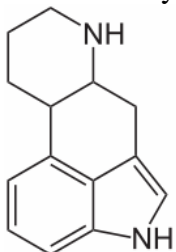


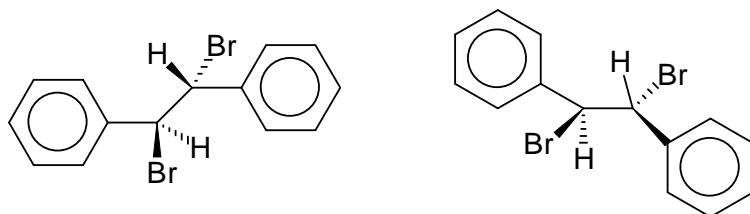
### Additional Problems

1. How many chiral centers does the alkaloid below have?



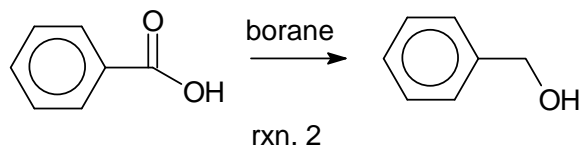
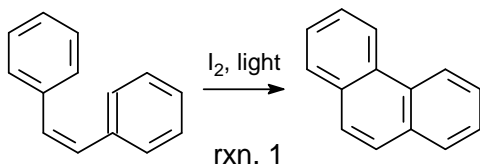
A. 0   B. 1   C. 2   D. 3   E. 4

2. Which statement is appropriate for the molecules below? (Hint: the (R,S) form is identical to the *meso* form, assign R or S to both chiral centers before answering this question).



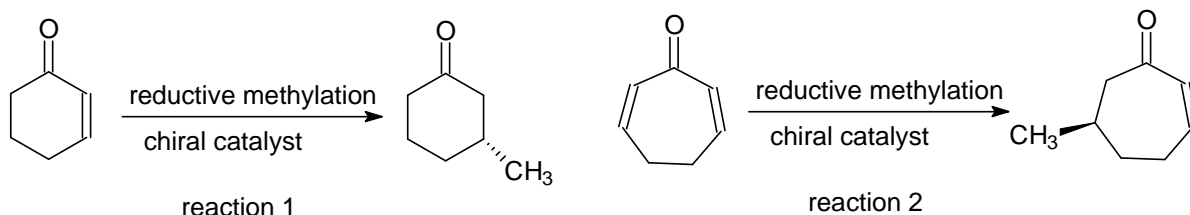
A. They are enantiomers      B. They are identical      C. Both are optically active  
D. The left one is the *meso* form      E. The right one is the *meso* form

3. Decide whether the following reactions are oxidations or reductions with respect to the organic molecules shown:



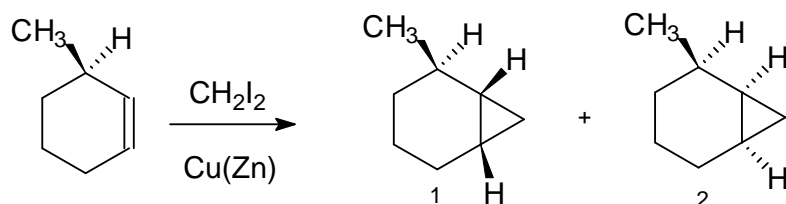
A. both are oxidations      B. both are reductions  
C. reaction 1 is an oxidation, reaction 2 a reduction  
D. reaction 1 is a reduction, reaction 2 an oxidation  
E. reaction 1 is a reduction, reaction 2 is neither an oxidation nor a reduction

4. Recently, a novel procedure for the reductive methylation of prochiral cyclic ketones was published. Is the methyl group added from the *si* face or the *re* face of these ketones?



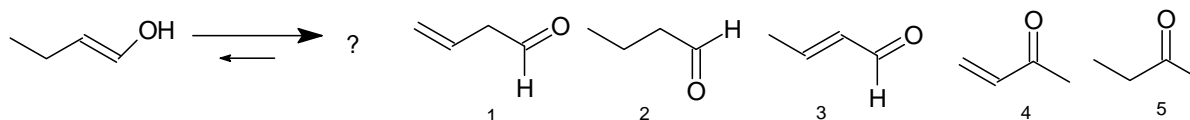
- A. From the *si* face in both reactions      B. From the *re* face in both reactions  
 C. Reaction 1, *si* face; reaction 2, *re* face      D. Reaction 1, *re* face; reaction 2, *si* face  
 E. Impossible to tell, based on the information given

