Reactions and Rates 3 Clicker Questions

Activity 3:
Introduction to **Equilibrium**

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PhET

Learning Goals

Students will be able to:

- Use a physical experiment to model chemical equilibrium

- Sketch how the number of reactants and products will change as a reaction proceeds

- Predict how changing the initial conditions will affect the equilibrium amounts of reactants and products.

- Predict how the shape of the reaction coordinate will affect the equilibrium amounts of reactants and products.

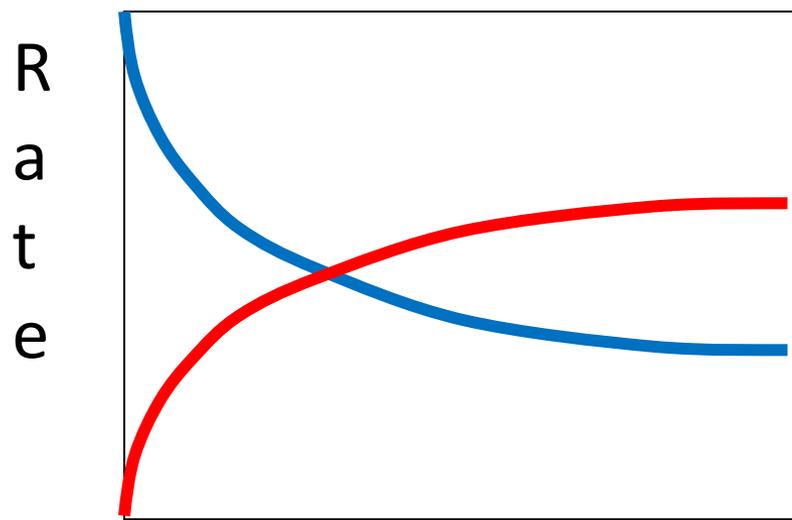# Which best shows that equilibrium has been reached?

A
Amount of substance vs time
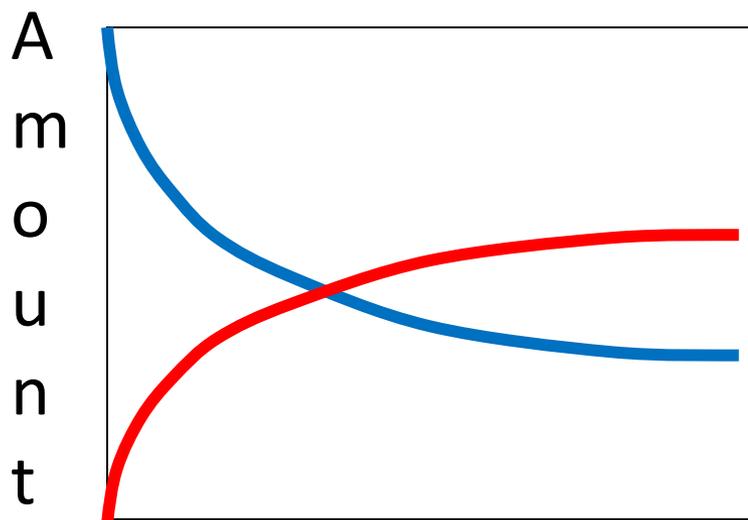
time

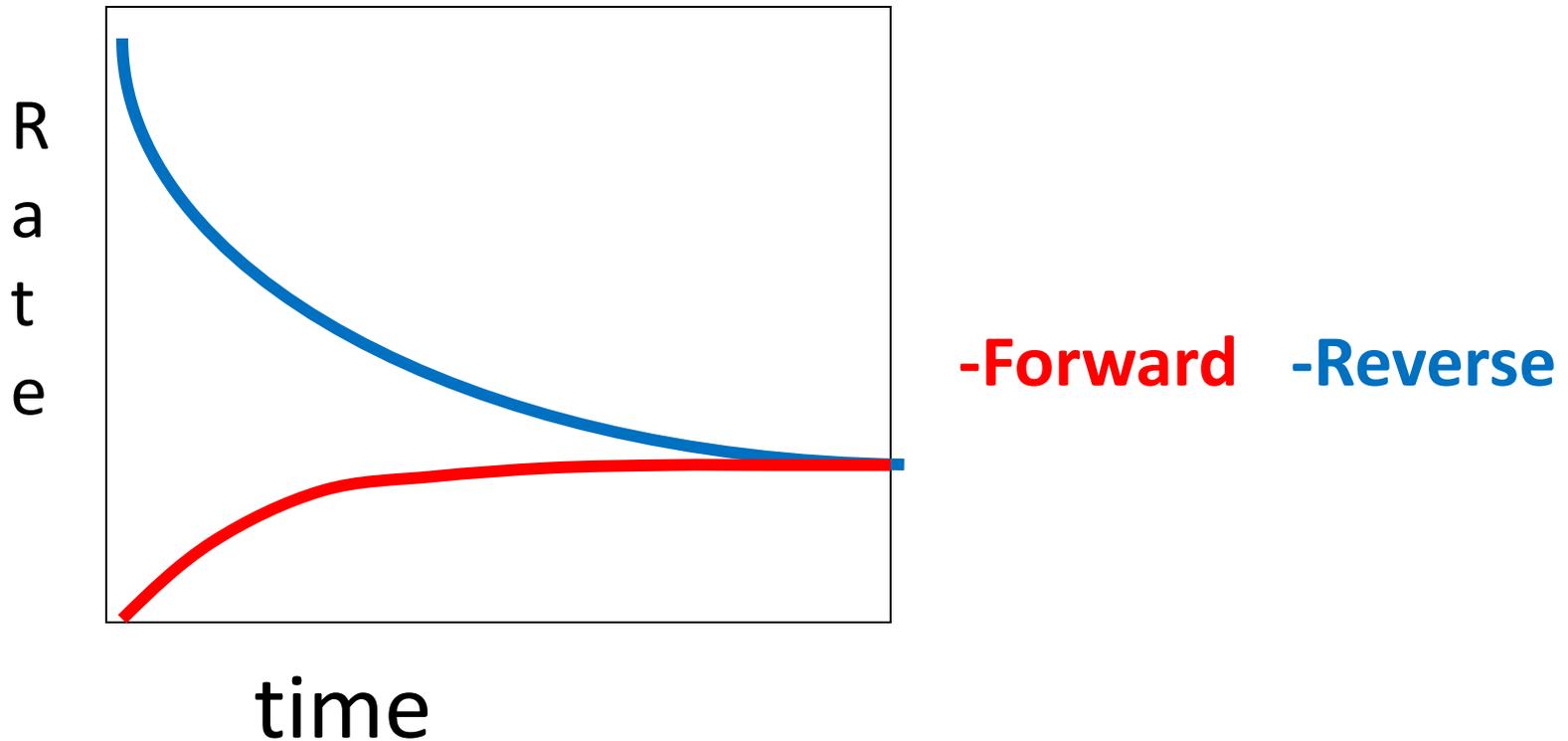**-Product** **-Reactants**

B
Reaction Rates vs time

time

-Forward **-Reverse**

Correct rate graph
Forward reaction rate = Reverse rate

Reaction Rates vs time

R
a
t
e

time

-Forward   -Reverse

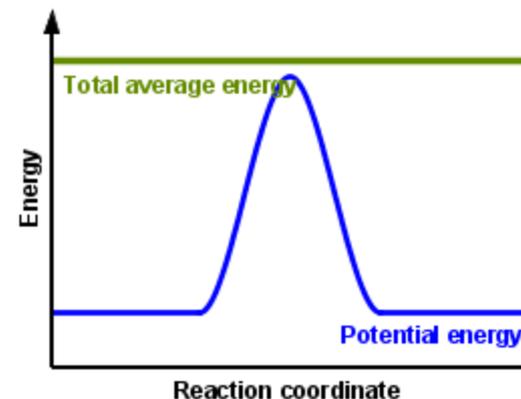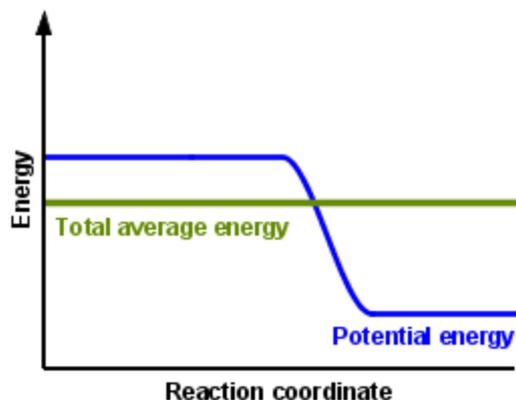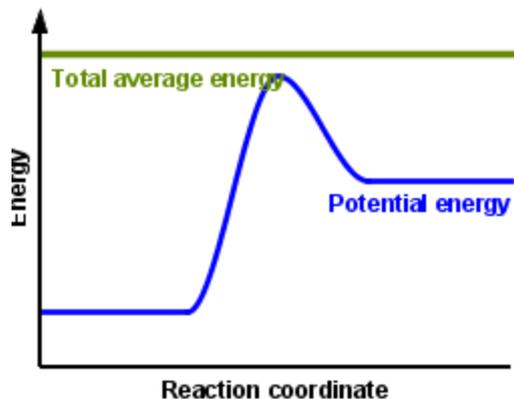# Which