

Organic Chemistry 1

Multiple Choice

1. The following name is incorrect according to IUPAC rules: 3-*sec*-butylpentane. What is the correct name?

- a) 3-ethyl-4-methylhexane
- b) 3-(1-methylpropyl)pentane
- c) 3-ethyl-2-methylpentane
- d) 2,3-diethylpentane
- e) 3,4-dimethylhexane

2. Each choice below lists two alkanes. In which choice is the alkane with the lower boiling point listed first?

- a) pentane; butane
- b) 2-methylpentane; 2,3-dimethylbutane
- c) 2-methylhexane; 2-methylbutane
- d) 2-methylpentane; hexane

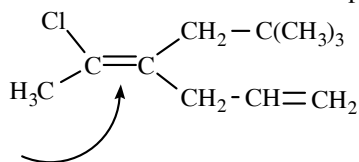
3. Which compound below is expected to have the highest (i.e., most exothermic) heat of hydrogenation?

- a) (E)-4-methyl-2-pentene
- b) (Z)-4-methyl-2-pentene
- c) 2-methyl-2-pentene
- d) 3-methyl-1-pentene
- e) 2-methyl-1-pentene

4. A compound of formula $C_{12}H_{12}BrCl_2N$ has two rings. How many molar equivalents of hydrogen does it absorb if all of the remaining unsaturations are double bonds?

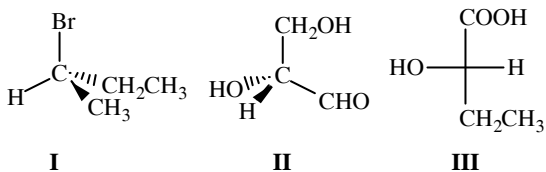
- a) 2
- b) 3
- c) 4
- d) 5
- e) 6

5. What is the best way to describe the stereochemistry of the double bond indicated in the compound below?



- a) *cis*
- b) *trans*
- c) E
- d) Z
- e) anti

6. Which of the compounds below should be designated with an (S) configuration?

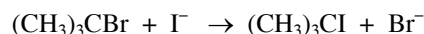


- a) I
- b) II
- c) III
- d) I and II
- e) none of these

7. What is the total number of stereoisomers of 2,4-dichloropentane?

- a) 0
- b) 1
- c) 2
- d) 3
- e) 4

8. Consider the following reaction:



If no other changes are made, what is the effect of doubling the concentration of iodide ion on the rate of the reaction?

- a) no change
- b) doubles the rate
- c) triples the rate
- d) quadruples the rate
- e) halves the rate

9. Which of the following alkyl halides would be expected to react the fastest under S_N2 conditions?

- a) 1-bromo-2-methylbutane
- b) 2-bromo-2-methylbutane
- c) 2-bromo-3-methylbutane
- d) 1-bromo-3-methylbutane
- e) 2-bromo-2,3-dimethylbutane

10. Which of the following is the best nucleophile in an S_N2 reaction?

- a) CH_3O^-
- b) Cl^-
- c) H_2O
- d) OH^-
- e) NH_3

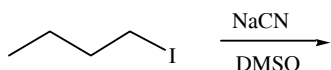
11. Which of the following correctly identifies the characteristics of an S_N2 reaction?

	<u>Number of steps</u>	<u>stereochemistry</u>
a)	1	racemization
b)	1	inversion
c)	1	retention
d)	2	racemization
e)	2	retention

12. Which of the substances below will react the fastest when treated with NaCN and DMSO?

- CH₃-F
- CH₃-Cl
- CH₃-Br
- CH₃-I
- CH₃-OTos

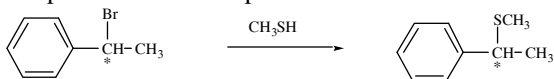
13. Consider the reaction of 1-iodobutane with the cyanide ion:



What would happen to the rate of the reaction if the concentration of both the cyanide ion and the 1-iodobutane are doubled?

- no change
- rate doubles
- rate triples
- rate quadruples
- rate is halved

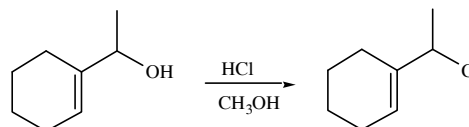
14. When (S)-1-bromo-1-phenylethane undergoes a substitution reaction with methanethiol (CH₃SH), the product is the compound shown.



What is/are the configuration(s) of the product obtained from this reaction?

- A mixture of (R) and (S), with slightly more (R) than (S).
- A mixture of (R) and (S), with slightly more (S) than (R).
- (R) only
- (S) only

15. Which term below best describes the mechanism of the following reaction?

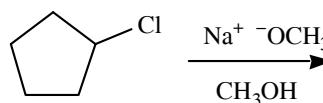


- S_N1
- S_N2
- E1
- E2
- Free Radical Halogenation

16. Which alkyl halide is expected to react the fastest under S_N1 conditions?

- (CH₃)₃Cl
- (CH₃)₃CBr
- (CH₃)₃CCl
- (CH₃)₃CF
- They would all react at the same rate.

17. What is the best description of the mechanism of the reaction below?



- free radical halogenation
- S_N1
- S_N2
- E1
- E2

Answers: 1a, 2d, 3d, 4c, 5d, 6c, 7d, 8a, 9d, 10a, 11b, 12e, 13d, 14a, 15a, 16a, 17e; Short Answer Question #2: 3-(iodomethyl)-2-isopropyl-1-pentanol

Short Answer

1. Use the information in the table below to answer the following question.

CH ₃ ⇌ H	1, 3 diaxial interaction	3.8 kJ/mol
H ⇌ H	eclipsed	4.0 kJ/mol
H ⇌ CH ₃	eclipsed	6.0 kJ/mol
CH ₃ ⇌ CH ₃	eclipsed	11 kJ/mol
CH ₃ ⇌ CH ₃	gauche	3.8 kJ/mol

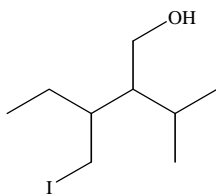
Consider the following two compounds:

trans-1,2-dimethylcyclohexane

cis-1,4-dimethylcyclohexane

Draw the most stable conformation of each molecule. Use the data in the table above to calculate the total strain energy of each structure. Indicate which, if either, is more stable, and calculate the energy difference between the two structures.

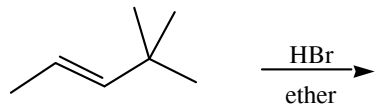
2. Name the following compound:



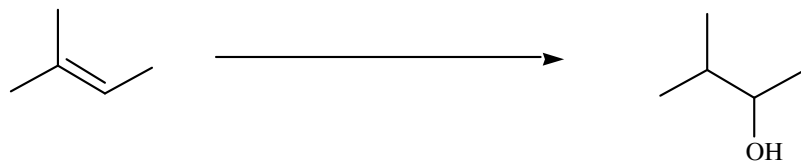
3. Compound **A**, C_7H_{14} , was found to be optically active. On catalytic reduction over a palladium catalyst, one equivalent of hydrogen gas was absorbed, yielding optically active compound **B**, C_7H_{16} . When compound **A** was treated with $KMnO_4$ in an acidic solution, CO_2 bubbled out and compound **C** was formed. Compound **C** has the formula $C_6H_{12}O$, and it is an optically active ketone. Draw the structures of compounds **A**, **B**, and **C**.

Reactions

1. Draw all possible products resulting from the reaction below:



2. What reagents are required to accomplish the transformation indicated below?



3. *trans*-2-butene $\xrightarrow{CHCl_3, KOH}$



- 5.

- 6.

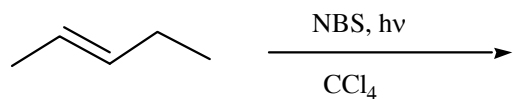
- 7.

- 8.

- 9.

- 10.

11. Draw all possible products for the following reaction:



Mechanism

1. When 3-methylcyclohexene reacts with HCl in ether, one of the products is 1-chloro-1-methylcyclohexane. Show the complete mechanism for the formation of this product using the curved arrow formalism.
2. Show the complete mechanism for the reaction of 2-methyl-2-pentanol with HBr.

Synthesis

1. acetylene as your only source of carbon $\xrightarrow{??}$ 3-methyl-3-pentanol
2. 1-bromobutane $\xrightarrow{??}$ 1-pentanol
3. 1-bromobutane $\xrightarrow{??}$ 2-hexanol
4. 1-bromobutane $\xrightarrow{??}$ 2-methyl-2-hexanol
5. 1-butanol $\xrightarrow{??}$ butanal
6. 1-butanol $\xrightarrow{??}$ butanoic acid
7. cyclohexane $\xrightarrow{??}$ cyclohexanone