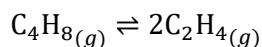


Different professors are covering different material in their classes. Therefore, the questions in this review are separated by chapter.

Chapter 16: Kinetics, Rate Laws

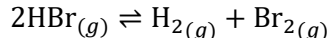
16.1 Cyclobutane decomposes in a first order reaction shown below.



Given that the initial concentration of C_4H_8 is 5M and the final concentration is 0.06M after 0.05 seconds, what is the rate constant and the expected rate law?

- a. 65 s^{-1} ; rate = $k[\text{C}_2\text{H}_4]^2$
- b. 88 s^{-1} ; rate = $k[\text{C}_4\text{H}_8]$
- c. 92 s^{-1} ; rate = $k[\text{C}_4\text{H}_8]$
- d. 88 s^{-1} ; rate = $k[\text{C}_2\text{H}_4]^2$
- e. 65 s^{-1} ; rate = $k[\text{C}_4\text{H}_8]$
- f. 92 s^{-1} ; rate = $k[\text{C}_2\text{H}_4]^2$

16.2 The decomposition of hydrogen bromide is shown below.



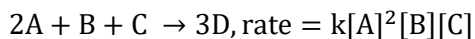
At 600 K, the rate constant is $1.50 \times 10^{-5} \text{ L/mol s}$. At 800 K, the rate constant is $6.80 \times 10^{-3} \text{ L/mol s}$. What is the activation energy for this reaction?

- a. $1.82 \times 10^2 \text{ kJ/mol}$
- b. $1.39 \times 10^2 \text{ kJ/mol}$
- c. $1.58 \times 10^2 \text{ kJ/mol}$
- d. $1.22 \times 10^2 \text{ kJ/mol}$
- e. $2.02 \times 10^2 \text{ kJ/mol}$

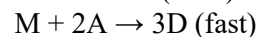
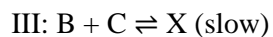
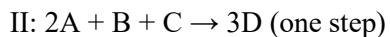
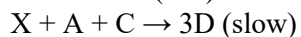
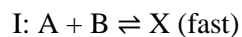
16.3 Using the information in the previous question (16.2), determine what temperature should be used if you wanted the rate to be three times as fast as it is at 600K?

- a. 576 K
- b. 582 K
- c. 626 K
- d. 654 K
- e. 730 K

16.4 A fictional reaction is shown below with its rate law.



Which of the following mechanisms can be considered possible mechanisms for this reaction and rate law?



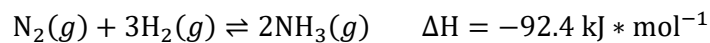
- a. I only
- b. II only
- c. III only
- d. I and II
- e. I, and III
- f. I, II, and III

Chapter 17: Chemical Equilibrium, K & Q, Le Chatelier's Principle

17.1 Using Le Chatelier's Principle, match the correct shift for the given change.

	Change	Shift
a)	Increase in Concentration of X	I. No shift
b)	Decrease in Concentration of X	II. Away from heat
c)	Increase in Pressure	III. Away from substance X
d)	Decrease in Pressure	IV. Toward Heat
e)	Increase in Temperature	V. Towards fewer moles of gas
f)	Decrease in Temperature	VI. Towards substance X
g)	Catalyst	VII. Towards more moles of gas

17.2 Ammonia is created on an industrial scale using the Haber-Bosch process shown below.



Predict the shift (left, right, or none) for each given change.

Change	Shift
Increase $[\text{NH}_3]$	_____
Decrease $[\text{N}_2]$	_____
Decrease $[\text{NH}_3]$	_____
Increase Pressure	_____
Increase Temperature	_____
Catalyst	_____
Increase $[\text{H}_2]$	_____

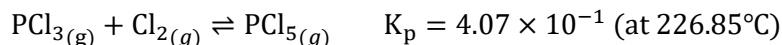
17.3 A fictional reaction is shown below.



To favor the production of the product (C), under what conditions should this reaction be carried out?

- High pressure, Low temperature
- High pressure, High temperature
- Low pressure, High temperature
- Low pressure, Low temperature

17.4 Calculate K_c given the following reaction.



If the Q_c was 20.5, is the reaction at equilibrium? Or will it proceed to the left or to the right?

