2.1	***2.2***	***2.3***	***Total***
5	5	5	15

Red Ruby (not really) *(CODS-CT Topic Test 2 #2)*

Mineral **X** (see right) has a gorgeous red color, and contains a transition metal commonly used to produce sulfuric acid on the industrial scale. A sample of the mineral is analyzed as follows:

1. First, the sample is boiled in nitric acid. Upon cooling, a white precipitate forms. The solution is filtered, and the filtrate is reserved for later.

2. The precipitate is found to weigh 1.395 g. It is added to 75 ml of water. When the water is heated, the precipitate dissolves. Upon the addition of excess silver nitrate, a precipitate again forms, which is found to weight 1.438 g.

3. The filtrate from before has a yellow color. When the solution is shaken with zinc mercury amalgam, step wise color changes are observed as follows (see right). Bubbling oxygen through the solution results in a color change back to yellow.

Yellow → Blue → Green → Violet

2.1 What ions are responsible for the 4 colors observed in part 3?
2.2 What is the identity of the precipitate in part 2?
2.3 It is known that mineral **X** has formula $A_x(BC_y)_zD$, where A, B, C, and D are distinct elements and *x, y, z* are integers. What is the formula of mineral **X**?

Proposed by Anugrah C.