5. Consider the reaction below and select the most appropriate statement



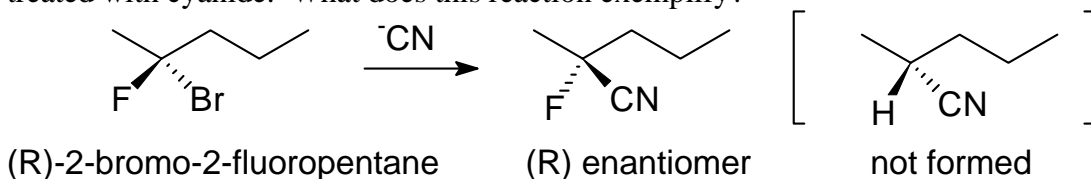
- A. This reaction actually forms one product only, 1 and 2 are identical  
 B. Compounds 1 and 2 are enantiomers  
 C. We can expect compounds 1 and 2 to form in equal amounts  
 D. Compound 1 is a meso form  
 E. Compounds 1 and 2 are diastereomers

6. Enols are not stable and will quickly tautomerize (rearrange) to the corresponding carbonyl compounds. What would the enol below rearrange to?



- A. Compound 1    B. Compound 2    C. Compound 3    D. Compound 4    E. Compound 5

7. Pure (R)-2-bromo-2-fluoropentane generated only one substitution product when treated with cyanide. What does this reaction exemplify?



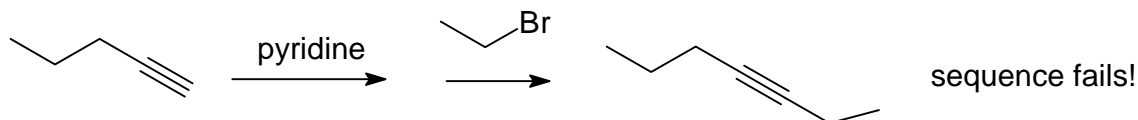
- A. inversion of configuration      B. retention of configuration      C. chiral induction  
 D. mutarotation      E. racemization

8. Which statement is appropriate for the molecules below?



- A. They are enantiomers      B. They are identical      C. They are diastereomers  
 D. The right one is a meso form      E. They are constitutional isomers

9. The reaction sequence below, intended to convert 1-pentyne to 3-heptyne by deprotonation with pyridine to an acetylide anion and subsequent alkylation with bromoethane, was **unsuccessful**. What is the most plausible explanation for this?



- A. It is impossible to deprotonate 1-pentyne  
 B. Bromoethane is a primary alkyl halide, this reaction requires a secondary alkyl halide  
 C. Pyridine is a weak base, this reaction requires a strong base  
 D. This reaction will generate 2-propylpentene rather than 3-heptyne  
 E. This reaction will generate 1-heptyne rather than 3-heptyne

10. How is acetylene (ethyne) manufactured industrially?

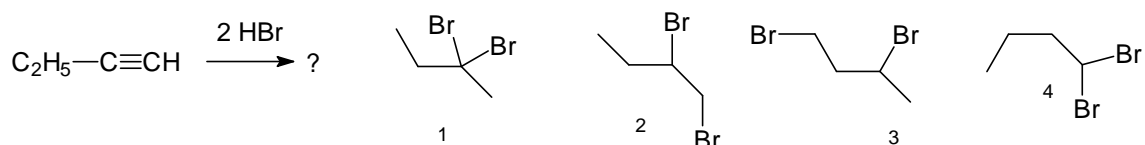
- A. From steam and ethane      B. From ethane and oxygen      C. from methane and ozone  
 D. From methane and steam      E. by acid treatment of ethanol

11. Which statement is appropriate for the molecules below?



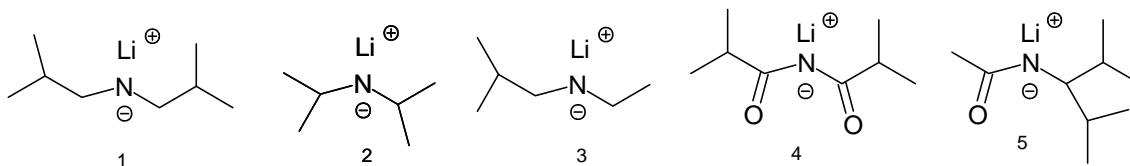
- A. They are enantiomers      B. They are identical      C. They are diastereomers  
 D. The right one is a meso form      E. They are constitutional isomers

