

- 10 1. You desire to synthesize 3-ethyl-3-pentanol starting with an *ester*. (i) What would be the name of the ester, and what is the name for the Grignard reagent (e.g., methyl magnesium bromide)? (ii) For the carbons shown in the product, show plausible hydrocarbons that you could start with to produce the ester and the Grignard reagent (as in a retrosynthesis).

- 12 2. (i) Show the step-by-step process required to produce propyllithium, which requires a free radical reaction mechanism, . (ii) Show the complete reaction mechanism for reaction between propyllithium and the correct ketone to produce 3-propyl-3-pentanol. (iii) Propose a possible reaction mechanism by which dipropyl cuprate (Cu^+ with two propyl groups attached) could react with ethyl bromide to produce a new hydrocarbon. (*This is a thinking exercise! So, think!*)



- 8 3. As mentioned in the text, diethyl ether, pentane, and 1-butanol have similar molar masses, but different physical properties. Boiling points are 35°C, 36°C, and 117°C, respectively. Their respective solubilities in water are 7.5g/100mL, insoluble, and 9g/100mL. (i) Draw structures for each of these compounds. (ii) Justify the observed boiling points and their solubilities.

- 16 4. Draw structures of the following compounds

2,3-heptanediol

isopropyllithium

benzylmagnesium bromide

benzoic acid

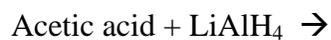
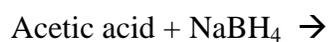
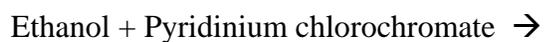
benzaldehyde

dimethyl sulfide

t-butyl methanoate

dibutyl ketone

- 12 5. Alcohols can be oxidized to produce other compounds, and can be produced by reduction. For the reactions shown below, show the structure for the expected product (if reaction does not occur, state: *No Reaction*) when treated with the indicated oxidizing or reducing agents.



- 10 6. Starting with methyl benzoate (an ester) and the appropriate Grignard reagent, show how you could produce triphenylmethanol (it is a 2-step reaction, using two Grignard reagent molecules). Include structures for reactants and product. (Does this reaction seem familiar?)

8 7. (i) Starting with butanoic acid, show how you could produce an ester with isopropyl alcohol using the Fischer esterification (acid catalyzed). (ii) What is the name of the ester product?

12 8. (i) Starting with *t*-butyl alcohol, show the reaction mechanism to produce an ether in acidic conditions. What is the name of this ether? (ii) Starting with sodium *t*-butoxide and bromoethane, show the reaction mechanism required to produce an ether in basic reaction conditions. What is the name of this ether? (iii) Starting with diethyl ether, show the reaction mechanism (with arrows) for its acid-catalyzed cleavage in HBr and its products.

12 9. Starting with benzyl magnesium bromide, show the products, with names, for reaction with (i) formaldehyde, (ii) acetaldehyde, and (iii) acetone. (*Show final product after reaction, and treatment with acid. Reaction mechanisms are not required.*)