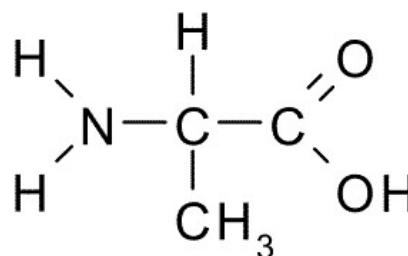
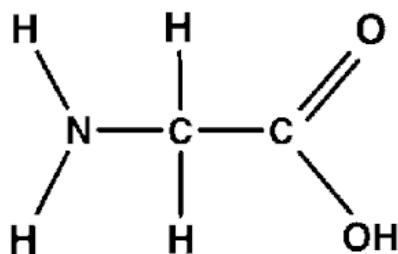


CHEMISTRY

Time Allowed – 1.5 hours

Answer two questions. You may use a calculator and a periodic table.

1. A number of techniques including nuclear magnetic resonance (NMR) spectroscopy, mass spectrometry (MS) and Infra-red (IR) spectroscopy are used for structural elucidation of molecules. Using butanol as an example, explain how these techniques are used.
2. Write an essay about the development and use of the periodic table.
3. Which of the following amino acids is chiral? Outline the importance of chirality.



4. Phosphate ion is an important component of many biological systems. A 25 cm³ (Ml) solution of phosphoric acid (H₃PO₄) was titrated with 0.1 M sodium hydroxide (NaOH) using phenolphthalein as an indicator. It took 21.0 cm³ of NaOH solution to change the colour of the indicator.
 - (a) What is an acid and what is a base?
 - (b) Write down the balanced equation for this acid-base reaction.
 - (c) Work out the concentration of the phosphoric acid in the solution in molar (M) units.
 - (d) What mass of phosphoric acid had been dissolved in the 25 cm³ of solution?

END OF PAPER

THE PERIODIC TABLE

Period **1** **2** **3** **4** **5** **6** **7** **0**

s Block

1.01 H Hydrogen 1

6.94 Li Lithium 3	9.01 Be Beryllium 4
----------------------------	------------------------------

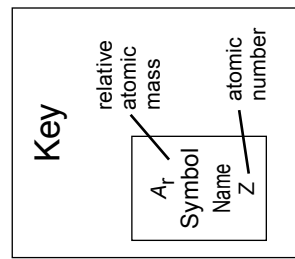
23.0 Na Sodium 11	24.3 Mg Magnesium 12
----------------------------	-------------------------------

39.1 K Potassium 19	40.1 Ca Calcium 20
------------------------------	-----------------------------

85.5 Rb Rubidium 37	87.6 Sr Strontium 38
------------------------------	-------------------------------

133 Cs Caesium 55	137 Ba Barium 56
----------------------------	---------------------------

(223) Fr Francium 87	(226) Ra Radium 88	(227) Ac Actinium 89
-------------------------------	-----------------------------	-------------------------------



d Block

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
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
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

f Block

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
---------------------------	---------------------------------	------------------------------	---------------------------------	-----------------------------	-------------------------------	-------------------------------	----------------------------	-------------------------------	----------------------------	---------------------------	----------------------------	------------------------------	-----------------------------

► Lanthanoid 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
----------------------------	-----------------------------------	---------------------------	--------------------------------	--------------------------------	--------------------------------	-----------------------------	--------------------------------	----------------------------------	----------------------------------	-------------------------------	-----------------------------------	--------------------------------	----------------------------------

►► Actinoid elements

p Block

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
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
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
115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	(210) Po Polonium 84	(210) At Astatine 85	(222) Rn Radon 86