

Your Name: \_\_\_\_\_

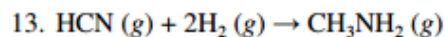
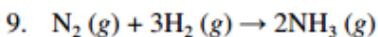
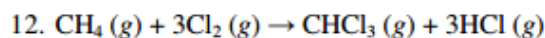
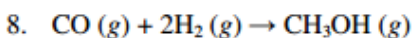
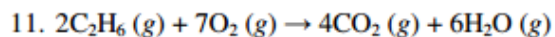
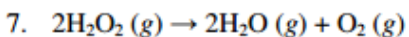
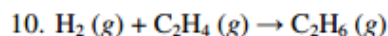
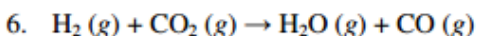
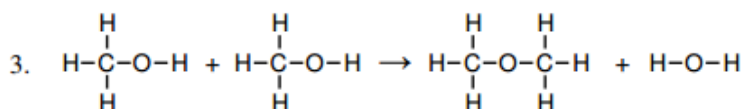
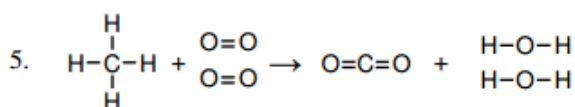
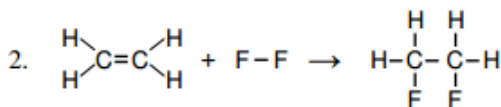
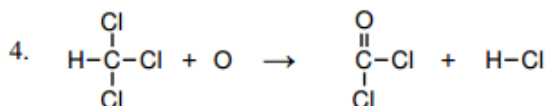
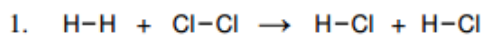
Directions: Bring the worksheet completed to class on Wednesday and be prepared to go to the board and show your work.



Use the following Bond Energy Table to answer questions 1 – 13 on the following pages.

### Average Bond Energies (kJ/mol)

|      |            |       |            |     |             |
|------|------------|-------|------------|-----|-------------|
| H-H  | 436 kJ/mol | C-H   | 413 kJ/mol | C=C | 614 kJ/mol  |
| H-Cl | 431 kJ/mol | C-C   | 348 kJ/mol | C≡C | 839 kJ/mol  |
| H-F  | 567 kJ/mol | C-N   | 293 kJ/mol | C=O | 799 kJ/mol  |
| N-H  | 391 kJ/mol | C-O   | 358 kJ/mol | O=O | 495 kJ/mol  |
| N-O  | 201 kJ/mol | C-F   | 485 kJ/mol | C≡O | 1072 kJ/mol |
| O-H  | 463 kJ/mol | C-Cl  | 328 kJ/mol | C=N | 615 kJ/mol  |
| O-O  | 146 kJ/mol | C-S   | 259 kJ/mol | N=N | 418 kJ/mol  |
| F-F  | 155 kJ/mol | Cl-Cl | 242 kJ/mol | N≡N | 941 kJ/mol  |
|      |            |       |            | C≡N | 891 kJ/mol  |







