

| Question 7 | | Marks | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------|--|---------------------------------|--------------------|---|-------------|--------------------|---|----------|---------|-----------------|----------|----------|----------|--------------|----------|----------|----------|--------------|----------|----------|-------------------------|----------|----------|----------|-------------------------|------------|----------|----------|--------|----------|----------|----------|------------|------------|----------|--|
| (a) | $C^{35}Cl_2F_2^+ = 120$ | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ratio 9 : 6 : 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (b) | <p>1 mark for peaks at correct masses, 1 mark for correct relative intensities and 1 mark for the formulae of the ions indicated correctly (allow mark if '+' sign omitted - as here).</p> | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | (c) | ratio 1 : 2 : 3 : 4 : 3 : 2 : 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (d) | <table border="1"> <thead> <tr> <th></th> <th>Common name</th> <th>Structural formula</th> <th>Number of different fluorine environments</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>CFC-113</td> <td>$Cl_2FC-CClF_2$</td> <td>2</td> </tr> <tr> <td>B</td> <td>CFC-113a</td> <td>Cl_3C-CF_3</td> <td>1</td> </tr> <tr> <td>C</td> <td>HFC-134a</td> <td>F_3C-CH_2F</td> <td>2</td> </tr> <tr> <td>D</td> <td>CFC-11 (Freon-11, R-11)</td> <td>CCl_3F</td> <td>1</td> </tr> <tr> <td>E</td> <td>CFC-12 (Freon-12, R-12)</td> <td>CCl_2F_2</td> <td>1</td> </tr> <tr> <td>F</td> <td>CFC-13</td> <td>$CClF_3$</td> <td>1</td> </tr> <tr> <td>G</td> <td>Halon 1211</td> <td>$CBrClF_2$</td> <td>1</td> </tr> </tbody> </table> | | | | Common name | Structural formula | Number of different fluorine environments | A | CFC-113 | $Cl_2FC-CClF_2$ | 2 | B | CFC-113a | Cl_3C-CF_3 | 1 | C | HFC-134a | F_3C-CH_2F | 2 | D | CFC-11 (Freon-11, R-11) | CCl_3F | 1 | E | CFC-12 (Freon-12, R-12) | CCl_2F_2 | 1 | F | CFC-13 | $CClF_3$ | 1 | G | Halon 1211 | $CBrClF_2$ | 1 | 3 marks for all 7 correct, 2 marks for 6 correct, 1 mark for 5 correct |
| | | Common name | Structural formula | Number of different fluorine environments | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | A | CFC-113 | $Cl_2FC-CClF_2$ | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | B | CFC-113a | Cl_3C-CF_3 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | C | HFC-134a | F_3C-CH_2F | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | D | CFC-11 (Freon-11, R-11) | CCl_3F | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | E | CFC-12 (Freon-12, R-12) | CCl_2F_2 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | F | CFC-13 | $CClF_3$ | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| G | Halon 1211 | $CBrClF_2$ | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Question 7 continued | | Marks | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------|--|--------------------------------------|--------------------------|--------------------|--------------------------|----------|---------|--------------------------------------|--------------|----------|----------|-----------------------------------|--|----------|----------|------------------------------------|--------------|----------|-------------------------|--------------------|--|----------|-------------------------|---------------------------------|--|----------|--------|-------------------|--|----------|------------|---------------------|--|---|
| (e) | <p>1 mark for structure showing -CF₃ group. 1 mark for mirror images shown correctly.</p> | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (f) | <table border="1"> <thead> <tr> <th></th> <th>Common name</th> <th>Structural formula</th> <th>Expected intensity ratio</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>CFC-113</td> <td>Cl₂FC-CClF₂</td> <td>1 : 2</td> </tr> <tr> <td>B</td> <td>CFC-113a</td> <td>Cl₃C-CF₃</td> <td></td> </tr> <tr> <td>C</td> <td>HFC-134a</td> <td>F₃C-CH₂F</td> <td>3 : 1</td> </tr> <tr> <td>D</td> <td>CFC-11 (Freon-11, R-11)</td> <td>CCl₃F</td> <td></td> </tr> <tr> <td>E</td> <td>CFC-12 (Freon-12, R-12)</td> <td>CCl₂F₂</td> <td></td> </tr> <tr> <td>F</td> <td>CFC-13</td> <td>CClF₃</td> <td></td> </tr> <tr> <td>G</td> <td>Halon 1211</td> <td>CBrClF₂</td> <td></td> </tr> </tbody> </table> | | Common name | Structural formula | Expected intensity ratio | A | CFC-113 | Cl ₂ FC-CClF ₂ | 1 : 2 | B | CFC-113a | Cl ₃ C-CF ₃ | | C | HFC-134a | F ₃ C-CH ₂ F | 3 : 1 | D | CFC-11 (Freon-11, R-11) | CCl ₃ F | | E | CFC-12 (Freon-12, R-12) | CCl ₂ F ₂ | | F | CFC-13 | CClF ₃ | | G | Halon 1211 | CBrClF ₂ | | 2 |
| | Common name | Structural formula | Expected intensity ratio | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A | CFC-113 | Cl ₂ FC-CClF ₂ | 1 : 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| B | CFC-113a | Cl ₃ C-CF ₃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C | HFC-134a | F ₃ C-CH ₂ F | 3 : 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D | CFC-11 (Freon-11, R-11) | CCl ₃ F | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E | CFC-12 (Freon-12, R-12) | CCl ₂ F ₂ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| F | CFC-13 | CClF ₃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| G | Halon 1211 | CBrClF ₂ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (g) | <p>Allow 1 mark for the correct structure and 1 mark for correct identification of fluorines.</p> | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |