Post-lab 3
Questions 2 – 5

In each of the following four situations, imagine that you have two unlabeled beakers in front of you which contain the two solutions listed. For each set of solutions, select a reagent from the list provided that could be added to both beakers in order to make a distinction between the two solutions. In each case identify the precipitate that is formed.

All of these are double-displacement reactions, so we are hooking up the cation of the added reagent with the anions of the reagents in the beakers, and the cations of the two given reagents with the anion of the added reagent.

Question 2: $AgClO_4$ and $MgCrO_4$

1. Add $Fe(NO_3)_3$ to form iron (III) chromate

These two reactions could potentially form $Fe(ClO_4)_3$, $Fe_2(CrO_4)_3$, $AgNO_3$, and $Mg(NO_3)_2$. Nitrates and perchlorates are always soluble, so we don't have to worry about those. That leaves us with $Fe_2(CrO_4)_3$, which the solubility table says is insoluble. This answer is correct!

2. Add K_2CrO_4 to form silver chromate

These two reactions could potentially form $KClO_4$, K_2CrO_4, Ag_2CrO_4, and $MgCrO_4$. Alkali metal compounds are always soluble, so we don't need to worry about the potassium compounds. That leaves us with Ag_2CrO_4, which the solubility table says is insoluble, and $MgCrO_4$.which the table says is soluble. This answer is also correct!

3. Add Na_2S to form silver sulfide

The compounds formed would be $NaClO_4$, Na_2CrO_4, Ag_2S, and MgS. Alkali metal compounds are always soluble, so we don't need to worry about the sodium compounds. That leaves us with Ag_2S, which the solubility table says is insoluble, and MgS, which the table says is soluble. This answer is also correct!

4. Any of these reagents will work.

By now you know this is going to end up being the correct answer, but let's keep going anyway.

5. Add $AgNO_3$ to form silver chromate

If you add $AgNO_3$ to the $AgClO_4$ beaker, they will switch anions and you will end up with the same compounds you started with, so there is no reaction in this beaker. If you add $AgNO_3$ to $MgCrO_4$, you'll form $Mg(NO_3)_2$ (soluble) and Ag_2CrO_4 (insoluble). So this answer is also correct.

6. None of these reagents will work.

This answer is as wrong as wrong can be.

Question 3: $BaCl_2$ and $Ba(ClO_3)_2$

Both of these beakers contain compounds which have barium as the cation. Any reaction that forms a precipitate with barium is going to form the same precipitate in both beakers, so you won't be able to tell them apart. So before we do anything else, we can go through and eliminate any reaction choice below that results in a barium-containing precipitate.

1. Add H_2SO_4 to form barium sulfate

The same precipitate forms in both beaker; this is no help.

2. Add Na_3PO_4 to form barium phosphate

The same precipitate forms in both beaker; this is no help.

3. Add K_2CrO_4 to form potassium chlorate

Potassium chlorate won't be a precipitate because all alkali metal compounds are soluble. Adding this reagent would also form $BaCrO_4$ in both beakers and KCl in one of them, but both of these compounds are also soluble, so there won't be any precipitate formed in any beaker.

4. Add $AgNO_3$ to form silver chloride

Adding $AgNO_3$ will form insoluble AgCl in one beaker and solumble $AgClO_3$ in the other (all chlorates are soluble), along with forming soluble $Ba(NO_3)_2$ in both beakers. This answer is correct!

5. Add $AgNO_3$ to form barium nitrate

Barium nitrate isn't even a precipitate!

6. Add NaCl to form barium chloride

Barium chloride isn't a precipitate either!

7. Add NaCl to form sodium chloride

If you match up the front ends and back ends of the reagents involved, you get NaCl, $NaClO_3$, $BaCl_2$, and $BaCl_2$ again. All of these are soluble, so no precipitate will form in either beaker.

8. Add K_2CrO_4 to form barium chromate

If you add K_2CrO_4 to both beakers, you will indeed form a barium chromate precipitate, $BaCrO_4$, but it will form in both beakers, so you still won't know which beaker is which. The other compounds formed in this reaction would be KCl and $KClO_3$, which are both soluble.