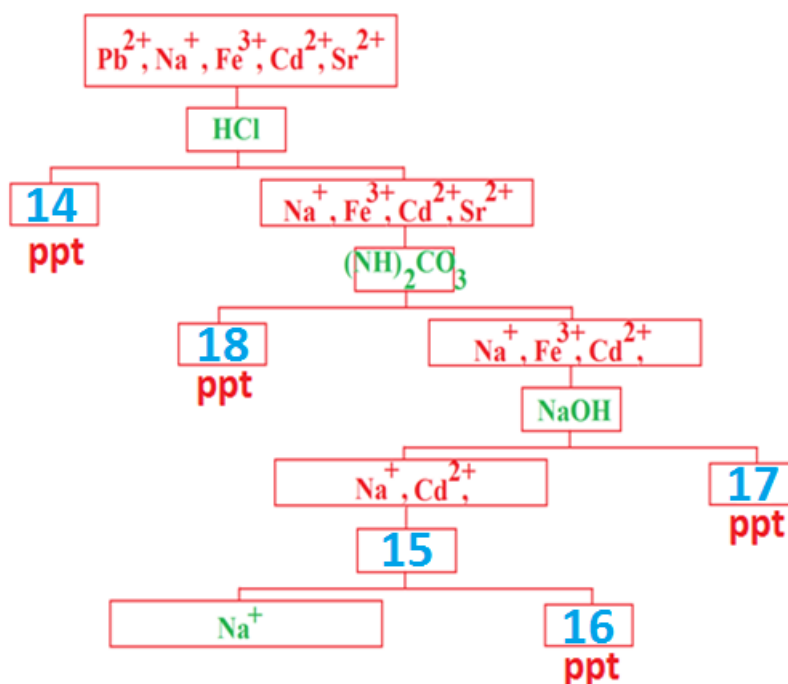


Use the following data table to complete the flow chart beneath it.

14) \_\_\_\_\_ 15) \_\_\_\_\_ 16) \_\_\_\_\_ 17) \_\_\_\_\_ 18) \_\_\_\_\_

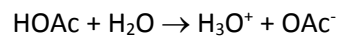
Complete the Flow Chart Using the Data, Below

| Reagent →                    | HCl                                        | NaOH                                       | <b>E</b> H <sub>2</sub> S + H <sup>+</sup>     | (NH <sub>4</sub> ) <sub>2</sub> CO <sub>3</sub> |
|------------------------------|--------------------------------------------|--------------------------------------------|------------------------------------------------|-------------------------------------------------|
| <u>Cation</u><br>Solutions ↓ |                                            |                                            |                                                |                                                 |
| Pb <sup>2+</sup> Solution    | White ppt<br><b>A</b> (PbCl <sub>2</sub> ) | <b>NR</b>                                  | Brown ppt<br>(PbS)                             | <b>NR</b>                                       |
| Na <sup>+</sup> Solution     | <b>NR</b>                                  | <b>NR</b>                                  | <b>NR</b>                                      | <b>NR</b>                                       |
| Fe <sup>3+</sup> Solution    | <b>NR</b>                                  | Red ppt<br><b>B</b> (Fe(OH) <sub>3</sub> ) | Brown ppt<br>(Fe <sub>2</sub> S <sub>3</sub> ) | <b>NR</b>                                       |
| Cd <sup>2+</sup> Solution    | <b>NR</b>                                  | <b>NR</b>                                  | Brown ppt<br><b>D</b> (CdS)                    | <b>NR</b>                                       |
| Sr <sup>2+</sup> Solution    | <b>NR</b>                                  | <b>NR</b>                                  | <b>NR</b>                                      | White ppt<br><b>C</b> (SrCO <sub>3</sub> )      |



Refer to the following for questions 19-22:

The  $K_a$  for HOAc is  $1.8 \times 10^{-5}$ . If a solution of 0.63 M HOAc dissociates in water as follows:



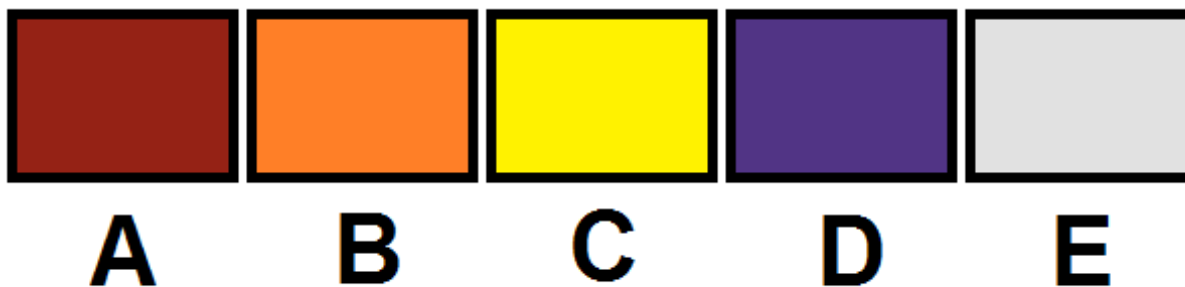
19) What is the molar concentration of hydronium ion in the solution?

20) What is the pH of this solution?

21) What is the pOH of this solution?

22) What's the  $K_b$  for HOAc?

