Checking Pressure When Vapor Particles Pair

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

A vapor model lets two molecules of one substance temporarily join as a pair through an attraction between the molecules. For pressure, each free molecule or joined pair counts as one independently moving particle. At fixed temperature and volume the model gives pressure proportional to the number of independently moving particles.

Vapor record	**Free molecules**	**Joined pairs**
P	100	0
Q	60	20

1 Which statement correctly compares the numbers of original molecules in P and Q?

(1) P has more.

(2) Q has more.

(3) They have equal numbers.

(4) There is no way to count the molecules in Q.

2 Explain why Q has fewer independently moving particles even though its amount of substance is the same as P’s. [1]

Answer and work

P has a pressure of 50 kPa. The chamber volume and temperature are identical in Q. The model can also switch off the pairing attraction without changing temperature, volume or the number of molecules.

3 Calculate Q’s pressure with pairing turned on, then predict its pressure after all pairs separate. [1]

Answer and work

4 A student says the pressure increase after switching off pairing shows that more matter entered Q. Evaluate the claim. [1]

Answer and work