could show that equilibrium has been reached?
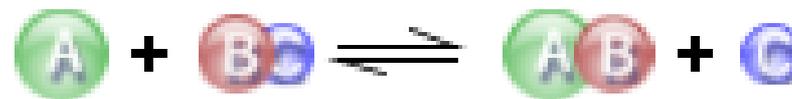

A

B

C neither

D either

All are at equilibrium within limits
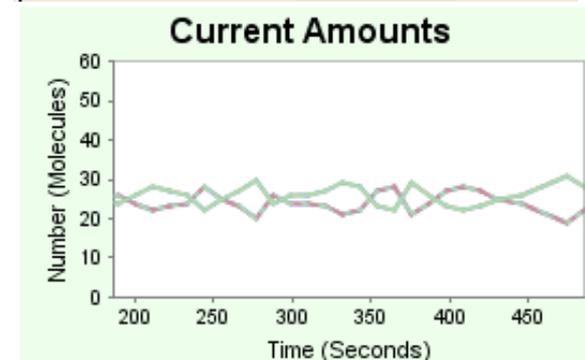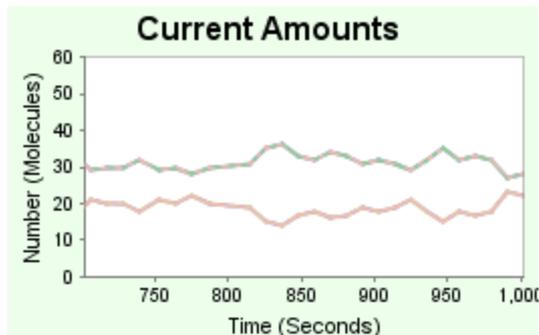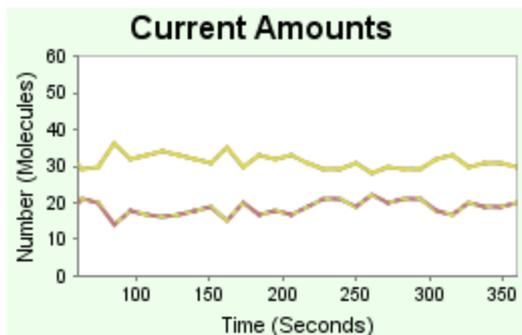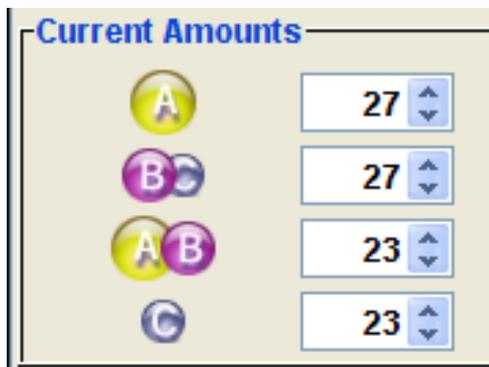
Which best shows that equilibrium has been reached?

A. The number of reactants is greater than the products

B. The number of products is greater than the reactants

C. The number of products is equal to the reactants

D. The number of products varies little

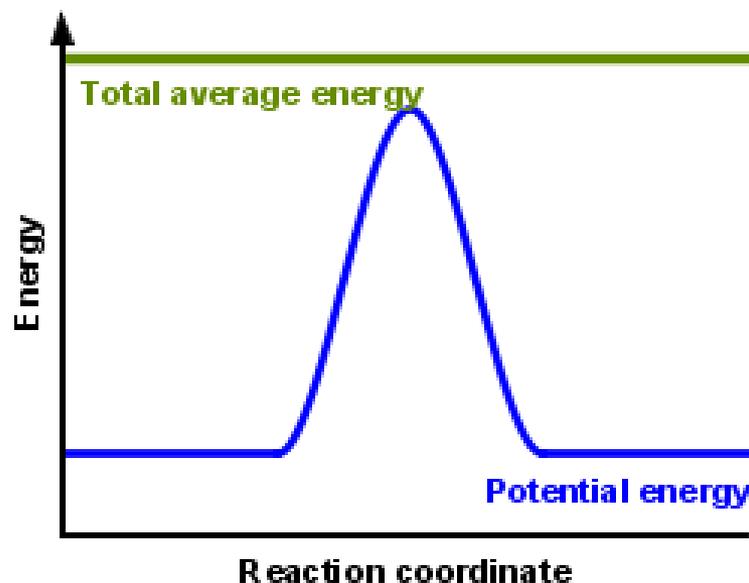# At equilibrium, what would you predict is in the container?

A + BC ⇌ AB + C

Start with how many...

