HL Questions on Rate expression

1. The rate constant for a particular reaction has the value 6.32×10^{-1} dm^6 mol^{-2} s^{-1}.
Deduce the overall order of this reaction.

2. Under acid conditions propanone can be brominated. The stoichiometric equation for this reaction is:

$$CH_3COCH_3(aq) + Br_2(aq) \xrightarrow{H^+(aq)} CH_3COCH_2Br(aq) + H^+(aq) + Br^-(aq)$$

The following experimental data gives the initial rate of the reaction at particular concentrations.

Experiment number	$[CH_3COCH_3(aq)]$ / mol dm^{-3}	$[Br_2(aq)]$ / mol dm^{-3}	$[H^+(aq)]$ / mol dm^{-3}	Initial rate / mol dm^{-3} s^{-1}
1	2.0×10^{-1}	5.0×10^{-2}	5.0×10^{-2}	5.0×10^{-5}
2	2.0×10^{-1}	1.0×10^{-1}	5.0×10^{-2}	5.0×10^{-5}
3	1.0×10^{-1}	5.0×10^{-2}	5.0×10^{-2}	2.5×10^{-5}
4	1.0×10^{-1}	5.0×10^{-2}	1.0×10^{-1}	5.0×10^{-5}
5	1.7×10^{-1}	2.2×10^{-1}	2.9×10^{-1}	?

i. Deduce the order of the reaction with respect to propanone.
ii. Deduce the order of the reaction with respect to bromine.
iii. Deduce the order of the reaction with respect to hydrogen ions.
iv. Deduce the overall order of the reaction.
v. Write the rate expression for this reaction.
vi. Calculate the value for the rate constant.
vii. Calculate the initial rate of reaction for experiment number 5.

3. For a zero order reaction the graph of concentration of reactant against time and the graph of rate of reaction plotted against concentration of reactant will both give a straight line.
i. How will these two straight lines differ?
ii. Deduce the units of the rate constant for a zero order reaction.

4. Describe how the graph of concentration of reactant against time for a second order reaction will differ to a graph of concentration of reactant against time for a first order reaction.

5. Deduce the units of the rate constant for
i. a first order reaction.
ii. a second order reaction.