

Conceptual Reframing in Action: How Students Build and Revise Predictions About a Simple Chemical Reaction

Onyinye Joy Ikenyirimba and Vicente Talanquer

Supplemental Information

Reasoning Diagrams for each Study Participant

Conceptual Frame Abbreviations

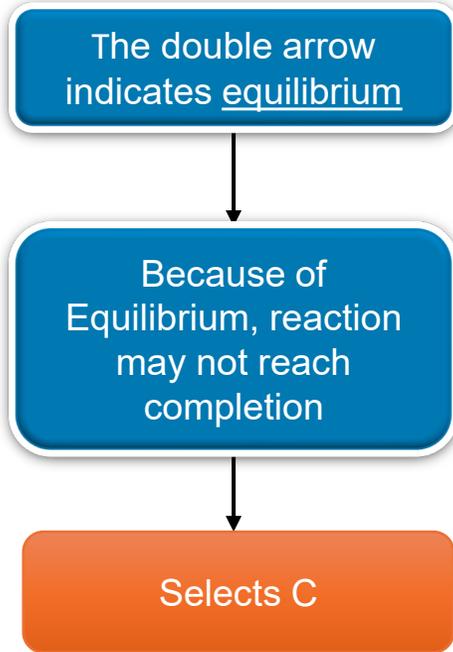
Stoichiometric Completion	SC
Surface Equilibrium	SE
Temperature-Feasibility	TF
Energetic Favorability	EF
Frame Collapse	FC
Particle Motion	PM

Reasoning Patterns Abbreviations

Semiquantitative Reasoning	SQR
ΔH -based heuristic	ΔHH

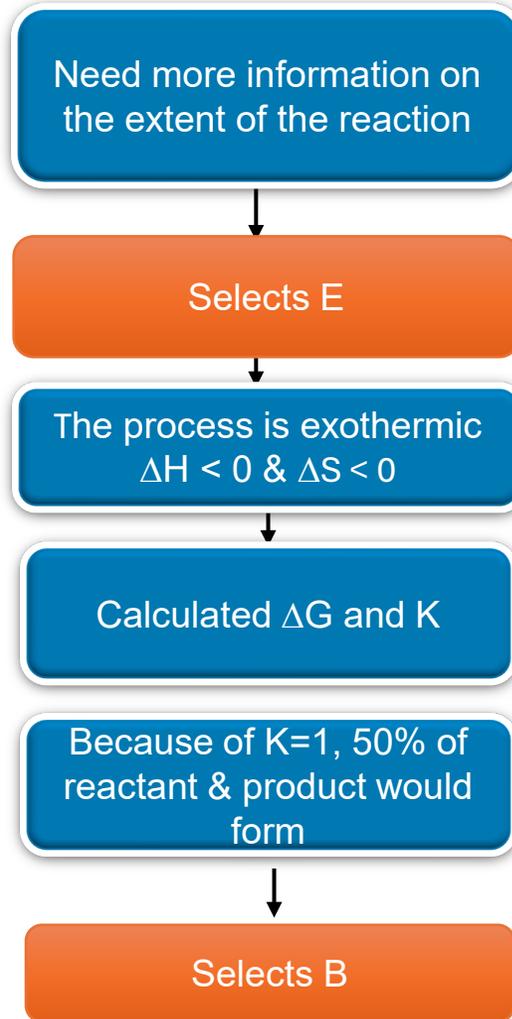
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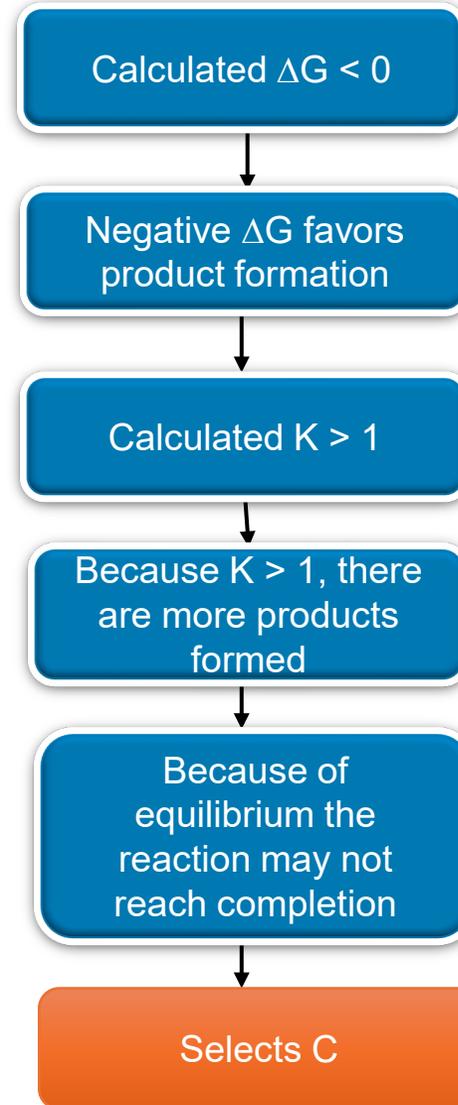
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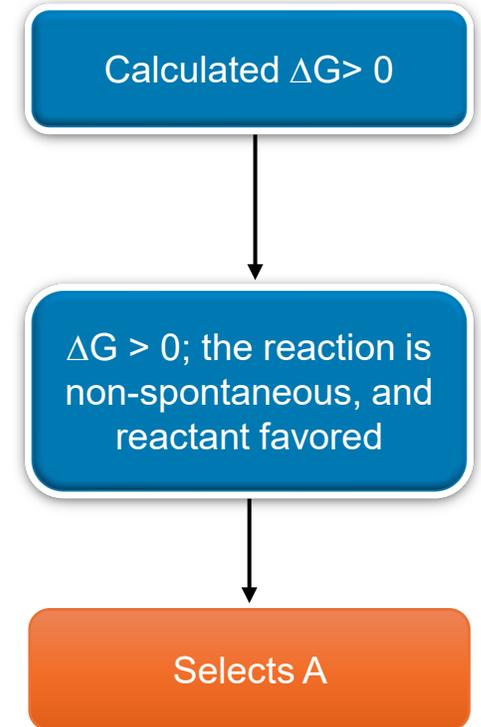
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Slide 3



→ (SQR)

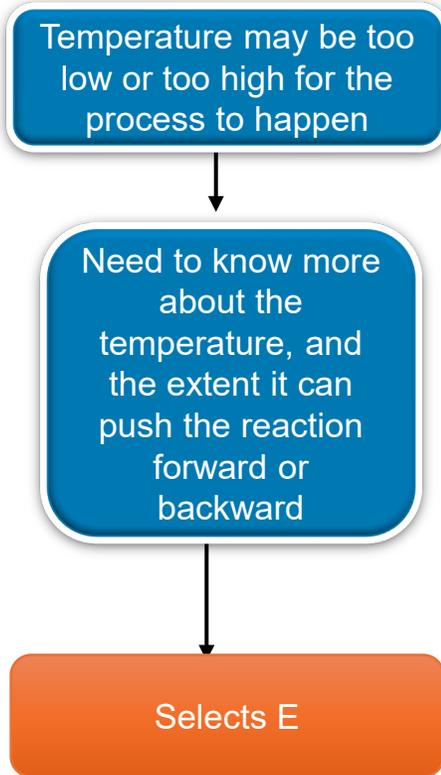
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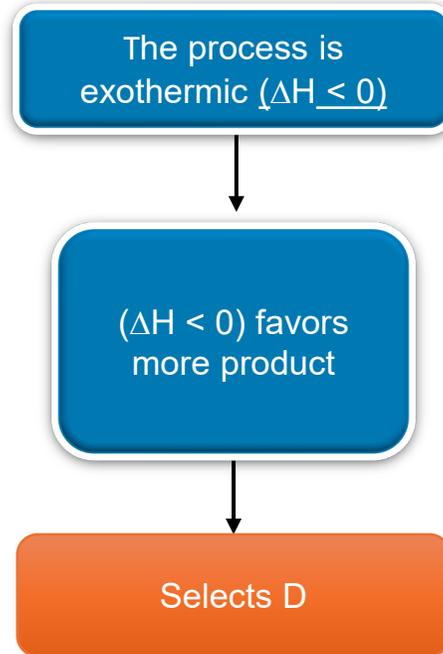
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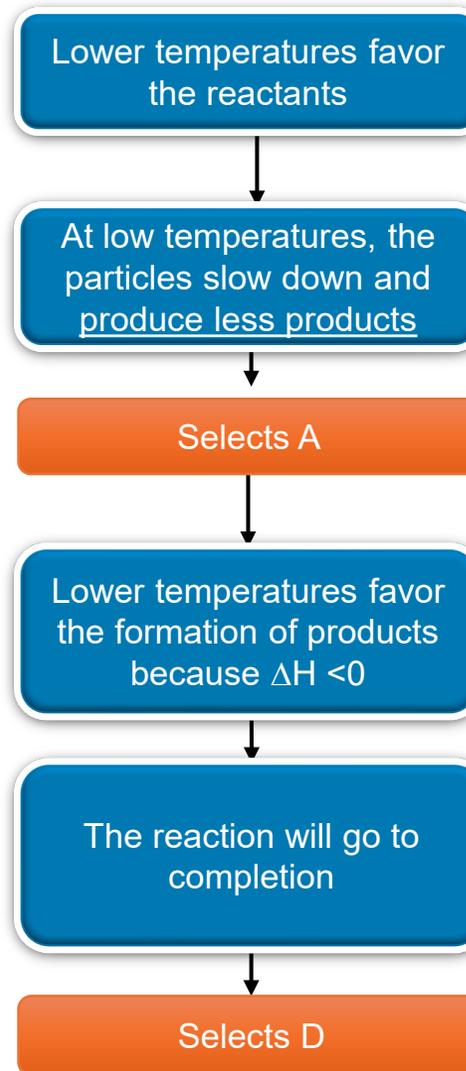
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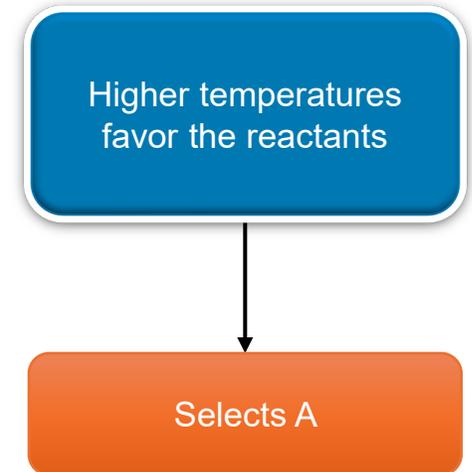
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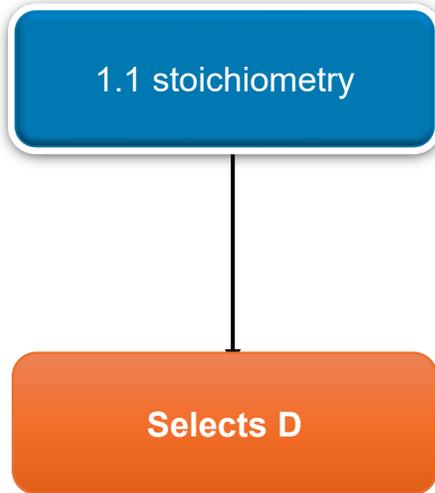
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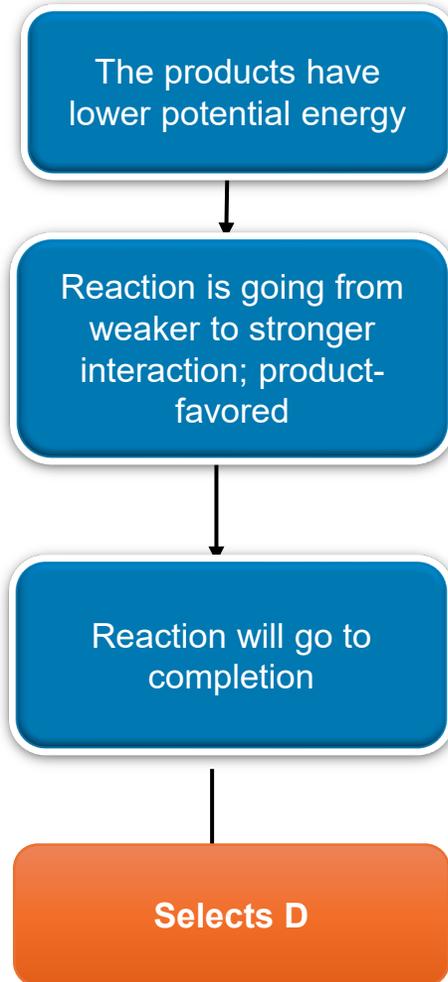
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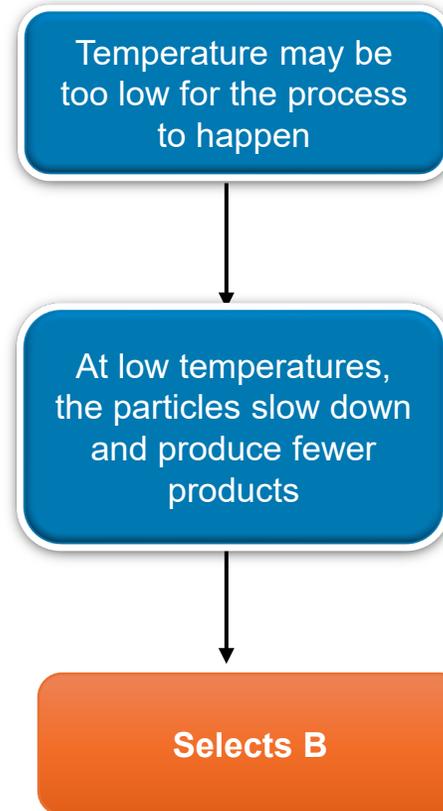
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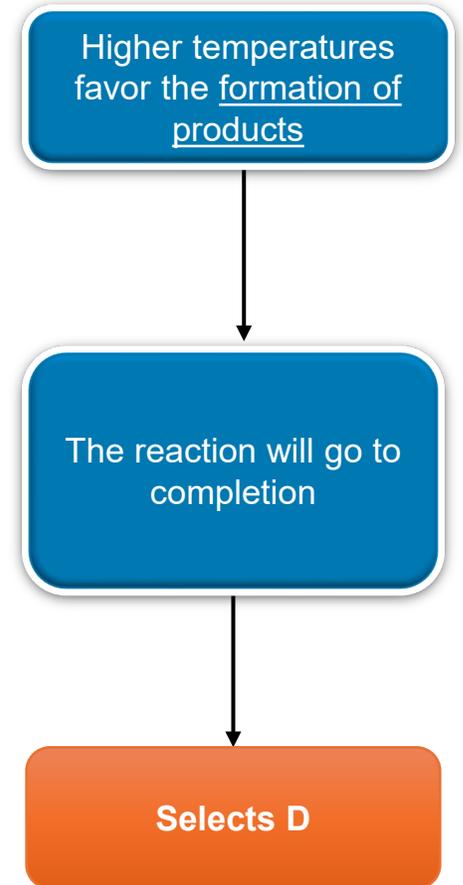
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→ PM

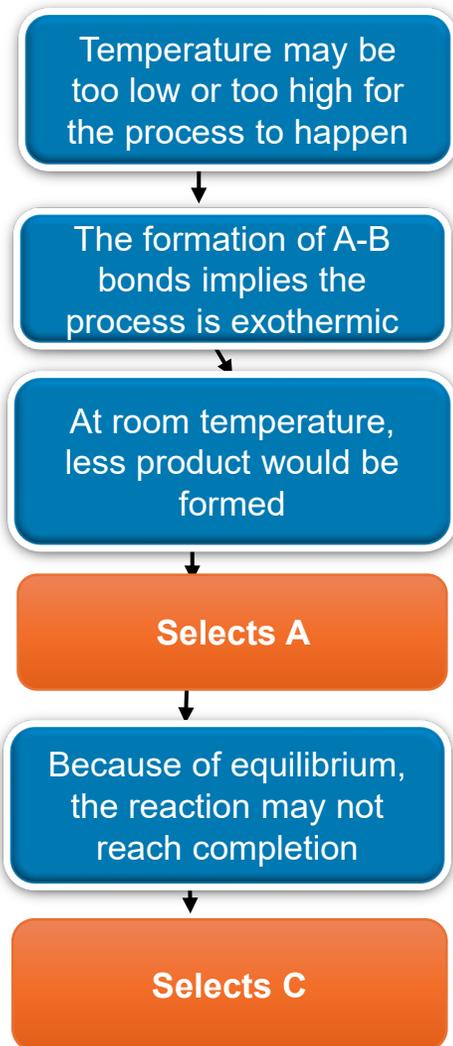
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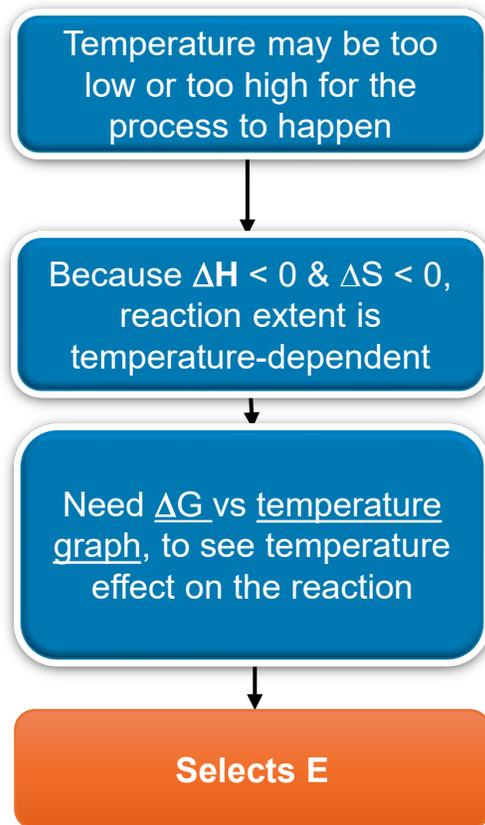
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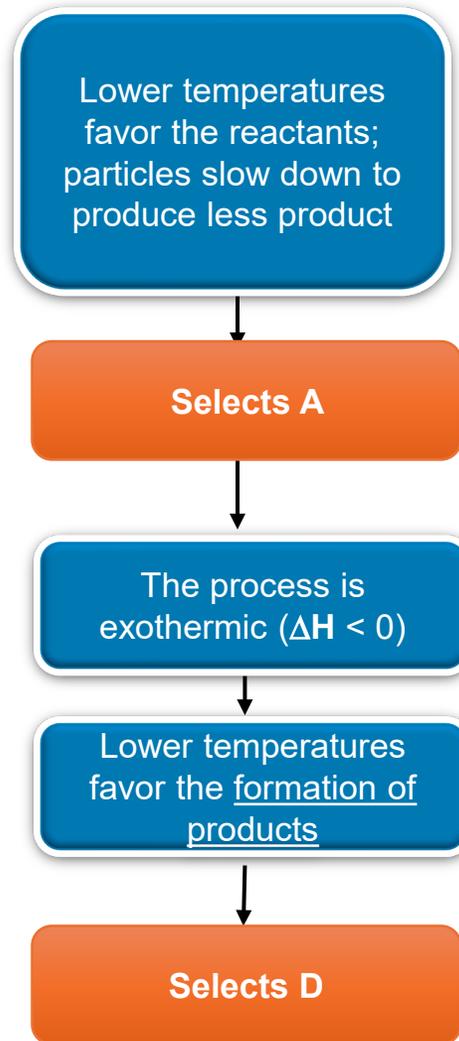
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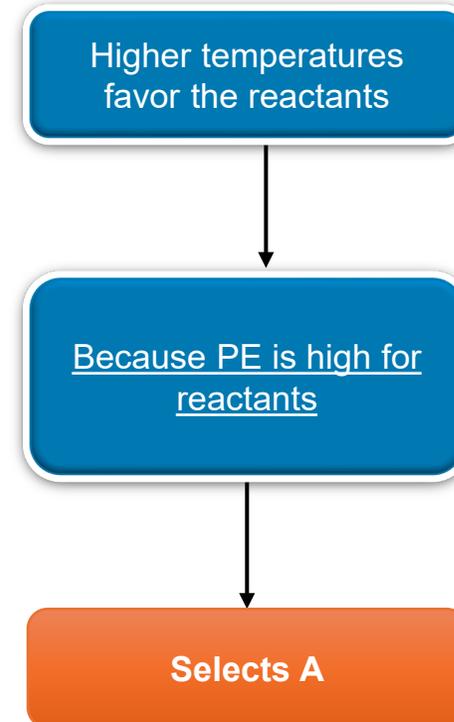
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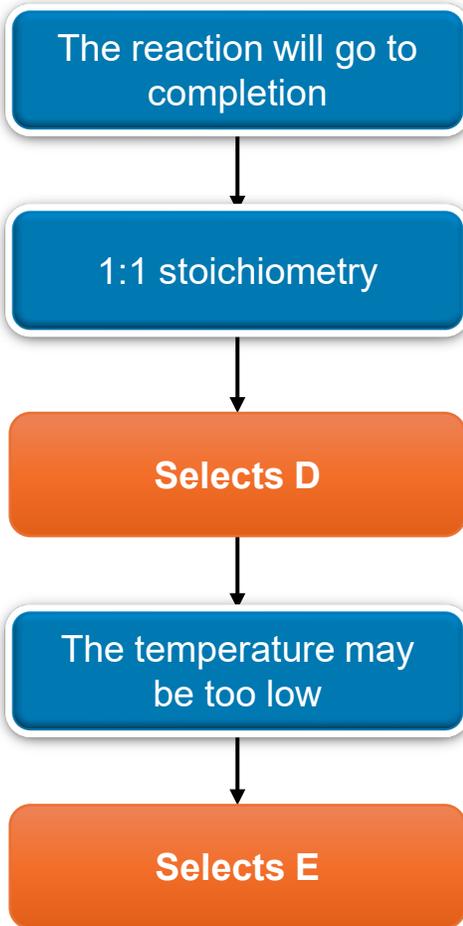
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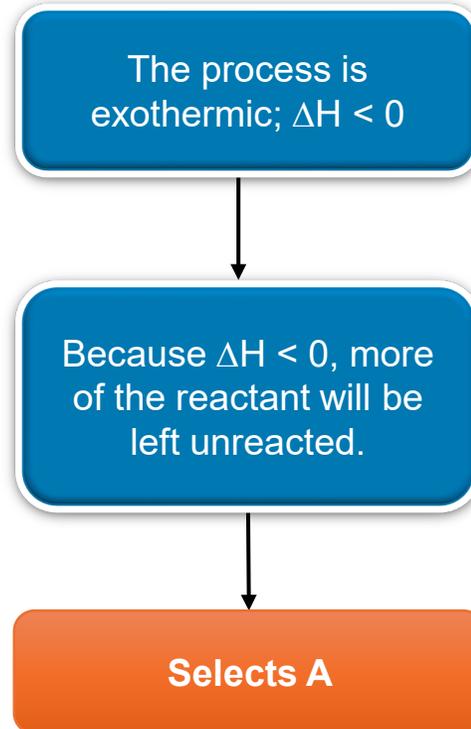
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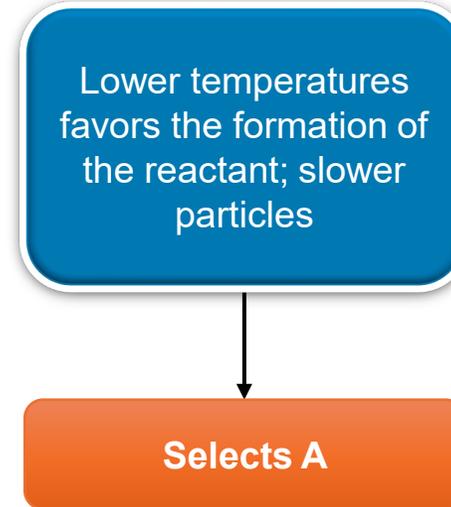
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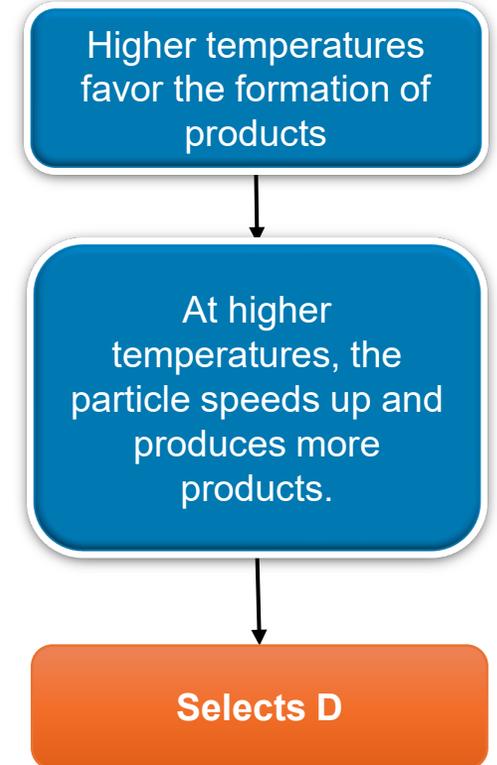
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→ PM

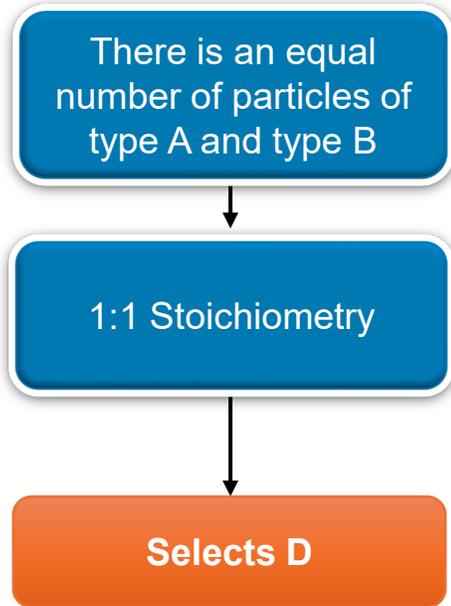
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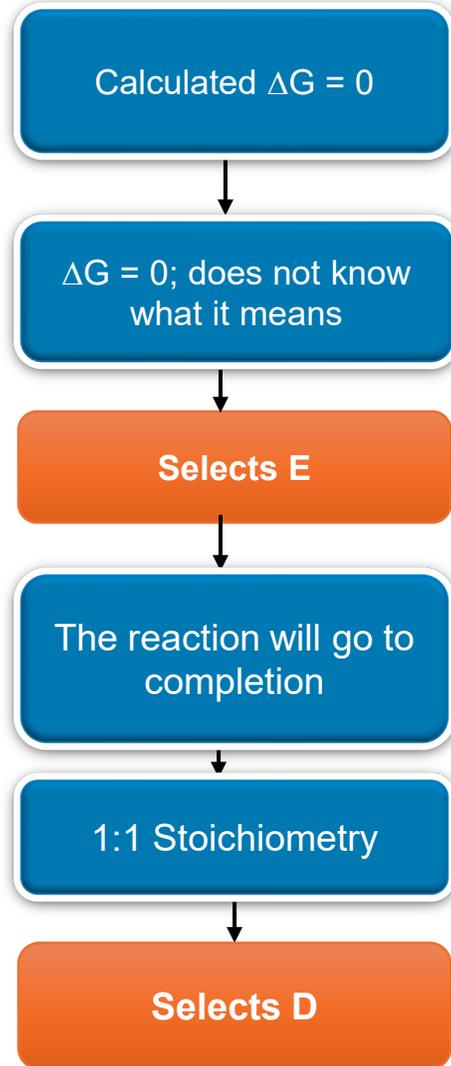
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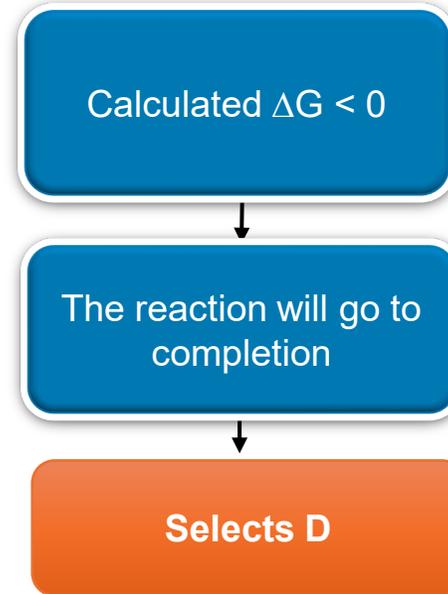
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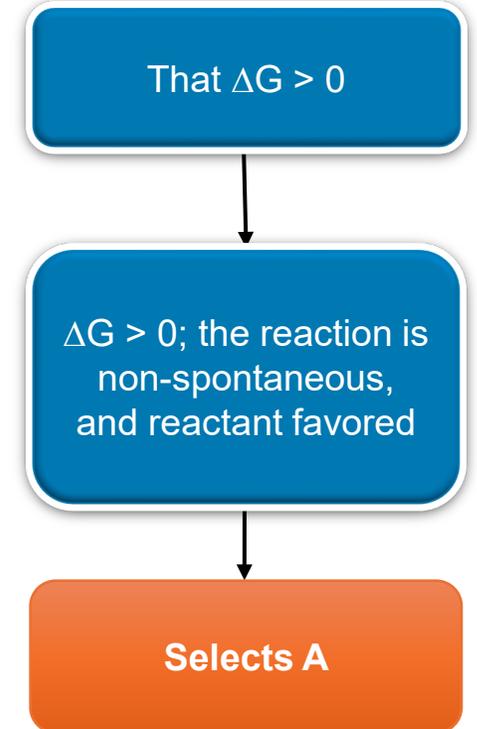
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Slide 3



