1983 C

Graphical methods are frequently used to analyze data and obtain desired quantities.

(a) $2\ HI_{(g)} \rightarrow H_{2(g)} + I_{2(g)}$

The following data give the value of the rate constant at various temperatures for the gas phase reaction above.

T (K)	k (litre/mol sec)
647	8.58×10^{-5}
666	2.19×10^{-4}
683	5.11×10^{-4}
700	1.17×10^{-3}
716	2.50×10^{-3}

Describe, without doing any calculations, how a graphical method can be used to obtain the activation energy for this reaction.

(b) $A_{(g)} \rightarrow B_{(g)} + C_{(g)}$

The following data give the partial pressure of A as a function of time and were obtained at 100°C for the reaction above.

P_A (mm Hg)	t (sec)
348	0
247	600
185	1200
105	2400
58	3600

Describe, without doing any calculations, how graphs can be used to determine whether this reaction is first or second order in A and how these graphs are used to determine the rate constant.

$$2\ HgCl_{2(aq)} + C_2O_4^{2-} \rightarrow 2\ Cl^- + 2\ CO_{2(g)} + Hg_2Cl_{2(aq)}$$

The equation for the reaction between mercuric chloride and oxalate ion in hot aqueous solution is shown above. The reaction rate may be determined by measuring the initial rate of formation of chloride ion, at constant temperature, for various initial concentrations of mercuric chloride and oxalate as shown in the following table

Experiment	Initial $[HgCl_2]$	Initial $[C_2O_4^{2-}]$	Initial Rate of Formation of Cl^- ($mol\cdot L^{-1}\cdot min^{-1}$)
(1)	0.0836 M	0.202M	0.52×10^{-4}
(2)	0.0836 M	0.404M	2.08×10^{-4}
(3)	0.0418 M	0.404M	1.06×10^{-4}
(4)	0.0316 M	?	1.27×10^{-4}

(a) According to the data shown, what is the rate law for the reaction above?

(b) On the basis of the rate law determined in part (a), calculate the specific rate constant. Specify the units.

(c) What is the numerical value for the initial rate of disappearance of $C_2O_4^{2-}$ for Experiment 1?

(d) Calculate the initial oxalate ion concentration for Experiment 4.