- $K_c=16.7$, proceed left until $Q_c=K_c$
- $K_c=38.5$, proceed right until $Q_c=K_c$
- $K_c=20.5$, the reaction is at equilibrium
- $K_c=30.2$, proceed right until $Q_c=K_c$

17.5 The decomposition of phosgene is shown in the reaction below.



Calculate the equilibrium partial pressures of COCl_2 , CO , and Cl_2 when the initial partial pressure of COCl_2 is 0.28 atm.

- a. $\text{COCl}_2=0.5$ atm, $\text{CO}=0.24$ atm, $\text{Cl}_2=0.014$ atm
- b. $\text{COCl}_2=0.071$ atm, $\text{CO}=\text{Cl}_2=0.85$ atm
- c. $\text{COCl}_2=0.26$ atm, $\text{CO}=\text{Cl}_2=0.024$ atm
- d. $\text{COCl}_2=0.29$ atm, $\text{CO}=0.21$ atm, $\text{Cl}_2=0.79$ atm
- e. $\text{COCl}_2=0.21$ atm, $\text{CO}=\text{Cl}_2=0.073$ atm

Chapter 18: Acid-Base Equilibrium (Not all professors are covering Chapter 18)

18.1 Calculate the $[\text{H}_3\text{O}^+]$, pH, $[\text{OH}^-]$, and pOH, of 0.5 M of H_2SO_4 .

- a. $[\text{H}_3\text{O}^+]=0.5$ M, $\text{pH}=0.30$, $[\text{OH}^-]=2 \times 10^{-14}$ M, $\text{pOH}=13.70$
- b. $[\text{H}_3\text{O}^+]=0.25$ M, $\text{pH}=0.60$, $[\text{OH}^-]=5 \times 10^{-10}$ M, $\text{pOH}=10.5$
- c. $[\text{H}_3\text{O}^+]=0.15$ M, $\text{pH}=0.90$, $[\text{OH}^-]=0.27$ M, and $\text{pOH}=13.2$
- d. $[\text{H}_3\text{O}^+]=0.90$ M, $\text{pH}=3.1$, $[\text{OH}^-]=8.1 \times 10^{-5}$ M, and $\text{pOH}=10.9$

18.2 Define each of the following and provide an example.

A Brønsted-Lowry acid is a proton donor. An example is HCl .

A Brønsted-Lowry base is a proton acceptor. An example is NH_3 .

A Lewis acid is an electron pair acceptor. An example is BF_3 .

A Lewis base is an electron pair donor. An example is H_2O .

18.3 Methylamine (CH_3NH_2) has a K_b of 4.4×10^{-4} . What is the pH of 5 M CH_3NH_2 ?

- a. 10.94
- b. 7.62
- c. 12.67
- d. 13.63

18.4 Potassium propionate ($\text{KCH}_3\text{CH}_2\text{COO}$) is a food preservative that is most commonly used as an antimicrobial agent in bread. What is the pH of 0.38 M $\text{KCH}_3\text{CH}_2\text{COO}$ at 298K? The K_a of propionic acid is 1.34×10^{-5} .

- a. 10.13
- b. 8.34
- c. 9.86
- d. 9.23

18.5 Which of the following is a potential Lewis acid?

- a. Cl^-
- b. OH^-
- c. BCl_3
- d. NH_4^+

Chapter 15: Organic Chemistry (Not all professors are covering Chapter 15)

15.1 What are the names of these four structures, in order (left to right)?



- a. Cyclohexane, Cyclobutane, Cycloheptane, Cyclooctane
- b. Cyclopropane, Cyclobutane, Cyclopentane, Cyclohexane
- c. Cyclopropane, Cyclooctane, Cyclononane, Cyclohexane
- d. Cyclobutane, Cyclopropane, Cyclohexane, Cyclononane
- e. Cyclodecane, Cyclononane, Cyclopropane, Cyclohexane

15.2 Draw an example of each functional group.

- a. Alkane
- b. Alkene
- c. Alkyne
- d. Alcohol

- e. Ether
- f. Halide
- g. Aldehyde
- h. Ketone
- i. Carboxylic Acid
- j. Ester
- k. Amine

15.3 C_6H_{14} has 5 different constitutional isomers. Draw each and name according to IUPAC naming rules.

- a.
- b.
- c.
- d.
- e.