A? 50   BC? 50
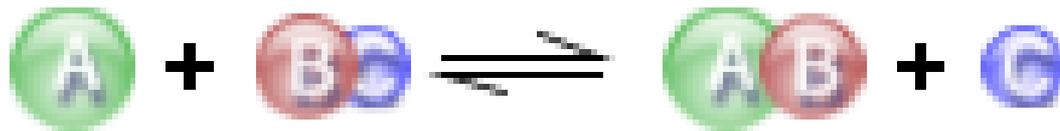
AB? 50   C? 50

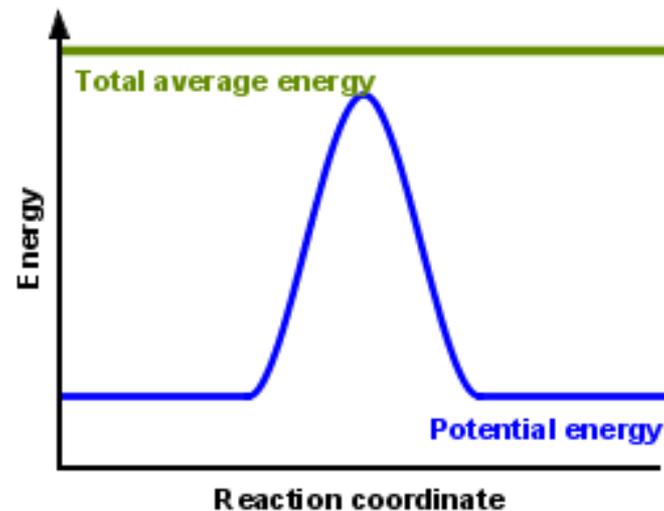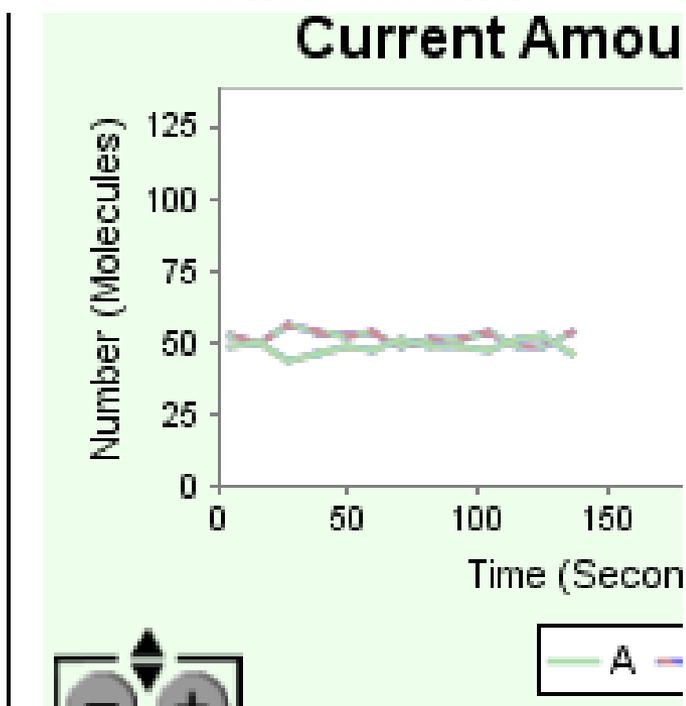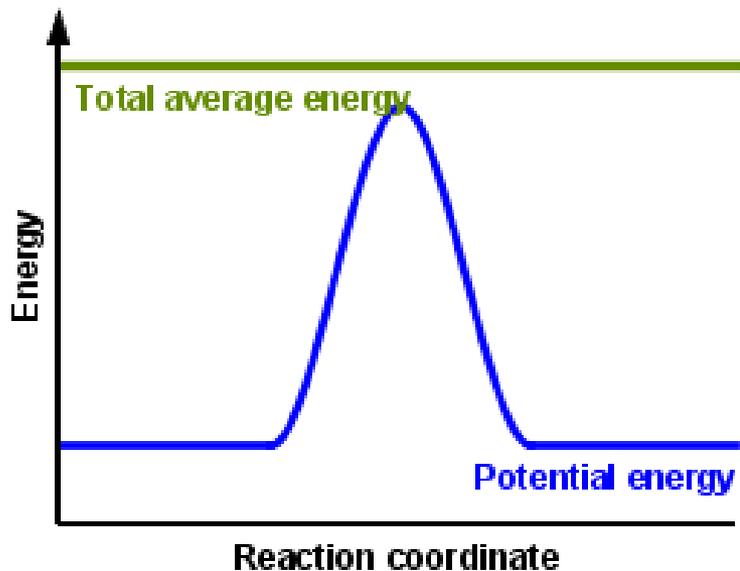Total average energy

Energy

Potential energy

Reaction coordinate

A. Container will have mostly A & BC

B. Container will have mostly AB & C

C. Container will have a mixture of all four with nearly equal amounts

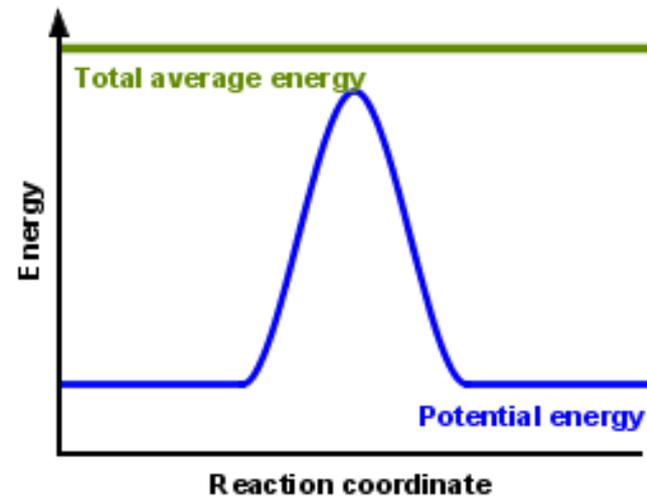D. No reaction will occur since the products and reactants have the same energy

data

How will the equilibrium of second trial compare to the equilibrium of the first?

