16–18 years

Organic synthesis quiz

ROYAL SOCIETY OF CHEMISTRY

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Learning objectives

1. Apply IUPAC nomenclature rules to a range of organic compounds.
2. Recall reagents and conditions for given interconversions in single- and multi-stage organic pathways.
3. Determine correct structures as intermediates or products in reaction sequences.

Get ready

- This quiz has 15 questions on organic synthesis.
- Write the numbers 1–15 on a page in your book or on scrap paper.

Question

1. Carboxylic acid $(CH_3)_2CHCOOH$ can be produced by oxidation of an alcohol at reflux. Deduce which alcohol would be oxidised at reflux to produce this carboxylic acid.

A. 2-methylbutan-1-ol

B. 2-methylpropan-1-ol

C. 1,1-dimethylethanol

D. propan-2-ol

Question

2. 2-methylbutylamine can be made in a three-step process starting from an alkene. The synthesis has the reagents and conditions:
Step 1: HBr
Step 2: Ethanolic KCN
Step 3: $LiAlH_4$

What was the starting alkene?

A. but-2-ene
B. methylpropene
C. 2-methylbut-1-ene
D. 2-methylbut-2-ene

Question

3. Consider the reaction sequence represented by the displayed formulae below. State which type of reaction is not involved in the synthetic sequence.

$CH_3CH_2CH_3 \rightarrow (CH_3)_2CHCl \rightarrow (CH_3)_2CHCN \rightarrow (CH_3)_2CHCH_2NH_2 \rightarrow (CH_3)_2CHCH_2NHCOCH_3$

A. halogenation
B. acylation
C. reduction
D. oxidation

4. Which of the following reactions involve free radicals?

A. dihalogenation of propene

B. hydrohalogenation of ethene

C. halogenation of propane

D. halogenation of benzene

Question

Question

5. Select the reagent from the list below which could produce an alcohol from an alkene.

A. acidified potassium dichromate(VI)

B. warm dilute acid

C. aqueous sodium hydroxide

D. steam and concentrated phosphoric acid

Question

6. Identify the compound that could not act as a monomer.

A. chloroethene

B. 2-amino-2-chloroethanoic acid

C. chloropropane

D. ethanedioic acid

Question

7. High atom economy is one of the aims of green chemistry. Which of the following types of reaction has the highest atom economy?

A. elimination

B. hydrolysis

C. addition

D. substitution

Question

8. Select which pair(s) of reagents could be used to make the amide $CH_3CH_2CONHCH_3$?

A. $CH_3CH_2CONH_2$ and CH_3Br

B. CH_3CH_2COCl and CH_3NH_2

C. $CH_3CH_2COCH_3$ and NH_3

D. CH_3CH_2COONa and CH_3NH_2

Question

9. The shortest synthetic pathway from benzene to phenylamine requires how many steps?

A. one

B. two

C. three

D. four

Question

10. What is the IUPAC systematic name of the major product formed in the reaction between 2-ethylbut-1-ene and hydrogen bromide?

A. 1-bromo-2-ethylbutane

B. 2-bromo-2-methylpentane

C. 2-bromo-2-ethylbutane

D. 3-bromo-3-methylpentane

Question

11. State which compound from the list below is not able to act as an electrophile.

A. hydrogen bromide

B. aminomethane

C. sulfuric acid

D. bromomethane

Question

12. 2-bromopropane is reacted with potassium cyanide in ethanol. The product is isolated and then reduced with sodium tetrahydridoborate. What is the length of the longest carbon chain in the final product molecule?

A. two

B. three

C. four

D. five

Question

13. What happens when 2-methylpropan-1-ol is heated together with acidified potassium dichromate(VI) and immediately distilled?

A. no new product is formed

B. 2-methylpropanoic acid is isolated

C. butanone is isolated

D. 2-methylpropanal is isolated

Question

14. Which pair of reagents results in the formation of a compound that has a functional group which is commonly found in flavourings and perfumes?

