Honors Assignment-1: Radical Reactions

1 Chlorination of pentane gives a mixture of isomers having the molecular formula $C_5H_{11}Cl$. The percentage of 1-chloropentane is 22%. Assuming the secondary hydrogens in pentane are equally reactive to monochlorination, what is the percentage of 3-chloropentane in the mixture?

1) 48% 2) 26% 3) 22% 4) 14%

2 Which one of the following gives a single monochlorination product?

1) 2,2-dimethylpropane
2) 2,2-dimethylbutane
3) 2,3-dimethylbutane
4) 2-methylpropane

3 Which of the following hydrocarbons has the slowest reaction rate with Br_2 and light?

1) CH_4 2) $CH_3CH_2CH_3$ 3) $CH_3CH_2CH_2CH_3$ 4) $(CH_3)_3CH$

4 Which of the following is not a good method to make bromocyclopentane?

1) cyclopentanol plus HBr
2) cyclopentanol plus NaBr
3) cyclopentanol plus PBr_3
4) cyclopentane plus Br_2 with light

5 How many monochlorination products do you expect in the following reaction?

$$(CH_3)_2CHCH_2CH_3 + Cl_2 \xrightarrow{\text{heat}}$$

1) one 2) two 3) three 4) four 5) five

6 How many monochlorination products do you expect in the following reaction?

$$(CH_3)_2CHCH_2CH(CH_3)_2 + Cl_2 \xrightarrow{\text{heat}}$$

1) one 2) two 3) three 4) four 5) five

7 Which of the following is the most stable radical?

1) $CH_3CH_2\dot{C}(CH_3)CH_3$ 2) $CH_3CH_2C(\dot{C}H_2)CH_3$ 3) $CH_3\dot{C}HCCH_3$ (with CH_3) 4) $\dot{C}H_2CH_2CCH_3$ (with CH_3)

8 Which constitutional isomer of C_6H_{14} gives only two monochlorination products?

1) 2-methylpentane
2) 3-methylpentane
3) 2,2-dimethylbutane
4) 2,3-dimethylbutane

9 Consider the following reaction (X = Cl or Br).

$$CH_3CH_2CH_3 + X_2 \xrightarrow{\text{light}} CH_3\underset{\underset{X}{|}}{C}HCH_3 + CH_3CH_2\underset{\underset{X}{|}}{C}H_2$$

Which statement(s) is(are) correct?

A. Statistically the 1-halopropane should be the major isomer.
B. The 2-halopropane to 1-halopropane ratio is largest when X=Br.
C. The 2-halopropane to 1-halopropane ratio is the largest when X=Cl.

1) B 2) C 3) A and B 4) A and C

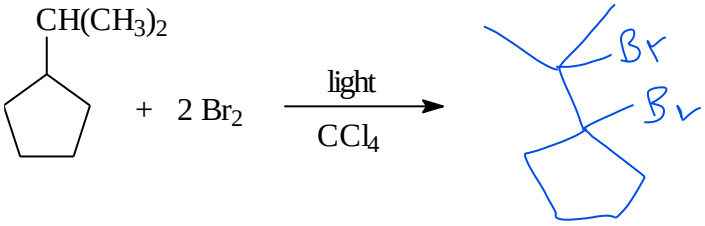
10 The central carbon of the *tert*-butyl carbocation is:

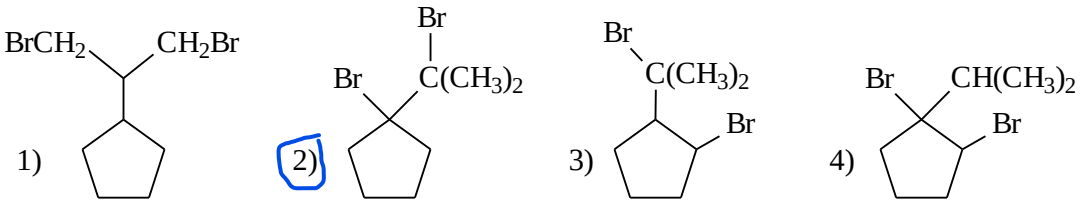
1) sp^2 hybridized with a +1 formal charge.
2) sp^2 hybridized with a 0 formal charge.
3) sp^3 hybridized with a +1 formal charge.
4) sp^3 hybridized with a 0 formal charge.

11 Studies indicate that the methyl radical is trigonal planar. Based on this, which of the following best describes the methyl radical?

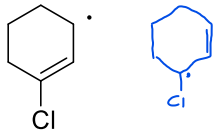
1) The carbon is sp^2 hybridized and the unpaired electron occupies an sp^2 orbital.
2) The carbon is sp^2 hybridized and the unpaired electron occupies a 2p orbital.
3) The carbon is sp^3 hybridized and the unpaired electron occupies an sp^3 orbital.
4) The carbon is sp^3 hybridized and the unpaired electron occupies a 2p orbital.

12 Dibromination of isopropylcyclopentane gives a product, which can be isolated in good yields. Which of the following would you predict to be this product?

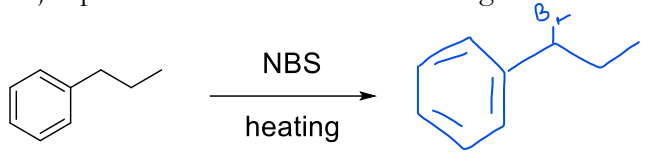


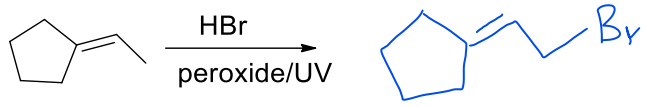


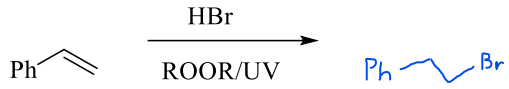
13. Draw all possible resonance structures for each of the following radicals:

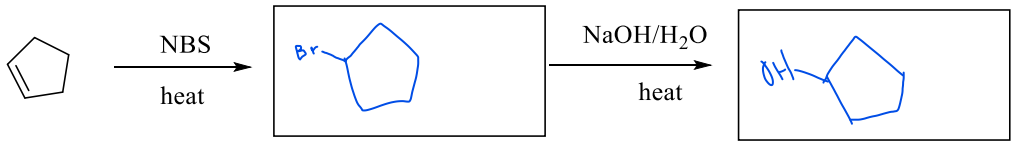


14: Predict the major product for each of the following reactions









15. Proposal a plan for the following multistep synthesis: