

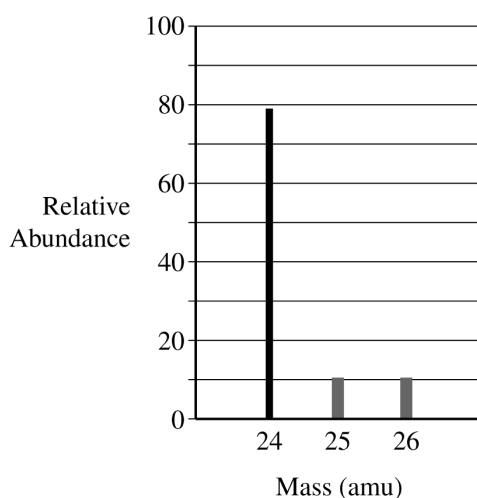
Question 1: Long Answer

10 points

A (i) For the correct plotted lines:

Point 01

The abundance for the two lines should be between 10 and 11.



(ii) For the correct answer:

Point 02

Magnesium-26 has one more neutron than magnesium-25 does.

B (i) For a correct explanation:

Point 03

The charge on the sodium ion is less than the charge on the magnesium ion. A smaller charge results in a weaker Coulombic attraction between Na^+ and water.

(ii) For a correct explanation:

Point 04

The Na^+ ion is larger than the Mg^{2+} ion, so the distance between the Na^+ and the oxygen on the water molecule will be greater. As distance increases, Coulombic attraction decreases.

C For the correct calculated value:

Point 05

$$\text{pOH} = -\log(2.80 \times 10^{-4}) = 3.553$$

$$\text{pH} = 14 - \text{pOH} = 14 - 3.553 = 10.447$$

D For the correct calculated value:

Point 06

$$M_1V_1 = M_2V_2$$

$$M_2 = \frac{(1.85 \times 10^{-3} M)(0.03500 \text{ L})}{(0.03500 \text{ L} + 0.05000 \text{ L})} = 7.62 \times 10^{-4} M$$

E	(i) For the correct expression: $K_{sp} = [\text{Mg}^{2+}][\text{OH}^-]^2$	Point 07
	(ii) For the correct calculated value, consistent with part D and part E (i): $Q = [\text{Mg}^{2+}][\text{OH}^-]^2 = (7.62 \times 10^{-4})(1.65 \times 10^{-4})^2 = 2.07 \times 10^{-11}$	Point 08
	(iii) For the correct prediction and justification, consistent with part E (ii). Examples of acceptable responses may include the following: • $Q > K_{sp}$, so a precipitate will form. • The concentration of the ions in solution (represented by Q) is greater than that of a saturated solution, so a precipitate will form.	Point 09
F	For the correct answer and justification: <i>Decrease. The H^+ from $\text{HNO}_3(\text{aq})$ will react with OH^-, decreasing $[\text{OH}^-]$ and causing $Q < K_{sp}$. As a result, more $\text{Mg}(\text{OH})_2(\text{s})$ will dissolve until equilibrium is reestablished, resulting in less $\text{Mg}(\text{OH})_2(\text{s})$.</i>	Point 10