A. $CH_3CH_2CH_2COCl + CH_3NH_2$

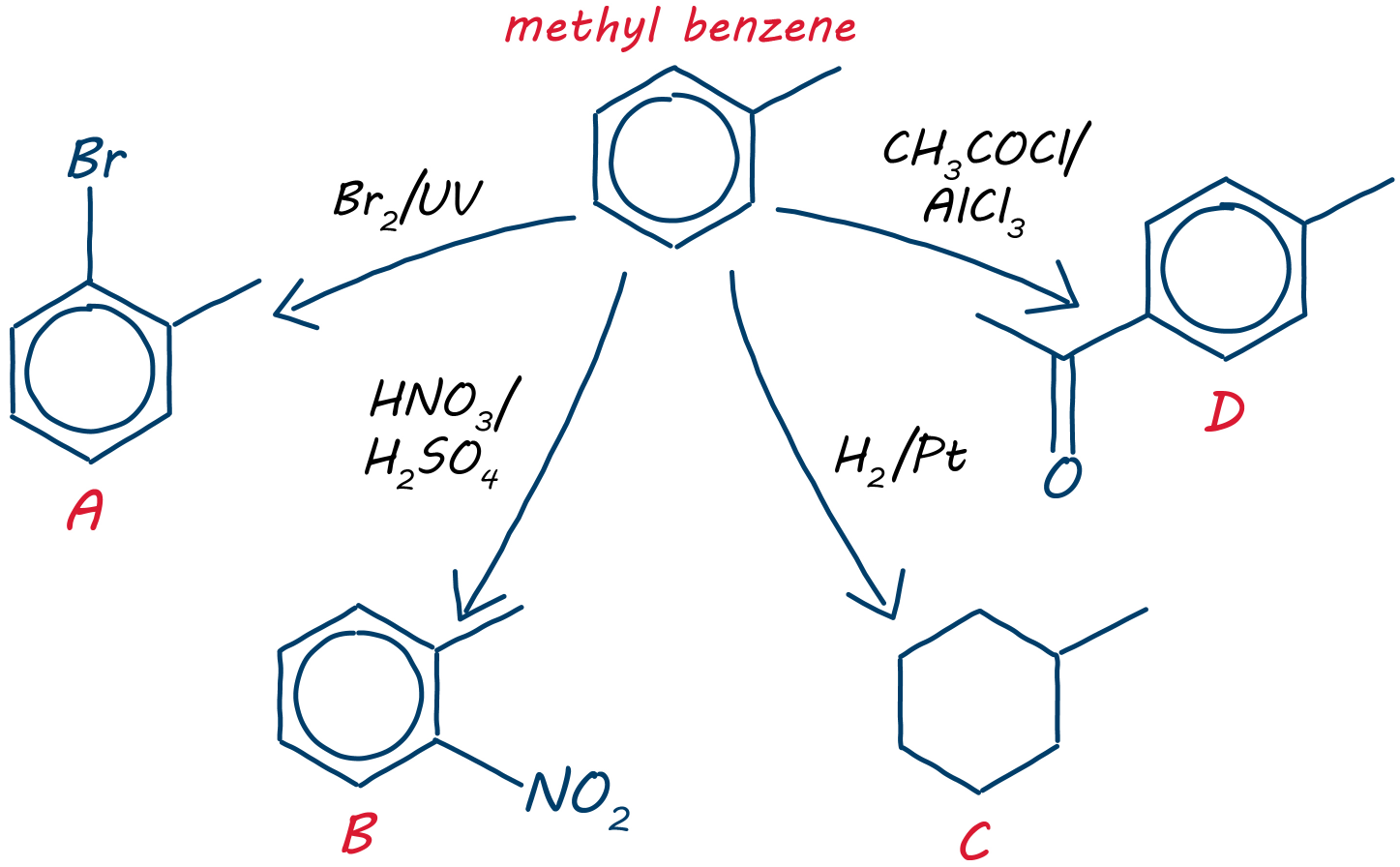
B. $CH_3CH_2COCl + CH_2CH_2OH$

C. $CH_3COOH + CH_3Cl$

D. $(CH_3CO)_2O + H_2O$

Question

15. The image shows a student's revision map of reactions of benzene. State which structure, A, B, C, or D, is incorrect.



Answers

1. B – 2-methylpropan-1-ol
2. A – but-2-ene
3. D – oxidation
4. C – halogenation of propane
5. D – steam and concentrated phosphoric acid
6. C – chloropropane
7. C – addition
8. B – CH_3CH_2COCl and CH_3NH_2
9. B – two
10. D – 3-bromo-3-methylpentane
11. B – aminomethane
12. B – three
13. D – 2-methylpropanal is isolated
14. B – $CH_3CH_2COCl + CH_2CH_2OH$
15. A is incorrect

    Correct structure of A: