1-10 Are True/False (10pts)

1) All alkynes have a Carbon-Carbon triple bond.

2) Pent-2-ene is an internal alkyne.

3) But-1-yne and Cyclobutene are stereoisomers.

4) Cyclohexanol is a better proton donor than Phenol.

5) Cyclopentanol has nine Hydrogens.

6) Tertiary alcohols can be oxidized to aldehydes and carboxylic acids.

7) Terminal alkynes are more acidic than internal alkynes.

8) Lindlar’s catalyst is used to control the Hydrogenation of alkynes so that the reaction proceeds only to alkene products.

9) Enols are unstable, and will tautomerize into their more stable keto form.

10) Carboxylic acids are stronger acids than alcohols and alkanes.
11) (1+1+1+1=4pts) a) Draw a line angle diagram (stick figure) of a primary alcohol that has 4 Carbon atoms.

b) What reagent(s) would you use to oxidize that primary alcohol to a Carboxylic acid?

c) What reagent(s) would you use to oxidize that primary alcohol to an Aldehyde?

d) Draw a line angle diagram (stick figure) of the species formed after your primary alcohol has been deprotonated by a Base.

12) (4+1pts) a) Identify the following functional groups.

\[ \text{R} - \text{O} \equiv \text{R} \quad \text{R} - \text{O} \equiv \text{O} \equiv \text{R} \quad \text{R} - \text{O} \equiv \text{OH} \quad \text{R} \equiv \text{O} \equiv \text{H} \]

b) Circle the functional group that can be used to initiate a free radical reaction.
13) Provide the products for the following reactions. (10 pts)

\[
\begin{align*}
&\text{1) } \text{NaNH}_2 \\
&\text{2) } \text{Ph} = \text{O} \text{Ph} \\
&\text{3) } \text{H}_3\text{O}^+ \\
&\text{H}_3\text{C} - \text{C} = \text{C} - \text{H} \\
&\text{1) 1 equiv. Br}_2 \\
&\text{2) 1 equiv. HCl} \\
&\text{HgSO}_4 \\
&\text{H}_2\text{SO}_4 \\
&\text{H}_2\text{O} \\
&\text{Si}_2\text{BH} \\
&\text{H}_2\text{O}_2, \text{NaOH} \\
\end{align*}
\]

---

14) Draw in the curly arrows to show the mechanism of the following double electrophilic addition. (4pts)

\[
\begin{align*}
&\text{H}_3\text{C} - \text{C} = \text{C} - \text{CH}_3 \\
&\text{H} - \text{Br} \\
&\text{H}_3\text{C} \text{C} = \text{C} - \text{CH}_3 \\
&\text{Br} \\
&\text{H}_3\text{C} \text{C} = \text{C} _{\text{Br}} \text{CH}_3 \\
&\text{H} - \text{Br} \\
&\text{H}_3\text{C} \text{C} - \text{C} _{\text{Br}} \text{CH}_3 \\
&\text{Br} \\
&\text{H}_3\text{C} \text{C} - \text{C} _{\text{Br}} \text{CH}_3 \\
&\text{Br} \\
&\text{H}_3\text{C} \text{C} - \text{C} _{\text{Br}} \text{CH}_3 \\
&\text{Br} \\
\end{align*}
\]
15) a) Name this molecule in IUPAC form. (2pts)

\[ \text{Br} \quad \text{OH} \]

b) Draw \textit{cis-3-chlorocyclopentanol} using line angle diagram (stick figure representation). (2pts)

16) Provide reagents for the following five transformations. (10pts)
17) Draw in the curly arrows to describe the mechanism for this nucleophilic addition reaction. (3pts)

\[ \text{R-Mg-Br} \quad \xrightarrow{\text{Ketone}} \quad \text{R-O}^+ \quad \text{Mg-Br} \]

\[ \xrightarrow{\text{H-O-H}} \]

\[ \text{H}_2\text{O} \quad \text{R-OH} \]

*****BONUS QUESTIONS (up to 2 points)*****

What is the oxidation state of Chromium in $\text{Na}_2\text{Cr}_2\text{O}_7$?

What color is a solution of $\text{KMnO}_4$?
Lanthide series

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Su15org1ex3.docx
1-10 Are True/False (10pts)

1) All alkynes have a Carbon-Carbon triple bond.  True

2) Pent-2-ene is an internal alkyne.  F

3) But-1-yne and Cyclobutene are stereoisomers.  F

4) Cyclohexanol is a better proton donor than Phenol.  F

5) Cyclopentanol has nine Hydrogens.  F

6) Tertiary alcohols can be oxidized to aldehydes and carboxylic acids.  F

7) Terminal alkynes are more acidic than internal alkynes.  True

8) Lindlar’s catalyst is used to control the Hydrogenation of alkynes so that the reaction proceeds only to alkene products.  True

9) Enols are unstable, and will tautomerize into their more stable keto form.  True

10) Carboxylic acids are stronger acids than alcohols and alkanes.  True
11) (1+1+1+1=4pts) a) Draw a line angle diagram (stick figure) of a **primary** alcohol that has 4 Carbon atoms.

![Diagram of primary alcohol](image)

b) What reagent(s) would you use to oxidize that primary alcohol to a Carboxylic acid?

![Diagram of Carboxylic acid](image)

C) What reagent(s) would you use to oxidize that primary alcohol to an Aldehyde?

![Diagram of Aldehyde](image)

d) Draw a line angle diagram (stick figure) of the species formed after your primary alcohol has been deprotonated by a Base.

![Diagram of deprotonated aldehyde](image)

12) a) Identify the following functional groups. (4+1pts)

- **O**
- **R-O-R**
  - **Ether**
- **R-O-O-R**
  - **Peroxide**
- **O**
  - **R-COOH**
  - **Carboxylic Acid**
- **O**
  - **R=H**
  - **Aldehyde**

b) Circle the functional group that can be used to initiate a free radical reaction.
13) Provide the products for the following reactions. (10 pts)

\[ \text{CH}_3 - \text{C} \equiv \text{C} - \text{C} = \text{C} - \text{H} \]

1) \( \text{NaNH}_2 \)
2) \( \text{Ph} \)
3) \( \text{H}_3 \text{O}^+ \)

\[ \text{H}_3 \text{C} - \text{C} \equiv \text{C} - \text{H} \]

1) 1 equiv. \( \text{Br}_2 \)
2) 1 equiv. \( \text{HCl} \)

\[ \text{H}_2 \text{SO}_4 \]
\[ \text{H}_2 \text{SO}_4 \]
\[ \text{H}_2 \text{O} \]

\[ \text{H}_2 \text{O}_2, \text{NaOH} \]

\[ \text{H}_3 \text{C} - \text{C} = \text{C} - \text{H} \]

14) Draw in the curly arrows to show the mechanism of the following double electrophilic addition. (4 pts)

\[ \text{H}_3 \text{C} - \text{C} = \text{C} - \text{CH}_3 \]

\[ \text{H}_3 \text{C} \quad \oplus \text{C} = \text{C} - \text{CH}_3 \]

\[ \text{H}_3 \text{C} \quad \text{C} = \text{C} - \text{CH}_3 \]

\[ \text{H}_3 \text{C} \quad \text{C} = \text{C} - \text{Br} \]

\[ \text{H}_3 \text{C} \quad \text{CH}_3 \]

\[ \text{H}_3 \text{C} \quad \text{CH}_3 \]

\[ \text{H}_3 \text{C} \quad \text{H} - \text{C} - \text{C} - \text{Br} \]

\[ \text{H}_3 \text{C} \quad \text{H} - \text{C} - \text{C} - \text{Br} \]

\[ \text{H}_3 \text{C} \quad \text{H} - \text{C} - \text{C} - \text{Br} \]
15) a) Name this molecule in IUPAC form. (2pts)

\[ \text{5-bromo-2-methyl hexan-3-ol} \]

b) Draw *cis-3-chlorocyclopentanol* using line angle diagram (stick figure representation). (2pts)

16) Provide reagents for the following five transformations. (10pts)
17) Draw in the curly arrows to describe the mechanism for this nucleophilic addition reaction. (3pts)

![Mechanism Diagram]

****BONUS QUESTIONS (up to 2 points)****

What is the oxidation state of Chromium in Na2Cr2O7?

+6

What color is a solution of KMnO4?

Purple