Slide 4



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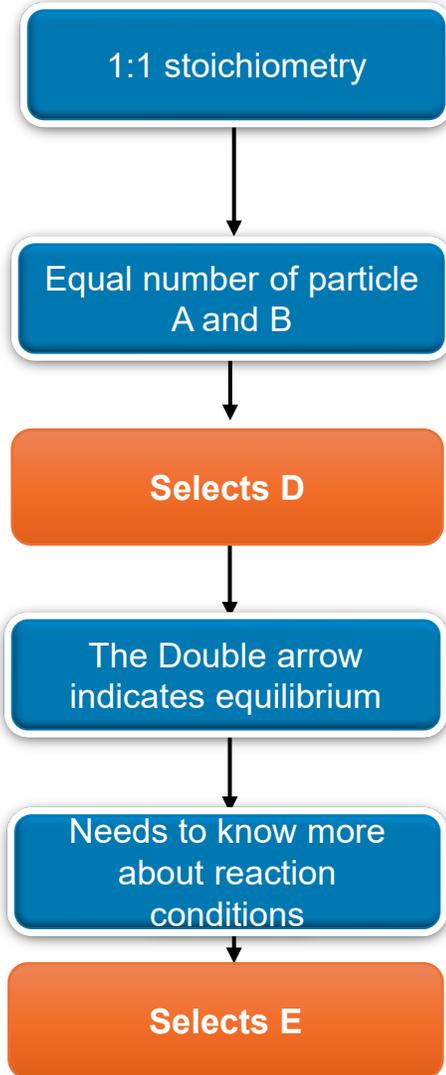
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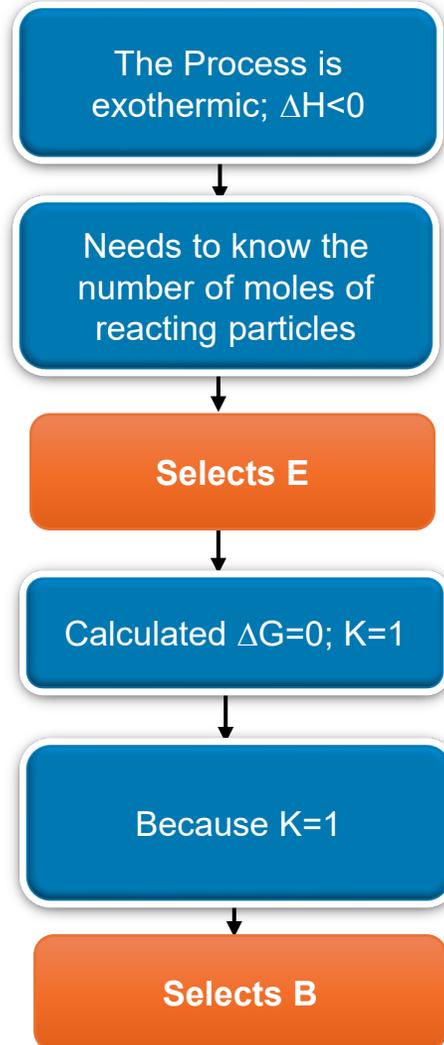
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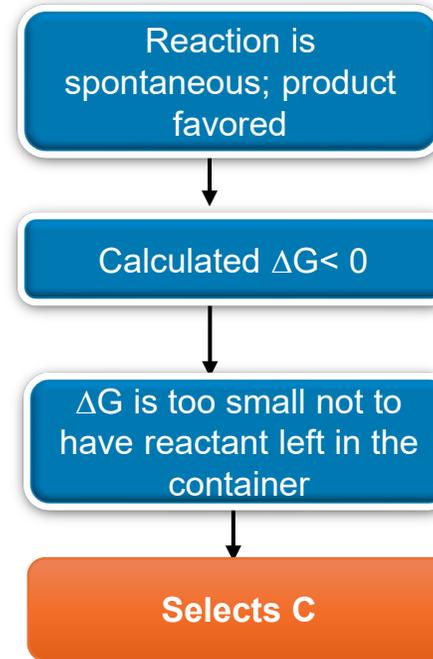
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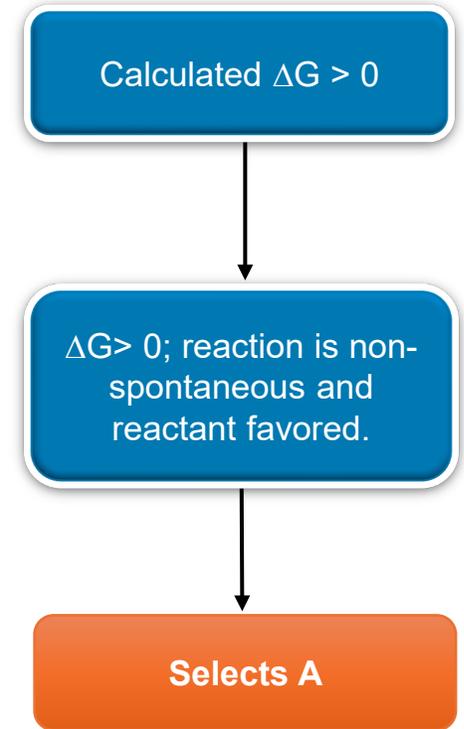
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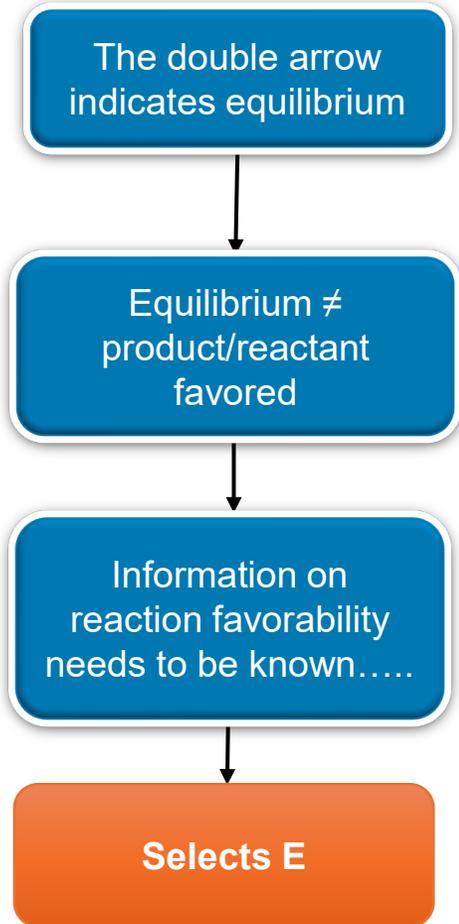
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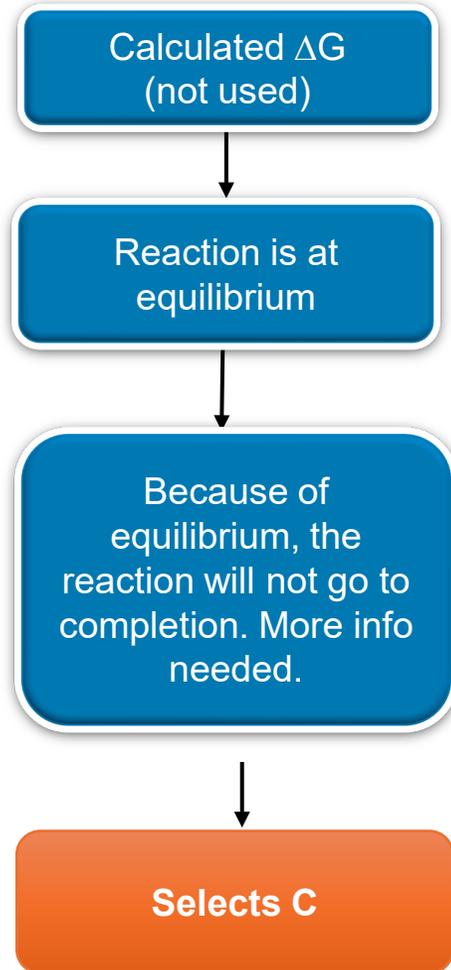
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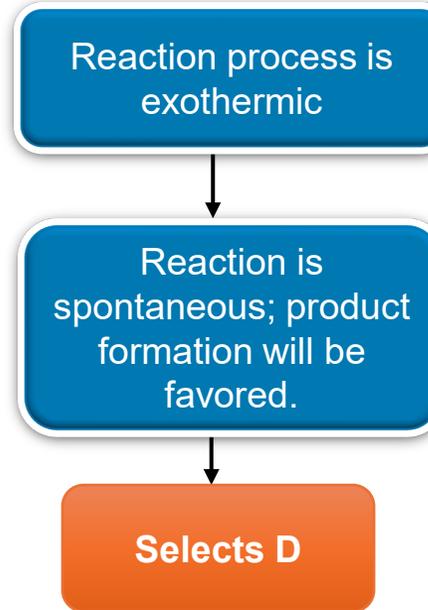
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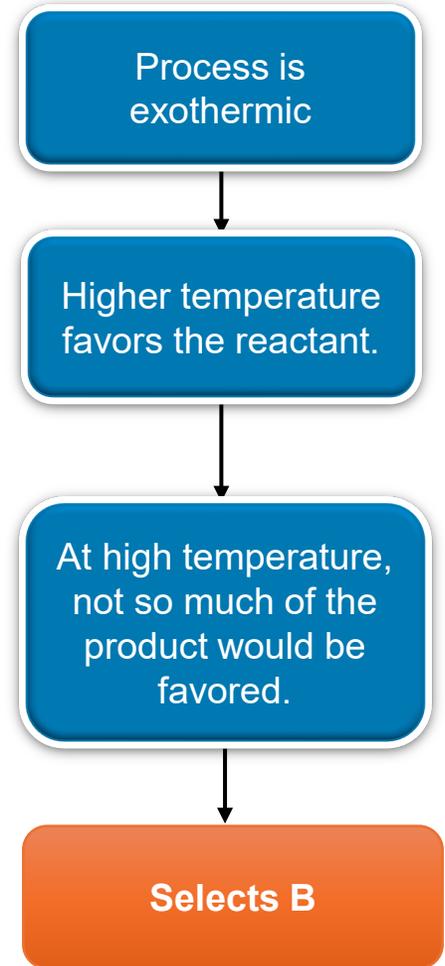
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Slide 3



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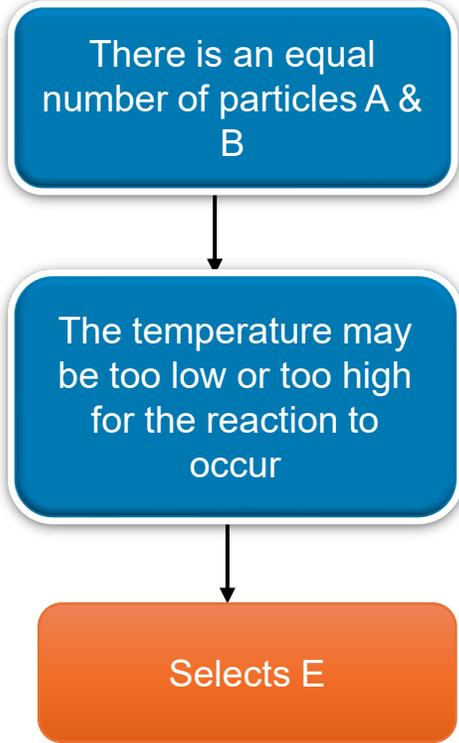
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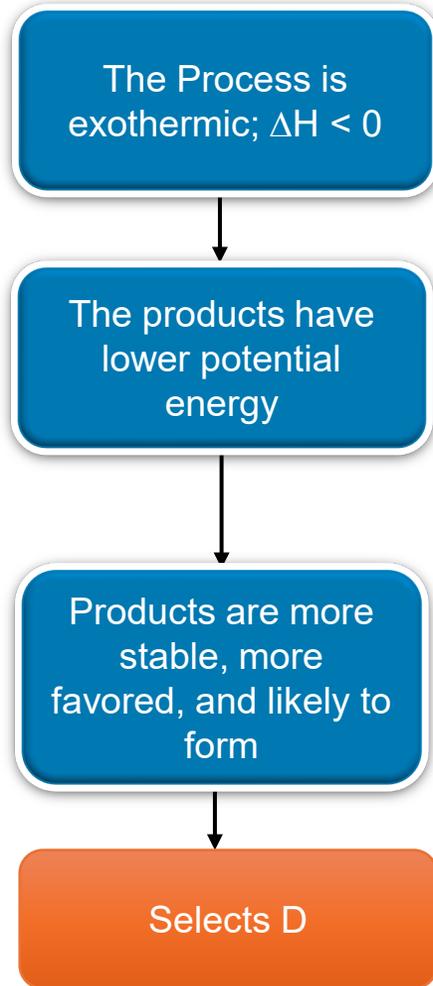
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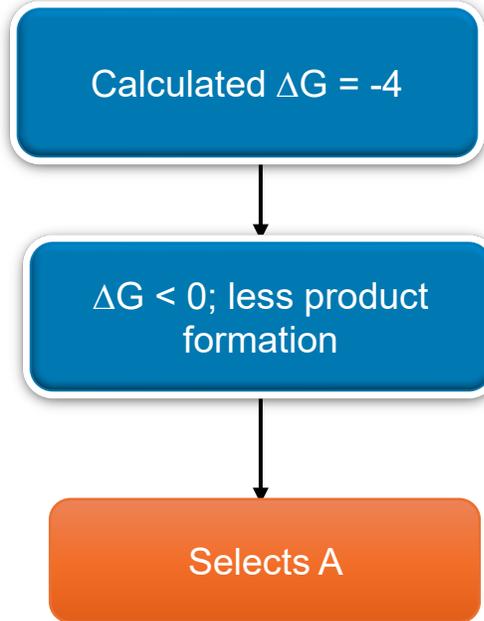
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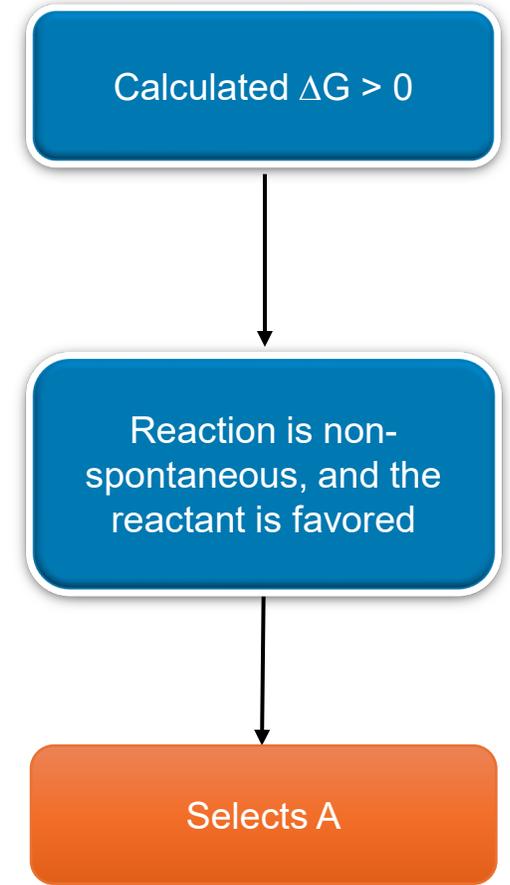
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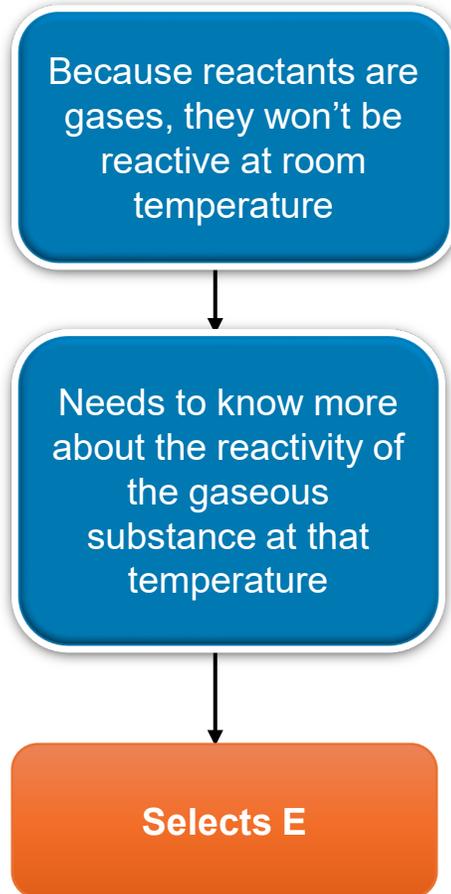
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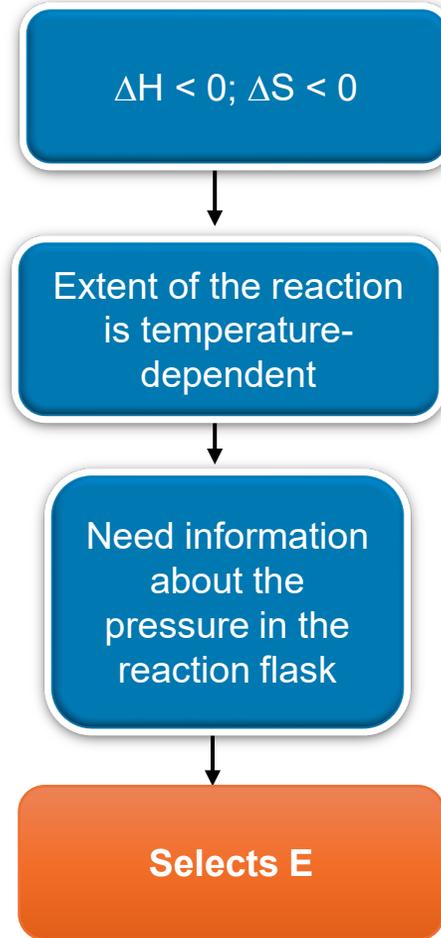
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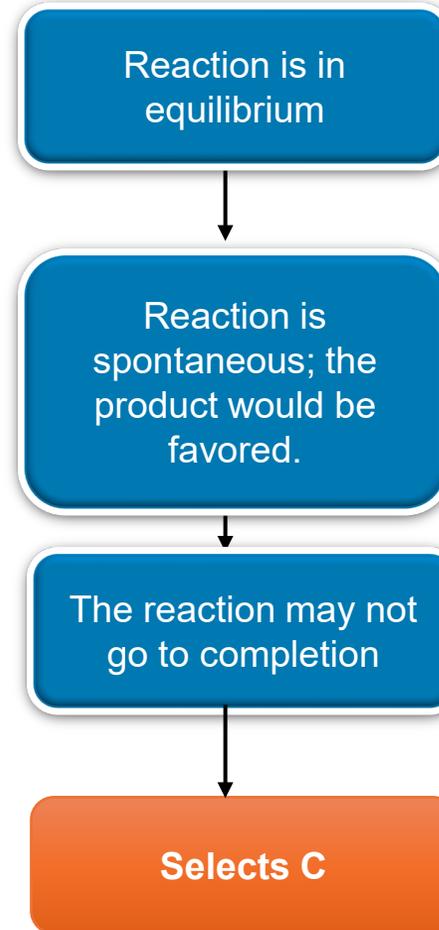
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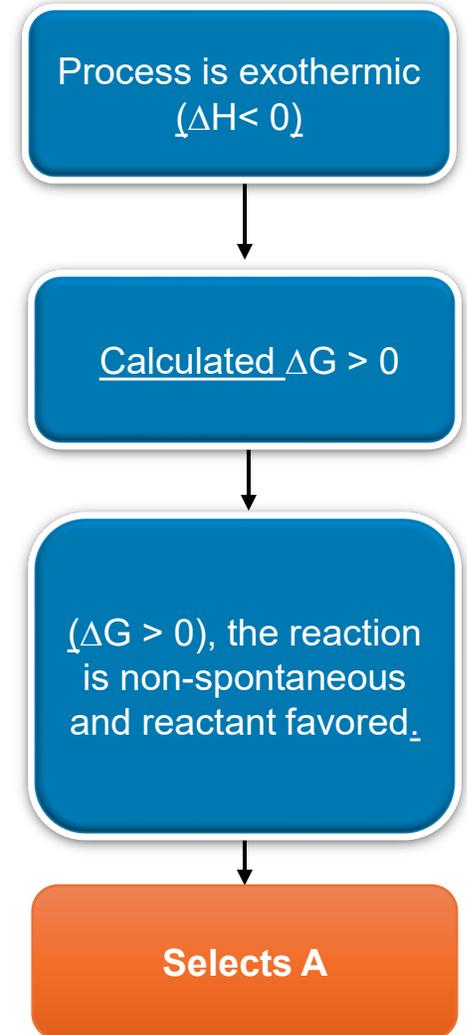
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Slide 3



Slide 4



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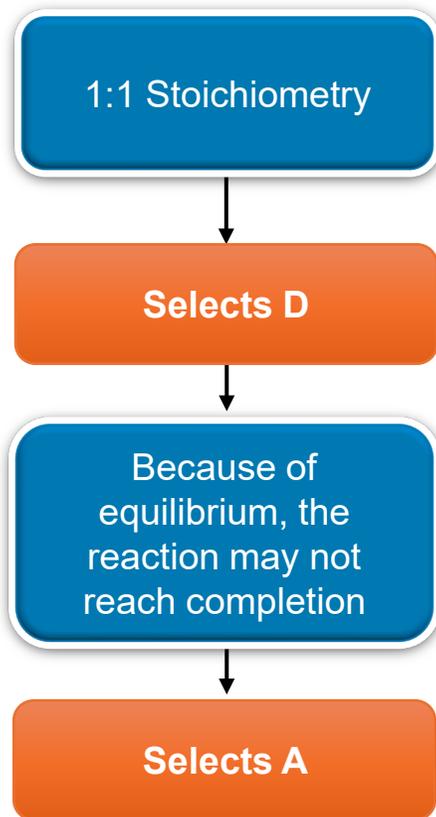
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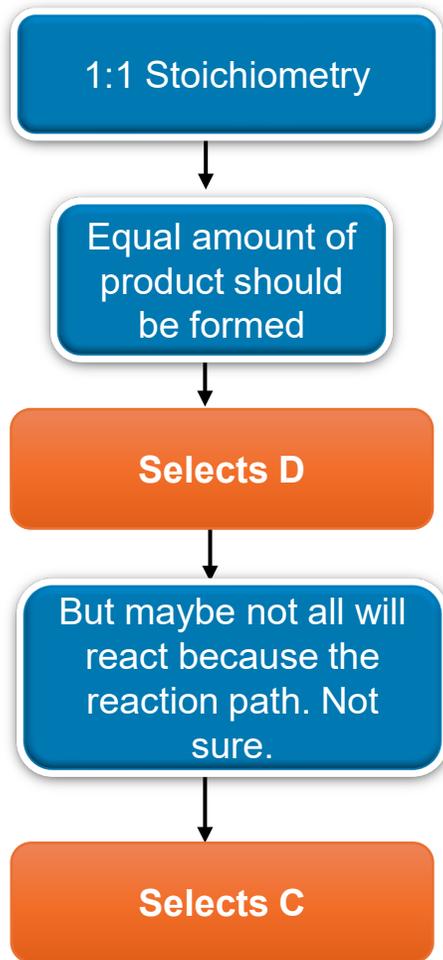
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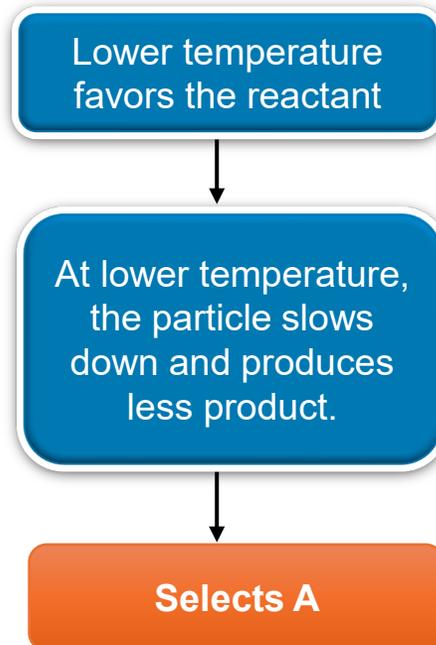
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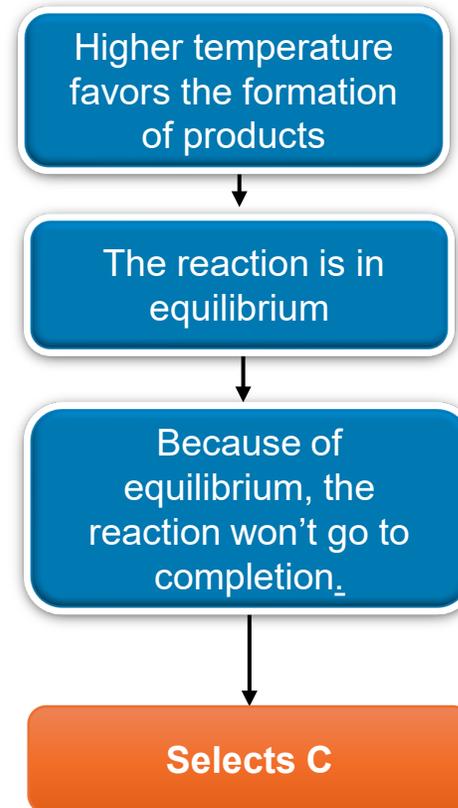
→ SC → FC

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→ PM

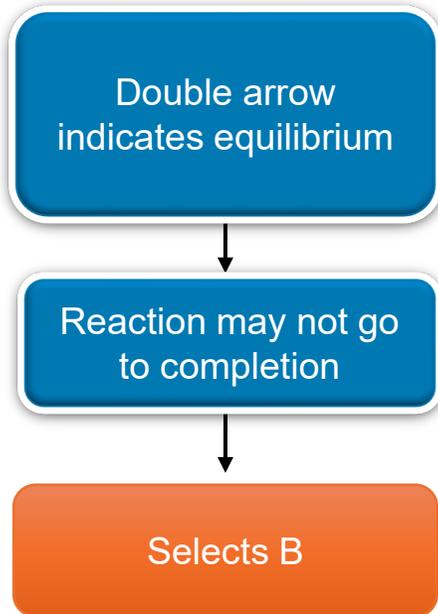
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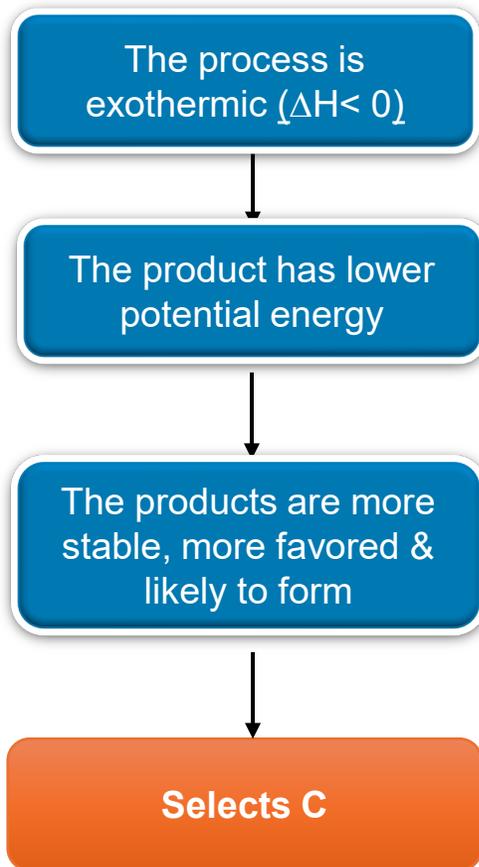
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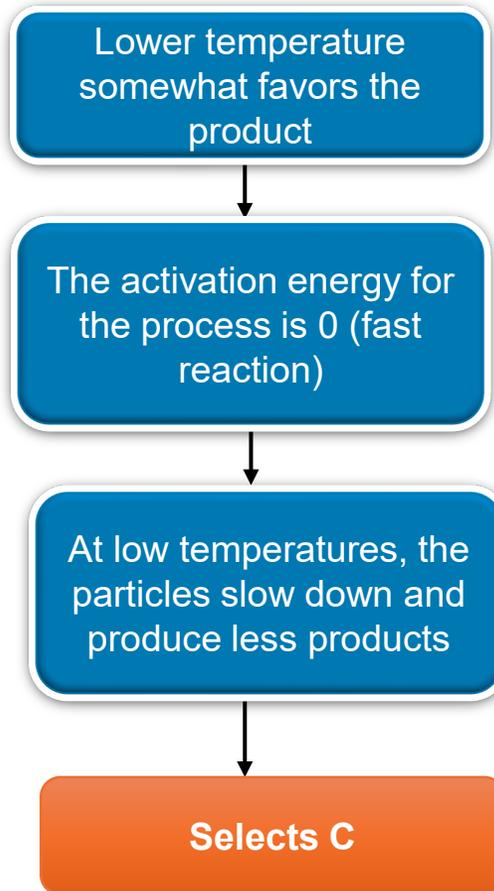
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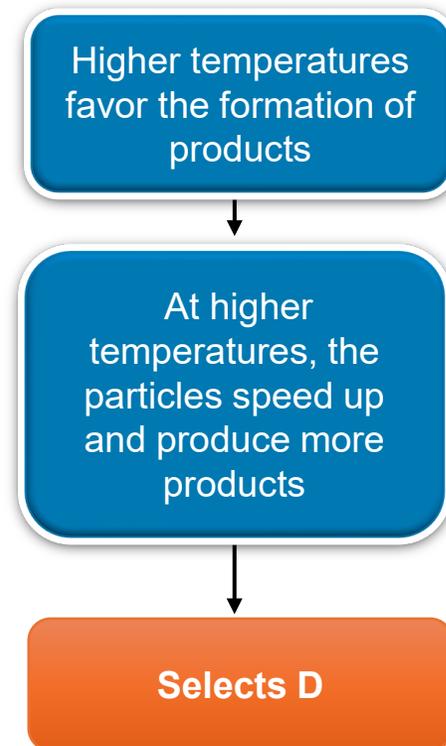
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Slide 3



