

Predicting molecular shape, bond angles and polarity

Chemistry grades 11-12 (A Level · IB · Class 11-12) · Test

Name: _____ Date: _____ Class: _____ Mark: ____ / 20

This test covers VSEPR shapes, bond angles, electronegativity and polarity. Answer every question, justify explanations with lone pairs or symmetry, and show any working. The total is 20 marks.

Level: Chemistry grades 11-12 (A Level · IB · Class 11-12) · **Curriculum:** IB S2.2

Time: 45 minutes · 8 questions · Total: 20 marks · Calculator allowed

Question 1 Shape of beryllium chloride (2 marks)

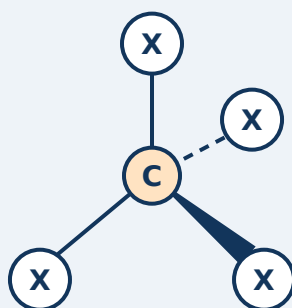
Gaseous BeCl_2 has two bonding pairs and no lone pairs on beryllium. Name its shape and state the Cl-Be-Cl angle. (2 marks)

Question 2 Water compared with methane (3 marks)

The H-O-H angle in water is 104.5° but the H-C-H angle in methane is 109.5° . Explain the difference. (3 marks)

Question 3 A non-polar molecule with polar bonds (3 marks)

The diagram shows CX_4 .



central atom C, four identical C-X bonds

A molecule CX_4 , where X is more electronegative than carbon.

Explain why CX_4 is non-polar although each C-X bond is polar. (3 marks)

Question 4 Bond polarity (2 marks)

Electronegativities: H 2.2, C 2.6, O 3.4, F 4.0. Calculate the difference for C-H, C-O and C-F and put the bonds in order of increasing polarity. (2 marks)

Question 5 Ammonium and ammonia (3 marks)

Compare the shape and bond angle of NH_4^+ with those of NH_3 . (3 marks)

Question 6 Sulfur dioxide polarity (2 marks)

Sulfur dioxide has a bent shape. State and explain whether it is polar. (2 marks)

Question 7 Hydrogen iodide (2 marks)

Electronegativities: H 2.2, I 2.7. State which atom carries δ^+ in H-I and give the difference in electronegativity. (2 marks)

Question 8 Boron trifluoride and ammonia (3 marks)

Both BF_3 and NH_3 contain three polar bonds. Explain why BF_3 is non-polar but NH_3 is polar. (3 marks)