

Name: _____

Period: _____

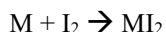
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Directions:

This is a practice FRQ. During the year you will have required FRQs that are graded as quizzes/tests. This is intended to help you learn how to answer FRQs. We will have lots of practice during the year, but it is a good idea to start now! You are NOT trying to answer the questions right now. You are simply trying to train your brain to process mixed topic questions by pausing to identify the relevant topics/equations/facts for each part of the question, as well as trying to practice keeping your brain alert for common mistakes and “gotcha” type questions that College Board loves to put on the real AP Chemistry Exam.

1. Read all parts of the FRQ first. Resist the temptation to start working!
2. Fill out as much of the chart as you can by yourself first.
3. Work with a partner to check your thoughts, fill in missing parts, etc.

To determine the molar mass of an unknown metal, M, a student reacts iodine with an excess of the metal to form water-soluble compound MI₂, as represented by the equation below.



The reaction proceeds until all the I₂ is consumed. The MI₂(aq) solution is quantitatively collected and heated to remove the water, and the product is dried and weighed to a constant mass. The student obtains the following data:

Data for Unknown Metal Lab	
Mass of beaker	125.457 g
Mass of beaker + metal M	126.549 g
Mass of beaker + metal M + I ₂	127.570 g
Mass of MI ₂ , first weighing	1.284 g
Mass of MI ₂ , second weighing	1.284 g

TOPIC(S)	EQUATIONS / KEY KNOWLEDGE/SKILLS	WARMINGS / TIPS
(a) Based on the reaction given, what charge does the unknown metal M have in the MI ₂ product?		
(b) Given that the metal M is in excess, calculate the number of moles of I ₂ that reacted.		
(c) Calculate the molar mass of the unknown metal.		

TOPIC(S)	EQUATIONS / KEY KNOWLEDGE/SKILLS	WARMINGS / TIPS
(d) Using your answer to part A and part C, identify a metal from the periodic table that would be a possible identity of the unknown metal M.		
(e) The student hypothesizes that the compound formed in the synthesis of reaction is ionic. Propose an experimental test the student could perform that could be used to support the hypothesis. Explain how the results of the test would support the hypothesis if the substance was ionic.		
(f) The student hypothesizes that Br_2 will react with metal M more vigorously than I_2 did because Br_2 is a liquid at room temperature. Explain why I_2 is a solid at room temperature whereas Br_2 is a liquid. Your explanation should clearly reference the types and relative strengths of the intermolecular forces present in each substance.		
(g) The student noticed and made an observation in their lab notebook that the metal used in the experiment appeared to have a metal oxide layer formed on the outside of the metal chunks. This sometimes occurs when metals are exposed to the air for periods of time. Would this metal oxide layer result in a higher, lower, or the same calculated molar mass for the unknown metal M? Justify your reasoning.		

Do not attempt to solve the FRQ on the next page until you have done this page with good effort and thought! Trust the process that I am trying to structure for you – I have been doing this for a long time...I have found a lot of things that help set students up for success, and this exercise is one of them!

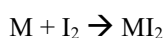


Directions: NOW you are trying to solve it! Set a timer and record how long it takes you. The most common issue during the year will be people not finishing on time. College Board timing is FAST...it never feels like enough!

Remember...if your brain is frozen, think about:

1. Questions are not always in order of difficulty! Questions at the end may be easier “stand alone” questions you could answer even if you were stuck on earlier parts! So, remember to read all parts of the FRQ first, and put marks next to ones you know how to solve already and could do quickly!
 2. Do as much of a problem as you can, you never know which baby steps along the way might be worth points! BUT do NOT allow yourself to get stuck on one question. MOVE ON if you need to! Come back later, sometimes things “click” part way through an FRQ!
 3. **Answer the actual question(s) being asked!** Mark up the questions, don’t ramble etc.
 4. Identifying the topics/equations/knowledge/skills needed for each part can help you recall information and “muscle memory” for the steps.
 5. Units are your friend! If you’re stuck, write the units out and figure out how to get each part.
 6. Remember the skills that never go away – dimensional analysis, unit conversion, etc.
 7. Remember the “Thou Shalt Not Forget” facts – often those are the common mistakes, or things that can help trigger your memory, or help get you partial credit. Some points are better than none!
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To determine the molar mass of an unknown metal, M, a student reacts iodine with an excess of the metal to form water-soluble compound MI_2 , as represented by the equation below.



The reaction proceeds until all the I_2 is consumed. The $MI_2(aq)$ solution is quantitatively collected and heated to remove the water, and the product is dried and weighed to a constant mass. The student obtains the following data:

Data for Unknown Metal Lab	
Mass of beaker	125.457 g
Mass of beaker + metal M	126.549 g
Mass of beaker + metal M + I_2	127.570 g
Mass of MI_2 , first weighing	1.284 g
Mass of MI_2 , second weighing	1.284 g

(a) Based on the reaction given, what charge does the unknown metal M have in the MI_2 product?

(b) Given that the metal M is in excess, calculate the number of moles of I_2 that reacted.

(c) Calculate the molar mass of the unknown metal.

(d) Using your answer to part A and part C, identify a metal from the periodic table that would be a possible identity of the unknown metal M.

- (e) The student hypothesizes that the compound formed in the synthesis of reaction is ionic. Propose an experimental test the student could perform that could be used to support the hypothesis. Explain how the results of the test would support the hypothesis if the substance was ionic.
- (f) The student hypothesizes that Br_2 will react with metal M more vigorously than I_2 did because Br_2 is a liquid at room temperature. Explain why I_2 is a solid at room temperature whereas Br_2 is a liquid. Your explanation should clearly reference the types and relative strengths of the intermolecular forces present in each substance.
- (g) The student noticed and made an observation in their lab notebook that the metal used in the experiment appeared to have a metal oxide layer formed on the outside of the metal chunks. This sometimes occurs when metals are exposed to the air for periods of time. Would this metal oxide layer result in a higher, lower, or the same calculated molar mass for the unknown metal M? Justify your reasoning.

NOW...

Check your answers to both the topic/knowledge/warnings section and the actual FRQ answers. Make sure you check both, not just your FRQ answers! You want to see if you noticed the same things I did on the first part of this activity!



<https://tinyurl.com/p97hba2y>