

CHEMISTRY

Time allowed: 1.5 hours (90 minutes)

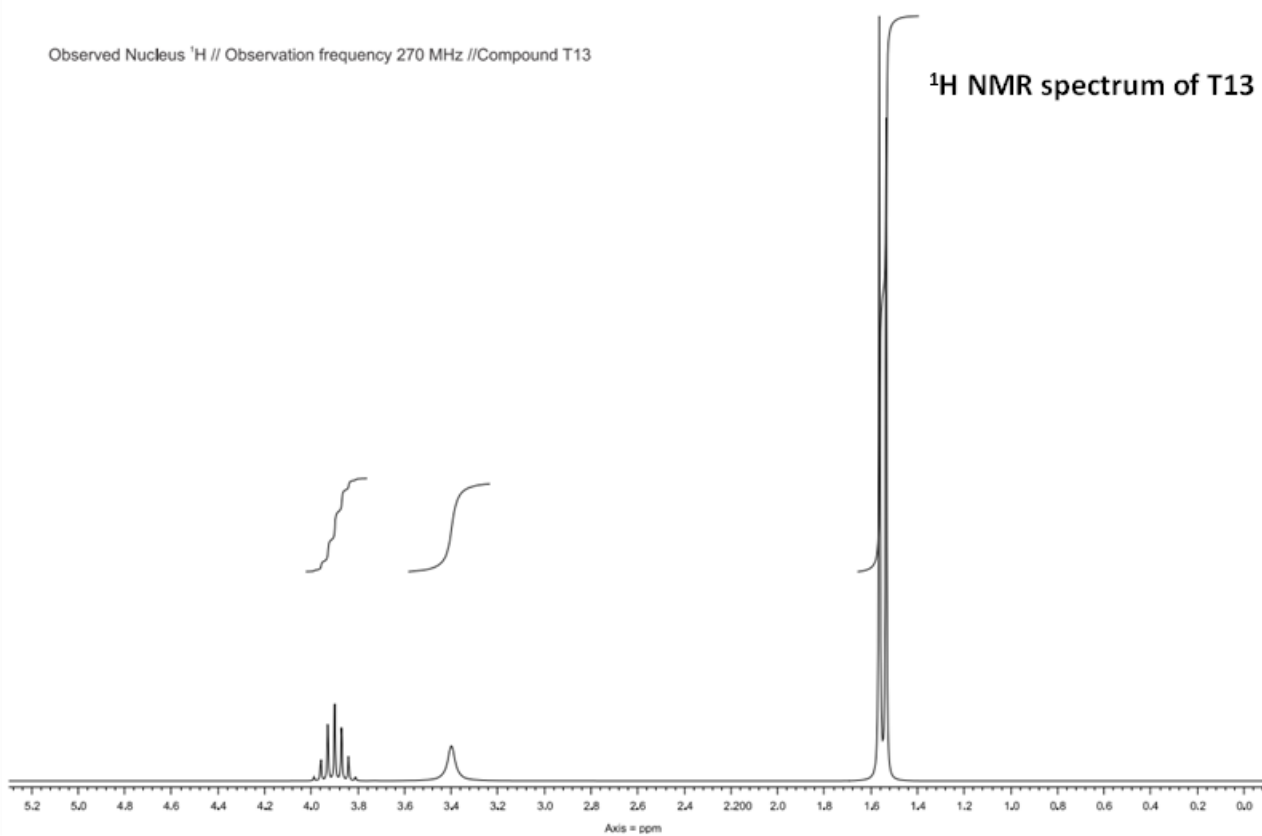
