GLY 4200C HW1 Answers
Fall 2019

1. The mineral hessite (Ag_2Te) has an isometric unit cell whose dimension is 0.6572 nm above 149.5°C. Isometric means that all three unit cell dimensions are identical. Z = 4. What is the calculated value of the density? Express your answer in grams per cubic centimeter, then convert the answer to kilograms per cubic meter.(5 points)

$$D = \frac{Z \bullet M}{N \bullet V} \qquad M = 2 \bullet 107.868 + 127.60 = 343.34 \frac{g}{mol}$$

$$V = a^3 = (0.6572nm)^3 = (0.6572 \bullet 10^{-7} cm)^3 = 2.839 \bullet 10^{-22} \frac{cm^3}{mol}$$

$$D = \frac{4(343.43)}{(6.023 \bullet 10^{23})(2.839 \bullet 10^{-22})} = \frac{1373.72}{170.993} = 8.034 \frac{g}{cm^3}$$

1 gram/cubic centimeter = 1 000 kilogram/cubic meter, so:

$$8.034 \frac{g}{cm^3} = 8.034 \times 10^3 \frac{kg}{m^3}$$

2. The mineral bismuthinite, Bi_2S_3, is orthorhombic, with unit cell dimensions:

a = 11.13 Å, b = 11.27 Å, c = 3.97 Å Z = 4

What is the calculated value of the density, expressed in a) grams per cubic centimeter and b) kilograms per cubic meter? (5 points)

$$M = (2(208.9804) + 3(32.064) = 514.153 \frac{g}{mol}$$

$$V = a \bullet b \bullet c = (11.13 \bullet 10^{-8})(11.27 \bullet 10^{-8})(3.97 \bullet 10^{-8}) = 4.980 \bullet 10^{-22} \frac{cm^3}{mol}$$

$$D = \frac{4(514.153)}{(6.023 \bullet 10^{23})(4.980 \bullet 10^{-22})} = \frac{2056.6}{299.95} = 6.86 \frac{g}{cm^3}$$

$$6.86 \frac{g}{cm^3} \bullet \frac{10^6\ cm^3}{m^3} \bullet \frac{kg}{1000\,g} = 6.86 \times 10^3 \frac{kg}{m^3}$$

3. The mineral nadorite, $PbSbO_2Cl$, has a density of 7,024 kg/m^3. Express this density in g/cm^3. (2 points)

$$7024 \frac{kg}{m^3} \bullet \frac{m^3}{10^6\ cm^3} \bullet \frac{1000\,g}{kg} = 7.024 \frac{g}{cm^3}$$

4. A sample of claudetite, As_2O_3, has a weight in air of 11.72 grams. The same sample has a weight in water of 8.90 grams. What is G? (2 points)

$$G = \frac{W_A}{W_A - W_W} = \frac{11.72}{11.72 - 8.90} = \frac{11.72}{2.82} = 4.16$$

5. A sample of strengite, $Fe(PO_4)_2.2\ H_2O$, is weighed in air. The weight is 18.53 grams. The weight of the same sample in water is 12.07 grams. What is G? (2 points)

$$G = \frac{18.53}{18.53 - 12.07} = \frac{18.53}{6.460} = 2.868$$

4 points for correct number of significant figures throughout paper

Total Possible - 20 points