For questions 23-25, refer to the following graphic:

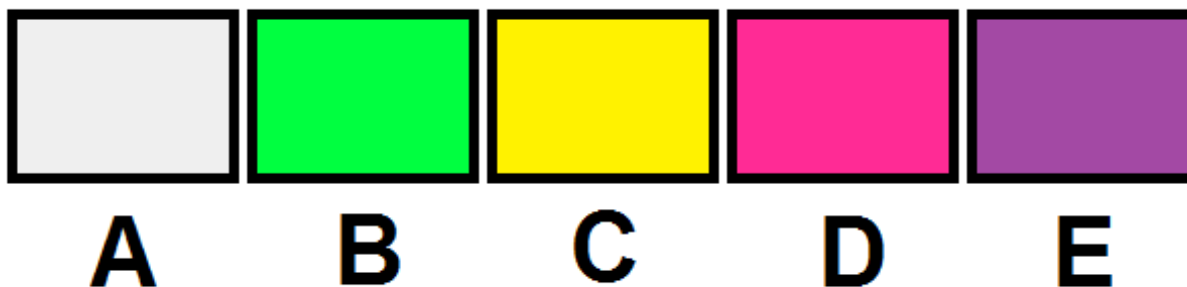


23) Which of the colors is the solution color best associated with starting the redox titration experiment?

24) Which of the colors is the color best associated with the solution into which to add the starch indicator?

25) Which of the colors is best associated with inclusion compound formation?

For questions 26-28, refer to the following graphic:



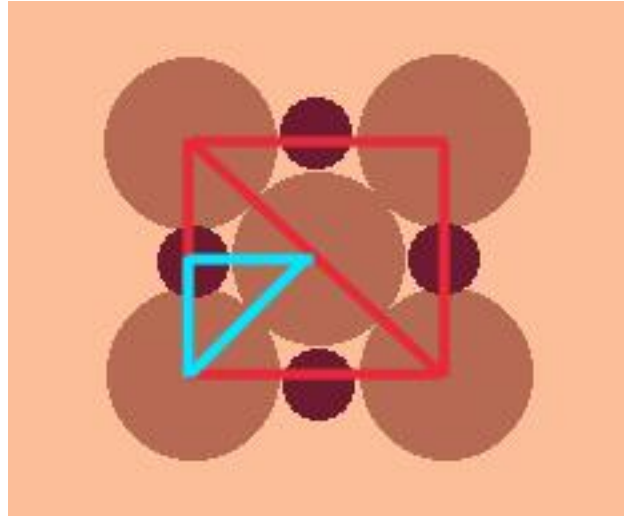
26) Which of the colors is best associated with the acid form of bromothymol purple?

27) Which of the colors is best associated with the endpoint of an acid-base titration using phenolphthalein?

28) Which of the colors do you want to obtain with phenolphthalein in an acid-base titration throughout the solution for 30 seconds to indicate the end-point of the titration?

For questions 29-31, refer to the following illustration: **the edge length (a) of a face centered cubic (fcc) LiCl crystal is 0.514 nm. Assume anion-anion contact.**

29) Calculate the Chloride ion diameter.



30) Calculate the Chloride ion radius.

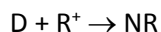
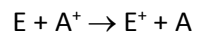
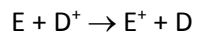
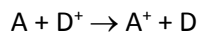
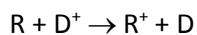
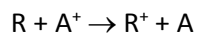
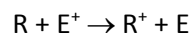
31) If the distance between the Cl<sup>-</sup> and Li<sup>+</sup> ion centers is half the edge length and the Cl<sup>-</sup> radius is 0.182 nm, calculate the Lithium (I) ionic radius length.



32) The EN for Mg is 1.2 and the EN for O is 3.5. What kind of bond really exists between Mg and O?

34) The EN for Ba is 0.9 and the EN for S is 2.5. What kind of bond really exists between Ba and S?

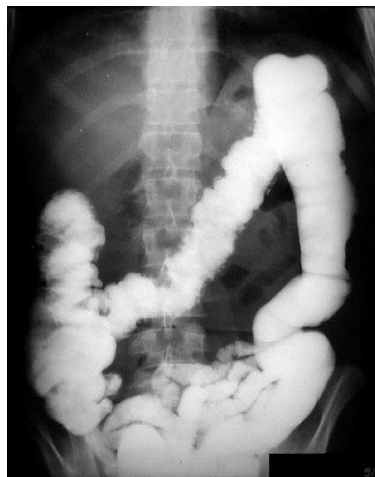
35) Refer to the following activity series' data – these are NOT real elements, they are being used as in the lab experiment to determine if you've got the concept.

