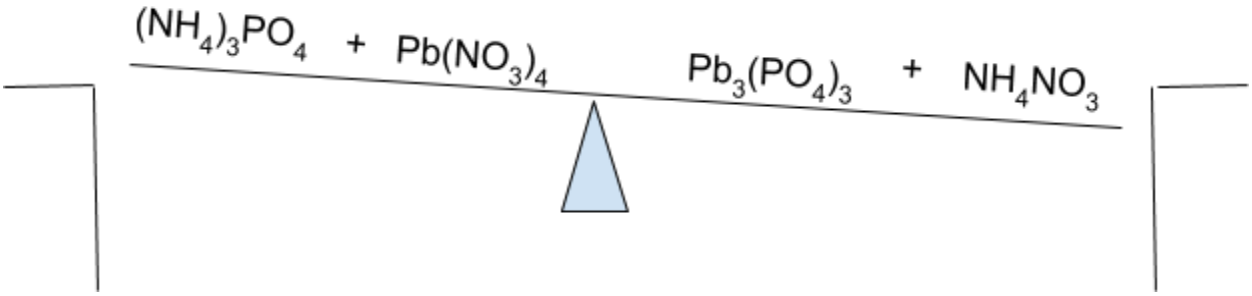
Spring Final Document, Chemistry

PROMPT:

You are invited to a special Mansion that has several “rooms” you must navigate in order to get the main court. The owner states that if any of your group makes it through to the courtyard, a wonderful treasure awaits you that would set you for life. Invited with you are eight other guests: Mr. Aalto, Mr. Campbell, Mrs. Fender, Mr. Johnson, Ms. Le, Mr. Marzoff, Mr. Polanco and Mr. Turmon. The owner also states that if a guest does not make it through, the remaining guests share the treasure equally.

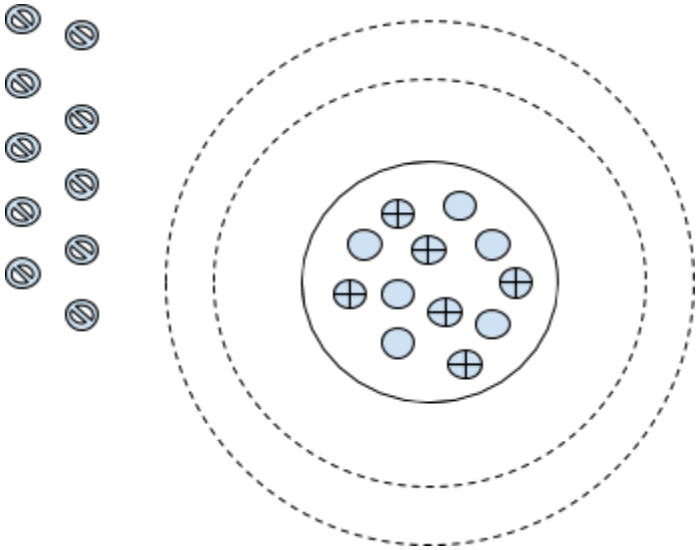
ONE:
The area looks more like a moat than anything. There seems to be a bridge-like thing that would allow you to safely cross the moat. Your group walks up to the bridge and notices some blocks with writing on them. The bridge seems to tilt on a pivot in the middle, kind of like a “teeter totter.” It looks like this:



Mr. Polanco is really excited about getting this treasure hunt started, so he quickly tries to cross the bridge. As soon as he steps on the bridge, it teeters, and Mr. Polanco slips off and falls into the moat. Everything seems fine until you see electric eels that attack him and shock him to his demise. You realize you must “balance” the bridge before you can safely cross. Correctly balance this chemical equation and write it down below.

TWO:

After crossing the bridge your group (minus Mr. Polanco) walks into a large room with lighted lines all over the floor. The lines have little sockets in them to plug something in. In the middle of the room is an area that has different glowing lights. You notice two different types: some that are marked with a plus and some not marked at all. Off to the side are spheres that are not lit up but have a minus marking on them. There is a staircase to a door with a large button near it. Ms. Le sees the stairs and runs up them to push the button. “I bet we push the button and the door opens up.” She pushes the button. The room lights flicker and then go dark for a few seconds. There is a loud scream. When the lights return, Ms. Le is gone. Just her shoes remain where she once stood. You go up to the stairs and look down. The floor looks like this:

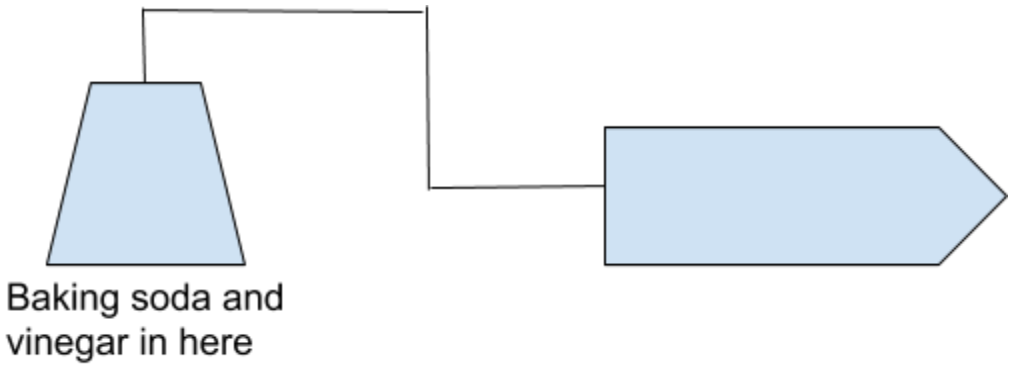


You realize the floor represents the BOHR model of an element on the periodic table. It obviously is not complete yet. You need to correctly draw the model for this element with all the parts in the appropriate places before you can push the button and release the door. Draw the correct model below and correctly identify which element is being shown.

THREE:

Your group (now minus two people) climb the stairs and successfully enter another room. To your surprise there is a large pond that crosses the room so you can't get to the other side. In the distance you see another opening, but it seems the only way to get there is by crossing the water. Off to the side you notice two large inflatable boats with motors. Mrs. Fender exclames, "Meet you guys on the other side." She quickly takes one of the boats thinking she can get a head start and keep all the treasure for herself. She gets part way across the pond when suddenly the motor stops. Mrs. Fender shrugs her shoulders and puts her hands up as if to say "Oh Well" when suddenly the boat shakes. In an instant there are three electronic sharks that attack the boat. The boat submerges and you can hear Mrs. Fender screams, then there is an eerie silence. You look at the second boat more closely and written on the boat is the following: Must have exactly 50.0 grams of gas inside to keep the motor running smoothly. You notice a gauge that reads the amount of CO_2 gas in the boat. It shows 42 grams. "HOW DO WE GET MORE CO_2 IN THE BOAT?!"

There is a contraption that is nearby that seems to be able to help inflate the boat. There is a container with a line that extends to the boat. It seems to be able to connect to the boat. It looks like this:



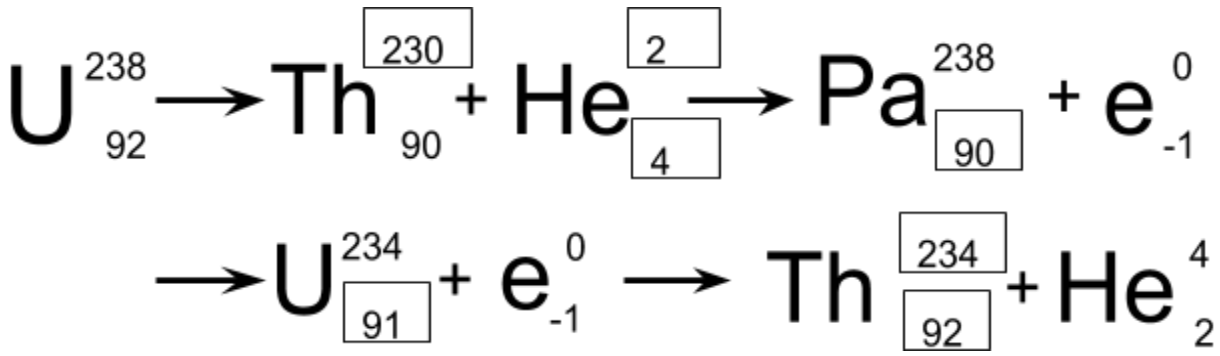
Near the container is a bottle of Vinegar (CH_3COOH) and a box of baking soda ($NaHCO_3$). Mr. Turmon remembers that baking soda and vinegar create carbon dioxide. He scribbles down an equation:

$$CH_3COOH + NaHCO_3 \rightarrow CO_2 + Na^+ + CH_3COO^-$$

Mr. Turmon pours all the vinegar into the chamber so there is plenty of that. It is up to you to figure out how many grams of baking soda needed to make the 8.0 grams of carbon dioxide needed for the boat. Show your calculation.

FOUR:

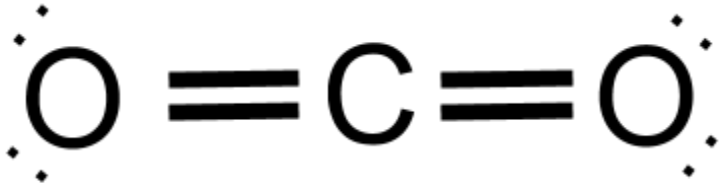
Your group makes it across the pond in the second boat. Now you are three people short in your group. Your group enters this larger area that has a special looking wall to the opposite side. To the left side of the wall is a door with a button. The wall looks like this:



Mr. Marzolf notices that the two Heliums do not match. He looks closer and sees that the outlined boxes are blocks that can be interchanged. He moves the 4 and the 2 around to look like the Helium that does not have boxes, figuring that is the problem and maybe we will be able to get through this room. He walks up to the door and pushes the button and says, “Look, I think I got it!” Nothing immediately happens, except you start to hear some noises like gears turning. Then out from the ceiling these panels open up. Laser Guns point straight at Mr. Marzolf and fire. He is vaporized in seconds. “Well, that must not have been all that was wrong,” exclaims Mr. Campbell. You are to rewrite the nuclear equations with the numbers in the correct places depending on what type of decay it is: alpha or beta.

FIVE:

After correctly replacing all the numbers and opening the door, the group (now you and four others) walk into a long corridor with large stones along the floor. It reminds you of the Indiana Jones movies where there must be some type of booby trap. Painted along the walls of the corridor is hundreds of the same drawing:



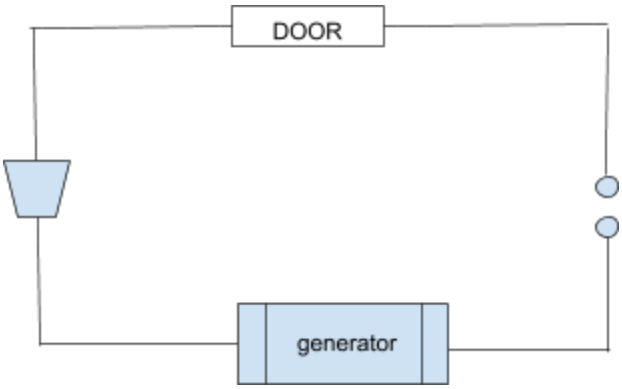
Mr. Campbell gets all excited because he thinks he's figured it out. "It's CARBON DIOXIDE. That must be the word you need to step on." Looking at the floor, you notice there are several letters that line the floor in a particular pattern. There happens to be a C on the front edge.

E	A	S	K	W	P	F	J
R	C	V	A	B	J	P	L
C	O	D	Y	L	I	U	N
G	A	R	B	S	E	X	T
H	B	M	Y	C	P	N	S

Mr. Campbell then steps on the C then the A. As he steps on the A he starts to say "I got it!," then all of a sudden the A falls out from under him. Mr. Campbell gasps and starts to fall. All you hear is him yelling "THAT'S NOT IT……" Obviously it's not carbon dioxide. But then you get to thinking. What about that drawing is so important? Mr. Turmon says "maybe it's the bond?" Then you get it. Spell out the APPROPRIATE WORD TO GET ACROSS. The letters all connect in some way to form the right word.

SIX:

It's now just you and three others: Mr. Turmon, Mr. Aalto, and Mr. Johnson. After safely getting across the corridor you find your group in a room with a bunch of electronic equipment and a door. "Oh no, not another door." The room is set up in this fashion:



You notice there are two pathways the generator can send electricity. It must be the way to open the door. One way has some type of container with water in it. The other is two metal prongs that look like handles. Mr. Aalto walks over to the prongs and looks at them. Curiously he touches one of the prongs. Nothing happens. Then he touches both prongs at the same time. Mr. Aalto starts to shake violently. You hear crackling noises like he is getting shocked. The door starts to open slowly. Before the door is open enough Mr. Aalto somehow gets loose from the handles, but not before he electrocuted. Mr. Aalto is unresponsive to any attempts to revive him. Your conclusion is not to use that way to open the door. Must be the other side of the room. In the container of water is two wires; one leads to the door, and the other to the generator. Near the container are two small vials labeled NaCl and $C_6H_{12}O_6$. Then it dawns on you. Water is not a very good conductor of electricity by itself, but if you introduced some ions into the liquid, they could help complete the circuit.

Which chemical do you place in the water? Why do you use that one and not the other? Explain thoroughly.

SEVEN:

Now just you, Mr. Turmon and Mr. Johnson remain. You go through the electric door and you find yourselves in a room made of large stone tiles. Across the room is a stone door. This door is cracked open slightly, but it seems to be a door that slides up and down. Mr. Turmon attempts to lift the door up. He starts to make some progress until he is using his whole body to hold the door. He tells you and Mr. Johnson to crawl under the opening he has made, and just before you get to him, you notice he is starting to strain under the weight of the door. You and Mr. Johnson take a step back to watch the door slide down and crush Mr. Turmon. You now wonder how to keep the door open long enough to crawl through the opening into the last room. You notice a large tire tube, the kind used to float on the river. There is also a pump in far corner. You think of an idea to prop the door up just enough to crawl under without the door crushing you. Explain your plan. Also explain the science behind how this works. Relate this to a laboratory exercise you have done in class this semester. Draw a diagram that shows how the tire works to open the door.

EIGHT:

After you and Mr. Johnson make it through the stone door, you enter a room with a pedestal in the middle of the room. The room is dimly lit except for the pedestal. A speaker must be in the room because you hear a voice saying, “congratulations, you have made it to the last room. This bag contains the necessary price to get you out of the room and into the treasure room.” You walk up towards the pedestal to notice a pressure plate with a bag of something in it. You notice that the bag is full of gold coins. It must be the price to get out of the game. Off to the side is a small table with a digital scale and several containers: NaCl, $NaHCO_3$, SiO_2, and Fe powder, and an empty bag. Printed on the bag of gold is the following: 1.25 mol Au. Mr. Johnson says to you he thinks he can switch it with one of the other substances, then the game is over. The scale measures grams, so he measures 69.8 g of Fe powder into the empty bag and tries to switch the bags. At first nothing happens and Mr. Johnson starts to turn towards you with a greedy grin as if to say we are going to be rich. Then you hear a swoosh as if something was shot from an air gun. A red dart hits Mr. Johnson in the neck. He drops the gold back on to the pedestal. His grin turns to a frown, and he immediately drops to the floor. At this point it is just you. 1.25 mol of Fe did not work. What are you going to do now? Explain your strategy, including which substance you use and how much you measure. Good Luck.