Matching Two Hydrogen-Bond Contact Sites

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

A model of a removable molecular coating has two N–H groups on one connector. Their H atoms are 0.60 nm apart. A facing surface has two oxygen atoms that can accept hydrogen bonds. In this alignment model, one H can face one O. Both H atoms can face both O atoms at once when the O–O spacing differs from the H–H spacing by no more than 0.05 nm.

Surface	**Spacing between the two oxygen sites (nm)**
P	0.62
Q	0.90

1 Which surface can make two hydrogen-bond contacts at once in the stated alignment model?

(1) P only

(2) Q only

(3) Both surfaces

(4) Neither surface

2 Explain why the two surfaces give different predictions even though each has two oxygen acceptor sites. [1]

Answer and work

The exhibit adds a surface R with its two O sites exactly 0.60 nm apart. Its display can show the two N–H groups as a row facing the row of oxygen sites.

3 Draw the two N–H groups and the two O sites. Use dotted lines to show both allowed hydrogen-bond contacts in surface R. Keep the N–H bonds solid. [1]

Draw your model

4 A modified connector has the same outline, but one of its two N–H groups is replaced by a group that cannot donate a hydrogen bond. Evaluate the claim that it can still make both contacts with R. [1]

Answer and work