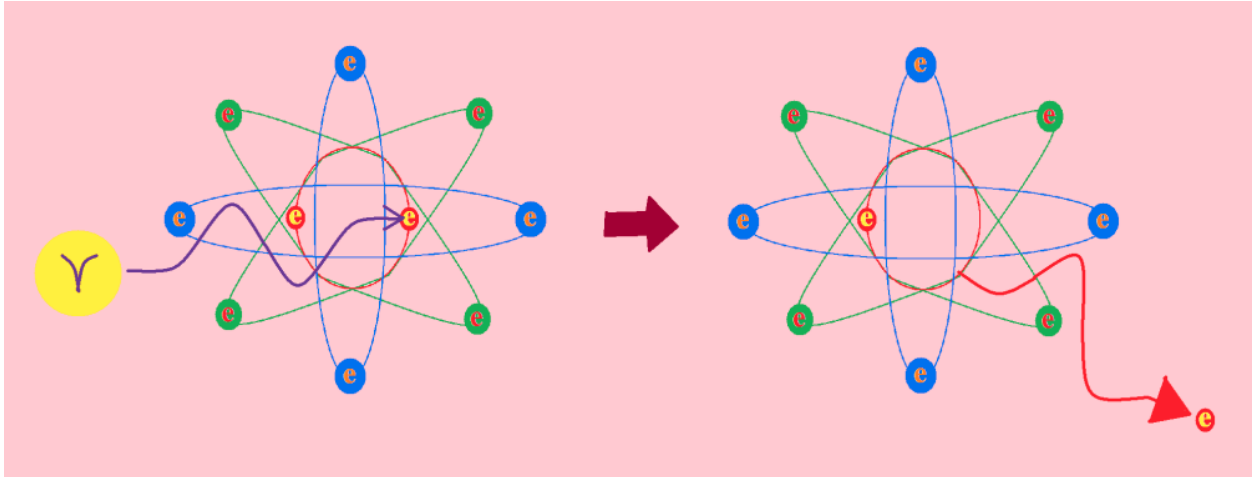


What is the "activity series" sequence from most reactive to least reactive?

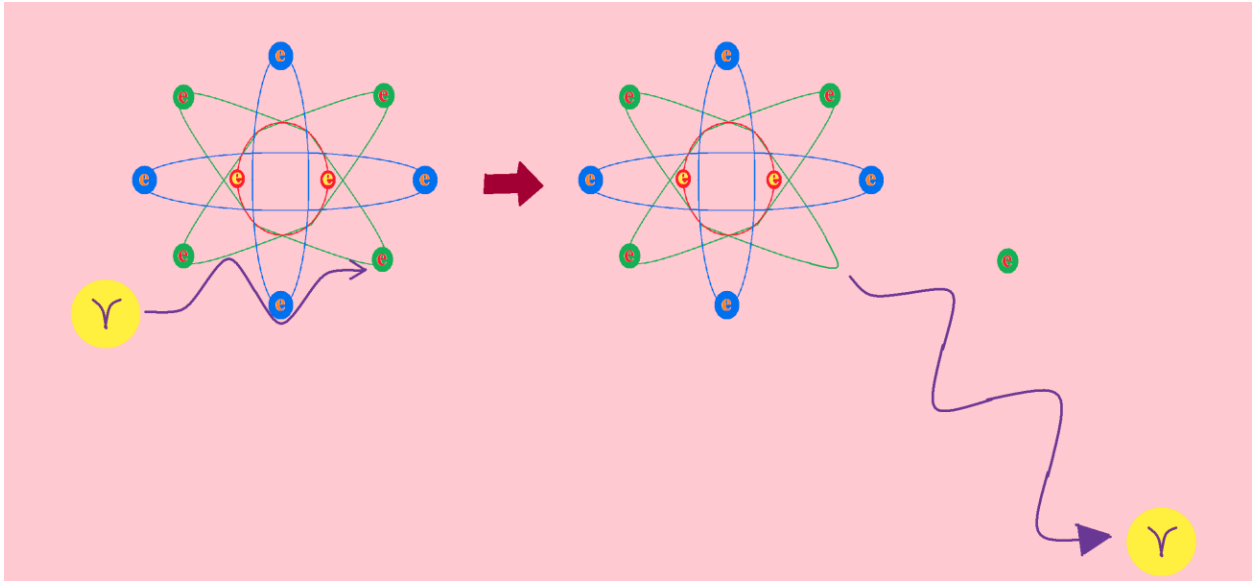
36) What is a quantum address for an N shell electron in a dumb-bell-shaped p subshell that's spinning counter clockwise?

