

Question 3: Long Answer

10 points

(a) For the correct answer: 1 point



(b)(i) For a valid explanation: 1 point

Silver and copper have similar radii, so the alloy would be substitutional versus interstitial.

(ii) For a valid explanation: 1 point

Silver has more occupied electron shells ($n = 5$) than copper ($n = 4$); the electrons in the fifth shell experience weaker Coulombic attractions and are farther away from the nucleus.

Total for part (b) 2 points

(c) For the correct calculated mass of Ag_2S (may be implicit): 1 point

$$409.21 \text{ g} - 398.94 \text{ g} = 10.27 \text{ g}$$

For the correct calculated moles of Ag: 1 point

$$10.27 \text{ g} \times \frac{1 \text{ mol Ag}_2\text{S}}{247.80 \text{ g Ag}_2\text{S}} \times \frac{2 \text{ mol Ag}}{1 \text{ mol Ag}_2\text{S}} = 0.08289 \text{ mol Ag}$$

Total for part (c) 2 points

(d)(i) For the correct balanced equation (state symbols not required): 1 point



(ii) For the correct calculated value, consistent with part (d)(i): 1 point

$$E_{\text{cell}}^{\circ} = +0.80 \text{ V} - 1.23 \text{ V} = -0.43 \text{ V}$$

(iii) For a correct explanation, consistent with part (d)(ii): 1 point

E_{cell}° is negative, which means the reaction is not thermodynamically favorable.

Total for part (d) 3 points

(e) For the correct calculated value of moles of electrons (may be implicit): 1 point

$$2.8 \text{ g Rh} \times \frac{1 \text{ mol Rh}}{102.9 \text{ g Rh}} \times \frac{3 \text{ mol } e^{-}}{1 \text{ mol Rh}} = 0.082 \text{ mol } e^{-}$$

For the correct calculated value of time: 1 point

$$0.082 \text{ mol } e^{-} \times \frac{96,485 \text{ C}}{1 \text{ mol } e^{-}} \times \frac{1 \text{ second}}{2.0 \text{ C}} = 3900 \text{ seconds}$$

Total for part (e) 2 points