1. Which of the following cannot be made by the reduction of a ketone or aldehyde with NaBH₄ in methanol?
   1) 1-butanol 2) 2-butanol 3) 2-methyl-1-propanol 4) 2-methyl-2-propanol

2. In general, the reduction of a ketone to an alcohol can be accomplished by all of the following except one. Which one will not reduce a ketone?
   1) H₂/Pt 2) HIO₄ 3) LiAlH₄ 4) NaBH₄

3. Which of the following is not readily oxidized by K₂Cr₂O₇ in H₂SO₄/H₂O?
   1) n-butyl alcohol 2) sec-butyl alcohol 3) isobutyl alcohol 4) tert-butyl alcohol

4. Give the product of the following reaction.

   \[ \text{CH}_3\text{CH}_2\text{C} = \text{CH}_2 \rightarrow \text{CH}_3\text{CH}_2\text{CH} = \text{CH}_2 \]

   1) 1 2) 2 3) 3 4) 4

5. The reaction of a Grignard reagent with ethylene oxide followed by dilute acid gives:
   1) a primary alcohol 2) a secondary alcohol 3) a tertiary alcohol 4) methanol

6. Consider the conversion of 1-butanol to each of the compounds shown below. In which conversion is an oxidizing agent needed?
   1) CH₃CH₂CH=CH₂ 2) CH₃CH₂CH₂CH₂Br 3) (CH₃CH₂CH₂CH₂)₂O 4) CH₃CH₂CH₂CH=O

7. Identify the reagent needed to carry out the following conversion.

   \[ \text{CH}_2\text{OH} \rightarrow \text{CH} \]

   1) K₂Cr₂O₇, H₂SO₄/H₂O 2) PCC/CH₂Cl₂ 3) HIO₄ 4) OsO₄, (CH₃)₃COOH, (CH₃)₃COH, OH⁻
8. Consider the structure of the $\text{AlH}_4^-$ ion. The formal charge of Al is:

1) -1  2) 0  3) +1  4) +3

9. Which of the following best describes the role of the coenzyme NAD$^+$ (nicotinamide adenine dinucleotide) in biological chemistry?

1) It reduces other species.
2) It oxidizes other species.
3) It catalyzes oxidation-reduction reactions.
4) It inhibits oxidation-reduction reactions.

10. Compound A, $\text{C}_6\text{H}_{12}\text{O}$, is readily oxidized with $\text{K}_2\text{Cr}_2\text{O}_7$ in $\text{H}_2\text{SO}_4/\text{H}_2\text{O}$ to give compound B, $\text{C}_6\text{H}_{10}\text{O}$. Compound B has four peaks in its C-13 NMR (broadband decoupling). Which one of the following fits the data for compound A?

   \[ \begin{array}{cccc}
   1) & \text{OH} & \text{CH}_2\text{OH} & \text{HO} \text{CH}_3 \\
   2) & \text{OH} & \text{CH}_2\text{OH} & \text{HO} \text{CH}_3 \\
   3) & \text{OH} & \text{CH}_2\text{OH} & \text{HO} \text{CH}_3 \\
   4) & \text{OH} & \text{CH}_2\text{OH} & \text{HO} \text{CH}_3 \\
   \end{array} \]

   1) 1  2) 2  3) 3  4) 4

11. Which of the following is the ester formed between methanol and nitric acid, $\text{HNO}_3$?

   \[ \begin{array}{cccc}
   1) \text{CH}_3\text{O}^+\text{N}_2\text{O}^- & 2) \text{CH}_3\text{O}^-\text{N}_2\text{O}^+ & 3) \text{CH}_3\text{O}^-\text{N}_2\text{O}^- & 4) \text{CH}_3\text{O}^+\text{N}_2\text{O}^- \\
   \end{array} \]

   1) 1  2) 2  3) 3  4) 4

12. What is the product of the reaction below?

   \[ \text{CH}_3\text{COH} + \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \xrightarrow{\text{H}_2\text{SO}_4/\text{heat}} \]

   \[ \begin{array}{cccc}
   1) \text{CH}_3\text{CH}_2\text{COCH}_3 & 2) \text{CH}_3\text{COCH}_2\text{CH}_2\text{CH}_3 & 3) \text{CH}_3\text{CH}_2\text{CH}_2\text{CCH}_3 \\
   \end{array} \]

   1) 1  2) 2  3) 3  4) 4

13. In which of the following forms does nicotinamide adenine dinucleotide have an aromatic pyridine ring?

   1) NADH  2) NAD$^+$
   3) both NADH and NAD$^+$  4) neither NADH or NAD$^+$
14. Which of the synthetic procedures below would carry out the following transformation?

![Chemical structures]

1) LiAlH₄ followed by H₂SO₄/heat  3) PCC/CH₂Cl₂ followed by HIO₄

2) O₃ followed by (CH₃)₂S  4) NaBH₄/methanol followed by HIO₄

1) 1  2) 2  3) 3  4) 4

15. Which compound below is the product expected from the following reaction?

![Chemical structures]

1) LiAlH₄, diethyl ether  2) H₂O

1) 1  2) 2  3) 3  4) 4
Answer Key for Test "211c15q1.tst", 2/23/2004

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