First experiment

Initial Conditions

Select a reaction:
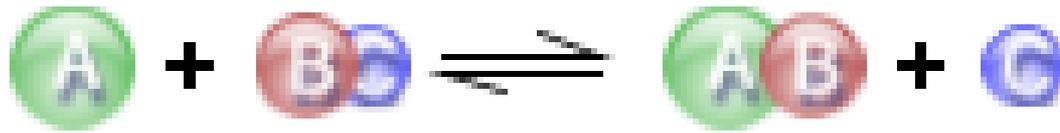A + BC

Start with how many...

A? 50   BC? 50
AB? 50   C? 50

Second experiment

Initial Conditions

Select a reaction:
A + BC

Start with how many...

A? 100   BC? 50
AB? 50   C? 50

A + B C ⇌ A B + C

First trial

A?	50	BC?	50
AB?	50	C?	50

Second trial

A?	100	BC?	50
AB?	50	C?	50

Total average energy

Energy

Potential e

Reaction coordinate

A. There will be more A & BC

B. There will be more AB & C
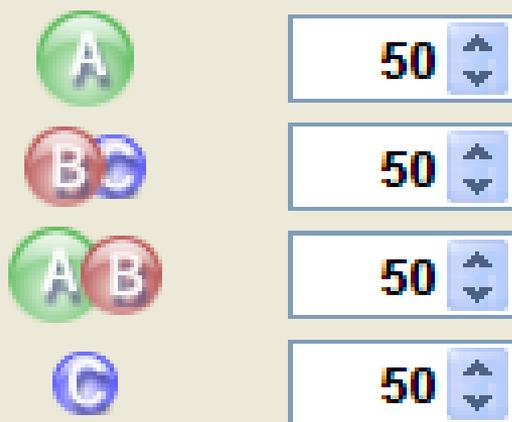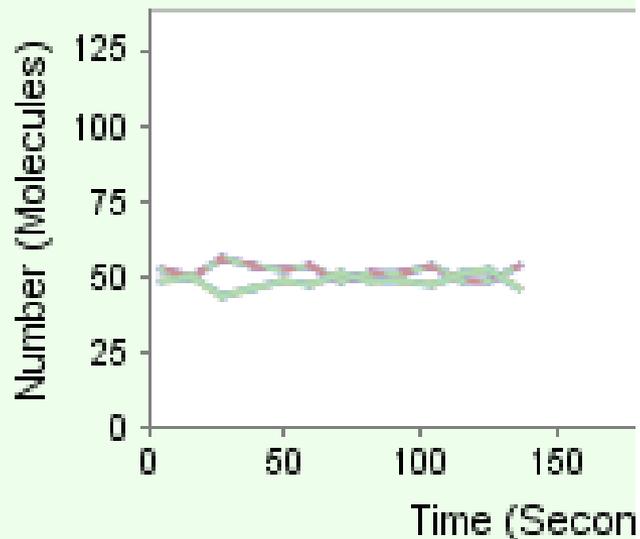
C. There will be more A & AB & C

