helium and oxygen are used in the “air” tanks of underwater divers for deep dives. For a particular dive, 12 L of O_2 at $25^\circ C$ and 1.0 atm and 46 L of He at $25^\circ C$ and 1.0 atm were both pumped into a 5.0-L tank. Calculate the partial pressure of each gas and the total pressure in the tank at $25^\circ C$. (10 %)