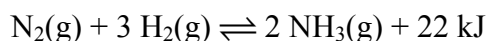


Worksheet: Le Chatelier's PrincipleName Answer Key

1. In the following reaction, what direction will the system shift after these stresses are applied?



- | | |
|--|---|
| a. $\text{NH}_3(\text{g})$ is added <u>Left</u>
Removes excess product | b. $\text{N}_2(\text{g})$ is removed <u>Left</u>
Replaces missing reactant |
| c. pressure is increased <u>Right</u>
Moves to side with fewer moles of gas | d. temperature is increased <u>Left</u>
Removes added "product" (heat) |

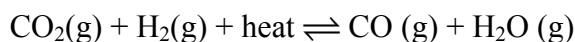
2. In the following reaction:



In which direction, left or right, will the equilibrium shift if the following changes are made?

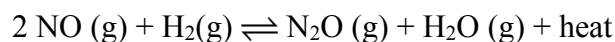
- | | |
|---|--|
| a. NO is added <u>Right</u>
Removes excess reactant | b. the system is cooled <u>Right</u>
Replaces missing "product" (heat) |
| c. H_2 is removed <u>Left</u>
Replaces missing reactant | d. pressure is increased <u>Right</u>
Moves to side with fewer moles of gas |
| e. N_2O is added <u>Left</u>
Removes added product | f. H_2O is removed <u>Right</u>
Replaces missing product |

3. In this reaction:



- a. Is heat absorbed or released by the forward reaction? absorbed
- b. In which direction will the equilibrium shift if these changes are made?
- | | |
|---|---|
| i. CO is added <u>Left</u>
Removes added product | ii. temperature is increased <u>Right</u>
Removes added "reactant" (heat) |
| iii. CO_2 is added <u>Right</u>
Removes added reactant | iv. system is cooled <u>Left</u>
Replaces missing "reactant" (heat) |
| v. H_2 is removed <u>Left</u>
Replaces missing reactant | vi. pressure is increased <u>No Change</u>
Equal moles of gas on either side |
| vii. catalyst is added <u>No Change</u>
Catalyst only speeds up reaction | |

4. In this reaction:



What will happen to the $[\text{H}_2\text{O}]$ when equilibrium is reestablished after these stresses are applied?

- | | |
|--|--|
| a. temperature is increased <u>Decrease</u>
System shifts left to remove excess "product" (heat), so consumes H_2O . | b. a catalyst is added <u>No Change</u>
Catalyst only speeds up reaction |
| c. pressure is decreased <u>Decrease</u>
System shifts left to side with more moles of gas, consumes H_2O . | d. NO is added <u>Increase</u>
System shifts right to remove excess reactant, so produces H_2O . |
| e. N_2O is removed <u>Increase</u>
System shifts right to replace missing product, so produces H_2O . | |

5. How would an increase in pressure affect the following reactions?

- a. $2 \text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2 \text{H}_2\text{O} (\text{g})$ Right (shifts to fewer moles of gas)
- b. $4 \text{H}_2(\text{g}) + \text{Fe}_3\text{O}_4(\text{s}) \rightleftharpoons 3 \text{Fe} (\text{s}) + 4 \text{H}_2\text{O} (\text{l})$ Right (shifts to fewer moles of *gas*)
- c. $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons 2 \text{HCl} (\text{g})$ No Change (equal moles of gas on either side)