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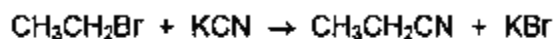
ORGANIC CHEMISTRY

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| Level & Board | AQA (A-LEVEL) |
| TOPIC: | HALOGENOALKANES |
| PAPER TYPE: | QUESTION PAPER - 3 |
| TOTAL QUESTIONS | 10 |
| TOTAL MARKS | 34 |

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Halogenoalkanes - 3

1. Bromoethane reacts with potassium cyanide to form compound D.



Compound D

(a) Outline the mechanism for this reaction.

(2)

(b) Give the IUPAC name of D.

(1)

(c) Calculate the percentage atom economy for the formation of D in this reaction.

Give your answer to the appropriate number of significant figures.

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(2)

2. Which compound has the fastest rate of reaction with potassium cyanide to form pentanenitrile?

- A. 1-bromobutane
- B. 1-chlorobutane
- C. 1-fluorobutane

D. 1-iodobutane

(1)

3. 2-Methylpropan-1-ol can be prepared by reacting 1-bromo-2-methylpropane with dilute aqueous sodium hydroxide.

(a) Name and outline the mechanism for this reaction.

(3)

- (b) When 2.0 cm^3 of 1-bromo-2-methylpropane ($M_r = 136.9$) were reacted with an excess of sodium hydroxide, 895 mg of 2-methylpropan-1-ol ($M_r = 74.0$) were obtained.

The density of 1-bromo-2-methylpropane is 1.26 g cm^{-3}
Calculate the percentage yield for this reaction.

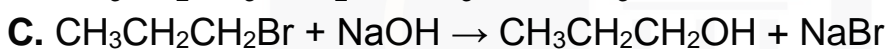
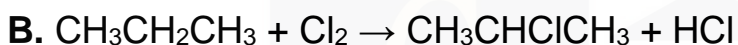
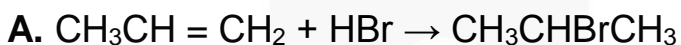
(3)

- (c) When 1-bromo-2-methylpropane reacts with hot, concentrated ethanolic potassium hydroxide rather than dilute aqueous sodium hydroxide, a different product is formed.

Name this organic product and name the mechanism for this reaction.

(2)

4. Which one of the following reactions involves nucleophilic addition?



(1)

5. Which one of the following is not a suitable method for the preparation of ethanol?

A. oxidation of ethane

B. hydration of ethene

C. reduction of ethanal

D. hydrolysis of bromoethane

(1)

6. A substitution reaction occurs when 2-bromopropane reacts with aqueous sodium hydroxide.

(a) Draw the structure of the organic product of this reaction and give its name.

(2)

(b) Name and outline the mechanism for this reaction.

(3)

7. When potassium hydroxide reacts with bromoethane, ethene can be formed.

Name and outline a mechanism for this reaction.

(4)

8. Which of the following mechanisms does not occur in reactions of bromoethane?

- A. Electrophilic addition
- B. Elimination
- C. Nucleophilic substitution
- D. Radical substitution

(1)

9. CCl_4 is an effective fire extinguisher but it is no longer used because of its toxicity and its role in the depletion of the ozone layer.

In the upper atmosphere, a bond in CCl_4 breaks and reactive species are formed.

(a) Identify the condition that causes a bond in CCl_4 to break in the upper atmosphere.

Deduce an equation for the formation of the reactive species.

(2)

(b) One of the reactive species formed from CCl_4 acts as a catalyst in the decomposition of ozone.

Write two equations to show how this species acts as a catalyst.

(2)

(c) A small amount of the freon CF_3Cl with a mass of 1.78×10^{-4} kg escaped from a refrigerator, into a room of volume 100 m^3 .

Assuming that the freon is evenly distributed throughout the air in the room, calculate the number of freon molecules in a volume of 500 cm^3 .

Give your answer to the appropriate number of significant figures.

The Avogadro constant = $6.02 \times 10^{23} \text{ mol}^{-1}$.

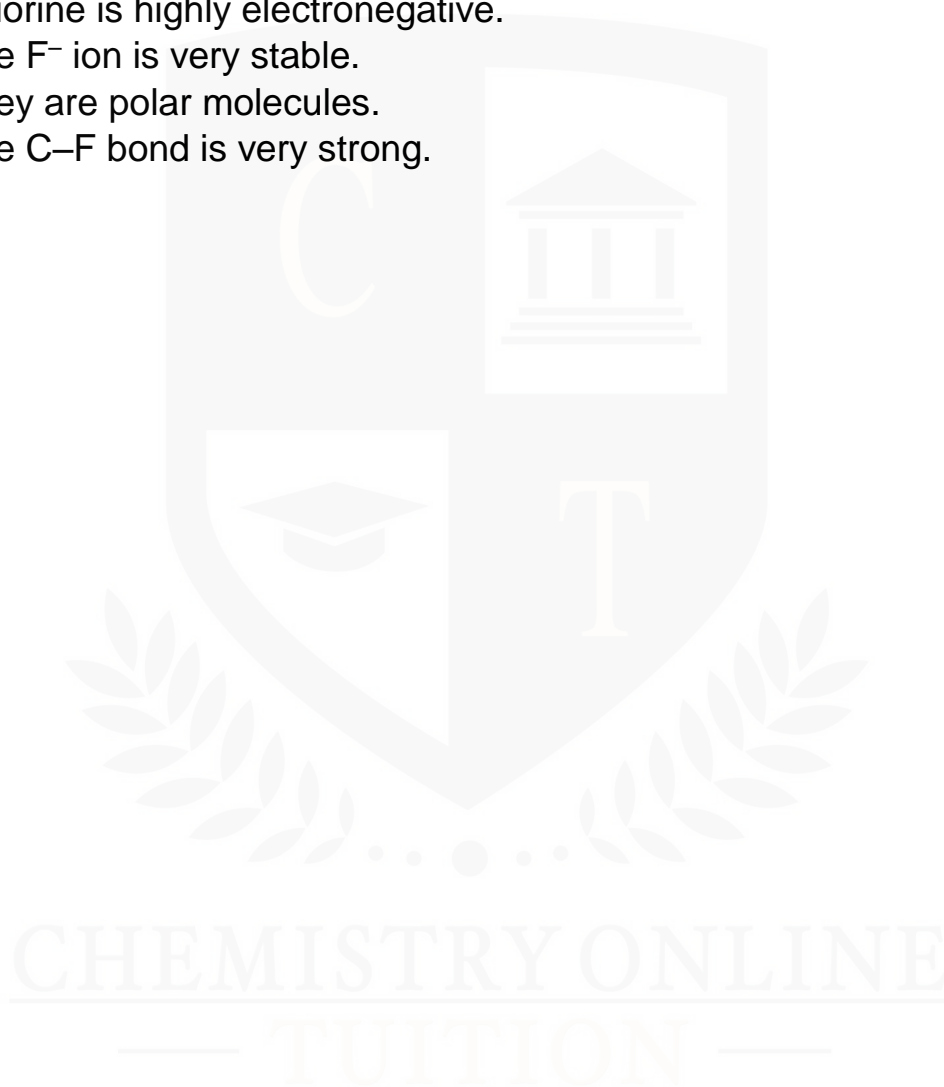
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(3)

10. Why are fluoroalkanes unreactive?

- A. Fluorine is highly electronegative.
- B. The F^- ion is very stable.
- C. They are polar molecules.
- D. The C–F bond is very strong.

(1)



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