

CHEMISTRY

Time Allowed – 1.5 hours

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

1. The following question is associated with butene.
 - a. Describe and provide a diagram for the formation of the π -bond in butene.
 - b. Give the shape and bond angles for each carbon in butene.
 - c. With examples, explain why some alkenes show *cis-trans* isomerism.

2. The following question is associated with NMR spectroscopy.
 - a. Sketch the NMR spectrum for each of the following compounds:
 - i. Propane
 - ii. Ethanoic acid
 - iii. Butanal
 - iv. Benzene
 - b. What would the relative areas under each peak be for the four compounds above?

3. This question concerns bonding.
 - a. Draw a diagram to show bonding in sodium chloride
 - b. Draw a diagram to show bonding in water.
 - c. Describe the characteristics of these compounds and relate them to the bond types

4. This question is about quantitative chemistry.
 - a. In the context of chemistry, define the term "mole".
 - b. Give the equation that relate mass and moles of a substance.
 - c. Why is the expression 1 mol of Oxygen ambiguous?
 - d. Calculate the mass in grams of each of the following:
 - i. 2 mol sodium chloride
 - ii. 1.25 mol calcium phosphate
 - iii. 1.45 mol ammonium carbonate

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
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23.0 Na Sodium 11	24.3 Mg Magnesium 12
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39.1 K Potassium 19	40.1 Ca Calcium 20
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85.5 Rb Rubidium 37	87.6 Sr Strontium 38
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133 Cs Caesium 55	137 Ba Barium 56
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(223) Fr Francium 87	(226) Ra Radium 88	(227) Ac Actinium 89
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Key	
Ar	relative atomic mass
Symbol	atomic number
Name	Z

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
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► Lanthanoid elements

►► Actinoid 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
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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