

Chemistry 12
Resource Exam B
Scoring Guide

1. (4 marks)

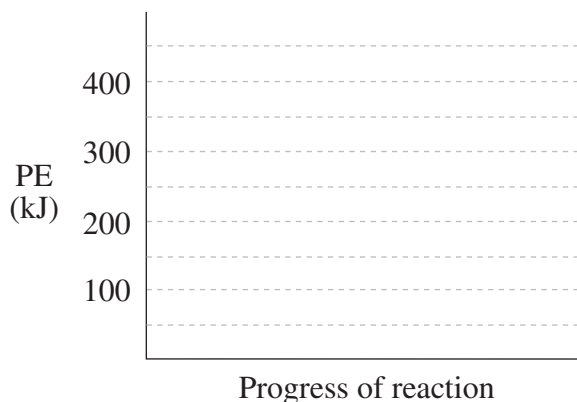
Consider the following values for a catalyzed reaction that goes to completion:

$$\text{PE}(\text{products}) = 250 \text{ kJ}$$

$$E_a = 175 \text{ kJ}$$

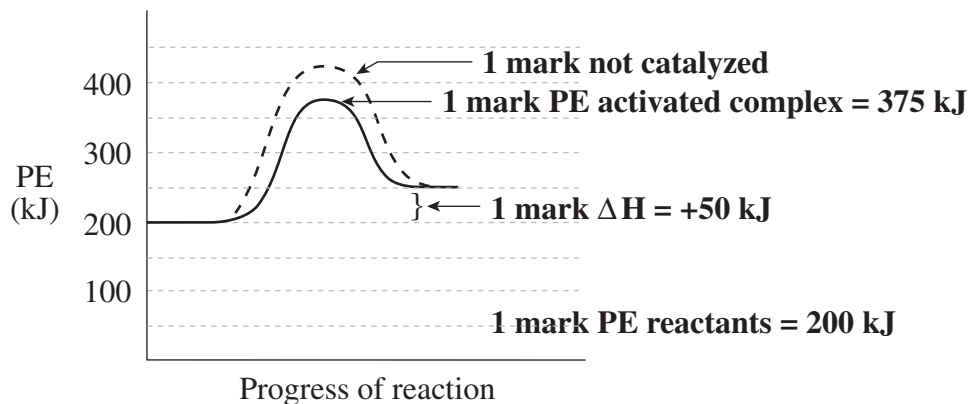
$$\Delta H = +50 \text{ kJ}$$

Sketch a PE diagram for this reaction on the grid provided, then use a dotted line to show how removing the catalyst would change the PE diagram.



Solution:

For Example:

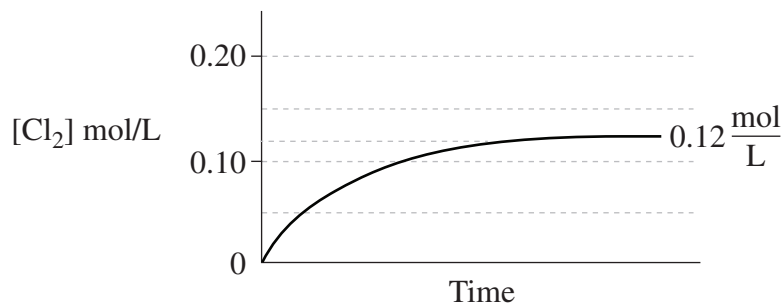


2. (4 marks)

Consider the following equilibrium:



A student added 2.40 mol CCl_4 to a 2.00 L flask and monitored the $[\text{Cl}_2]$. The following graph was produced.



Calculate the value of K_{eq} .

Solution:

For Example:

	$\text{CCl}_4(\text{g}) \rightleftharpoons \text{C}(\text{s}) + 2\text{Cl}_2(\text{g})$	} ← 2 marks
I	1.20 mol/L 0 0	
C	-0.06 +0.12	
E	1.14 0.12	

$$\begin{aligned}
 K_{eq} &= \frac{[\text{Cl}_2]^2}{[\text{CCl}_4]} && \left. \begin{array}{l} \\ \\ \end{array} \right\} \leftarrow 1 \text{ mark} \\
 &= \frac{(0.12)^2}{1.14} \\
 &= 0.013 && \leftarrow 1 \text{ mark}
 \end{aligned}$$

3. (4 marks)

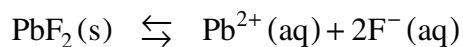
A 0.15 g sample of solid PbF_2 is recovered from 300.0 mL of its saturated solution.
What is the K_{sp} of PbF_2 ?

Solution:

For Example:

$$\text{moles PbF}_2 = 0.15 \text{ g} \times \frac{1 \text{ mol}}{245.2 \text{ g}} = 6.12 \times 10^{-4} \text{ mol}$$

$$[\text{PbF}_2] = 6.12 \times 10^{-4} \text{ mol} \times \frac{1}{0.300 \text{ L}} = 2.04 \times 10^{-3} \text{ M} \quad \leftarrow \text{1 mark}$$



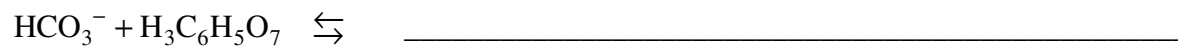
$$[\text{Pb}^{2+}] = 2.04 \times 10^{-3} \text{ M} \times \frac{1}{1} = 2.04 \times 10^{-3} \text{ M}$$

$$[\text{F}^{-}] = 2.04 \times 10^{-3} \text{ M} \times \frac{2}{1} = 4.08 \times 10^{-3} \text{ M} \quad \leftarrow \text{2 marks}$$

$$\begin{aligned} K_{sp} &= [\text{Pb}^{2+}][\text{F}^{-}]^2 \\ &= (2.04 \times 10^{-3})(4.08 \times 10^{-3})^2 \\ &= 3.4 \times 10^{-8} \quad \leftarrow \text{1 mark} \end{aligned}$$

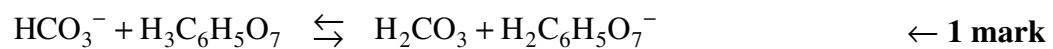
4. (3 marks)

Complete the Brønsted–Lowry acid base equation below and predict whether reactants or products will be favoured at equilibrium, and justify your answer.



Solution:

For Example:



Since $K_a(\text{H}_3\text{C}_6\text{H}_5\text{O}_7) > K_a(\text{H}_2\text{CO}_3)$, products are favoured } $\leftarrow \text{2 marks}$

6. (3 marks)

The following two experiments were conducted:

- Titration A: a strong base was titrated with a strong acid.
- Titration B: a weak base was titrated with a strong acid.

How does the pH at the equivalence point of Titration B compare with the pH at the equivalence point of Titration A? Explain.

Solution:*For Example:*

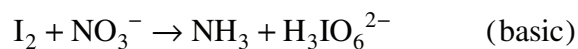
The pH at the equivalence point of Titration B is lower than that of Titration A. ← **1 mark**

In Titration A, a neutral salt is formed ($\text{pH} = 7$). ← **1 mark**

In Titration B, an acidic salt is formed ($\text{pH} < 7$). ← **1 mark**

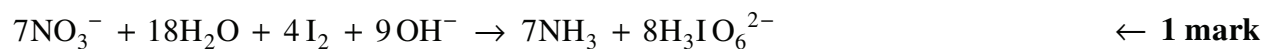
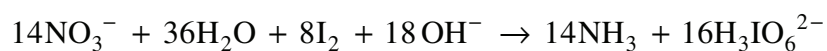
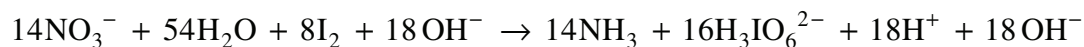
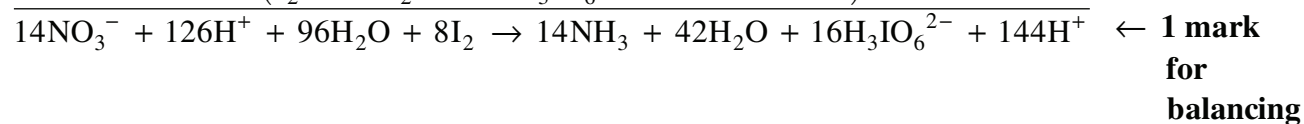
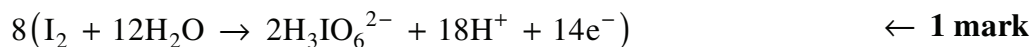
7. (4 marks)

Balance the following in basic solution:



Solution:

For Example:



8. (3 marks)

Draw and label the parts of an electrolytic cell capable of copper plating an inert carbon electrode.

Solution:

For Example:

