

- (10%) Calculate the root-mean-square (rms) speed of O_2 molecules in a tank at $21^\circ C$ and $15.7 atm$.
- (10%) Explain the Greenhouse effect from the viewpoint of Chemistry.
- (10%) What is the enthalpy of reaction, ΔH , for the formation of tungsten carbide, WC , from the elements? $W(s) + C(\text{graphite}) \rightarrow WC(s)$
 $2W(s) + 3O_2(g) \rightarrow 2WO_3(s); \Delta H = -1680.6 kJ$
 $C(\text{graphite}) + O_2(g) \rightarrow CO_2(g); \Delta H = -393.5 kJ$
 $2WC(s) + 5O_2(g) \rightarrow 2WO_3(s) + 2CO_2(g); \Delta H = -2391.6 kJ$
- (10%) What is the wavelength of light emitted when the electron in hydrogen atom undergoes a transition from energy level $n = 4$ to level $n = 2$? ($R_H = 2.179 \times 10^{-18} J$, $h = 6.626 \times 10^{-34} J$, $c = 2.998 \times 10^8 m/s$)
- (10%) Estimate the vapor pressure of water at $85^\circ C$. Note that the boiling point of water is $100^\circ C$ and that its heat of vaporization is $40.7 kJ/mol$.
- (10%) Iodide ion is oxidized in acidic solution to triiodide ion, I_3^- , by hydrogen peroxide.



A series of four experiments was run at different concentrations, and the initial rates of I_3^- formation were determined (see table). (a). From these data, obtain the reaction orders with respect to H_2O_2 , I^- , and H^+ . (b). Then find the rate constant.

	Initial Concentrations (mol/L)			Initial Rate [mol/(L · s)]
	H_2O_2	I^-	H^+	
Exp. 1	0.010	0.010	0.00050	1.15×10^{-6}
Exp. 2	0.020	0.010	0.00050	2.30×10^{-6}
Exp. 3	0.010	0.020	0.00050	2.30×10^{-6}
Exp. 4	0.010	0.010	0.00100	1.15×10^{-6}

- (20%) Please describe and explain (a) Lewis acid, (b) the second law of thermodynamic (c) Gas chromatography, (d) Nerst Equation, (e) Voltaic cell.

(背面仍有題目,請繼續作答)

8. (10%) Automobiles are being equipped with air bags that inflate on collision to protect the occupants from injury. Many such air bags are inflated with nitrogen, N_2 , using the rapid reaction of sodium azide, NaN_3 , and iron(III) oxide, Fe_2O_3 , which is initiated by a spark. The overall reaction is



How many grams of sodium azide would be required to provide 75.0 L of nitrogen gas at 25 °C and 748 mmHg? (N = 14, O = 16, Na = 23, Fe = 56)

9. (10%) The degree of ionization of acetic acid, $HC_2H_3O_2$, in a 0.1 M aqueous solution at 25 °C is 0.013. K_a at this temperature is 1.7×10^{-5} . Calculate the degree of ionization of $HC_2H_3O_2$ in a 0.10 M solution at 25 °C to which sufficient HCl is added to make it 0.010 M HCl. How is the degree of ionization affected?