Comparing Waste in Two Model Reactions

Base your answers on the information provided and your knowledge of chemistry. Use the 2025 Chemistry Reference Tables as needed.

A classroom display compares two model reactions that make the same desired product, AB. The letters represent different kinds of atoms. Their model masses are A = 10, B = 20, and C = 5 mass units per atom. The equations represent one complete reaction event each.

Route P: $A_2 + B_2 \rightarrow 2AB$

Route Q: $2AC + B_2 \rightarrow 2AB + C_2$

1 Which statement compares the desired products of the two events?

(1) P makes two AB particles, and Q makes one.

(2) Both make two AB particles, and Q also makes a by-product.

(3) Q makes twice as much AB as P.

(4) Both make AB and the same amount of by-product.

2 Calculate the total mass of the products of Q in model mass units. Show how both products are counted. [1]

Answer and work

In repeated model trials, the two routes start with enough reactants to make 60 units of AB mass each. The team recovers 42 units of AB from P and 54 units of AB from Q.

3 Calculate the fraction of the expected AB mass recovered from each route. Show your work. [1]

Answer and work

4 A student says the route with the higher recovered fraction must make less by-product. Use the equations and recovery results to evaluate the claim. [1]

Answer and work