Year 12 Science: Reactions of organic compounds

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. Ethene with H_2 and a Pt catalyst: give the type of reaction and the organic product.

2. Chloroethane heated with KOH(aq): type and product?

3. Propan-2-ol heated with concentrated H_2SO_4: type and product?

4. Butan-1-ol heated with $Cr_2O_7^{2-}/H^+$: type and product?

5. Propene with HCl: type and major product?

Exam-style question: starting from 2-bromobutane

A chemist starts with 2-bromobutane, $CH_3CHBrCH_2CH_3$.

6. Classify 2-bromobutane as primary, secondary or tertiary, and give the reason.

7. Give the reagent and conditions that turn it into butan-2-ol, and the reaction type.

8. Heated with KOH(alc), 2-bromobutane gives two alkenes. Name both, say which is major, and justify your choice.

9. Describe how bromine water could tell the alkene products apart from 2-bromobutane.

Fix the mistake

10. Correct this statement: "1-Bromopropane heated with KOH gives propene."

11. Correct this statement: "In the major product, the Br adds to the carbon with more H atoms."

12. Correct this statement: "2-Methylpropan-2-ol turns acidified dichromate green."

13. Correct this statement: "Polypropene is drawn with a double bond in each repeating unit."

Answer key (for parents and tutors)

1. Ethene with H_2 and a Pt catalyst: give the type of reaction and the organic product.
   Addition; ethane, CH_3CH_3.
2. Chloroethane heated with KOH(aq): type and product?
   Substitution; ethanol, CH_3CH_2OH, with KCl.
3. Propan-2-ol heated with concentrated H_2SO_4: type and product?
   Elimination; propene, $CH_2=CHCH_3$, the only product, because both neighbours of C2 are CH_3 groups.
4. Butan-1-ol heated with $Cr_2O_7^{2-}/H^+$: type and product?
   Oxidation; butanoic acid, $CH_3CH_2CH_2COOH$, and the orange dichromate turns green.
5. Propene with HCl: type and major product?
   Addition; 2-chloropropane is major and 1-chloropropane minor, by Markovnikov's rule.
6. Classify 2-bromobutane as primary, secondary or tertiary, and give the reason.
   Secondary: the carbon holding the Br (C2) is bonded to two other carbons (Achieved).
7. Give the reagent and conditions that turn it into butan-2-ol, and the reaction type.
   KOH(aq) and heat; substitution, as OH replaces Br (Achieved).
8. Heated with KOH(alc), 2-bromobutane gives two alkenes. Name both, say which is major, and justify your choice.
   But-2-ene, $CH_3CH=CHCH_3$, is major and but-1-ene, $CH_2=CHCH_2CH_3$, is minor. 2-Bromobutane is asymmetric about C2, so the H can be removed from C1 or C3 along with the Br; C3 has fewer H atoms (2) than C1 (3), so removing H from C3 gives the major product, but-2-ene, which forms as cis and trans isomers (Merit for the two products and the rule, Excellence for applying it to C1 and C3).
9. Describe how bromine water could tell the alkene products apart from 2-bromobutane.
   The alkenes turn orange bromine water colourless quickly, because Br_2 adds across the C=C; 2-bromobutane has no C=C, so the colour stays (Achieved for the observation, Merit for the reason).
10. Correct this statement: "1-Bromopropane heated with KOH gives propene."
    It depends on the solvent: KOH(aq) substitutes to give propan-1-ol, and only KOH(alc) eliminates to give propene.
11. Correct this statement: "In the major product, the Br adds to the carbon with more H atoms."
    It is the H that goes to the carbon with more H atoms; the Br goes to the other carbon.
12. Correct this statement: "2-Methylpropan-2-ol turns acidified dichromate green."
    It is a tertiary alcohol, so it is not oxidised and the dichromate stays orange.
13. Correct this statement: "Polypropene is drawn with a double bond in each repeating unit."
    The double bonds open to form the chain, so the polymer has only single bonds and is saturated.