Slide 4



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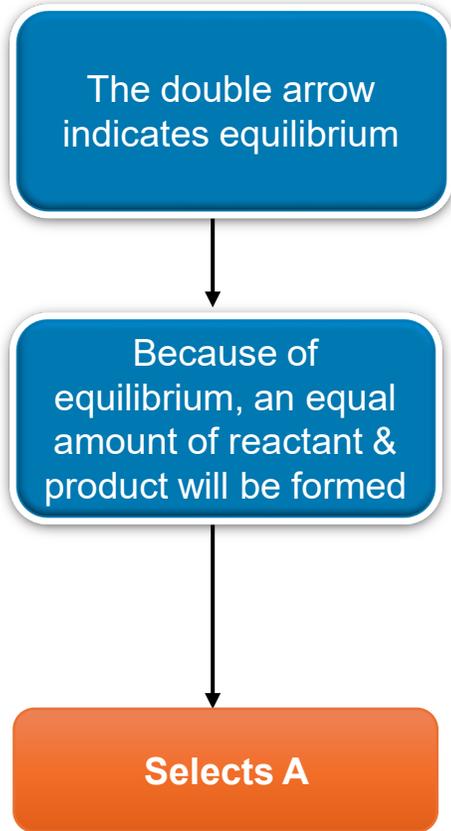
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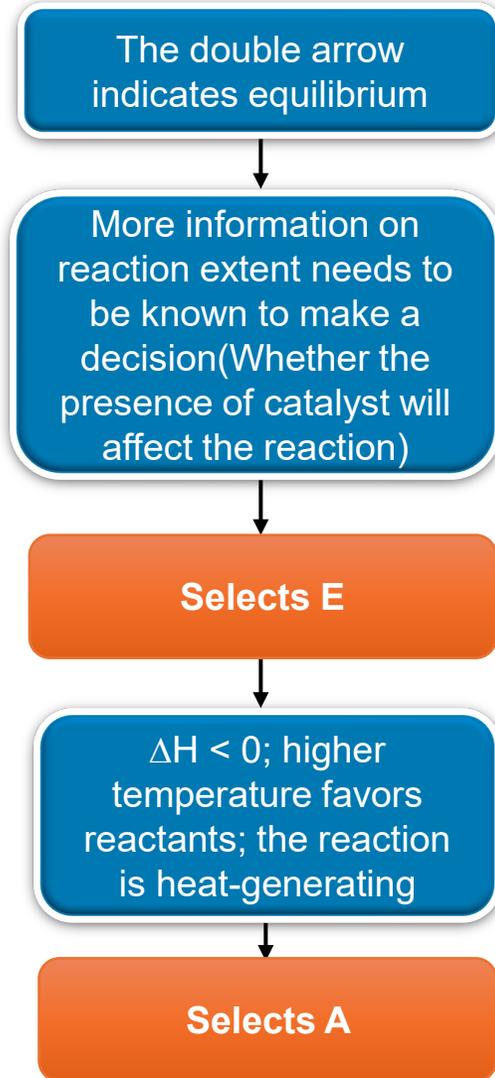
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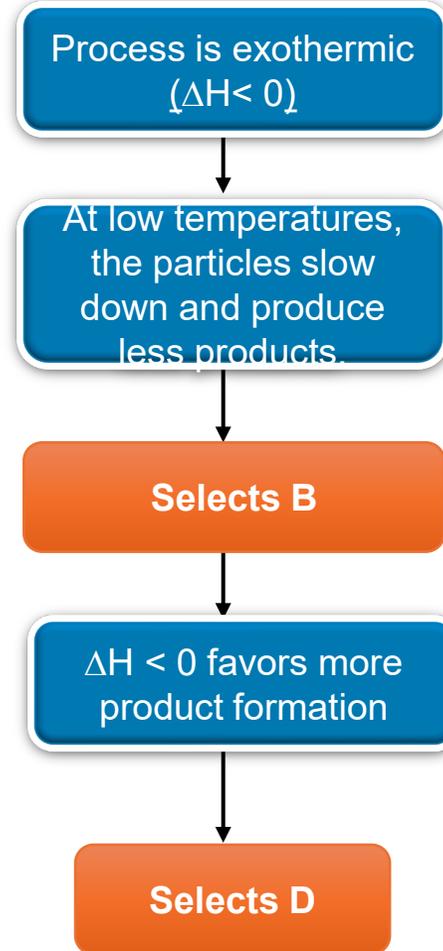
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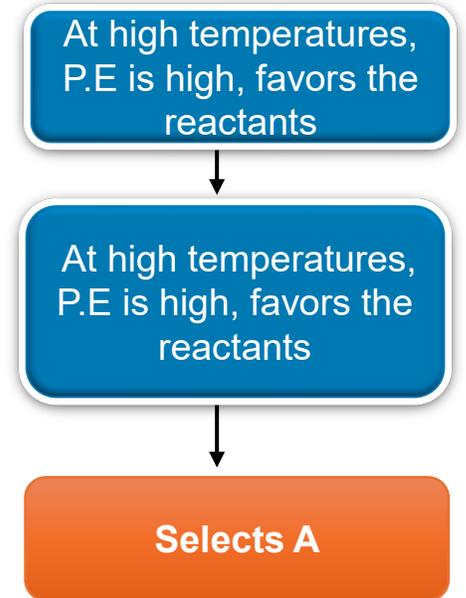
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Slide 3



Slide 4



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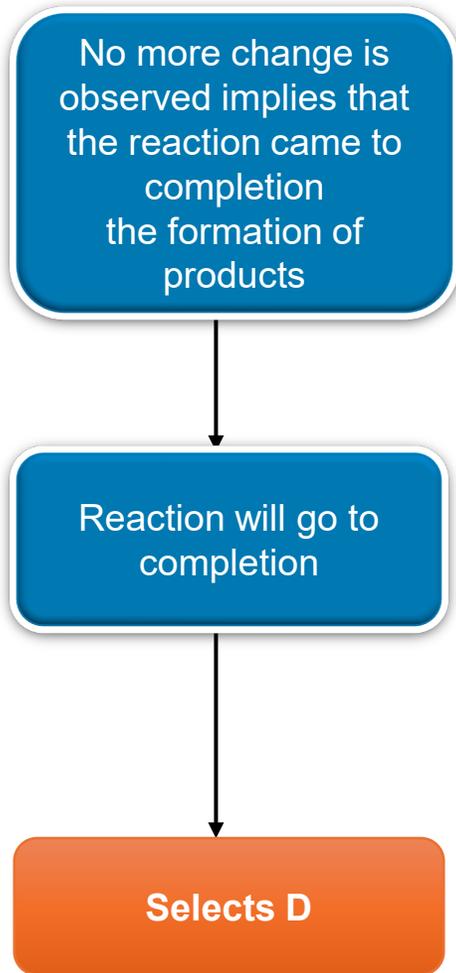
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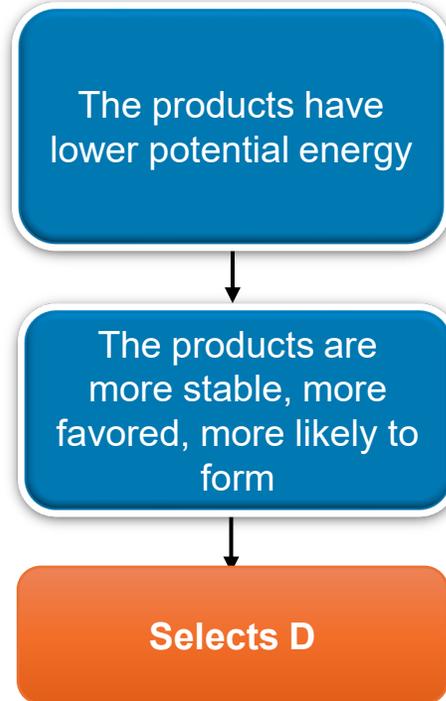
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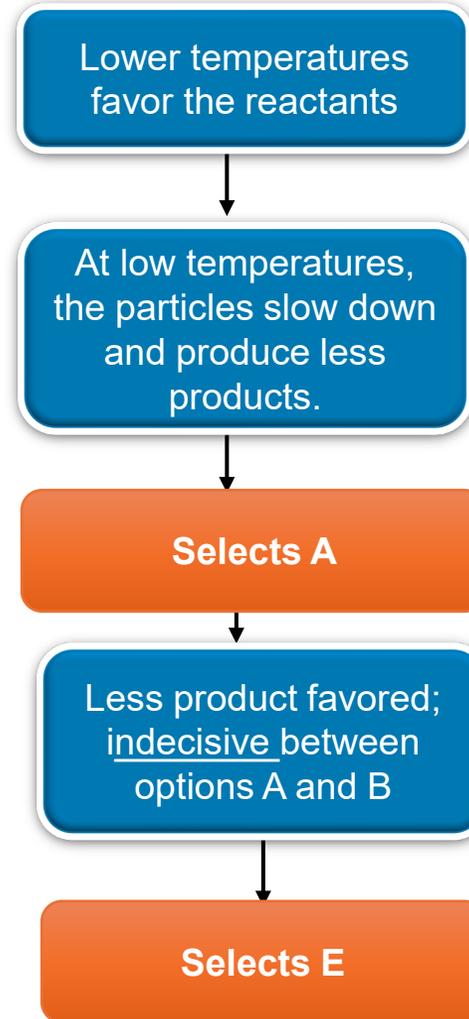
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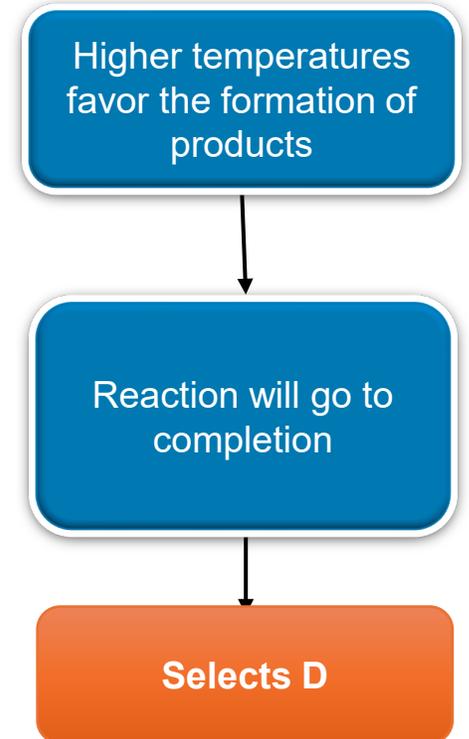
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Slide 3



Slide 4



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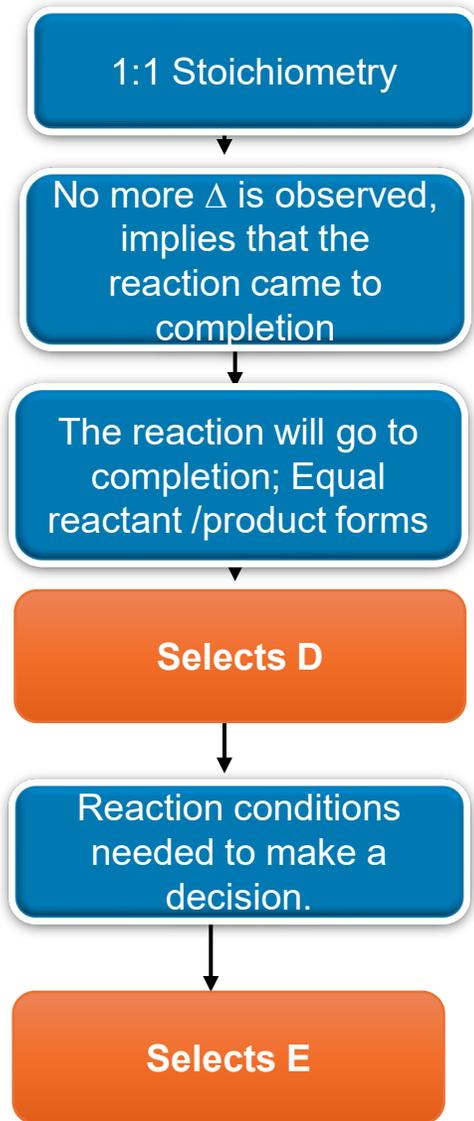
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→ EF (ΔH)

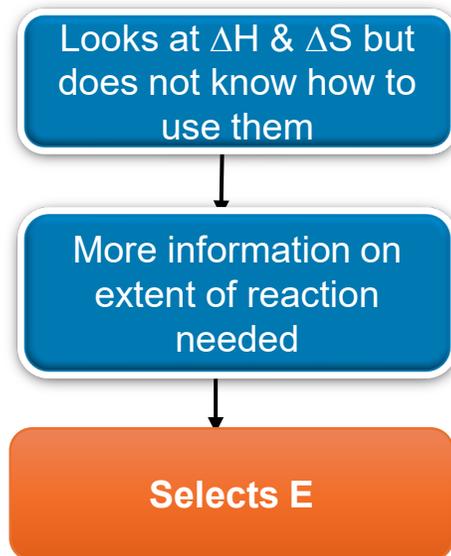
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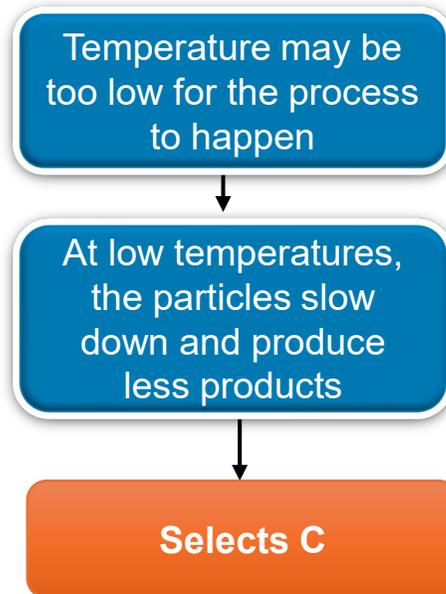
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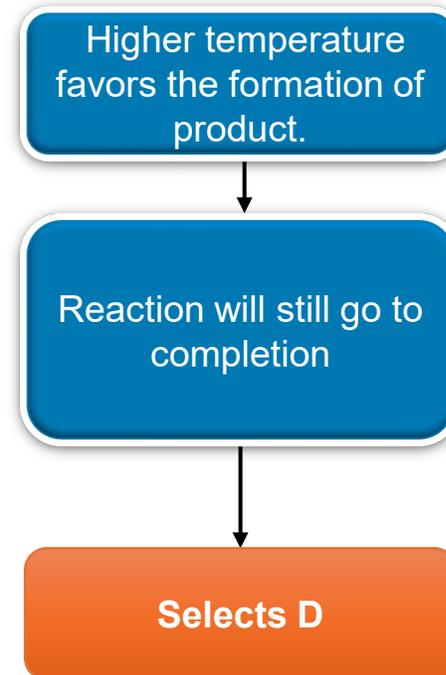
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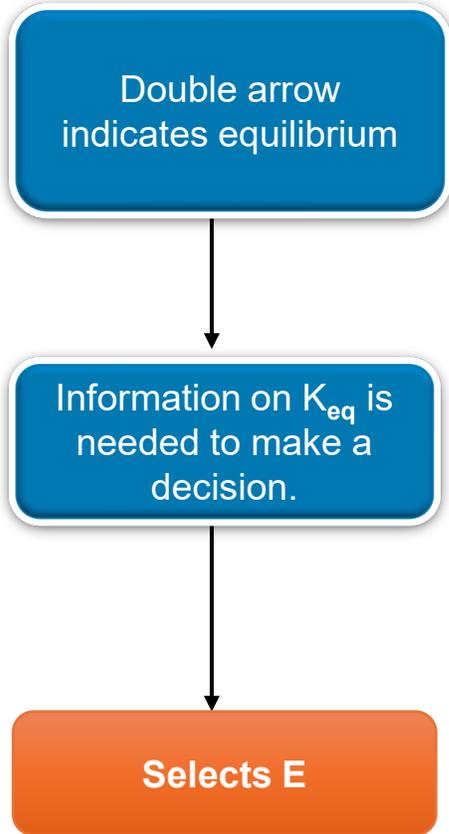
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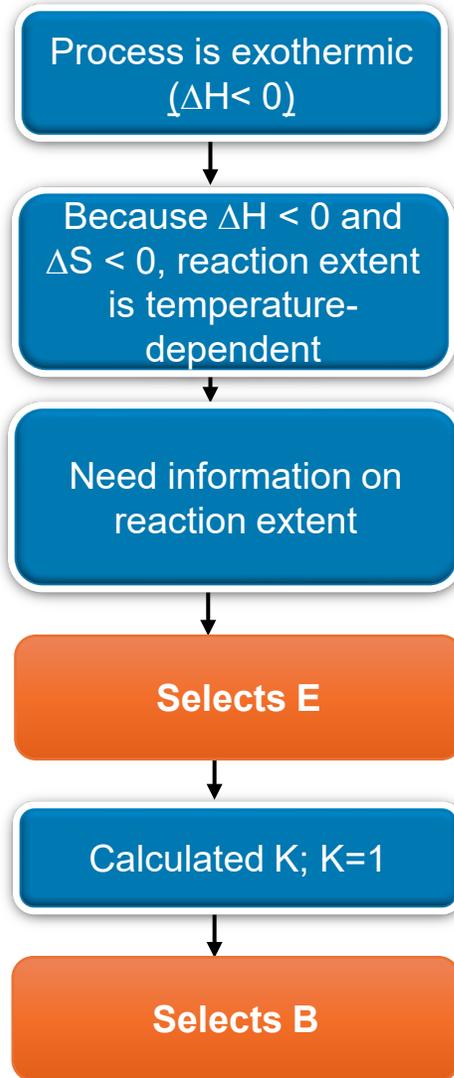
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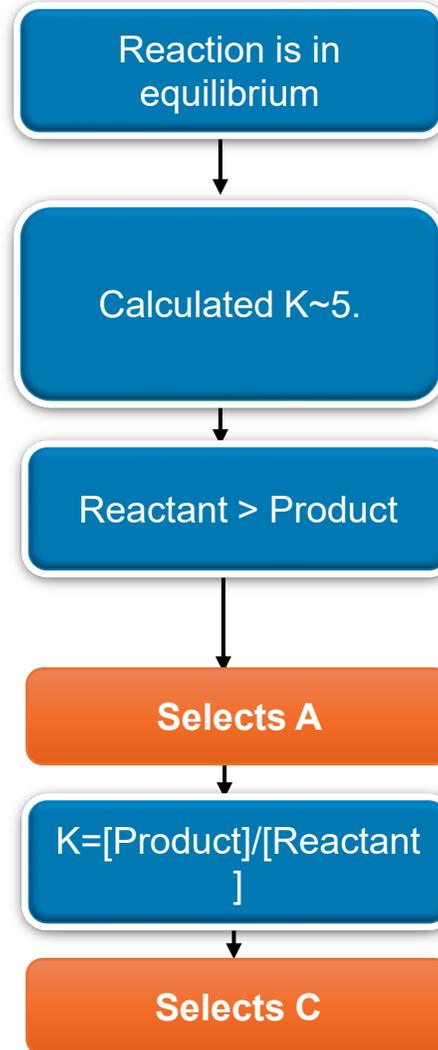
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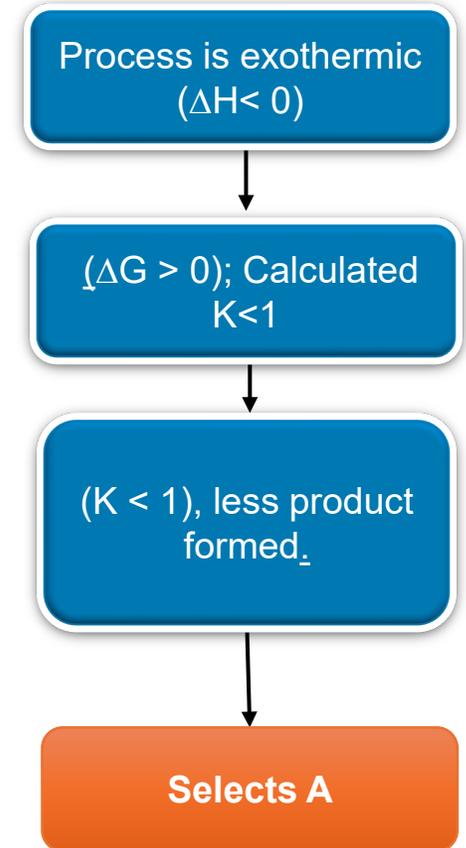
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Slide 4



