Following a Labeled Hydrogen in a Transfer

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

A classroom acid–base display uses a water molecule containing one ordinary hydrogen atom, H, and one deuterium atom, D. D is an isotope of hydrogen. In the model the water molecule can transfer either H^+ or D^+ to NH_3. The two electrons of the original oxygen–hydrogen bond stay with oxygen.

Ion detected after transfer	**Contains deuterium**
NH_3D^+	Yes
NH_4^+	No
OH^-	No
OD^-	Yes

1 Which positive product forms when D^+ transfers to NH_3?

(1) NH_3D^+

(2) NH_4^+

(3) OH^-

(4) OD^-

2 If an NH_4^+ ion forms from one of the labeled water molecules, which negative ion forms in the same event? Explain where D remains. [1]

Answer and work

In a test, 20 labeled water molecules each transfer one hydrogen ion to NH_3. The model counts 12 NH_3D^+ ions and 8 NH_4^+ ions. There are no other reactions.

3 Predict the counts of OH^- and OD^-. Explain how each one corresponds to a positive product. [1]

Answer and work

4 Explain why measuring the total positive and negative charges would not reveal which isotope moved in a particular event. [1]

Answer and work