Practice exam questions for Chapter 6: Molecules and intermolecular forces (Paper-saver version)

Question 1 (Bursary 2000 Question 6)

Hydrogen fluoride, HF, is liquid at 0 °C whereas all the other hydrogen halides are gases at this temperature.

a Name the intermolecular attraction responsible for the unusually high boiling point of HF. A

b HF is called a binary compound because it contains only two elements.
Name TWO binary compounds (other than HF) where the same type of intermolecular attraction present in HF is also important. A

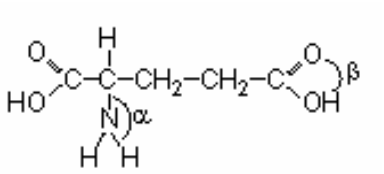
Question 2 (Bursary 2001 Question 1: modified)

Element	Atomic Number	Melting Point / °C
Aluminium	13	660
Silicon	14	1410 ',
Chlorine	17	−101

The table above shows the melting points of three elements from row 3 of the periodic table. Discuss why the melting points of aluminium and silicon are much higher than that of chlorine. A M E

Question 3 (Bursary 2001 Question 4: modified)

Monosodium glutamate (MSG) is a food additive often used in cooking to enhance taste. It is made from glutamic acid, which has the formula:



Complete the table below for the angles labelled α and β in the glutamic acid molecule above.
Choose the angle from the list in the box below. A M E

90°	*109^0*	*120°*	*180°*	*210°*

Angle α	Angle β
Justify your answer.	Justify your answer.

Question 4 (Bursary 2001 Question 5: modified)

a The table below contains data on some compounds that can be used as fuels.

Name	**Formula**	***M*/g mol^{-1}**	**Melting point/°C**	**Boiling point/°C**	**$\Delta_c H$ /kJ mol^{-1}**
ethane	C_2H_6	30	–183	–88	–1557
methanol	CH_3OH	32	–97	64	–725
hydrazine	H_2NNH_2	32	1	114	–534

What is the physical state of the following substances at room temperature (25 °C)? Circle your chosen answer. A

i Ethane: solid liquid gas

ii Hydrazine: solid liquid gas

iii Use the data in the table above to explain how you made your choice. A M

b Oxygen, O_2, has a similar molar mass to methanol, but melts at –219 °C.

Explain why there is a difference between the melting points of oxygen and methanol. A M

c Draw the Lewis structure for hydrazine, H_2NNH_2. A

d Hydrazine has been widely used as a fuel. However, it melts at 1°C so it is not an ideal fuel if the temperature drops below this point. Methylhydrazine, CH_3HNNH_2, or dimethylhydrazine, $(CH_3)_2NNH_2$, are often used in rocket fuel as they melt at lower temperatures.

Explain why methylhydrazine and dimethylhydrazine have lower melting points than hydrazine. A M