

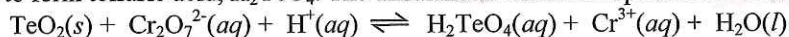
AP Chemistry Exam

Part II: Essays. Show ALL work below. Work should be done in a clear and orderly fashion. Label and draw a border around each answer.

4 Essays – 40 minutes Calculator Allowed.

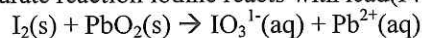
Essay #1

A sample of ore containing the mineral tellurite, TeO_2 , was dissolved in acid. The resulting solution was then reacted with a solution of $\text{K}_2\text{Cr}_2\text{O}_7$ to form telluric acid, H_2TeO_4 . The unbalanced chemical equation for the reaction is given below.



- (a) Identify the molecule or ion that is being oxidized in the reaction.
 (b) Give the oxidation number of Cr in the $\text{Cr}_2\text{O}_7^{2-}(aq)$ ion.
 (c) Give the oxidation number of Te in the $\text{H}_2\text{TeO}_4(aq)$ ion.
 (d) Balance the chemical equation given above.

In a separate reaction iodine reacts with lead(IV) oxide in an acidic environment.

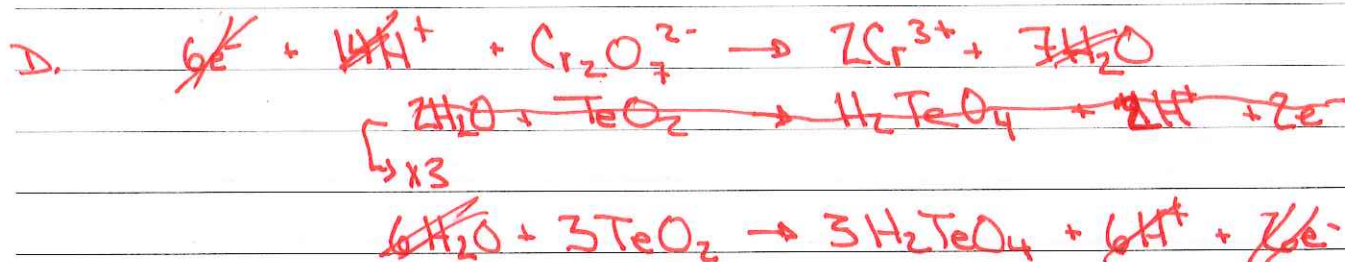


- (e) Identify the molecule or ion that is the oxidizing agent the reaction.
 (f) Balance the chemical equation given above.

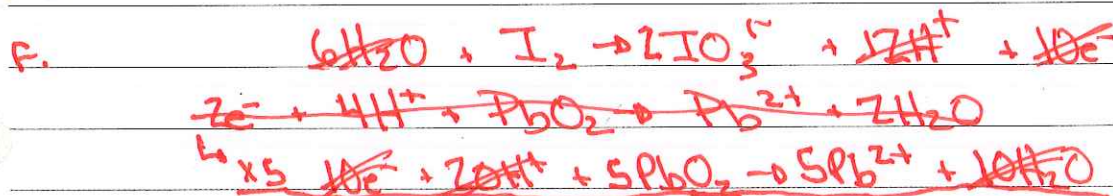
A. TeO_2

B. +6

C. +6



E. PbO_2



Essay #2

Suppose that a stable element, atomic number 120, symbol St (sartepium), is discovered.

- (a) Would St be a metal or a non-metal? Explain/justify your answer.
- (b) What would be the most likely charge of the St ion in stable ionic compounds?
- (c) An isotope of St has a mass number of 293. How many neutrons does it have?
- (d) Write the formula for the compound formed between St and the oxalate ion.
- (e) Using your solubility rules, would sartepium oxalate be soluble in water? Explain your reasoning.

