Question 6 Define the term 'molecularity'. The gas-phase reaction

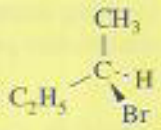
$$F_2(g) + CCl_3F(g) = ClF(g) + CCl_2F_2(g) \qquad (1)$$

was found to have an experimental rate equation of the form

$$J = k_R[F_2]^{1/2}[CCl_3F] \qquad (2)$$

Briefly discuss whether or not this reaction is composite.

Question 7



$\xrightarrow{NaOH}$ a single, optically active product (3)

Give the structure of the product obtained in the above reaction. Using curly arrows, draw out the reaction mechanism to show how the product is formed.

Question 8 (*a*) (*2 marks*) In one sentence, describe how an electron in a hydrogen 1s orbital would differ from an electron in a fluorine 1s orbital.

(*b*) (*3 marks*) Explain why, in a fluorine molecule, F_2, the molecular orbitals formed from 1s orbitals are at an energy close to that of 1s orbitals in the fluorine atom.

Question 9 Predict the product of the following reaction:

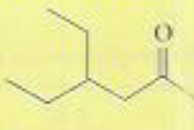
$$CH_3{-}CH_2{-}CH{=}CH_2 + HBr \longrightarrow ? \qquad (4)$$

Using curly arrows, draw out the mechanism that accounts for its formation.

Question 10 Explain what is meant by the 'mutual exclusion rule' in vibrational spectroscopy, and give an example of a molecule that obeys the rule.

Question 11 Why is CO extremely toxic, whereas CO_2 is only a suffocating gas?

Question 12 Predict the product of the following reaction. Using curly arrows, draw out the mechanism for its formation.



$\xrightarrow[\text{heat}]{\text{Na/xylene}}$ (5)