COLOURED BORAX BEADS

Heat a small amount of borax in the eye of a platinum wire in the flame of a burner. After water stops evolving (how can this be established?), slightly cool the melt and wet it with a chromium(III) or cobalt(II) nitrate solution. Again heat the substance up to melting (in the flame of a burner). What colour does the substance acquire after cooling? Write the equation of the reaction. What does the colour of borax beads depend on?

SUPPLEMENTARY EXPERIMENTS AND SYNTHESES

1. Preparation of Boron Trichloride by Reacting Aluminium Trichloride with Boron Trifluoride. (*Perform the experiment in a fume cupboard!*) Assemble an apparatus as shown in Fig. 112.

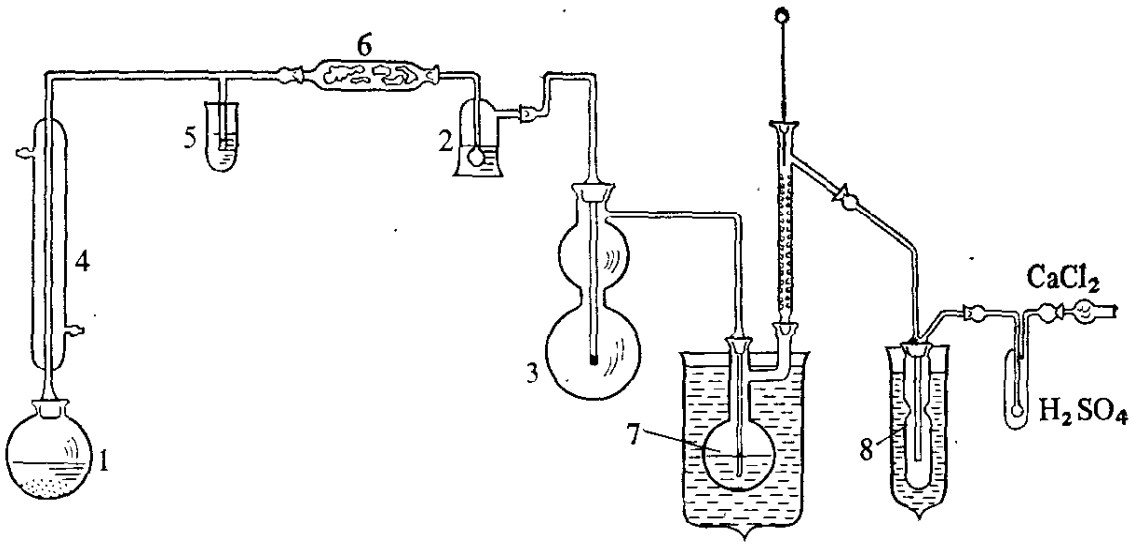

Fig. 112. Apparatus for preparing boron trichloride

Thoroughly dry all the parts of the apparatus. Put 80 g of sodium tetrafluoborate and 14 g of boric acid anhydride into 250-ml round-bottomed flask *1*; pour in a mixture of 60 ml of concentrated sulphuric acid and 20 ml of 20% oleum ($d^{20} = 1.90$). Pour concentrated sulphuric acid saturated with boric acid anhydride into wash bottle *2*, fill tube *6* with phosphoric anhydride applied onto glass wool, and pour glycerin into vessel *5* for functioning as a seal if the pressure in the apparatus rises. Spill 40 g of anhydrous aluminium trichloride into reaction vessel *3* through a funnel reaching the middle of the lower flask. Cool receiver *7* with a mixture of dry ice and ethanol and make sure that the receiver is completely submerged in the cooling mixture (see Fig. 112).

Heat flask *1* with the flame of a gas burner through an asbestos gauze and estimate the rate of gas evolution according to the number of bubbles in wash bottle *2*. When a uniform stream of gas is established, carefully (*wear eye protection!*) heat the bottom part of vessel *3* with the open flame of a burner. Do not let the products clog the gas-discharge tube. The amount of the aluminium chloride condensing in the upper part of the apparatus should be insignificant.

When 10-15 ml of boron trichloride gather in receiver *7* (in about one hour), disconnect vessel *3* and rapidly close the receiver with a stopper. Stop cooling the receiver and distil the boron trichloride

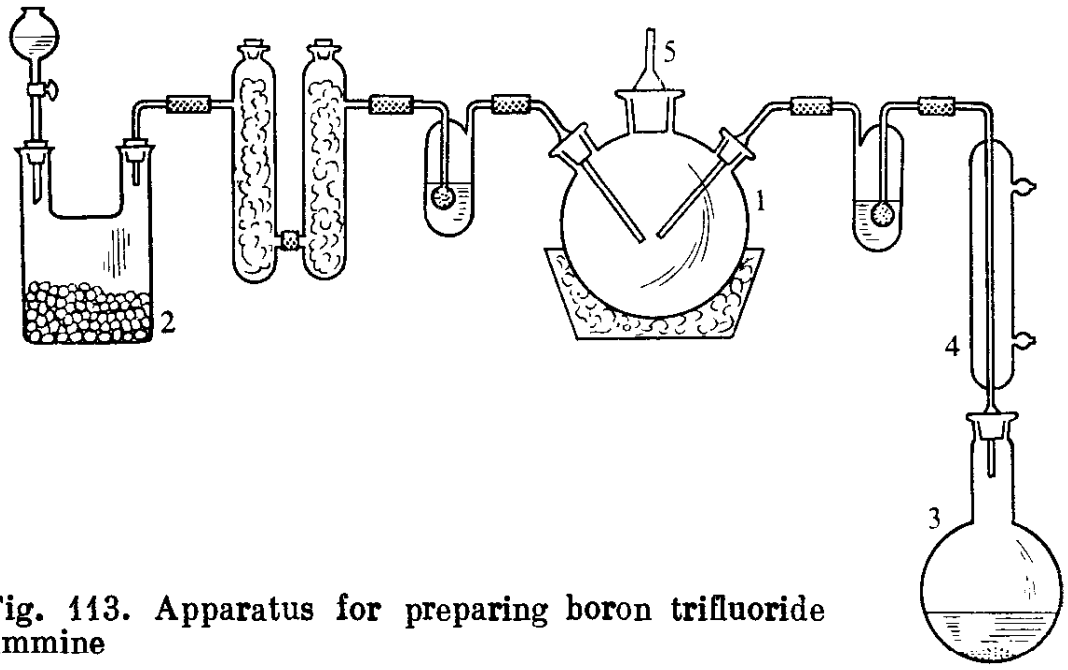

Fig. 113. Apparatus for preparing boron trifluoride ammine

into ampoule *8* cooled with a mixture of dry ice and acetone by heating flask *7* with your hand. When the ampoule is half filled, disconnect it and replace it with a new one. Close the half-filled ampoule with a stopper and immerse it into liquid nitrogen, and after some time rapidly seal it on a brazing burner (*wear eye protection!*).

2. Preparation of Boron Tribromide. (*Perform the experiment in a fume cupboard!*) Assemble a part of the apparatus shown in Fig. 112 beginning from vessel *3* without a gas-discharge tube. Put 54 g of aluminium tribromide and 13 g of potassium tetrafluoborate into reaction vessel *3* and close it. Carefully heat the vessel with the flame of a burner. Prepare and purify the boron tribromide in the same way as boron trichloride.

3. Preparation of Boron Trifluoride Ammine. Assemble an apparatus as shown in Fig. 113. Place flask *1* into a bath with ice. To produce ammonia, spill solid granulated sodium or potassium hydroxide into bottle *2*. Pour a concentrated ammonia solution into the dropping funnel.