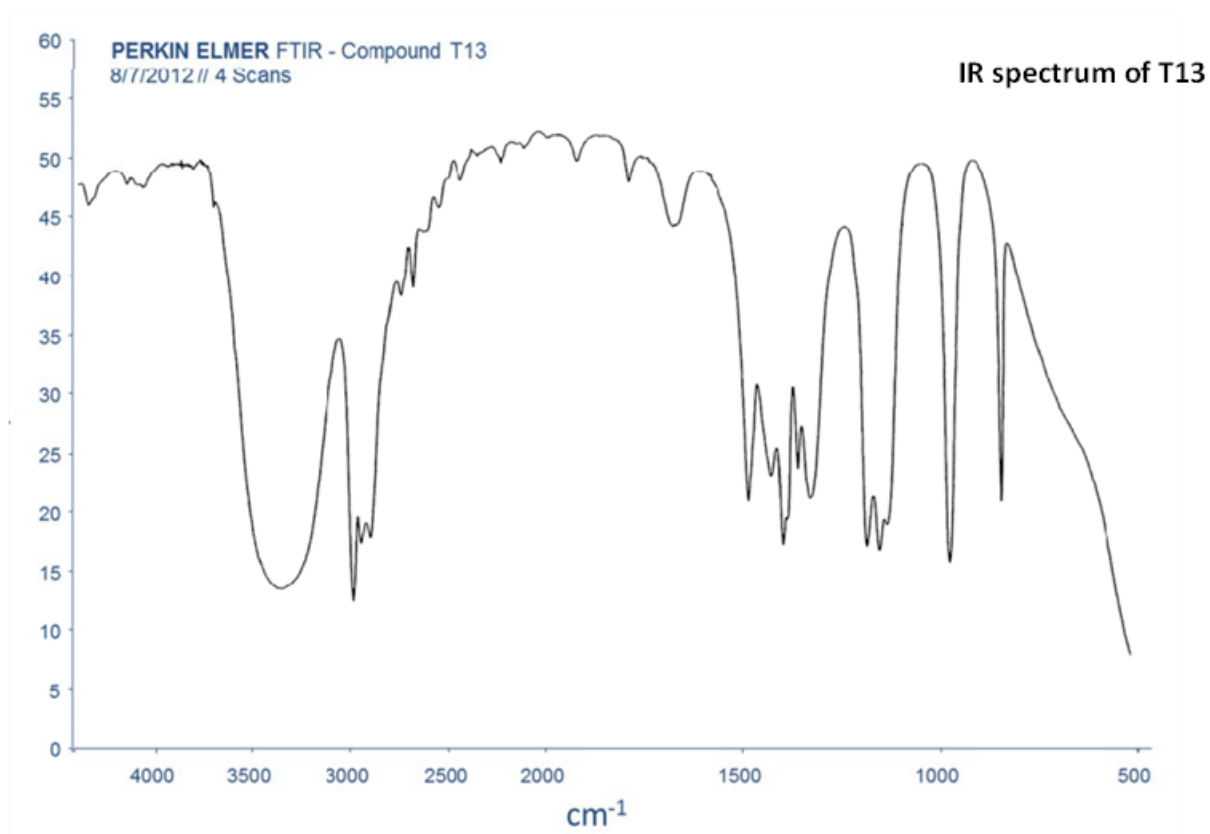
Answer TWO questions

You may use a calculator and a periodic table

1. This question relates to chemical bonding – answer parts a-d.
 - (a) Draw a diagram to illustrate bonding interactions in sodium chloride. [2 marks]
 - (b) Draw a diagram to show bonding in water. [2 marks]
 - (c) Draw a diagram to show bonding in benzene. [2 marks]
 - (d) Describe the characteristics of these compounds and relate them to the bond types. [4 marks]

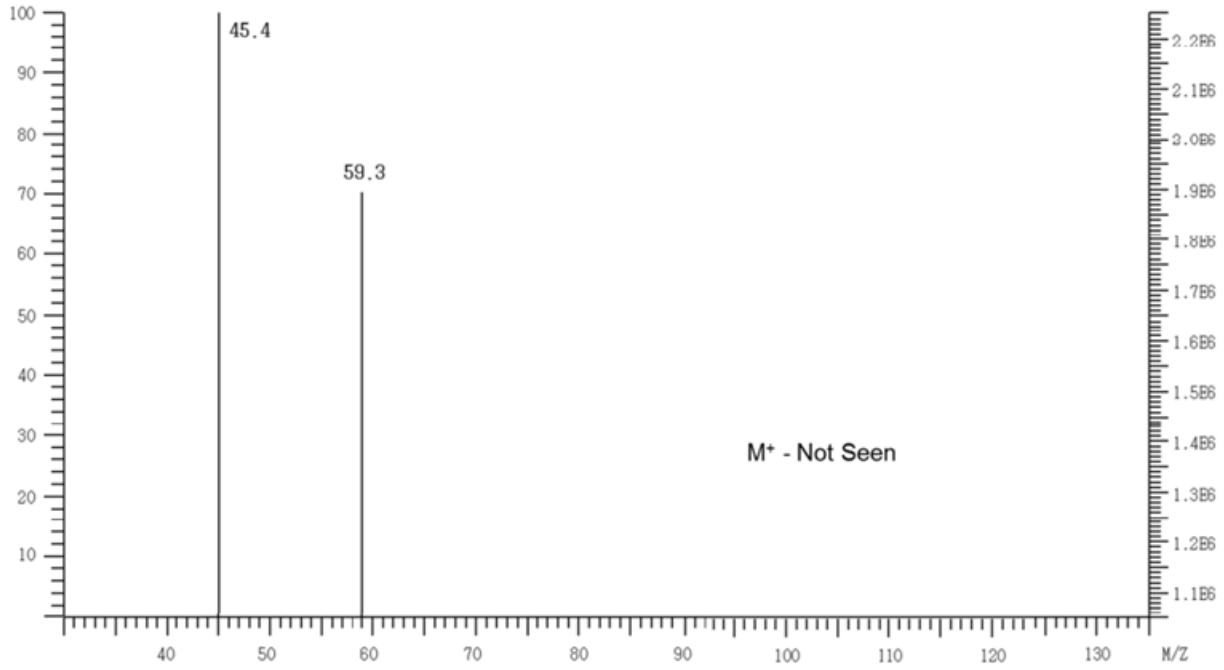
2. This question relates to quantitative chemistry – answer parts a-e.
 - (a) Define the term ‘mole’ as used in chemistry. [1 mark]
 - (b) Give the equation that correctly relates the amount in moles to the mass. [2 marks]
 - (c) How would you estimate the number of atoms in exactly 1 gram of potassium? [3 marks]
 - (d) Why is the expression 1 mol of oxygen ambiguous? [2 marks]
 - (e) Explain how you would prepare 200 ml 0.05 M aqueous aluminium nitrate solution from the anhydrous salt? [2 marks]

3. Look at the three spectra on the next two pages and, using the data, deduce the structure of compound **T13**. Provide evidence for your structure. [10 marks]

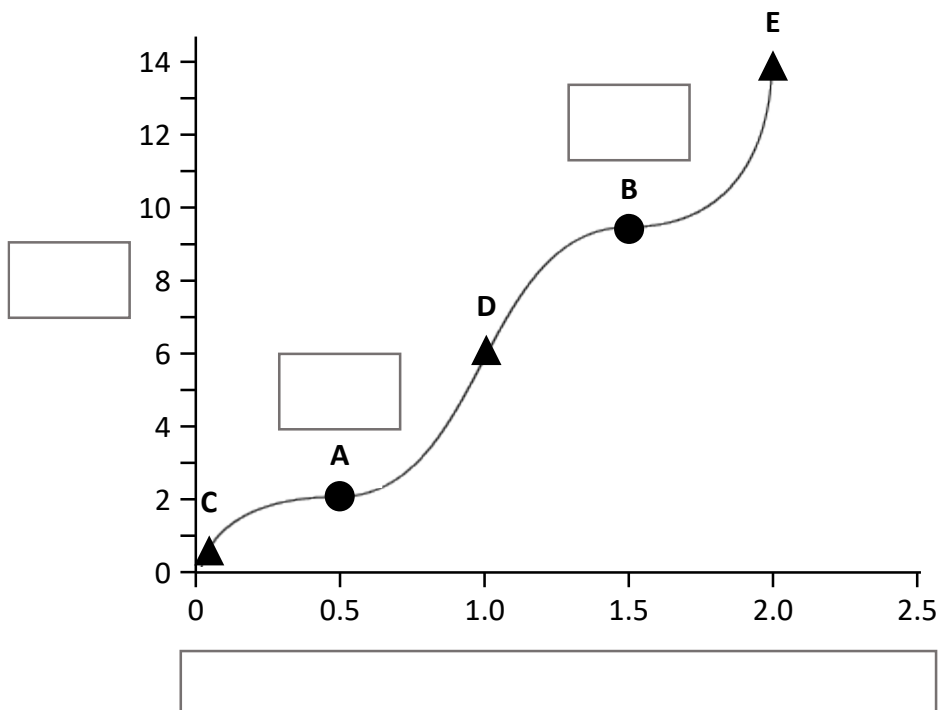


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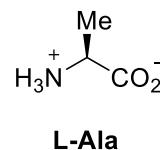
EI mass spectrum of T13



4. Answer all parts of this question. This graph shows the titration profile of the amino-acid, L-Ala (L-alanine; Me = CH₃).



- (a) Label the X and Y axes and give units as appropriate. [2 marks]
- (b) Label points A and B. [2 marks]
- (c) Draw the structures of the predominant forms present at C, D and E. [4 marks]
- (d) Polymers of amino-acids are which sort of biological macromolecules? [2 marks]



THE PERIODIC TABLE

Group

Period	1	2	d Block										3	4	5	6	7	0	
1	1.01 H Hydrogen 1																		4.00 He Helium 2
2	6.94 Li Lithium 3	9.01 Be Beryllium 4											10.8 B Boron 5	12.0 C Carbon 6	14.0 N Nitrogen 7	16.0 O Oxygen 8	19.0 F Fluorine 9	20.2 Ne Neon 10	
3	23.0 Na Sodium 11	24.3 Mg Magnesium 12											27.0 Al Aluminium 13	28.1 Si Silicon 14	31.0 P Phosphorus 15	32.1 S Sulfur 16	35.5 Cl Chlorine 17	40.0 Ar Argon 18	
4	39.1 K Potassium 19	40.1 Ca Calcium 20	45.0 Sc Scandium 21	47.9 Ti Titanium 22	50.9 V Vanadium 23	52.0 Cr Chromium 24	54.9 Mn Manganese 25	55.8 Fe Iron 26	58.9 Co Cobalt 27	58.7 Ni Nickel 28	63.5 Cu Copper 29	65.4 Zn Zinc 30	69.7 Ga Gallium 31	72.6 Ge Germanium 32	74.9 As Arsenic 33	79.0 Se Selenium 34	79.9 Br Bromine 35	83.8 Kr Krypton 36	
5	85.5 Rb Rubidium 37	87.6 Sr Strontium 38	88.9 Y Yttrium 39	91.2 Zr Zirconium 40	92.9 Nb Niobium 41	95.9 Mo Molybdenum 42	98.9 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54	
6	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	(210) Po Polonium 84	(210) At Astatine 85	(222) Rn Radon 86	
7	(223) Fr Francium 87	(226) Ra Radium 88	(227) Ac Actinium 89	f Block															
		▶ Lanthanoid elements	140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	(147) Pm Promethium 61	150 Sm Samarium 62	(153) Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	163 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71			
		▶▶ elements	232 Th Thorium 90	(231) Pa Protactinium 91	238 U Uranium 92	(237) Np Neptunium 93	(242) Pu Plutonium 94	(243) Am Americium 95	(247) Cm Curium 96	(245) Bk Berkelium 97	(251) Cf Californium 98	(254) Es Einsteinium 99	(253) Fm Fermium 100	(256) Md Mendelevium 101	(254) No Nobelium 102	(257) Lr Lawrencium 103			

Key

A_r	relative atomic mass
Symbol Name	
Z	atomic number