NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 1, 2003

Chemistry: Describe the chemistry of selected non-metals and their compounds (90173)

National Statistics

Assessment Report

Assessment Schedule

Chemistry: Describe the chemistry of selected non-metals and their compounds (90173)

National Statistics

Number of Results	Percentage achieved			
	Not Achieved	Achieved	Merit	Excellence
1,638	31.7%	42.8%	20.5%	5.0%

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.

Part B of Question 1, and Questions 3 and 4 were particularly well answered. On the other hand Question 1 (Part D) and Question 2 (Part B) presented difficulty for many candidates. Question 2 (Part B (c) and (d)) in particular showed that candidates were not confident in general with their knowledge about the causes and effects of photochemical smog. In this respect, candidates did not appear to understand photochemical smog as a context distinct from that of acid rain and global warming.

Key ideas for candidates to understand include:

1 Candidates commonly confused observations with inferences. Many candidates wrote down what they thought should happen, rather than what they thought they should see happening. For example, nitrogen dioxide gas was given off instead of a brown gas was given off, and water formed instead of a colourless liquid condensed on the side of the test tube. Candidates also gave non-specific observations such as the solution changed colour, instead of the colourless solution turned green.

2 All questions should be attempted, and not the first few questions only. All questions in the examination paper offer opportunities for candidates to provide evidence for Achievement, Merit or Excellence. Errors made in the first few questions often resulted in candidates not achieving the standard when many of the later questions were not attempted.

3 Making links between ideas, and in explaining and analysing concepts. For example
- Linking the properties of carbon dioxide to the structure of the fire extinguisher
- Comparing the solubility of superphosphate with rock phosphate and linking this to the uptake of fertilisers by plants.

4 An increased familiarity with terms such as soluble, insoluble, corrosive, and the purpose of a catalyst.

Assessment Schedule

Chemistry: Describe the chemistry of selected non-metals and their compounds (90173)

Evidence Statement

Question	Evidence	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
ONE Part A	(a) hydrogen sulfide / H_2S	Correct		
	(b) • Monoclinic – yellow needle-like crystals (cylinder shaped crystals) • Rhombic – yellow rhombic-shaped crystals (coffin shaped crystals) • Plastic – stretchy/elastic/dark/rubbery	Two allotropes identified by name or description.	Name and description correctly linked for two allotropes.	
Part B	(a) (i) SO_2 sulfur dioxide (ii) SO_3 sulfur trioxide	Both correct.		
	(b) (i) Step I – sulfur is burned in air or oxygen $S + O_2 \rightarrow SO_2$ $S_2 + 2O_2 \rightarrow 2SO_2$ $S_8 + 8O_2 \rightarrow 8SO_2$ sulfur + oxygen → sulfur dioxide (ii) Step II – • more air is added – sulfur dioxide needs to be further oxidised • the mixture is passed across beds of vanadium pentoxide catalyst at 450°C so that the reaction to form sulfur trioxide can occur. Without the catalyst it would be very slow. ($2SO_2 + O_2 \rightarrow 2SO_3$)	Reaction is described in words or in an equation.	Recognition that more oxygen is needed in Step II before SO_3 can form **or** that a catalyst is required to increase rate/ speed up reaction.	
	(c) It is corrosive/eats into metals and flesh.	Correct.		

Question	Evidence	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
	(d) Concentrated sulfuric acid • No water • Lack of corrosion/rust • Few H^+ ions Dilute sulfuric acid • Water present • Water will cause corrosion in tanks • H^+ ions react with Fe Steel tanks Steel/iron will corrode with acid when water is present, so conc. acid can be stored in steel tanks, but dilute acid cannot.	Describes at least 2 correct properties or components.	Explanation **links** either dilute or concentrated acid to corrosion/ lack of corrosion of steel/iron.	Explanation links dilute acid to corrosion of steel/iron, **and** links lack of water in concentrated acid to its storage in stainless steel tanks.
Part C	• plants need P for growth • plants can only take up soluble phosphate from soil through their roots • rock phosphate is insoluble whereas superphosphate is more soluble	Solubility/lack of solubility described.	Solubility linked to uptake of P by plants or to plant growth.	

Question	Evidence	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
TWO Part A	(a) • a brown gas given off • metal gets smaller • solution turns green, will eventually turn blue on standing (or if water added) • heat is given out	2 correct observations.		
	(b) The brown gas released/nitrogen dioxide: • is poisonous • is acidic and corrosive (lung damage).	1 property described.		
	(c) $Cu + \mathbf{4}HNO_3 \rightarrow \mathbf{Cu(NO_3)_2 + 2NO_2 + 2H_2O}$	Correct products identified.	Correctly balanced.	
Part B	(a) Soot	Correct.		
	(b) Effects of sulfur dioxide **on people** • Breathing problems/asthma/weakens lung tissue • Eye damage/skin damage due to acidity **on the natural environment** • Increased acidity of soil/water means some plants and animals cannot survive • Inhibits plant growth/cuts production	One relevant effect on either people or the natural environment (ignore extra irrelevant effects).	Two relevant effects for people or the natural environment with no extra incorrect or irrelevant (eg corroded buildings) effects.	
	(c) Diesel contributes less to photochemical smog because primary pollutants of photochemical smog are **nitrogen oxides, hydrocarbons** which react to form ozone. Carbon monoxide plays a lesser role than the other two. eg Diesel produces 59 g of nitrogen oxides compared to 29 g from petrol / total for NO_x+HC of 76 g compared to 54 g from petrol (Petrol produces more hydrocarbons and carbon monoxide but less NO_x) *(Note: Soot is present in industrial smog but not in photochemical smog.)*	Answer states that the SO_2 and soot aren't components of photochemical smog. **Or** NO_x, hydro-carbons, CO are **Or** diesel contributes less than petrol to photochemical smog.	Links diesel with NO_x (and HC and CO) but **not** to soot (or SO_2) **OR** links petrol to higher CO (and HC) levels but **not** to soot (or SO_2)	Correctly links photochemical smog to NO_x in diesel (not to soot or SO_2). Answer integrates comments about components of pollution from both types of fuel and their contribution.

Question	Evidence	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
	(d) Effects of photochemical smog **on people** • unpleasant odour • irritation of throat • shortness of breath • irritation of eyes and nose • impaired lung function, chest pains, coughing • unconsciousness/death **on environment** • reduces visibility • damages leaves • inhibits photosynthesis • exposes plants/trees to disease/pests • affects animals in similar way to humans • degradation/breakdown plastics, rubber, textiles, paint from ozone formed **Ways to reduce photochemical smog:** • cycle or walk/use public transport, rather than cars • make sure vehicles well maintained • use alternative fuel vehicles – electric, fuel cells, hydroelectric • use alternative energy sources – solar, wind • fit catalytic converters to all cars	At least 1 effect on people and 1 correct effect on the environment identified by description OR 1 effect identified and a relevant step to reduce it described, for either people or the environment. (not accepting cleaner burning cars without explanation)	1 effect on people AND 1 effect on the environment AND links the effects to a relevant solution step.	Discussion of effects on both people and the environment shows understanding of how the solution steps taken would **decrease the level of pollutants**.

Question	Evidence	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
THREE	(a) Yellow/green	Both correct.		
	(b) Sodium chloride			
	(c) • Chlorine is heavier than air (drops to bottom of gas jar, pushing air out the top) • Chlorine gas is soluble in water so cannot be collected by water displacement	1 reason for the upward displacement of air or one for not using water.	Both reasons show ability to link the property of the gas to the method.	
	(d) Option one $NaCl + H_2SO_4 \rightarrow HCl + NaHSO_4$ (major reaction – *note: if correct products no balancing needed)* OR Option two $2NaCl + H_2SO_4 \rightarrow 2HCl + Na_2SO_4$		Either equation correct.	
FOUR Part A	(a) $CO_2 + H_2O \rightarrow H_2CO_3$ OR $CO_2 + H_2O \rightarrow H^+ + HCO_3^-$ OR $CO_2 + H_2O \rightarrow 2H^+ + CO_3^{2-}$	Correct product(s).	Balanced correctly.	
	(b) Blue or neutral litmus will turn red (pink).	Correct.		
Part B	• Carbon dioxide is easily liquefied under pressure (not extremely high pressure) • Carbon dioxide readily undergoes the change of state from liquid to solid and from liquid to gas • The solid dry ice cools the materials • Carbon dioxide does not support combustion • Carbon dioxide is more dense than air so it 'blankets' the fire/The carbon dioxide excludes oxygen/air • Fire extinguisher stores carbon dioxide under pressure, so remains in liquid form. Relatively large amount can be stored, enough to be useful for small fires	1 correct **and relevant** property of carbon dioxide is identified.	Explanation **links** at least 2 properties to the use of carbon dioxide in putting out fires.	Answer shows integration of ideas in the **construction of the extinguisher** by relating physical and chemical properties to aspects of the extinguisher use.

Judgement Statement

Judgement statements (formerly referred to as sufficiency statements) help students understand how their overall results for each standard were arrived at.

Achievement:	**NINE** of the achievement opportunities (Q3(d) can be used for count back evidence for achievement if required)
Merit:	**Achievement plus SIX** of the merit opportunities
Excellence:	**Merit plus TWO** of the excellence opportunities