D. There will be more BC & AB & C

E. The ratios will still be about the same

Data for reactions

Current Amounts

Molecule	Amount
A	50
BC	50
AB	50
C	50

Current Amou

Number (Molecules) vs. Time (Secon

Current Amounts

Molecule	Amount
A	92
BC	42
AB	58
C	58

Current Amounts
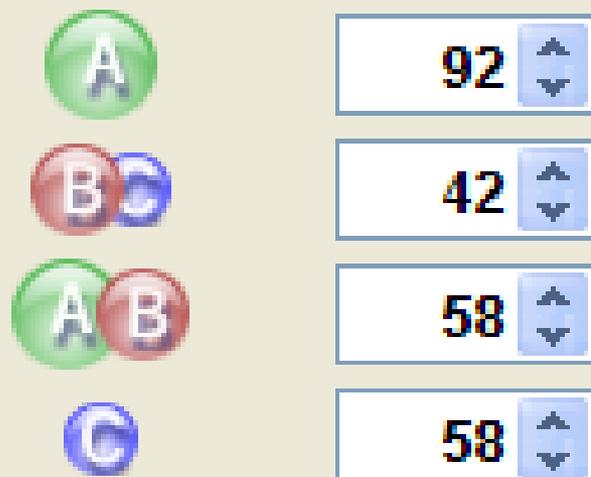
Number (Molecules) vs. Time (Seconds)
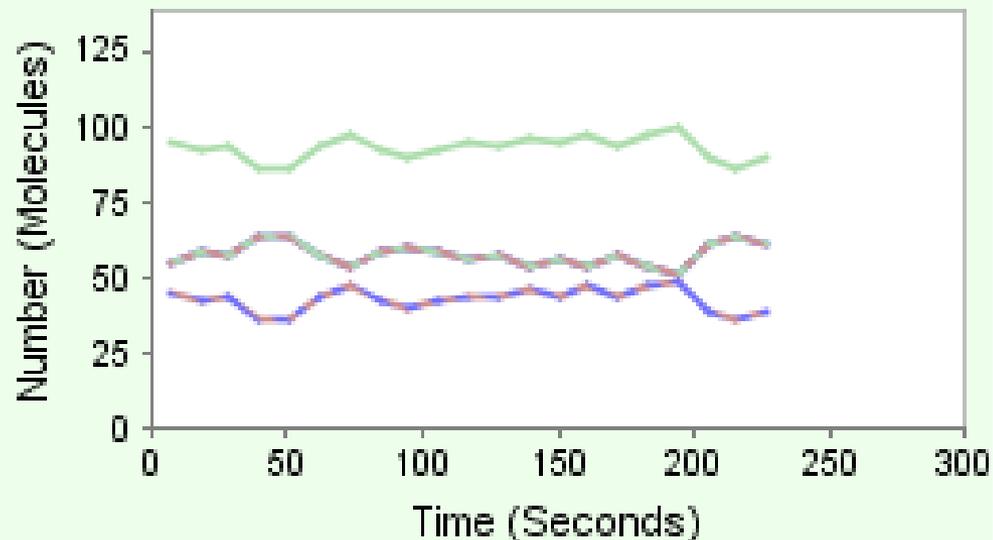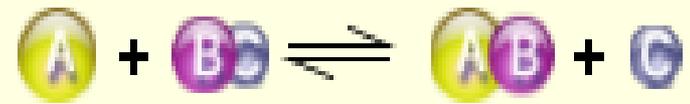
At equilibrium, what would you predict is in the container?

Initial Conditions

Select a reaction:

Start with how many...

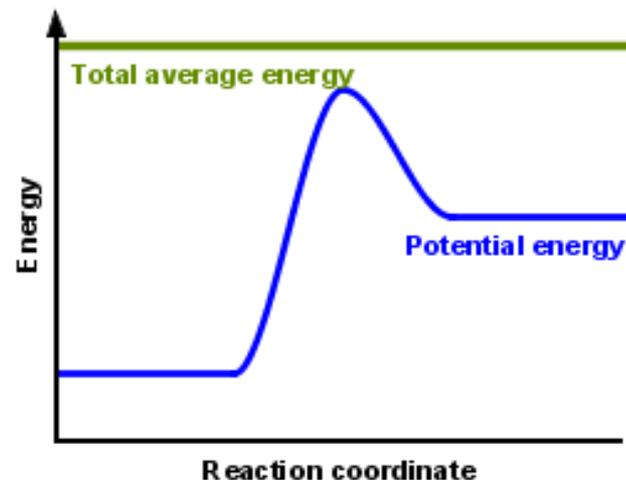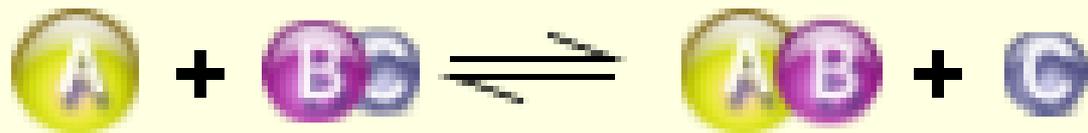A? 100   BC? 100

AB? 0   C? 0

A + BC ⇌ AB + C

Start with how many...

A?	100	BC?	100
AB?	0	C?	0

A. Container will have only [AB] & [C]

B. Container will have only [A] & [BC]

C. Container will have a mixture of all four with more [AB] & [C]

D. Container will have a mixture of all four with more [A] & [BC]

data