

Problems : 70%

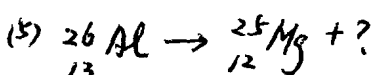
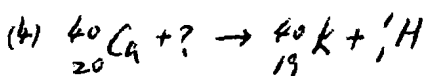
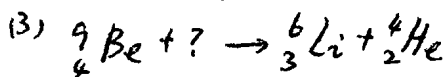
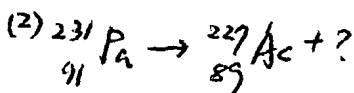
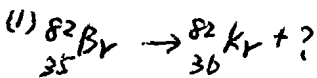
1. The rate equation for decomposition of  $N_2O_5$  is  $\text{Rate} = k[N_2O_5]$ . The value of  $k$  is  $6.7 \times 10^{-5} s^{-1}$ . Calculate the half-life time of  $N_2O_5$ . 10%
2. The activation energy  $E_a$  for a reaction is  $260 kJ/mol$ . At  $800K$ , the rate constant  $k = 0.0315 s^{-1}$ . Determine the value  $k$  at  $850K$ . 10%
3. A reaction has rate equation,  $\text{Rate} = k[A]^2$ . How will the rate change if the concentration of  $A$  is doubled? If the concentration of  $A$  is halved? 10%
4. You dissolve  $15.0g$  of sucrose,  $C_{12}H_{22}O_{11}$ , in a cup of  $225g$  water. What is the freezing point of the solution?  $K_f$  of  $H_2O$  is  $-1.86$ . 10%
5. Calculate the osmotic pressure of a  $0.0120M$  solution of  $NaCl$  in water at  $0^\circ C$ . Assume the van't Hoff  $i$  factor is  $1.94$  for this solution. 10%
6. You burn  $0.1523g$  of an unknown compound  $C_xH_yO_z$  and isolate  $0.3718g$  of  $CO_2$  and  $0.1522g$  of  $H_2O$ . What's the empirical formula of the compound? If molecular weight is  $72.17/mol$ , what's the molecular formula?  $C=12.0, O=16.0, H=1.0$  10%
7. Data for reaction  $CO(g) + NO_2(g) \rightarrow CO_2(g) + NO(g)$  are given in the table below. 10%

Experiment	$[CO]$ in M	$[NO_2]$ in M	rate in M/h
1	$5.0 \times 10^{-4}$	$0.36 \times 10^{-4}$	$3.4 \times 10^{-8}$
2	$5.0 \times 10^{-4}$	$0.18 \times 10^{-4}$	$1.7 \times 10^{-8}$
3	$1.0 \times 10^{-3}$	$0.36 \times 10^{-4}$	$6.8 \times 10^{-8}$

What is the rate constant for the reaction?

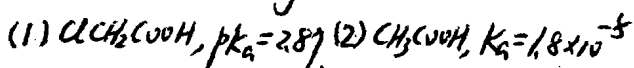
B. Questions = 30%

1. Complete the following equations. 5%



2. Indicate two types of catalysis. 5%

3. Which is the stronger acid? 5%



4. Consider the following molecules: 5%  
 (1)  $H_2O$  (2)  $NH_3$  (3)  $CO_2$  (4)  $Cl_2$  (5)  $CCl_4$  (6)  $BeCl_2$  (7)  $C_6H_6$   
 Which compounds are not polar?

5. Which pairs of liquids will be miscible? 5%  
 (1)  $H_2O$  and  $CH_3CH_2CH_2CH_3$  (2)  $C_6H_6$  and  $CCl_4$   
 (3)  $H_2O$  and  $CH_3COOH$  (4)  $CCl_4$  and  $H_2O$

b. Define acid and base according to Arrhenius and Bronsted-Lowry theory. 5%