

Department of Chemistry and Biochemistry

Chemistry 59-230

Time: 50 min.

Lab Exam

Nov. 25, 2009

NAME _____ ID# _____

LAB SECTION (and TA name) _____

Note: Read all questions and these instructions CAREFULLY! Answer all questions on the test paper **by indicating in the box beside the question** the letter of the answer you select as the **BEST** answer. There are 21 questions; **do any 20**.

MAKE SURE YOUR NAME, STUDENT NUMBER AND LAB SECTION ARE **CORRECTLY ENTERED ABOVE**. Tests written in pencil will be marked, but cannot be returned for remarking.

B

1. Celite is mostly used as a -----
- Decolorizing agent
 - Filter – aid, keeping small particles from blocking the filter
 - Dehydrating agent
 - A solid, insoluble source of H⁺

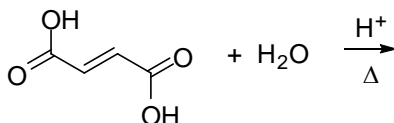
A

2. A boiling stone (boiling chip) is used in reactions being heated to reflux for:
- Avoiding spattering of the heated solution.
 - Salting out product
 - Neutralizing extra acid
 - Absorbing water, to dry the solution

A

3. In recrystallization, which of the following are considered the criteria for choosing the right solvent?
- The solute must be more soluble in the hot solvent than in the cold
 - The solute must be more soluble in the cold solvent than in the hot
 - The solvent should dissolve both the impurities and the solute very well
 - The solvent should react readily with the solute

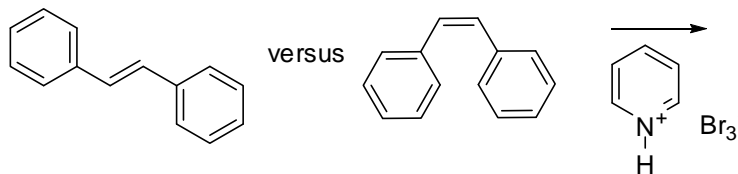
4. If Fumaric acid is refluxed in H₂O under acidic conditions for 24 hours, the major product will be?



B

- 50% Maleic Acid / 50% Fumaric Acid
- Fumaric Acid
- Maleic Acid
- Fumaric anhydride

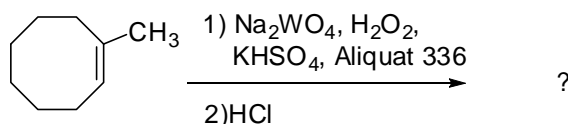
5. The difference between using *cis*-stilbene instead of *trans*-stilbene in reaction with pyridinium tribromide is:



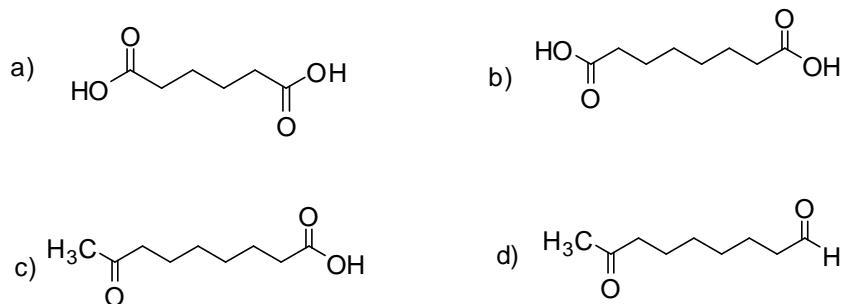
A

- cis*-stilbene gives a racemic mixture of (R,R)- and (S,S)-enantiomers; *trans*-stilbene gives the diastereomeric *meso*-form.
- cis*-stilbene gives the *meso*-form; *trans*-stilbene gives a racemic mixture of (R,R)- and (S,S)-enantiomers.
- No difference. The *cis*-isomer is isomerized to the *trans*-isomer before reaction, so the same product is obtained.
- Due to greater steric repulsion, *cis*-stilbene much less reactive and inert to pyridinium tribromide.

6. What is the product formed from the following oxidation?



C



7. Which of the following is not an oxidizing agent?

D

- O₃
- KMnO₄
- Na₂WO₄
- KHSO₄

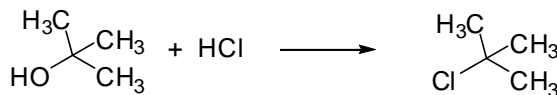
8. Silver nitrate (AgNO₃) will react with what type of compound the fastest

D

- Secondary alkyl halides
- Primary alkyl halides
- Ketones
- Tertiary alkyl halides

9. In the experiment 5, you prepared 2-chloro-2-methylpropane from 2-methyl-2-propanol using HCl as the hydrogen halide. (see eqn below)

A

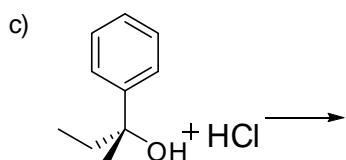
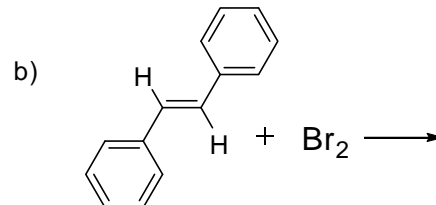
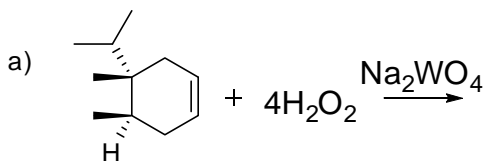


Which is the mechanism of this reaction?