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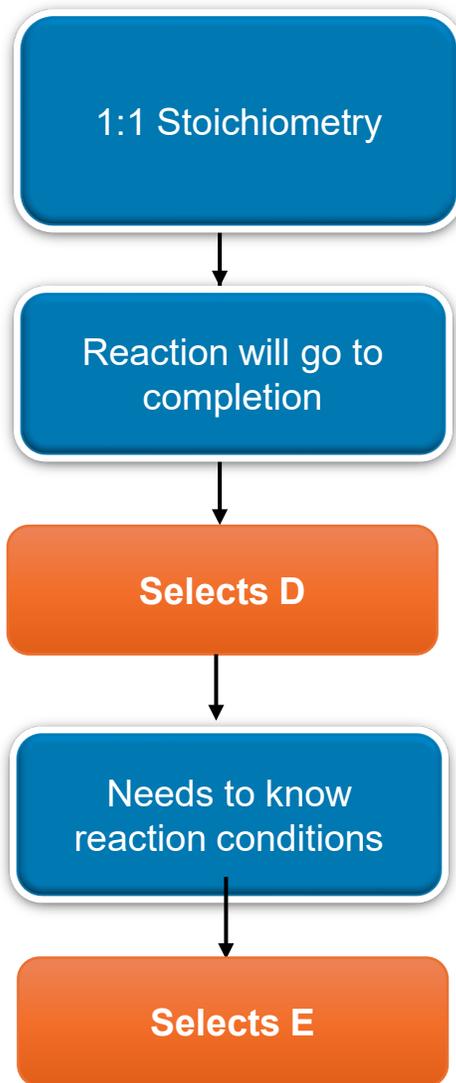
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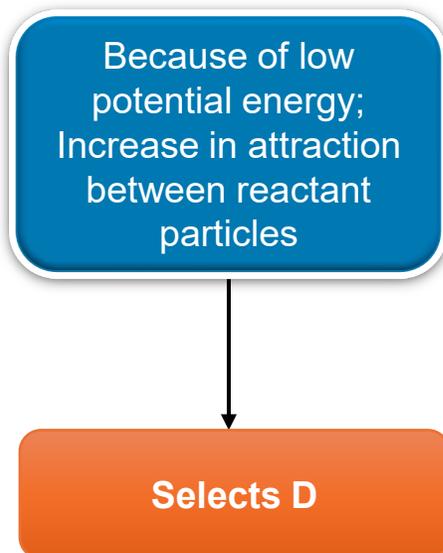
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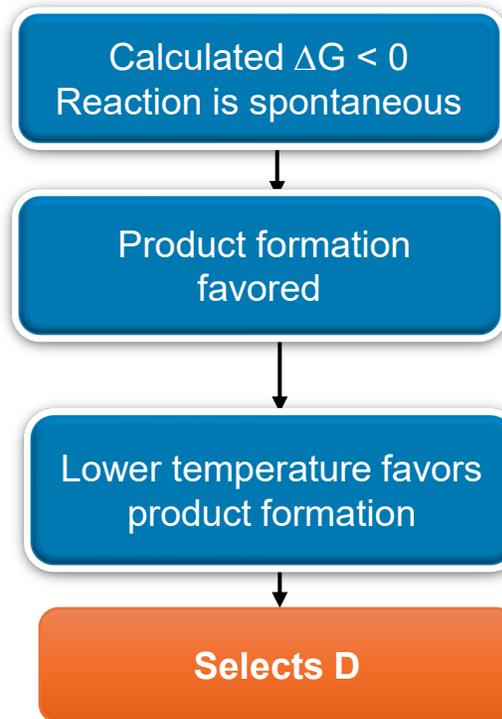
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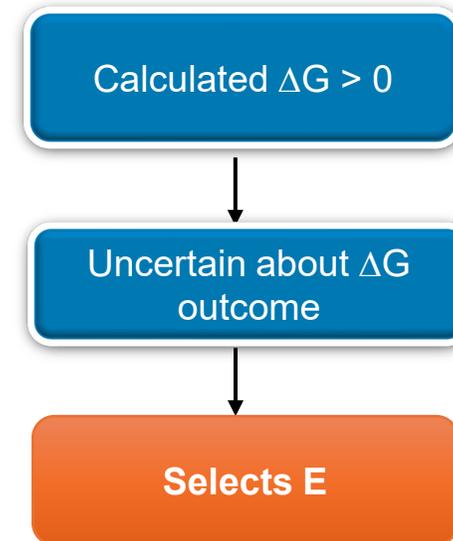
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Slide 3



→ (SQR)

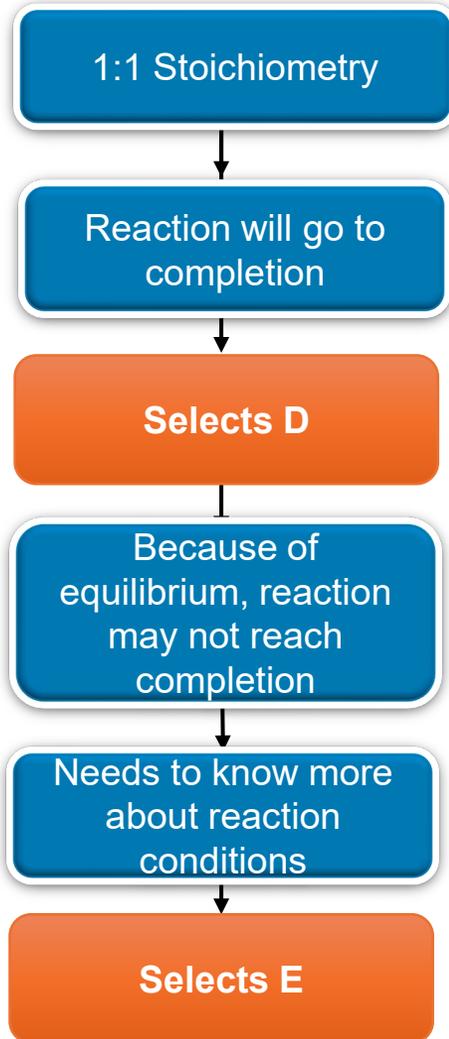
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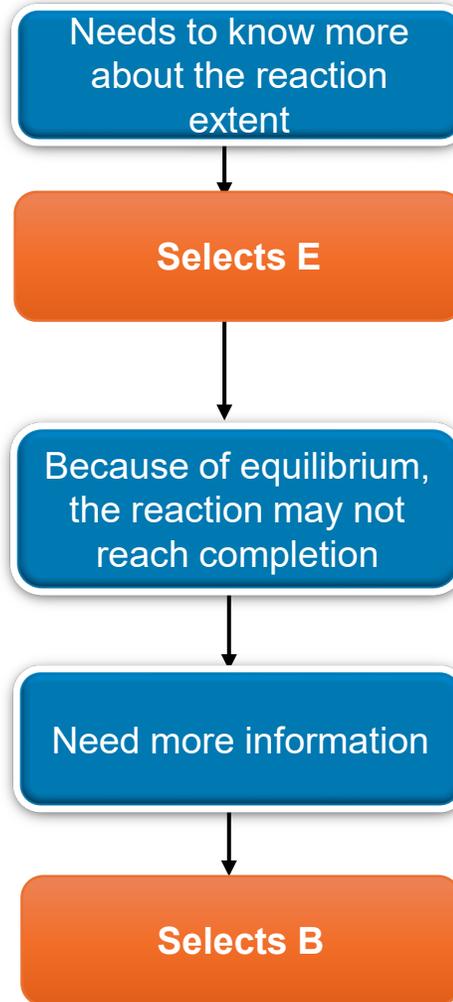
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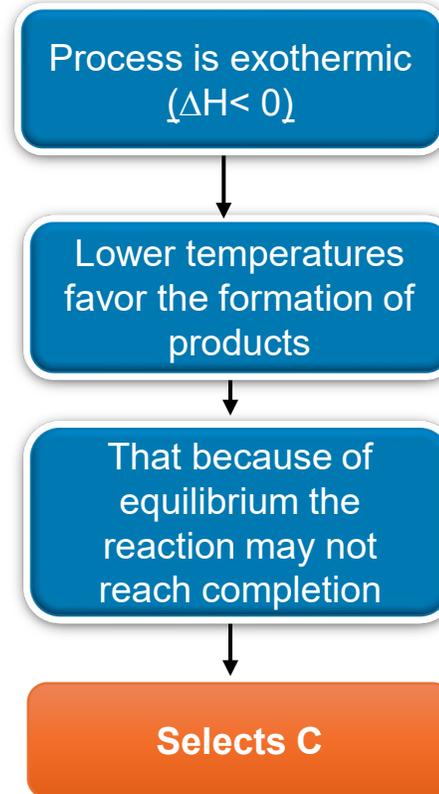
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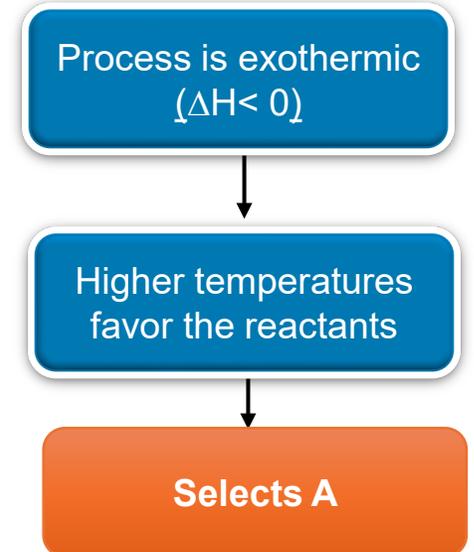
→ FC

Slide 3



→ EF (ΔH)

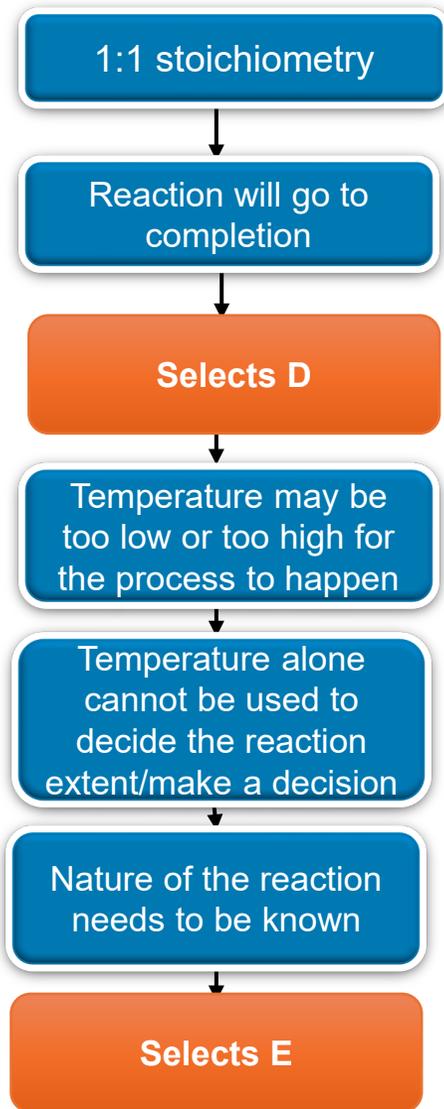
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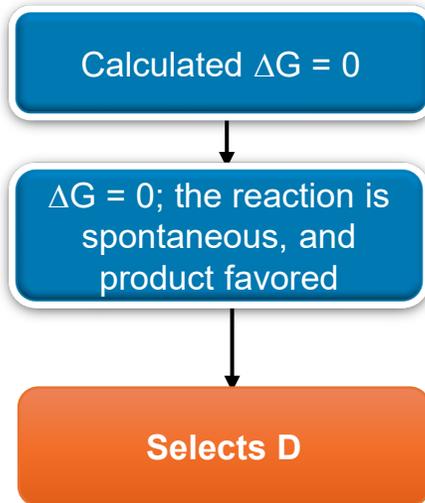
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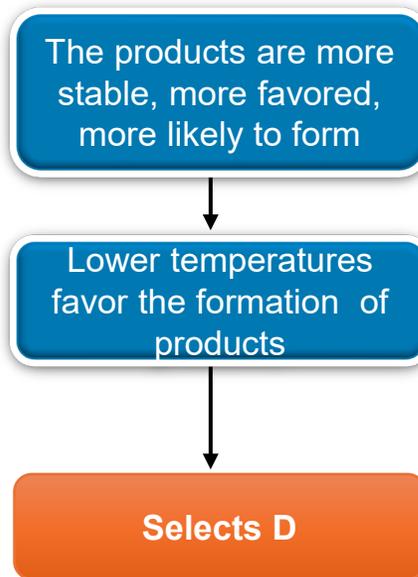
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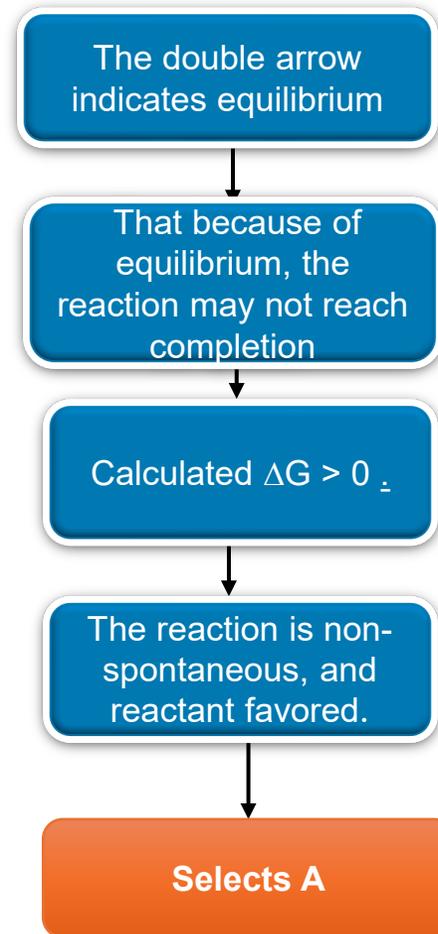
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Slide 3



