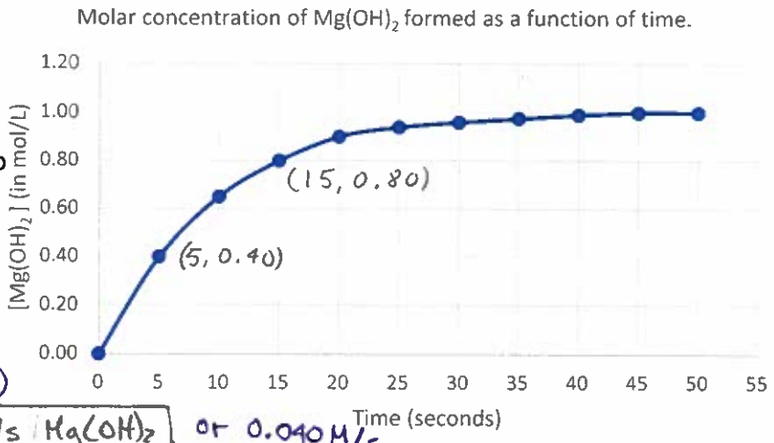
Chemical Kinetics III v3 **2020** **Name:** Answers. /16

1. The graph describes the rate of formation of $Mg(OH)_2$ from the following reaction.

$Mg^{2+} + 2\,OH^- \rightarrow Mg(OH)_2$



a) Determine the average rate of formation of $Mg(OH)_2$ from 5 s to 15s into the experiment.

$\text{rate} = \frac{\Delta [Mg(OH)_2]}{\Delta \text{ time}} = \frac{0.80 - 0.40}{15 - 5}$

$= \frac{0.40}{10}$ (2)

rate $= 4.0 \times 10^{-2}$ M/s $Mg(OH)_2$ or 0.040 M/s

b) Determine the average rate of formation of $Mg(OH)_2$ during the first 20 seconds.

$\text{rate} = \frac{\Delta [Mg(OH)_2]}{\Delta \text{ time}} = \frac{0.90}{20s} =$ 0.045 M/s (2)

/4

c) Determine the average rate of consumption of Mg^{2+} & OH^- during the first 20 seconds.

Mg^+ 1:1 ratio

-0.045 M/s

OH^- 1:2 ratio

-0.045 M/s $\times 2 =$ -0.090 M/s

/2

2. In the reaction $N_2 + 3\,H_2 \rightarrow 2\,NH_3$, if the ammonia is produced at a rate of 1.50 mol/s, how fast is the H_2 consumed?

$\frac{1.50 \text{ mol/s}}{2 \text{ mol } NH_3} = \frac{x}{3 \text{ mol } H_2}$ $\quad x =$ -2.25 mol/s of H_2

/1

3. It takes a 0.486 g strip of magnesium 2 minutes and 14 seconds to completely dissolved at SATP. /5
Reaction: $Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + H_{2(g)}$

a) At what rate was the magnesium consumed in **mol/s**?

$\frac{1 \text{ mol Mg}}{x} = \frac{24.3 \text{ g}}{0.486}$ (1)

$x = 0.0200$ mol Mg

$\text{rate} = \frac{\Delta \text{ Mg}}{\Delta \text{ time}} = \frac{-0.0200 \text{ mol}}{134} =$ -1.49×10^{-4} mol/s (1)

b) At what rate was the hydrogen produces in **mL/s**?

0.0200 mol Mg will make 0.0200 mol H_2 (1)

$PV = nRT$

$V = \frac{nRT}{P}$

$= \frac{(0.0200)(8.31)(298)}{101.3}$ (1)

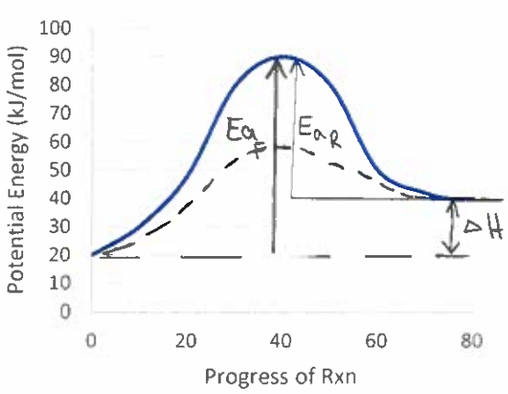
$V = 0.48892$ L

$\text{rate} = \frac{\text{mL}}{\text{time}}$

$= \frac{488.92 \text{ mL}}{134 \text{ s}}$ (1)

rate $= 3.65$ mL/s

4. Use the graph below to answers the questions. /4



a) What is the ΔH of the forward reaction?
$\Delta H = \text{products} - \text{reactants} = 40 - 20 = +20$ kJ/mol

b) What is the activation energy of the forward reaction?
$90 - 20 =$ 70 kJ/mol

c) What is the activation energy of the reverse reaction?
$90 - 40 =$ 50 kJ/mol

d) Draw a curve that would represent a catalysed reaction. - - - -