



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 1, 2003

Chemistry: Represent and describe atomic structure and bonding (90172)

National Statistics

Assessment Report

Assessment Schedule

Chemistry: Represent and describe atomic structure and bonding (90172)**National Statistics**

Number of Results	Percentage achieved			
	Not Achieved	Achieved	Merit	Excellence
5,299	30.3%	39.2%	24.0%	6.5%

Assessment Report**General Comments**

Every candidate for a National Certificate of Educational Achievement examination paper is expected to:

- read the question and do what the question asks
- allow adequate time to complete answers
- be accurate: check and/or proofread
- use appropriate technical terms
- bring the correct equipment
- write and/or draw clearly
- use pen if work is to be eligible for reconsideration.

This standard requires a knowledge of the types and nature of particles in chemistry. This knowledge includes the way in which these particles interact and behave in different situations, and why they are linked together in groups and rows in the periodic table.

While many candidates performed well in parts of this paper, there are some key ideas for candidates to understand. These include:

- 1 chemically particles react in order to move to a lower energy state, a stable outer complete valence level.
- 2 physically particles move to achieve 'energy equilibrium' with their surroundings, a rapid random state to an almost motionless fixed state.
- 3 particles in the liquid state have very little space (cannot be compressed), and diagrams must show this.
- 3 atomic mass is not the same as mass number.
- 4 accurate use of terms, in particular atom, ion, and molecule.
- 5 the process of ionic bond formation.

Assessment Schedule

Chemistry: Represent and describe atomic structure and bonding (90172)

Evidence Statement

Question	Evidence	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence	
ONE	(a) (i) 2,4 (ii) 2,5 (iii) P (iv) K ⁺	3 correct.			
	(b)(i)	isotope	p	n	All correct.
		⁶ Li	3	3	
		⁷ Li	3	4	
	(b) (ii)	Isotopes are atoms of the same element / with same no. of protons : different number of neutrons in the nucleus / different mass no. (not atomic mass). ⁶ Li has 3 neutrons and ⁷ Li has 4 neutrons.	Definition indicates same atom / proton number : different mass / no. of neutrons.	Application to lithium.	
(b) (iii)	Most of the Li atoms are ⁷ Li rather than ⁶ Li.	More ⁷ Li than ⁶ Li.	Most / almost all atoms are ⁷ Li or very small % of them are ⁶ Li.		
TWO	(a) (i) S is the exception. (a) (ii) Because it has 6 valence electrons / in group 16 / needs 2 to complete level / forms 2- ions : whereas the other three all have 2 electrons in their outermost level / forms 2+ ions / will lose 2 electrons / in group 2 : to complete outer level (stable).	S is a non-metal / on RHS of periodic table / Ca, Mg, Sr are metals / on LHS of periodic table.	The others are in group 2 / have two valence electrons / lose two electrons / S is in group 16 / 6 / needs two electrons.	Answer as in evidence column / correct discussion of gain / share / of 2 electrons for S / loss of 2 electrons for the other three : to complete outer level (stable).	

Question	Evidence	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
	<p>(b) (i) In the liquid state in NaCl, there are Na^+ ions and Cl^- ions that can carry the current. In SCl_2, there are no ions / free electrons to carry the current, only molecules.</p> <p>(b) (ii) the melting point indicates strong attractive forces / ionic bond must be strong in the solid NaCl : high temperature needed to break. The m.p. of SCl_2 is low because : weak intermolecular forces / Van der Waals / weak attractive forces exist between molecules.</p>	<p>Ionic : molecular substances stated or implied by description.</p> <p>OR</p> <p>one correct statement about nature of the particles / the attractive forces between them for either NaCl or SCl_2.</p>	<p>Links presence of mobile ions in NaCl : lack of ions / lack of free electrons in SCl_2 to conductivity.</p> <p>OR</p> <p>type of bonding / the attractive force : nature of particles present : linked correctly to m.p.</p>	<p>Clearly indicates complete understanding of the particles present in both compounds : the relevance of the attractive forces : linked to the conductivity and melting point of both compounds.</p>
THREE	<p>A magnesium atom loses 2 electrons to become a Mg^{2+} ion. Two chlorine atoms each accept one electron to complete their valence / outer levels and become Cl^- ions. Since there is a +2 charge on the Mg ion, it needs two -1 ions to make the overall charge = 0 : attraction.</p>	<p>Answer indicates that Mg loses electrons and chlorine gains (an) electron. Description of gain/loss.</p>	<p>Explanation of number of electrons gained / lost : full outer shell (stable).</p>	<p>Evidence answer : positively charged ions attracted to negative ions / strong attraction between ions and ratio.</p> <p>$\text{Mg}^{2+}:\text{Cl}^-$ as 1:2 discussed.</p>
FOUR	<p>argon: :Ar:</p>	<p>Two Lewis structures correct.</p>	<p>Three Lewis structures correct.</p>	
	<p>hydrogen sulfide: H : S : H or H – S – H $\text{H}:\ddot{\text{S}}:\text{H}$ or $\text{H}-\ddot{\text{S}}-\text{H}$</p>	<p>Diagrams must show all valence electrons.</p>		
	<p>carbon dioxide: O C O or O = C = O $:\ddot{\text{O}}::\text{C}::\ddot{\text{O}}:$ or $:\ddot{\text{O}}=\text{C}=\ddot{\text{O}}:$</p>			

Question	Evidence	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
FIVE	(a) number of protons (electrons) must be between 1 and 17 (most likely 8 or 9) : the number of protons (electrons) in an element must be a whole number, could be implied and there are no missing elements between 1 and 17 so it cannot exist / it is an isotope of one of the elements already known.	Single isolated idea.	Answer correctly explains either of the points in the evidence column / two ideas linked.	Detailed answer that indicates a clear understanding of both points (three ideas).
	(b) It has one proton and no neutrons in the nucleus. When the atom loses an electron to form an H⁺ ion, this leaves only the proton.	Answer includes either of the two points stated.	Answer includes both points.	

Question	Evidence	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
SIX	<p>Energy of the particles</p> <p>Gas state, the particles have a high kinetic energy. As the gas cools, energy is lost to the surroundings so</p> <p>Liquid state kinetic energy decreases / is less and most of the particles are moving more slowly and they come closer together.</p> <p>Solid state at a lower temperature, they have even less kinetic energy.</p> <hr/> <p>Motion of the particles</p> <p>In gas – fast random straight line motion between collisions.</p> <p>Liquid – slower with limited opportunity to move freely / slower but relative positions can change.</p> <p>Solid – particles cannot move through the structure / relative positions remain fixed / held in position by attractive forces / only vibrating.</p> <hr/> <p>Relative position of the particles</p> <p>Gas particles very widely spaced / fill the whole container / can be compressed .</p> <p>Liquid particles are mostly close to their neighbours / random arrangement take shape of container.</p> <p>Solid particles are as close as they can be / cannot be pushed closer together / particles touch each other : relative position fixed / hold their shape / fixed lattice (array).</p>	For two properties , explanation is clear and correct but it may not have compared all three states .	For one property , the answer shows full understanding of the property in all three states .	For two properties , the answer shows full understanding of the property in all three states .

Judgement Statement

ACHIEVEMENT

SIX achievement opportunities

ACHIEVED with MERIT

FIVE merit opportunities plus **ONE** achievement opportunity

ACHIEVED with EXCELLENCE

THREE excellence opportunities plus **TWO** merit and **ONE** achievement