Slide 4



Frames: SC → TF

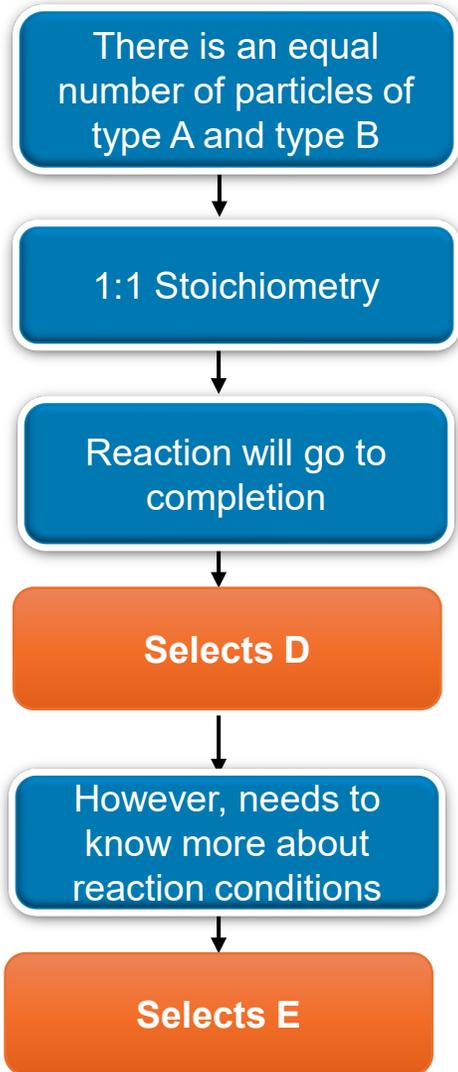
→ SE (SQR)

→ EF (ΔH)

→ SE (SQR)

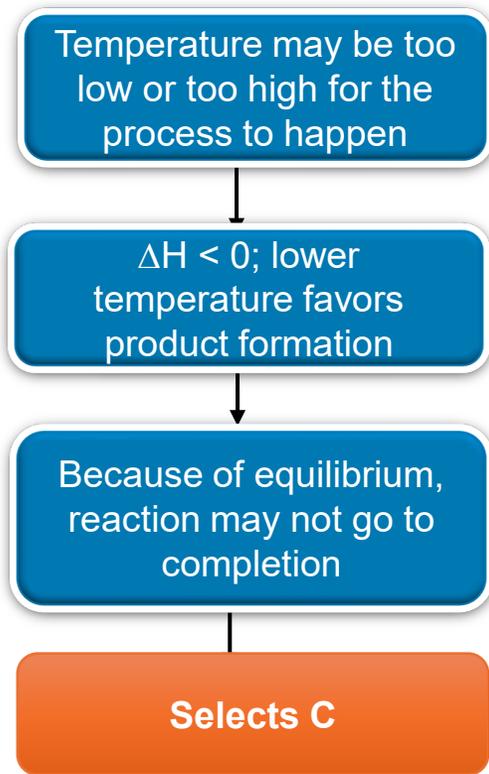
Participant 20 (P20)

Slide 1



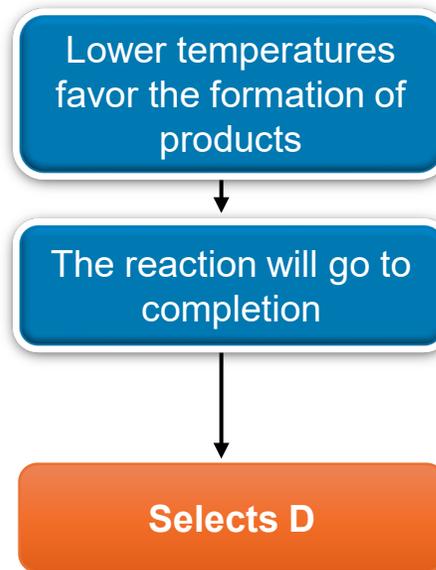
Frames: SC → SE

Slide 2



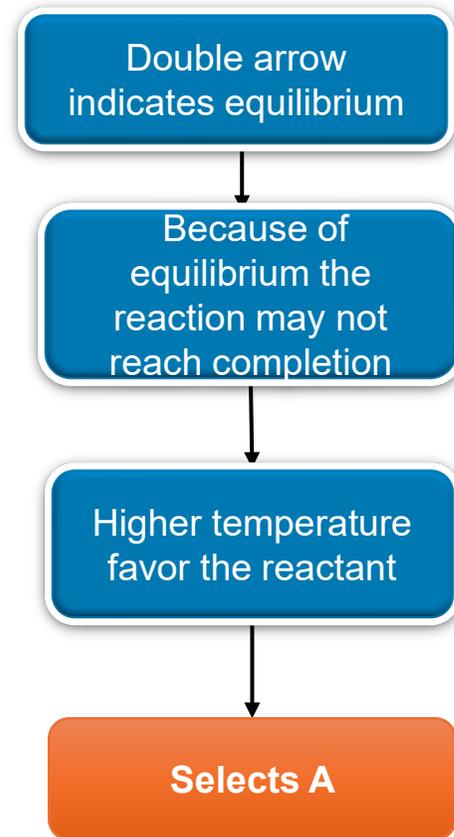
→ EF(ΔH)

Slide 3



→ EF(ΔH)

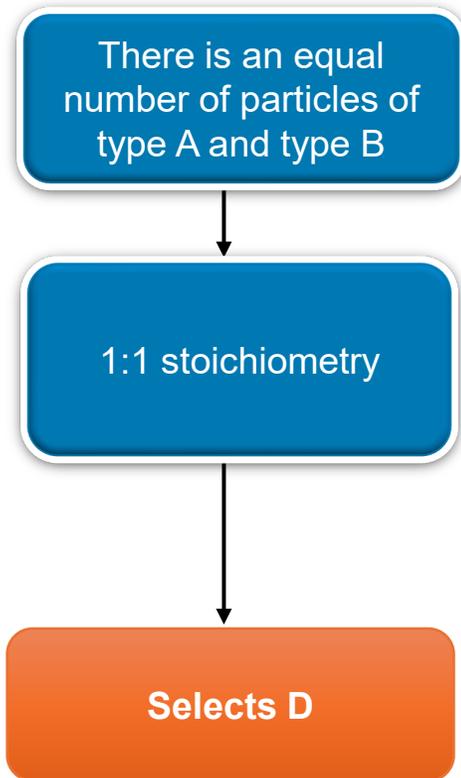
Slide 4



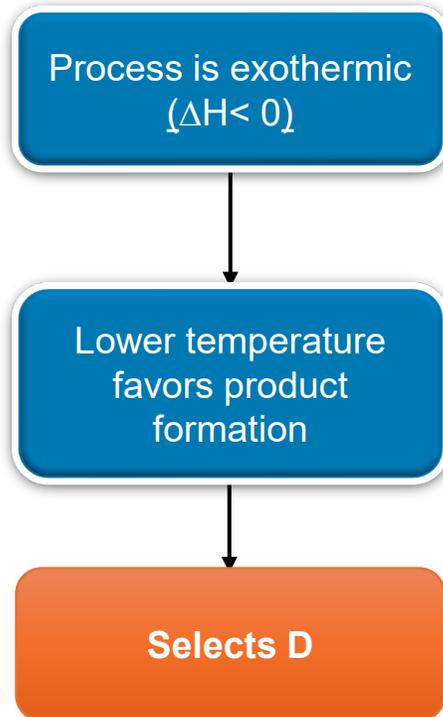
→ EF(ΔH)

Participant 21 (P21)

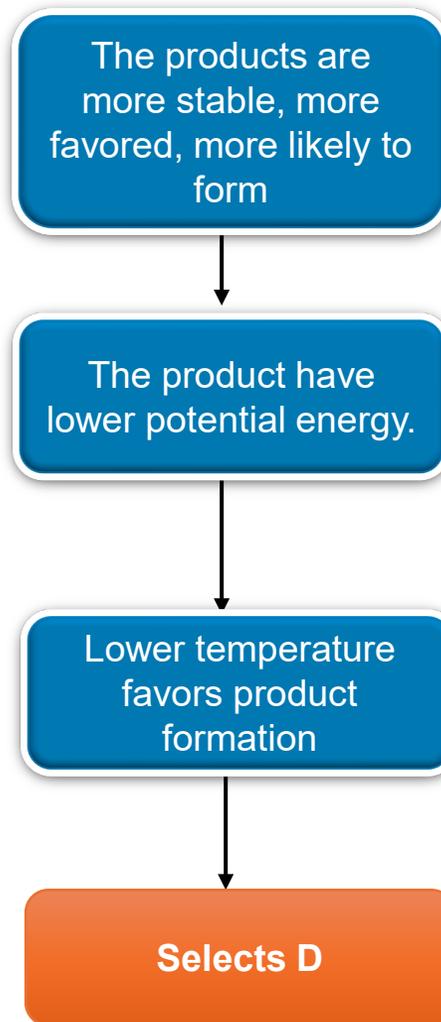
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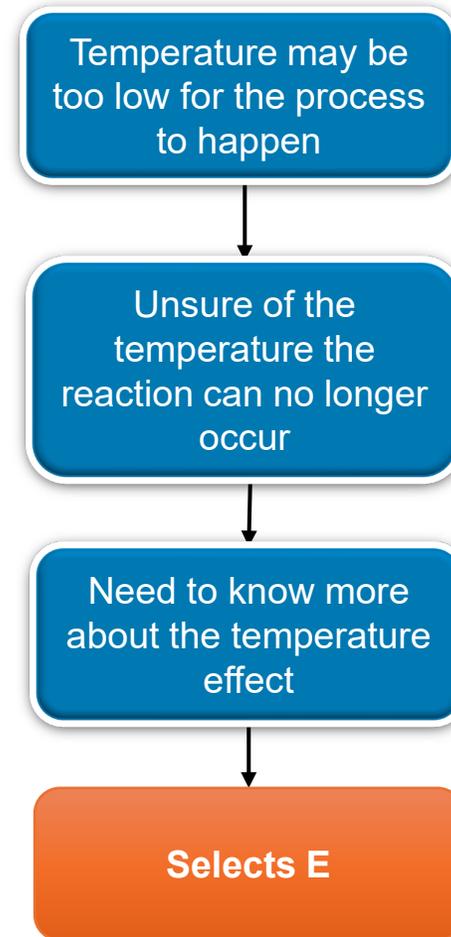
Slide 2



Slide 3



Slide 4



Frames: SC

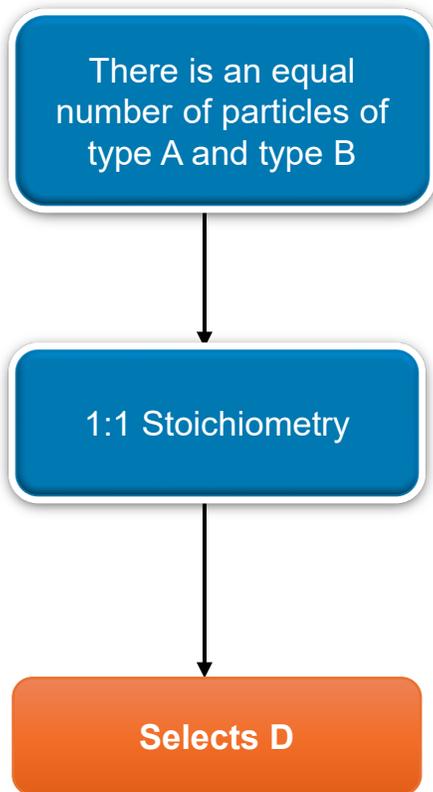
→ EF (ΔH)

→ EF

→ TF

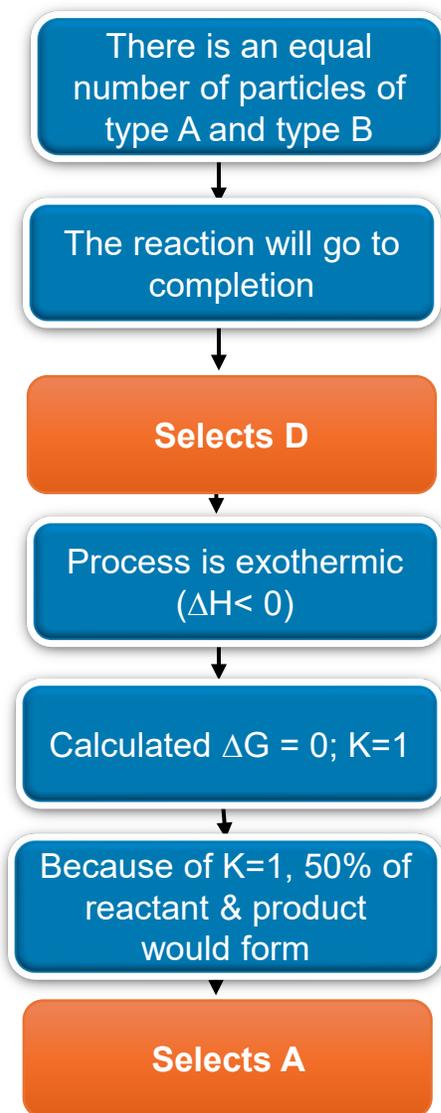
Participant 22 (P22)

Slide 1



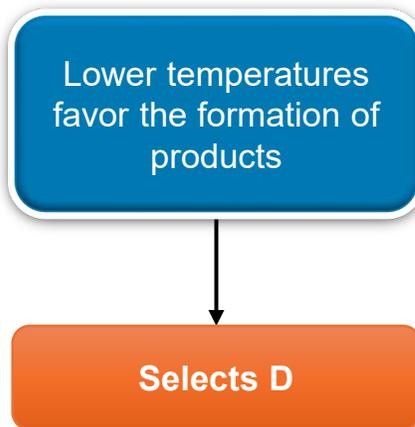
Frames: SC

Slide 2



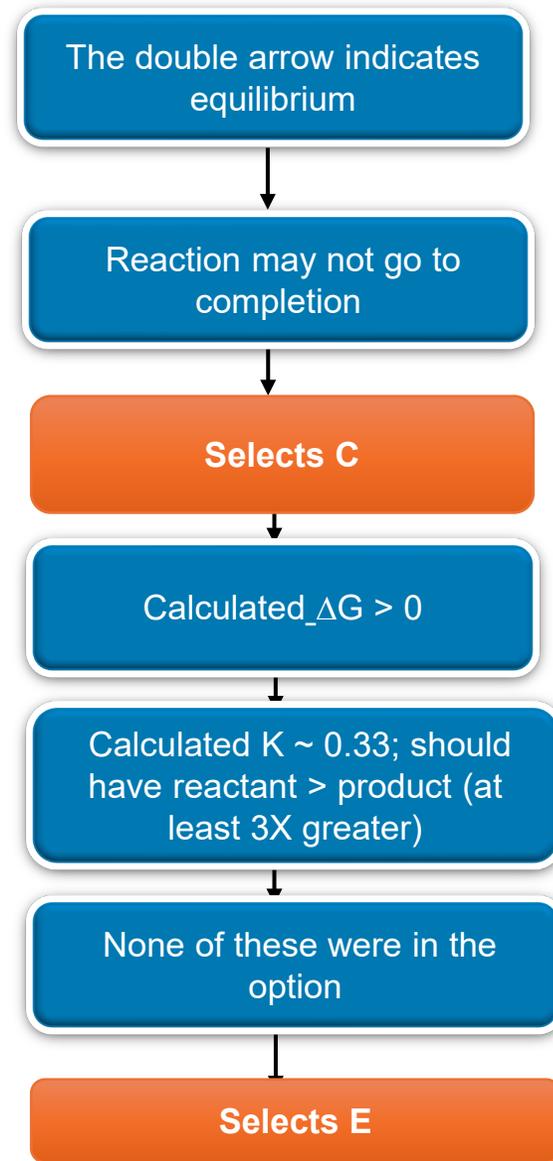
→ SE (SQR)

