

Heep Woh College
F.6 Reading Assignment 2

Mark:

/ 10

Group Name: _____ Class: 6 S

Group Member: 1. _____ () 2. _____ ()

3. _____ ()

02-I-4 [10 marks]

Read the passage below answer the questions that follow.

Parallels exist between main group chemistry and organic chemistry. One of the best known of these parallels is between benzene, C_6H_6 , and the isoelectronic borazine (the so-called "inorganic benzene"), $B_3N_3H_6$. All the B—N bond distances in the planar borazine ring are equal to 0.144 nm and the C—C bond distances in benzene are also 0.144 nm, indicating that the structure of borazine can be represented by a delocalized bonding scheme. Some of the similarities in physical properties between these two compounds are striking, as shown in the table below. However, their chemistry is different because of the difference in electronegativity between boron and nitrogen. For example, borazine reacts with hydrogen chloride gas whereas benzene does not.

Physical property	Benzene	Borazine
Melting point / K	279	216
Boiling point / K	353	338
Density / g cm ⁻³	0.81	0.81

Another interesting parallel between boron-nitrogen chemistry and carbon chemistry is exemplified by boron nitride, $(BN)_x$. Boron nitride can exist in a hexagonal form, similar to graphite. In graphite, the π -electrons are involved in an extended delocalized system and this gives rise to a high electrical conductivity. In hexagonal boron nitride, the structure is composed of layers of hexagonal B_3N_3 rings, which share common edges. Within a layer, the B—N distances are 0.145 nm, which is almost equal to the B—N distance in borazine. In hexagonal boron nitride, the layers lie directly over one another and are arranged so the boron and nitrogen atoms lie over each other. This contrasts with the staggered pattern found in graphite. In hexagonal boron nitride, the inter-layer separation is 0.330 nm. Unlike graphite, hexagonal boron nitride is a poor conductor of electricity.

Question:

- (a) What is the physical state of borazine at room temperature? [1]
- (b) Draw the structure of a molecule of borazine, and deduce whether or not borazine possesses a net dipole moment. [3]
- (c) (i) Suggest why borazine reacts with HCl while benzene does not.
- (ii) Borazine reacts with HCl to give an addition product with molecular formula $B_3N_3H_9Cl_3$. Draw the structure of a molecule of $B_3N_3H_9Cl_3$. [2]

- (d) Draw the three-dimensional structure of hexagonal boron nitride, indicating clearly the B—N distance within a layer and the distance between two layers. Label, on your diagram, the types of interactions present in the compound. [3]

- (e) Suggest why hexagonal boron nitride is a poor conductor of electricity. [1]

The End