

Chemistry 2.4: Structure, bonding and energy changes

Paper 4

Interactive version

Complete this paper by typing your answers into the form fields provided, and using the Comment and Markup Tools to draw diagrams. Special characters you might need are printed at the top of each page for you to copy and paste as needed.

When you have finished answering the questions, click the Mark Answers button at the end of the final question. Mark your work by clicking the check-boxes that match your answers. Where appropriate, a model answer is shown after the check-box statements. The computer will automatically grade your work for each question and calculate your final grade for the paper.

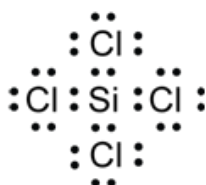
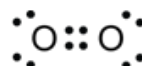
Questions for this paper are from NZQA examinations in 2010.

You are advised to spend 65 minutes answering the questions in this booklet.

QUESTION ONE

(a) Draw the Lewis structure (electron dot diagram) for each of the following molecules.

Molecule	Lewis structure
O ₂	
SO ₂	
SiCl ₄	



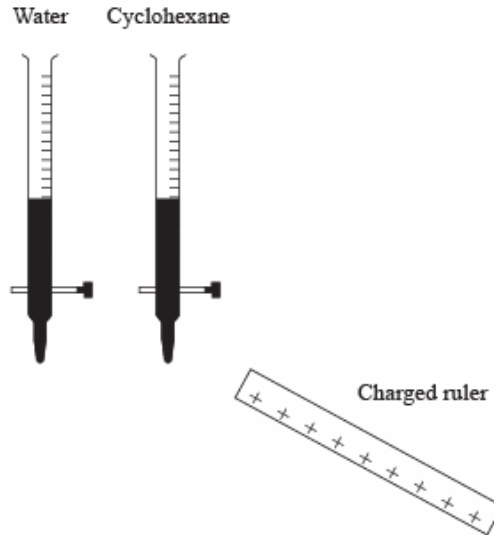
(b) Lewis structures for three molecules are given below.

Complete the table by giving the name of the shape of each molecule.

Molecule	Lewis structure	Name of shape
CH ₂ Cl ₂	$\begin{array}{c} \text{H} \\ \cdot\cdot \\ \cdot\text{Cl}:\text{C}:\text{Cl}:\cdot \\ \cdot\cdot \\ \text{H} \end{array}$	tetrahedral
NCl ₃	$\begin{array}{c} \cdot\cdot \\ \cdot\text{Cl}:\text{N}:\text{Cl}:\cdot \\ \cdot\cdot \\ \cdot\text{Cl}:\cdot \\ \cdot\cdot \end{array}$	trigonal pyramidal
BF ₃	$\begin{array}{c} \cdot\cdot \\ \cdot\text{F}:\cdot \\ \cdot\cdot \\ \cdot\text{F}:\text{B}:\text{F}:\cdot \\ \cdot\cdot \\ \cdot\text{F}:\cdot \\ \cdot\cdot \end{array}$	trigonal planar

QUESTION TWO

(a) Two burettes are set up. One burette contains water (a polar liquid) and the other contains cyclohexane (a non-polar liquid). The liquid is allowed to run from each burette in a steady stream. A charged plastic ruler is then placed near the stream of each liquid.



(i) Describe what will be seen when the charged ruler is placed near the stream of each liquid.

Stream of water is deflected.

Stream of cyclohexane is not deflected.

(ii) Explain these observations.

The polar water molecules are attracted to the charged ruler, causing the stream to be deflected towards the ruler.

The non-polar cyclohexane molecules are not attracted to the charged ruler, so the stream remains undeflected.

Q	Achievement	Merit	Excellence
<p>3 a</p> <p>b</p>	<p>THREE of:</p> <ul style="list-style-type: none"> • Particles correct for both solids. • MgCl₂ is an ionic solid. <p>OR</p> <p>SiO₂ is a covalent network solid.</p> <ul style="list-style-type: none"> • Attractive forces between particles described for either MgCl₂ or SiO₂. • States that melting point is related to nature and strength of attractive forces between particles. • States that solubility is related to nature and strength of attractive forces between particles. 	<p>Melting point OR solubility correctly linked to particles and attractive forces for both solids,</p> <p>OR</p> <p>Melting point and Solubility correctly linked to particles and attractive forces for one solid.</p>	<p>BOTH physical properties (melting point and solubility) fully discussed with reference to particles, type of solid and the attractive forces between particles for both solids.</p>
<p>Overall grade for question 3 =</p>			

PERIODIC TABLE OF THE ELEMENTS

18

		Atomic Number																	
		1 H 1.0		2 He 4.0															
1	2	Molar Mass/g mol⁻¹																	
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18				
Li 6.9	Be 9.0																		
Na 23.0	Mg 24.3																		
K 39.1	Ca 40.1	Sc 45.0	Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	Fe 55.9	Co 58.9	Ni 58.7	Cu 63.6	Zn 65.4	Ga 69.7	Ge 72.6	As 74.9	Se 79.0	Br 79.9			
Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9	Tc 98.9	Ru 101	Rh 103	Pd 106	Ag 108	Cd 112	In 115	Sn 119	Sb 122	Te 128	I 127			
Cs 133	Ba 137	Lu 175	Hf 179	Ta 181	W 184	Re 186	Os 190	Ir 192	Pt 195	Au 197	Hg 201	Tl 204	Pb 207	Bi 209	Po 210	At 210			
Fr 223	Ra 226	Lr 262	Rf 261	Db 262	Sg 263	Bh 264	Hs 265	Mt 268											

Lanthanide Series	La 139	Ce 140	Pr 141	Nd 144	Pm 147	Sm 150	Eu 152	Gd 157	Tb 159	Dy 163	Ho 165	Er 167	Tm 169	Yb 173
Actinide Series	Ac 227	Th 232	Pa 231	U 238	Np 237	Pu 239	Am 241	Cm 244	Bk 249	Cf 251	Es 252	Fm 257	Md 258	No 259