***Student Name* (first, last):**

_____

Student Number:

_____

CHEMISTRY 3371
SECOND MIDTERM EXAMINATION

Josef Michl

March 15, 2013

---

valence els in atom	3	4	5	6	7	8	9	10	11	12
period 4	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
period 5	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd
period 6	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg

1. (15 points) Check the correct statements only and make no other marks:

( ) Carboxylic acids react with diazomethane to give carboxamides.
( ) Vinyl halides undergo S_N2 substitution with nucleophiles easily.
( ) $Cl_2Pt(NH_3)_2$ contains platinum in the oxidation state +2.
( ) There are 18 electrons in the valence shell of the platinum atom in $Cl_2Pt(NH_3)_2$.
( ) $Cl_2Pt(NH_3)_2$ is a d^8 complex of platinum.
( ) *p*-Nitrophenol is more acidic than phenol.
( ) In aqueous solution, formaldehyde is present mostly in the form of its hydrate, a 1,1-diol.
( ) Sodium borohydride is not a strong enough reducing agent to reduce ketones to alcohols.
( ) Acetals are useful protecting groups for carboxylic acids.
( ) Tertiary amines react with ketones to yield enamines.
( ) Grignard reagents react with CO_2 to yield carboxylic acids.
( ) Malonic acid cannot be decarboxylated by heating.
( ) Oxidation of hydroquinone yields *p*-benzoquinone.
( ) Rotation around the C-N bond in benzamide is easy (the barrier is about 3 kcal/mol).
( ) In the phosphorus ylide $(-)CH_2P(+)(C_6H_5)_3$, the valence shell of the P atom has 10 electrons.

2. (20 pts) Write a plausible mechanism for the Fischer esterification of acetic acid with ethanol (include all steps, catalysts, and intermediates and use curved arrows to indicate electron movement in each step).

3. (25 pts) Propose a reaction sequence for the synthesis of benzyl *p*-nitrobenzoate from toluene and inorganic reagents. Show all steps and all reagents (no mechanisms, no curved arrows, no solvents).

4. (20 pts) Write the structures of the principal organic product in the following reactions. You do not need to show solvents, mechanisms, or curved arrows.

(a) 1,9-decadiene + Grubbs olefin metathesis catalyst ➜

(b) benzoyl chloride + lithium dimethylcuprate ➜

5. (20 points) Write a plausible mechanism for the Heck reaction of iodobenzene with cyclohexene (include all steps, catalysts, and intermediates and use curved arrows to indicate electron movement in each step).