37) The image at right is an x-ray of a lower GI (colon; large bowel) study. Which alkaline earth compound would you expect to have been used in this diagnostic study?





38) Gamma radiation interacts with atoms in several ways to lose its energy. The illustration, above, shows one of those manners. Which energy loss mechanism is this?



39) Gamma radiation interacts with atoms in several ways to lose its energy. The illustration, above, shows one of those manners. Which energy loss mechanism is this?

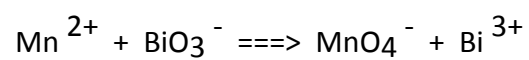
40) Gamma radiation interacts with atoms in several ways to lose its energy. The illustrations, above in questions 38 and 39, show two of these mechanisms. Which energy loss mechanism is not illustrated above? Draw and explain your version of this mechanism.

41) Complete the following scheme:

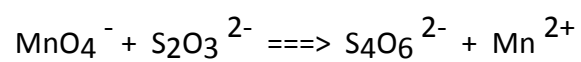
The diagram shows a redox reaction scheme with the following components:

- Top:** A box containing "3)  $\text{Co}^{2+}$  is \_\_\_\_\_ to Co." with a green arrow pointing to the  $2e^-$  in the half-reaction below.
- Left:** A box "10) \_\_\_\_\_ half reaction" pointing to the half-reaction  $2e^- + \text{Co}^{2+} \rightarrow \text{Co}$ . The  $2e^-$  is circled in green.
- Right:** A box "6) Coefficient = \_\_\_\_" with a pink arrow pointing to the  $2e^-$  in the half-reaction above.
- Center:** The main reaction  $\text{Au} + \text{Co}^{2+} \rightarrow \text{Au}^{3+} + \text{Co}$ .
  - A box "8) \_\_\_\_\_ Agent" has a purple arrow pointing to  $\text{Co}^{2+}$ .
  - A box "9) \_\_\_\_\_ Agent" has an orange arrow pointing to  $\text{Au}$ .
  - A pink arrow points from  $\text{Au}$  to  $\text{Au}^{3+}$ .
  - A purple arrow points from  $\text{Co}^{2+}$  to  $\text{Co}$ .
- Bottom-Right:** A box "2) \_\_\_\_\_ total electrons are transferred between reactants." with a green arrow pointing to the  $2e^-$  in the half-reaction above and the  $3e^-$  in the half-reaction below.
- Bottom-Left:** A box "5) Coefficient = \_\_\_\_" with an arrow pointing to the  $\text{Co}^{2+}$  in the main reaction.
- Bottom-Middle:** A box "11) \_\_\_\_\_ half reaction" pointing to the half-reaction  $\text{Au} \rightarrow \text{Au}^{3+} + 3e^-$ . The  $3e^-$  is circled in green.
- Bottom-Right (below 2):** A box "7) Coefficient = \_\_\_\_" with a purple arrow pointing to the  $3e^-$  in the half-reaction above.
- Bottom-Center:** A box "1) Au is \_\_\_\_\_ to  $\text{Au}^{3+}$  and  $3e^-$ ".
- Bottom:** A box "12) Overall Reaction is \_\_\_\_\_." with a red border.

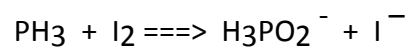
42) Balance the following reaction by the first redox balancing method:



43) Balance the following reaction by the first redox balancing method:



44) Balance the following reaction by the first redox balancing method:



45) Balance # 42 by the second method.

46) Balance #43 by the second balancing method.

47) Balance #44 by the second balancing method.

Using the following reduction half-reaction table, answer the following questions.

| Half-reaction                                                | Half-reaction                                        |
|--------------------------------------------------------------|------------------------------------------------------|
| $F_2 + 2e^- \rightarrow 2F^-$                                | $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$               |
| $Ag^{2+} + e^- \rightarrow Ag^+$                             | $Cu^{2+} + 2e^- \rightarrow Cu$                      |
| $Co^{3+} + e^- \rightarrow Co^{2+}$                          | $Hg_2Cl_2 + 2e^- \rightarrow 2Hg + 2Cl^-$            |
| $H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O$                     | $AgCl + e^- \rightarrow Ag + Cl^-$                   |
| $Ce^{4+} + e^- \rightarrow Ce^{3+}$                          | $SO_4^{2-} + 4H^+ + 2e^- \rightarrow H_2SO_3 + H_2O$ |
| $PbO_2 + 4H^+ + SO_4^{2-} + 2e^- \rightarrow PbSO_4 + 2H_2O$ | $Cu^{2+} + e^- \rightarrow Cu^+$                     |
| $MnO_4^- + 4H^+ + 3e^- \rightarrow MnO_2 + 2H_2O$            | $2H^+ + 2e^- \rightarrow H_2$                        |
| $IO_4^- + 2H^+ + 2e^- \rightarrow IO_3^- + H_2O$             | $Fe^{3+} + 3e^- \rightarrow Fe$                      |
| $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$          | $Pb^{2+} + 2e^- \rightarrow Pb$                      |
| $Au^{3+} + 3e^- \rightarrow Au$                              | $Sn^{2+} + 2e^- \rightarrow Sn$                      |
| $PbO_2 + 4H^+ + 2e^- \rightarrow Pb^{2+} + 2H_2O$            | $Ni^{2+} + 2e^- \rightarrow Ni$                      |
| $Cl_2 + 2e^- \rightarrow 2Cl^-$                              | $PbSO_4 + 2e^- \rightarrow Pb + SO_4^{2-}$           |
| $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$   | $Cd^{2+} + 2e^- \rightarrow Cd$                      |
| $O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$                        | $Fe^{2+} + 2e^- \rightarrow Fe$                      |
| $MnO_2 + 4H^+ + 2e^- \rightarrow Mn^{2+} + 2H_2O$            | $Cr^{3+} + e^- \rightarrow Cr^{2+}$                  |
| $IO_3^- + 6H^+ + 5e^- \rightarrow \frac{1}{2}I_2 + 3H_2O$    | $Cr^{3+} + 3e^- \rightarrow Cr$                      |
| $Br_2 + 2e^- \rightarrow 2Br^-$                              | $Zn^{2+} + 2e^- \rightarrow Zn$                      |
| $VO_2^+ + 2H^+ + e^- \rightarrow VO^{2+} + H_2O$             | $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$               |
| $AuCl_4^- + 3e^- \rightarrow Au + 4Cl^-$                     | $Mn^{2+} + 2e^- \rightarrow Mn$                      |
| $NO_3^- + 4H^+ + 3e^- \rightarrow NO + 2H_2O$                | $Al^{3+} + 3e^- \rightarrow Al$                      |
| $ClO_2 + e^- \rightarrow ClO_2^-$                            | $H_2 + 2e^- \rightarrow 2H^-$                        |
| $2Hg^{2+} + 2e^- \rightarrow Hg_2^{2+}$                      | $Mg^{2+} + 2e^- \rightarrow Mg$                      |
| $Ag^+ + e^- \rightarrow Ag$                                  | $La^{3+} + 3e^- \rightarrow La$                      |
| $Hg_2^{2+} + 2e^- \rightarrow 2Hg$                           | $Na^+ + e^- \rightarrow Na$                          |
| $Fe^{3+} + e^- \rightarrow Fe^{2+}$                          | $Ca^{2+} + 2e^- \rightarrow Ca$                      |
| $O_2 + 2H^+ + 2e^- \rightarrow H_2O_2$                       | $Ba^{2+} + 2e^- \rightarrow Ba$                      |
| $MnO_4^- + e^- \rightarrow MnO_4^{2-}$                       | $K^+ + e^- \rightarrow K$                            |
| $I_2 + 2e^- \rightarrow 2I^-$                                | $Li^+ + e^- \rightarrow Li$                          |
| $Cu^+ + e^- \rightarrow Cu$                                  |                                                      |

48) Balance # 42 by the third method.

49) Balance #43 by the third balancing method.

50) Balance #44 by the third balancing method.