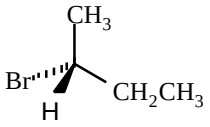
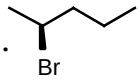
For each substrate and reagent combination in **26** to **29**, indicate the major product:

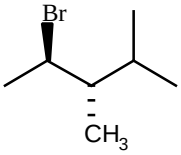
26.  + CH_3S^- (aqueous)

A. (R)-2-methylthiobutane B. (S)-2- methylthiobutane C. (±)-2- methylthiobutane D. None of these

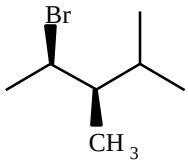
NOTE: the —S-CH_3 group is the "methylthio" group.

27.  + H_2O

A. (R)-2-pentanol B. (S)-2-pentanol C. (±)-2-pentanol D. None of these

28.  + EtO^-

A. (E)-3,4-dimethyl-2-pentene B. (Z)-3,4-dimethyl-2-pentene
C. (R)-3,4-dimethyl-1-pentene D. (S)-3,4-dimethyl-1-pentene E. None of these

29.  + *tert* -BuO^-

A. (E)-3,4-dimethyl-2-pentene B. (Z)-3,4-dimethyl-2-pentene
C. (R)-3,4-dimethyl-1-pentene D. (S)-3,4-dimethyl-1-pentene E. None of these

For questions **30** to **33**, tell what the effect on each reaction below of each change indicated with it. Use these choices:

A. same product(s), decreased rate B. no change in product(s) or rate
C. same product(s), increased rate D. different product ratio, increased rate
E. different product ratio, decreased rate

30. 2-bromo-2-methylpentane with acetate ion, switched from a solvent with low polarity to a solvent of high polarity

31. 1-bromopentane with acetate ion, switching it from a solvent with low polarity to a solvent of high polarity

32. 2-bromo-2-methylpentane with acetate ion, switched from low temperature to high temperature

33. What mechanism does the reaction in **31** follow? A. S_N1 B. S_N2 C. E1 D. E2

34. What will be the major product formed when (1R, 2S)-1-bromo-1,2-diphenylbutane is treated with sodium ethoxide at relatively high temperatures?

A. (E)-1,2-diphenyl-1-butene B. (Z)-1,2-diphenyl-1-butene
C. (1S, 2S)-1-ethoxy-1,2-diphenylbutane D. (1R, 2S)-1-ethoxy-1,2-diphenylbutane
E. (1S, 2R)-1-ethoxy-1,2-diphenylbutane F. (1R, 2R)-1-ethoxy-1,2-diphenylbutane
G. no reaction

35. Why does the reaction of sodium ethoxide with (2R, 3S)-2-fluoro-3-methylpentane produce an "anti-Zaitsev" alkene?

A. the base can't reach the other hydrogen
B. the transition state is less crowded that way
C. the transition state is lower energy if the carbanion character forms at the more substituted carbon
D. the transition state is lower energy if the carbanion character forms at the less substituted carbon
E. none of these

36. Why does the reaction of sodium *t*-butoxide with (2R, 3S)-2-bromo-3-methylpentane produce an "anti-Zaitsev" alkene?

A. the base can't reach the other hydrogen
B. the transition state is planar
C. the transition state is lower energy if the carbanion character forms at the more substituted carbon
D. the transition state is lower energy if the carbanion character forms at the less substituted carbon
E. none of these

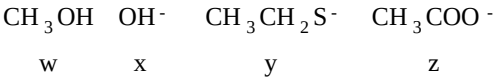
37. A chemist heated (1-bromoethyl)cyclobutane in water for an extended time. What was the major product?

A. no product B. 1-cyclobutylethanol C. 2-methylcyclopentanol
D. 1-methylcyclopentane E. product not given

38. What will be the effect of placing (R)-2-bromobutane in a high concentration of aqueous sodium bromide?

A. no reaction B. loss of optical activity C. formation of the alcohol

39. What is the correct order for increasing nucleophilicity of the species below when they react in water?



A. w,x,y,z B. x,y,z,w C. w,y,x,z D. y,w,x,z E. y,x,z,w F. Not given

40. What is the correct order for decreasing nucleophilicity of the species below when they react in water? (best first)

CH_3OH	OH^-	SH^-	CH_3COO^-
w	x	y	z

A. x,y,z,w B. y,x,z,w C. z,y,x,w D. x,z,y,w E. y,z,x,w F. z,x,y,w G. not given

41. What is the correct order for decreasing nucleophilicity of the halide ions when they react in DMSO?

A. F^-, Cl^-, Br^-, I^- B. I^-, Br^-, Cl^-, F^- C. not given

For questions 42-50, mark

A. True for both
B. False for both
C. True for S_N2 only
D. True for S_N1 only

for statements regarding nucleophilic substitution reactions.

42. 1-Bromopropane reacts faster than 2-bromopropane.

43 The rate of disappearance of substrate speeds up with increasing T.

44 The rate of disappearance of R-I = k[R-I].

45. A stereochemical inversion of configuration takes place.

46. A carbocation intermediate is involved in this reaction.

47. The rate of disappearance of substrate is faster when CH_3S^- is added.

48. The reaction involves a single step with no intermediate(s).

49. The reaction rate depends on whether the substrate is R-Br or R-Cl.

50. The reaction goes faster in an aprotic solvent.