

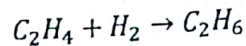
(0905422) Chemical Reaction Engineering II

Quiz # 1 (Chapter 10)

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The following reaction is carried out over a cobalt molybdenum catalyst:



The following data were obtained for this reaction.

| Run number | Reaction rate (mol/kg-catalyst · s) | P_E (atm) | P_{EA} (atm) | P_H (atm) |
|------------|-------------------------------------|-------------|----------------|-------------|
| 1 | 1.04 | 1 | 1 | 1 |
| 2 | 3.13 | 1 | 1 | 3 |
| 3 | 5.21 | 1 | 1 | 5 |
| 4 | 3.82 | 3 | 1 | 3 |
| 5 | 4.19 | 5 | 1 | 3 |
| 6 | 2.33 | 0.5 | 1 | 3 |
| 7 | 2.25 | 0.5 | 3 | 3 |
| 8 | 0.75 | 0.5 | 5 | 1 |
| 9 | 0.40 | 0.5 | 15 | 1 |

(a) To what class of catalysts does cobalt molybdenum belong to?

heterogeneous catalyst

a.b = 1

$10 = 1.8^x$

(b) Determine which of the following rate laws best describes the experimental data, supporting your answer (on the back of the paper) by discussing the relevant experimental data runs:

(a) $-r'_E = \frac{k P_E P_H}{1 + K_E P_E + K_{EA} P_{EA}}$

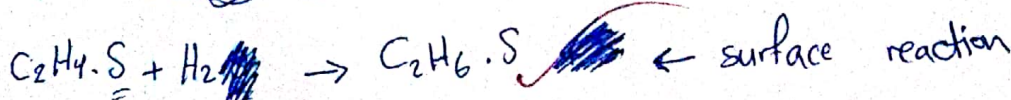
b. $-r'_E = \frac{k P_E P_H}{1 + K_E P_E}$

c. $-r'_E = \frac{k P_E P_H}{(1 + K_E P_E)^2}$

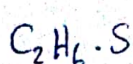
(c) Suggest a mechanism consistent with your chosen rate law, naming the type of chemisorption and surface reaction you are suggesting.



adsorption



surface reaction



desorption

from Run 1 and 2

$$-r'_E \propto P_A$$

from run 4 and 5

$$-r'_E \propto P_E$$

from run 8 and 9

$$-r'_E \propto P_{EA}$$

$$-r'_E \propto \frac{1}{P_{EA}}$$