- a) S_N1
- b) S_N2
- c) Both of S_N1 and S_N2 ; there is lot of character of each of these in this case
- d) Neither; it's the rare S_Ni mechanism.

10. Which of the following reactions produces an optically active product?

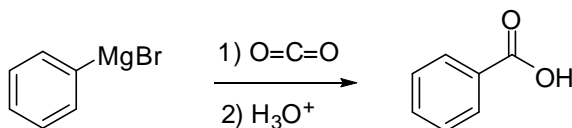
A



d) both a) and c)

11. In performing a Grignard reaction between phenylmagnesium bromide and CO₂, one must ensure a completely dry environment because:

B



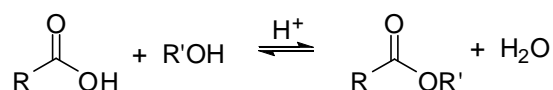
- a) Water becomes another impurity one will need to worry about.
- b) The Grignard reagent will very readily react with water, and hence become destroyed.
- c) Water reacts with CO₂ to give carbonic acid, which is inert to the Grignard reagent.
- d) No real reason; the environment need not actually be dry – it's just good practice.

12. During the diethyl ether / aqueous acid extraction to purify benzoic acid, which of the following is true?

C

- a. The diethyl ether (containing the benzoic acid) layer is on bottom; the aqueous layer is on top.
- b. If the aqueous layer is acidic, the benzoic acid is in the aqueous layer, since like dissolves like
- c. The diethyl ether (containing the benzoic acid) is on top; the aqueous layer is on bottom.
- d. You don't actually have benzoic acid until you make the aqueous layer basic.

13. Equilibrium constant of esterification reaction is calculated by equation:



C

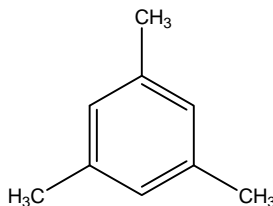
- a) $K_c = [\text{alcohol}] [\text{ester}] / [\text{water}] [\text{acid}]$
 b) $K_c = [\text{alcohol}] [\text{acid}] / [\text{ester}] [\text{water}]$
 c) $K_c = [\text{ester}] [\text{water}] / [\text{alcohol}] [\text{acid}]$
 d) $K_c = [\text{water}] [\text{alcohol}] / [\text{ester}] [\text{acid}]$

14. In ^1H NMR spectroscopy, neighbouring protons will split a certain proton's signal peak:

A

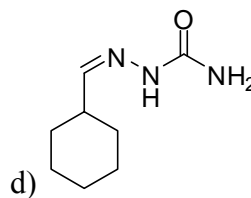
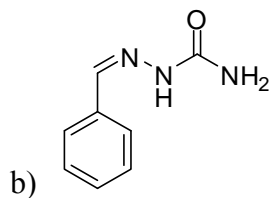
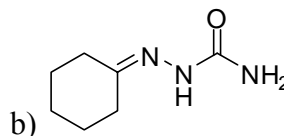
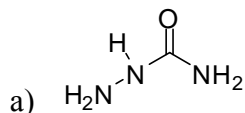
- a) According to The n+1 rule
 b) According to The n+2 rule
 c) Only in cases where the neighbouring protons are on electronegative atoms like in OH's or NH's
 d) Only in cases where the chemical shift differences are less than 1 ppm

15. How many distinct proton chemical **environments** does 1,3,5-trimethylbenzene possess?

**B**

- a. 1
 b. 2
 c. 6
 d. 12

16. The structural formula of semicarbazide is

**A**

17. Compound **A** can react to form either **B** or **C**. The rate of formation of **B** is 0.5 times that of **C**. If **C** is higher in energy than **B**, then:

A

- a) **B** is the thermodynamic product whereas **C** is the kinetic product
 b) **B** is the kinetic and thermodynamic product
 c) **C** is the thermodynamic product whereas **B** is the kinetic product
 d) **C** is the kinetic and thermodynamic product

18. Geometric isomerism possible for the following cases?

D

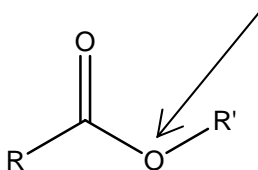
- a) $(\text{CH}_3)_2\text{C}=\text{CHBr}$
- b) $\text{Br}_2\text{CH}-\text{CHBr}_2$
- c) $\text{CH}_3\text{C}\equiv\text{CCl}$
- d) $\text{Br}-\text{CH}_2-\text{CH}=\text{CHCl}$

19. Which of the following would not make a good solvent pair for recrystallization?

B

- a) Methanol and water
- b) Methanol and hexanes
- c) Hexanes and acetone
- d) Ethyl acetate and acetone

20. In a Fischer esterification reaction (carboxylic acid + alcohol + acid catalyst), where does this oxygen atom come from?



A

- a) The alcohol
- b) The H_2SO_4 catalyst
- c) The OH moiety of the carboxylic acid
- d) The $\text{C}=\text{O}$ moiety of the carboxylic acid

21. In recrystallization, the heated solution of the material to be crystallized is cooled *slowly* because

D

- a) We need as much time as possible to destroy the impurity in the compound
- b) It's a 3 hour lab, and we need some way of taking up those 3 hours
- c) More solvent evaporates when it's warm, so there's less to remove at the end
- d) There's less opportunity for impurities to get trapped in the crystallizing compound, so the crystals are more pure.