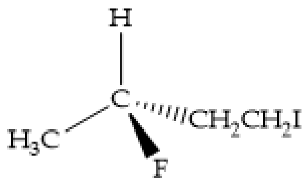
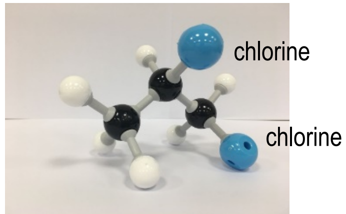
APPENDIX 1. REPRESENTATIVE LESSON ACTIVITIES

PC1 Laboratory-based Questions (LBQ)	**Laboratory Tasks**	**Sample Post-laboratory Test**
(1) A 50.0 mL stock solution was prepared by dissolving 14.0 g of KOH in water. (a) Calculate stock [KOH]. (b) Give detailed procedures to prepare 250 mL of 0.5 M KOH from stock solution. (2) Refer to the practical task. Will adding more water affect the aim of the experiment?	(a) Do a 10-fold dilution of stock NaOH solution (unknown analyte) (b) Add about 0.25 g of potassium hydrogen phthalate (KHP) in a conical flask. Dissolve the solid with deionized water (c) Titrate diluted NaOH in burette with KHP solution (d) Calculate original stock [NaOH]	Reversed protocol: (a) A known volume of the NaOH standard solution (10-fold diluted) pipetted into a conical flask. (b) Prepare 250 mL of precise 0.01 M KHP using a volumetric flask (c) Titrate solution (i) with (ii) in a burette Question: • Describe procedures to prepare solution (b)
OC Laboratory-based Questions (LBQ)		**(Not used for analysis)**
Build the molecular model of this molecule in your tutorial sheet. Identify if it is (*R*) or (*S*) configuration. (Traditional classes need only to identify configuration) 	• Construct models of various molecules to show *meso*, enantiomers, diastereomers	Which of the following is the correct name for the model shown?  a) (R)-1,1-dichloropropane b) (S)-1,1-dichloropropane c) (R)-1,2-dichloropropane d) (S)-1,2-dichloropropane
PC2 Buffer Preparation		
No LBQ. Baseline tutorial objectives for traditional classes are: • apply pH formula of buffer • calculate acid dissociation constant K_a of a weak acid by formula • K_a by half-equivalence point (½ eqv) on a titration curve	• Lab 1: Microsoft excel dry lab • Lab 2: traditional classes prepare buffer solutions with given procedures • Lab 2 hybrid classes:	• Write an equation to explain why a solution of $NaHCO_3$ is basic • Identify molecular species on a titration curve before, at and after neutralization • Explain how to use a titration curve to compute K_a

	(a) In the last experiment, both you and your partner used Excel to determine the mass of CH_3COONa to prepare 100 mL of pH 4, 4.5 and 5.0 buffer solutions *(b) In this lab, you would prepare them using the required reagents and glassware available in the lab.* *(c) Review the questions in the last Microsoft Excel lab and Question 3 in Tutorial 1.2* *(d) Discuss with your lab partner. Outline the steps required. Show your draft procedures to the instructor before starting benchwork* • Lab 3 traditional classes: (a) Compare pH changes when acidic impurities are added to water and buffer solutions (b) Measure pH of basic salt solutions (c) Identify ½ eqv on titration curve to obtain K_a • Lab 3 hybrid classes: baseline + extended activities: (a) Write molecular species to explain why CH_3COONa is basic, after measuring pH (b) Explore how ½ eqv on titration curve reduces to K_a mathematically	
PC2 stereochemistry. No LBQ. Baseline tutorial objectives for traditional classes are: • Compute metal M oxidation state • Sketch structure of isomers of transition metal complexes with different geometries, for example, **M**$(H_2O)_2Br_2$ (square planar)	Traditional classes use molecular models to construct transition metal complexes of various geometries, for example: • **M**$(NH_3)_2Cl_2$ • **M**$(NH_3)_4Cl_2]^+$ • [**M**$(en)_3]Cl_3$ Hybrid classes: baseline + extended activities to explore the relationship between ligand nature, coordination number and isomerism. For example:	(Essay take-home test) Comment as much as you can, on the important features of the given complex, for example, isomerism, shape, ligand type and so on.

- Determine if optical or geometric isomerism exists for a given structure, for example $[\mathbf{M}Cl_4(H_2O)_2]^{2+}$

- *Start with a square planar complex* $\mathbf{M}A_2(en)$*, en = ethylenediamine. Connect the A ligands in a trans orientation. Then connect the two nitrogen atoms to the remaining positions. Can you fit the molecule well? What do you observe?*

- *So, how many ways can you arrange the A ligands and the en ligand?*

- *Summarize the conditions required for optical and geometric isomerism in 4-coordinated complexes*

- *Construct 6-coordinated complex* $\mathbf{MA}_4en$*, with a bidentate ligand* $H_2NCH_2CH_2NH_2$ *(en) and 4 identical A ligands. Sketch one possible isomer and construct a model of it.*

- *Try to construct the mirror image of* $\mathbf{M}A_4en$*. Are the two models superimposable on each other?*

- *Now increase the number of en ligands to 2. Construct the 2 structures with 2 A ligands as far away, and near to each other as possible*

- *Summarize the conditions required for optical and geometric isomerism in 6-coordinated complexes*