2016, 3

Points 1, 2, 2, 2, 2, 1

(a) 127.570 – 126.549 = mass of I_2 reacted = 1.021 g

Moles of $I_2 = \frac{1.021}{(126.90)(2)} = 0.004023$ moles of I_2

(b) Moles of MI_2 = moles of I_2 = 0.004023 moles

Molar Mass of $MI_2 = \frac{1.284}{0.004023} = 319.2\ \text{gmol}^{-1}$

Molar Mass of M = 319.2 – 253.8 = 65.4 gmol^{-1}

(c) Melt some MI_2 to create a molten sample, and compare the conductivity of the solid and the molten samples. If the molten sample is a good conductor of electricity, and the solid a poor one, then that would suggest an ionic compound. (Other answers possible).

(d) In each case London dispersion forces are the relevant intermolecular force. LDF's increase with surface area, number of electrons, and the polarizability of the molecule increases accordingly. Since I_2 is a larger molecule than Br_2, the IMF's (LDF's) are stronger between I_2 molecules, hence the energy needed to break these forces is greater, and I_2 has a higher melting point making it a solid at room temperature and bromine a liquid.

(e) $Na_2S_2O_3$

The REDOX reaction that must take place involves the I_2 being converted to I^-, i.e., the second half-reaction going forward. In order for that reduction to be paired with a suitable oxidation, the other reactions would need to be reversed. The only reaction that would achieve a positive voltage, i.e., one that is thermodynamically favored, would be the one achieved by reversing the first half-reaction and adding it to the second half-reaction.

E° = 0.54 – 0.08 = +0.46 V

(f) $2S_2O_3^{2-}{}_{(aq)} + I_{2(s)} \rightarrow 2I^-{}_{(aq)} + S_4O_6^{2-}{}_{(aq)}$