A. For the thermal decomposition of acetaldehyde, $CH_3CHO \rightarrow CH_4 + CO$, the following data at 800 K are given:

Exp't	$[CH_3CHO]$ (M)	Rate (M/s)
1	0.10	9.0×10^{-7}
2	0.20	36.0×10^{-7}
3	0.30	81.0×10^{-7}
4	0.40	14.4×10^{-6}

1. Write the rate equation for the reaction. What is the order of the reaction?
2. Calculate the rate constant for the reaction at 800 K.
3. Calculate the decomposition rate at 800 K at the instant when $[CH_3CHO] = 0.250$ M.

B. For the reaction $W + X + Y \rightarrow Z$ the following data were obtained at a constant temperature:

Expt	[W]	[X]	[Y]	Rate (M/s)
1	0.05	0.05	0.01	6.25×10^{-3}
2	0.10	0.05	0.01	1.25×10^{-2}
3	0.10	0.10	0.01	5.00×10^{-2}

1. What is the order with respect to each reactant?
2. Write the rate law.
3. Calculate average rate constant.

C. In a 45.5 second period during a reaction, the concentration of product *W* changes by 8.63×10^{-2} M. Calculate the average rate of reaction.

D. A certain first order reaction is 35.5% complete in 4.90 min at 25°C. What is its rate constant?

E. The rate constant for $2NO_2 \rightarrow 2NO + O_2$ is 0.54 $M^{-1}s^{-1}$ at 300°C. How long in seconds would it take for the concentration of NO_2 to decrease from 0.62 M to 0.28 M?

F. The half-life of the first order reaction $4PH_3 \rightarrow P_4 + 6H_2$ is 35.0 sec at 680°C. Calculate (a) the rate constant for the reaction and (b) the time required for 95% of P_4 to decompose.

G. Benzoyl peroxide, the substance most widely used against acne, has a half life of 9.8×10^3 days when refrigerated. How long will it take to lose 5% of its potency (95% remaining)?

H. In a catalytic experiment involving Haber process, synthesis of ammonia from nitrogen and oxygen gas, the rate of the reaction was measured as Rate = $\Delta[NH_3]/\Delta t = 2.0 \times 10^{-4}$ M/s. Find the numerical value for the rate of reaction in terms of the rate of disappearance of (1) H_2 gas (2) N_2 gas.

I. Draw and label the energy diagram. A) E_A for combustion of glucose ($C_6H_{12}O_6$) B) E_A for photosynthesis of CO_2, C) Actual Products and Reactants. Given that the two processes are reverse of each other and combustion is always exothermic.

J. Butadiene reacts to form its dimer according to the reaction: $2\ C_4H_6\ (g) \rightarrow C_8H_{12}\ (g)$. The following data were collected for this reaction at a given temperature:

$[C_4H_6]$ (M)	Time (s)
0.01000	0
0.00625	1000
0.00476	1800
0.00370	2800
0.00313	3600
0.00270	4400
0.00241	5200
0.00208	6200

What is the order of the reaction?
What is the value of the rate constant?