Slide 3



→ EF (ΔH)

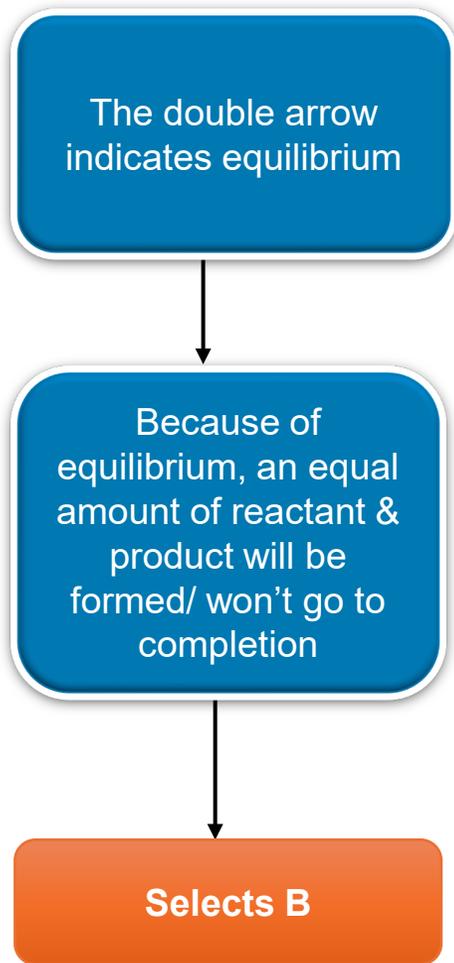
Slide 4



→ SE (SQR)

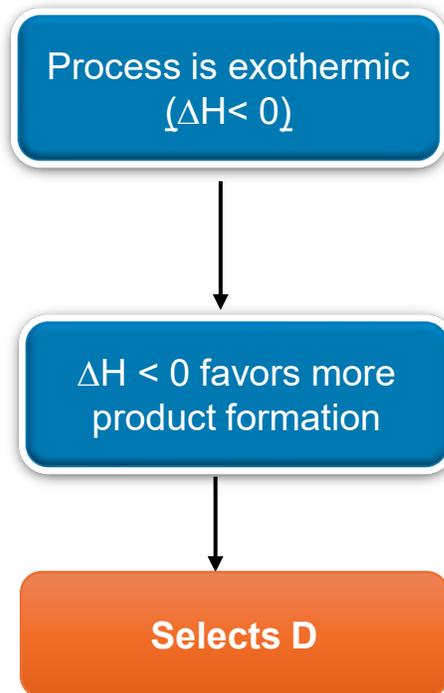
Participant 23 (P23)

Slide 1



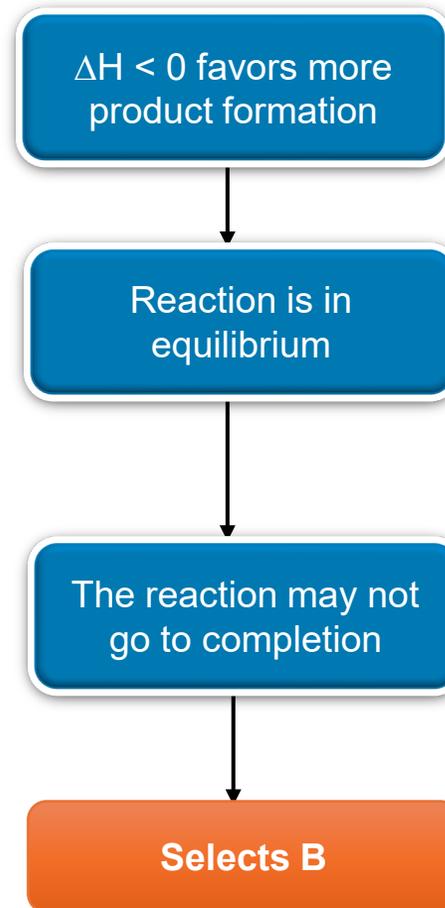
Frames: SE

Slide 2



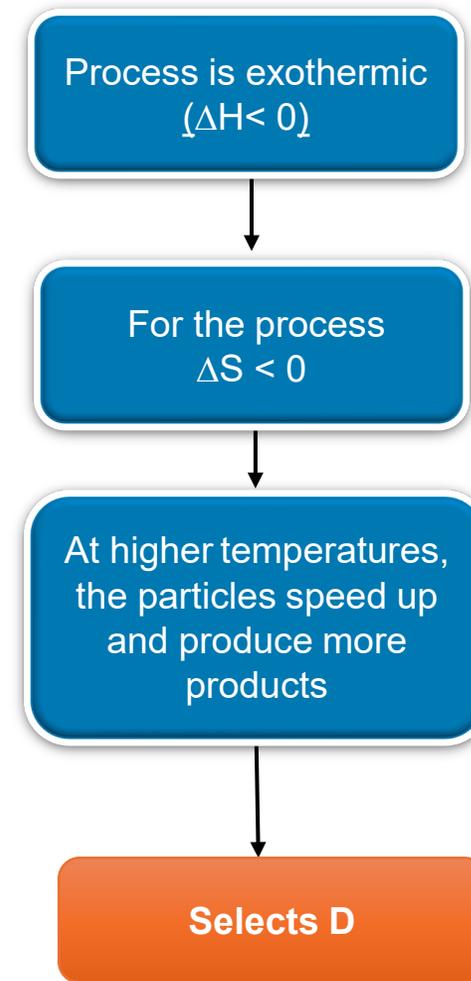
→ EF (ΔH)

Slide 3



→ EF (ΔH)

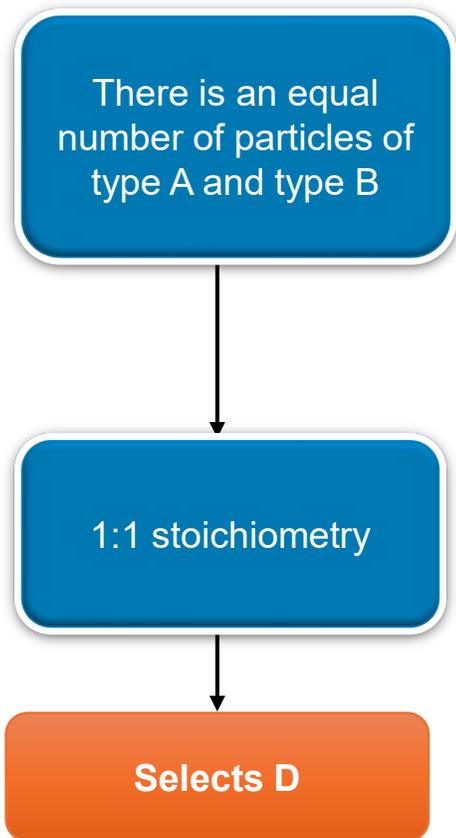
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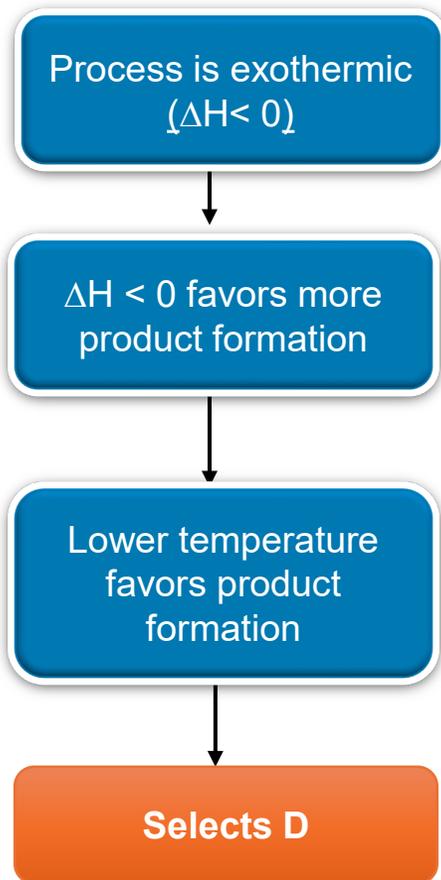
→ PM

Participant 24 (P24)

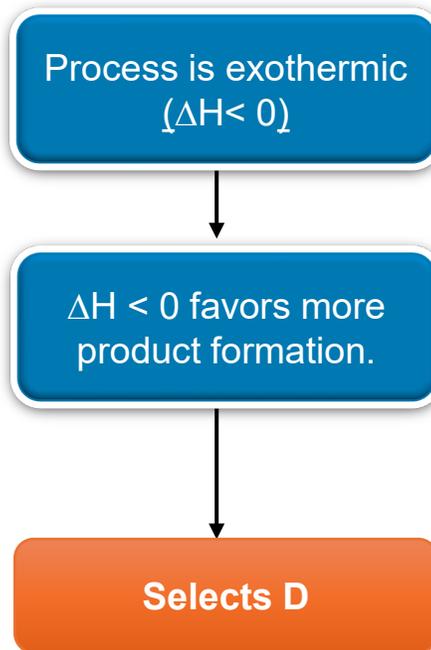
Slide 1



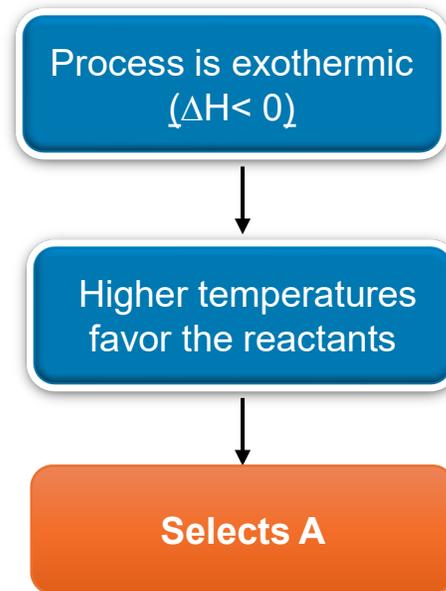
Slide 2



Slide 3



Slide 4



Frames: SC

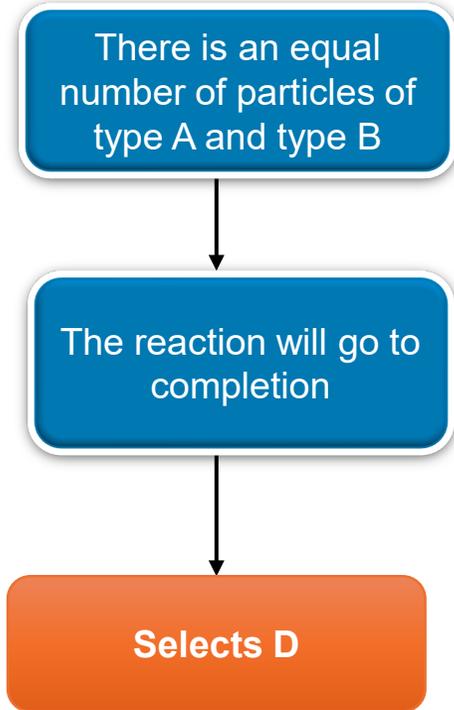
→ EF (ΔH)

→ EF (ΔH)

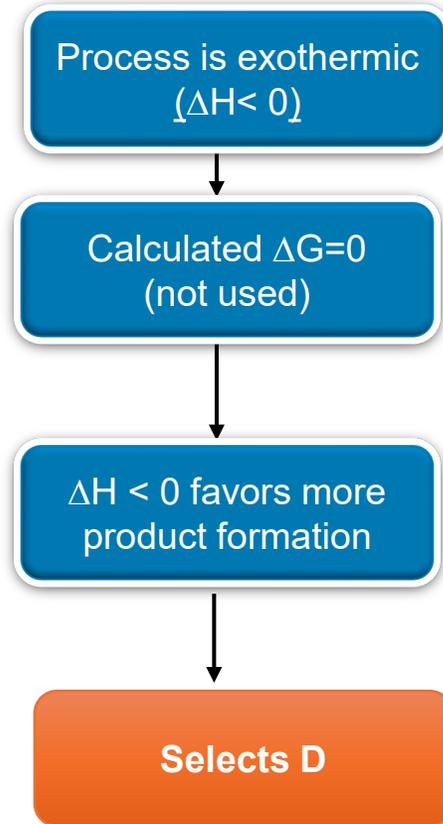
→ EF (ΔH)

Participant 25 (P25)

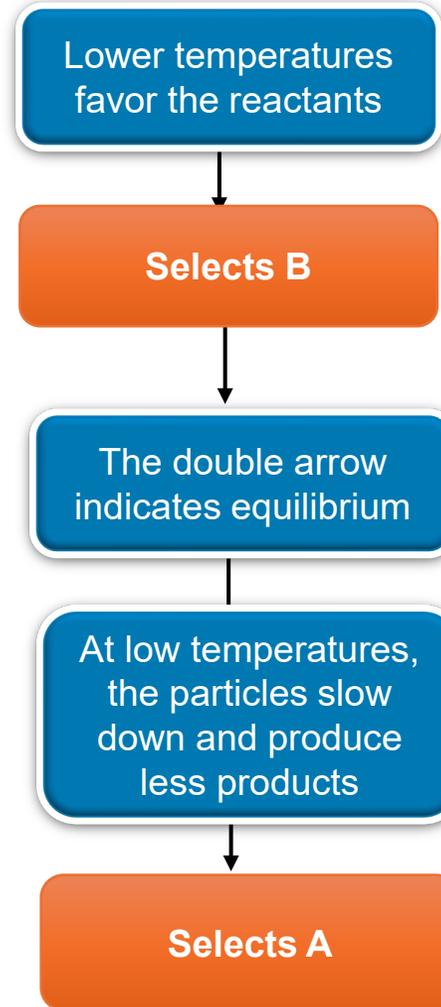
Slide 1



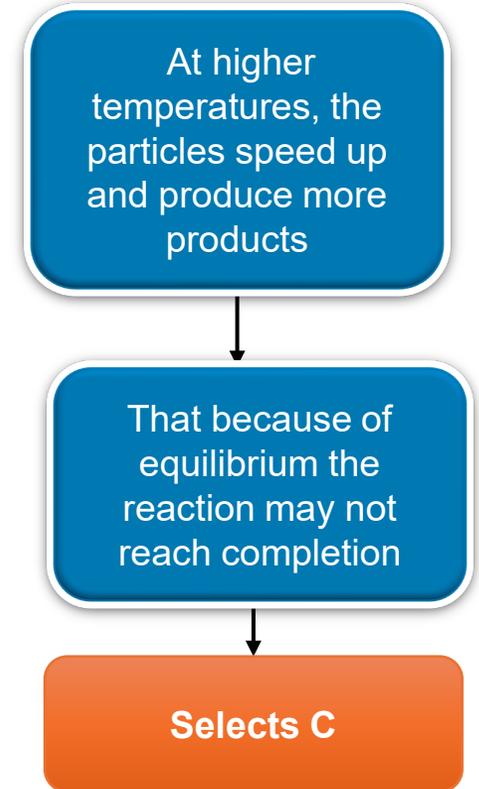
Slide 2



Slide 3



Slide 4



Frames: SC

→ EF (ΔH)

→ PM

→ PM