A. It would be an alkaline-earth metal

B. $2+$

C. 173

D. ~~StO₂~~ StC_2O_4

E. It would be insoluble

Essay #3:

In a chemical reaction 35.0 mL of 0.40 M lead(II) nitrate is added to 25.0 mL of 0.80 M sodium carbonate.

(a) Write the complete balanced chemical equation for the reaction.

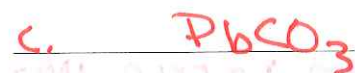
(b) Write the net-ionic equation for the reaction.

(c) What is the formula of the precipitate?

(d) What substance is the limiting reagent?

(e) What mass of precipitate formed?

(f) Determine the concentration of each ion remaining in solution.

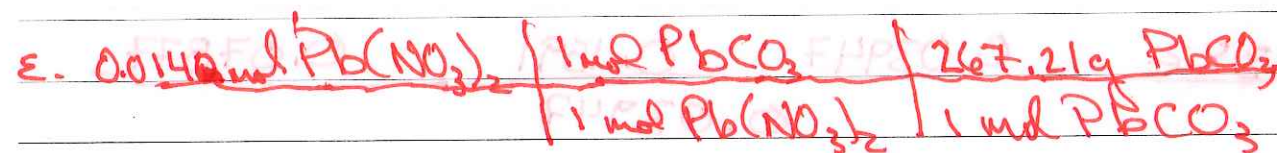


D. $0.40 = \frac{x}{35}$ $0.80 = \frac{x}{25}$

14 mmol

20 mmol

$\text{Pb}(\text{NO}_3)_2$ is the limiting reagent



3.74 g PbCO_3

F. Na^+ : ~~20 mmol~~ $20 \times 2 = 40 \div 60 = 0.667 \text{ M}$

NO_3^- : $14 \times 2 = 28 \div 60 = 0.467 \text{ M}$

CO_3^{2-} : $\frac{14 \text{ mmol Pb}(\text{NO}_3)_2}{1 \text{ mmol Pb}(\text{NO}_3)_2} \times 1 \text{ mmol Na}_2\text{CO}_3 = 14 \text{ mmol}$
 $20 - 14 = 6 \text{ mmol} \div 60 = 0.100 \text{ M}$

Essay #4:

Answer the following questions that relate to the analysis of chemical compounds.

(a) A compound containing the elements C, H, N, and O is analyzed. When a 3.5560 g sample is burned in excess oxygen, 6.0838 g of $\text{CO}_2(\text{g})$ is formed.

(i) Determine the mass, in grams, of C in the 3.5560 g sample of the compound.

(ii) When the compound is analyzed for O content only, the mass percent of O is found to be 17.76 percent. Determine the mass, in grams, of O in the original 3.5560 g sample of the compound.

(iii) The combustion analysis showed that 1.4338 grams of water was produced. Calculate the percent of hydrogen in the compound.

(iv) Determine the mass, in grams, of N in the original 3.5560 g sample of the compound.

(v) Determine the empirical formula of the compound.

$$\text{C: } 6.0838 \left(\frac{12.01}{44.01} \right) = 1.6602 \text{ g C}$$

$$\text{O: } 0.1776 (3.5560) = 0.6315 \text{ g O}$$

$$\text{H: } 1.4338 \left(\frac{2.02}{18.02} \right) = 0.1607 \text{ g H} \quad 0.1607 \div 3.5560 \times 100 = 4.52\%$$

$$\text{N: } 3.5560 - 1.6602 - 0.6315 - 0.1607 = 1.1036$$

C	O	H	N
$\frac{1.6602}{12.01}$	$\frac{0.6315}{16.00}$	$\frac{0.1607}{1.01}$	$\frac{1.1036}{14.01}$

$$\frac{0.1382}{0.03947} \quad \frac{0.03947}{0.03947} \quad \frac{0.1591}{0.03947} \quad \frac{0.07877}{0.03947}$$

3.505

1

4

2

x2

7

2

8

4