12. What is the most plausible outcome for the reaction below?



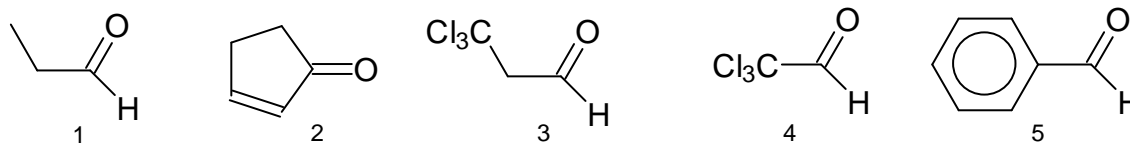
- A. compound 1      B. compound 2      C. compound 3      D. compound 4  
 E. a mixture of compounds 1 and 2

13. We discussed the compound LDA (lithium diisopropylamide) as a strong base. Which compound is LDA?



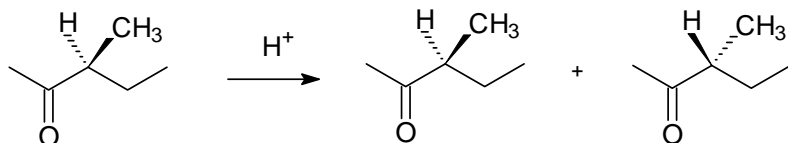
- A. Compound 1      B. Compound 2      C. Compound 3      D. Compound 4      E. Compound 5

14. Some of the compounds below have enols while others do not. Which ones have enols?



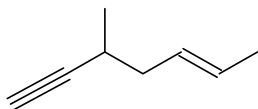
- A. Only 1      B. 1 and 2      C. 1,2 and 3      D. 1, 2, 3 and 4      E. 4 and 5

15. Under acidic conditions, pure (S)-2-methyl-2-pentanone rapidly converts to a mixture of the (R) and (S) enantiomers. What best describes this reaction?



A. inversion B. levorotation C. chiral induction D. mutarotation E. racemization

16. What is the best name for the compound below?



A. 3-methyl-5-hepten-1-yne  
 B. (E)-3-methyl-5-hepten-1-yne  
 C. (E)-5-methyl-2-hepten-6-yne  
 D. (E)-3-methyl-1-heptyne-5-ene  
 E. 3-methyl-1-heptyne-6-ene

17. What is the correct formula for NBS (N-bromosuccinimide)?

A.  $C_4H_4BrNO_2$  B.  $C_{10}H_{10}BrNO_2$  C.  $C_4H_4Br_2NO_2$  D.  $C_4H_6BrNO$   
 E.  $C_4H_2BrNO_2$

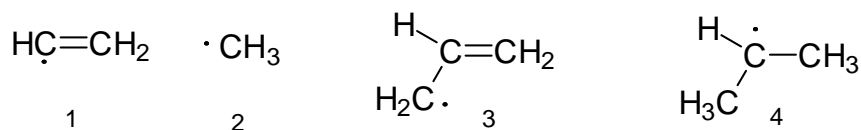
18. Which answer shows the correct ranking of the stated bases, **weakest** base to **strongest** base?

A. sodium amide < pyridine < sodium hydroxide  
 B. triethylamine < sodium hydroxide < sodium methoxide  
 C. pyridine < potassium tert-butoxide < sodium hydroxide  
 D. triethylamine < lithium diisopropylamide < pyridine  
 E. triethylamine < sodium methoxide < pyridine

19. Only one of the following formulas is both valid and represents a Gilman reagent:

A.  $(C_2H_5)_2CuLi$  B.  $C_2H_5CuLi$  C.  $C_2H_5MgBr_2$  D.  $(C_2H_5)_2CuLi_2$  E.  $C_2H_5Cu_2Li$

20. Rank the following radicals in increasing order of stability:



A.  $1 < 3 < 2 < 4$  B.  $1 < 2 < 4 < 3$  C.  $1 < 2 < 3 < 4$  D.  $2 < 1 < 4 < 3$   
 E.  $2 < 1 < 3 < 4$

Key:

1. C
2. B
3. C
4. B
5. E
6. B
7. A
8. A
9. C
10. D
11. C
12. A
13. B
14. C
15. E
16. B
17. A
18. B
19. A
20. B