



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

# **Level 3, 2004**

## **Science**

**Describe genetic processes (90729)**

**Describe selected chemical substances and their uses (90730)**

**Describe geological processes affecting New Zealand (90731)**

**Describe properties and applications selected from EMR,  
radioactive decay, sound and ultrasound (90732)**

## **National Statistics**

## **Assessment Report**

## **Assessment Schedule**

## Science, Level 3, 2004

### General Comments

Candidates gaining Achievement had understood the standard required from the key words of the achievement standard title, the achievement criteria and the explanatory notes. They were able to read and understand all parts of the questions. They were able to use their knowledge and understanding to give accurate and legible answers as required by the question. Candidates writing down prepared definitions were not successful in attaining the standards if these were not required by the question. Candidates who gained Achievement, recognised that each word in a question was important, and answered questions taking this into account.

Candidates gaining Achievement with Merit and Achievement with Excellence could not only explain the science required by a question, but also relate the science to the context of the question. They were also able to show understanding by linking pieces of information together to exhibit understanding.

### Science: Describe genetic processes (90729)

#### National Statistics

Number of Results	Percentage			
	Not Achieved	Achieved	Merit	Excellence
1,122	36.6%	39.8%	15.4%	8.2%

#### Assessment Report

Candidates gaining Achievement in this standard had a correct understanding of the specific concepts presented in the assessment. Successful candidates carefully read all parts of each question so that what was required by each question was understood. Not only was the science required for the answer described or explained, but for Excellence, also the science related to the specific context, eg as required in Question Two (c).

Successful candidates were also able to exhibit understanding of the implications of genetic engineering, and express these in well-constructed paragraphs. These implications are still not well understood by many students.

### Science: Describe selected chemical substances and their uses (90730)

#### National Statistics

Number of Results	Percentage			
	Not Achieved	Achieved	Merit	Excellence
1,036	48.8%	39.2%	10.2%	1.7%

#### Assessment Report

Candidates gaining Achievement in this standard had learnt and understood key points about the selected chemical substances and their uses. They also accurately represented chemical formulae as required by Question One (b), and identified trends in data as required by Question Two (c)(i).

Successful candidates also carefully read all parts of each question so that what was required by each question was understood. This was seen in Question Two (c)(ii), where candidates who were able to apply the science required by the question to the context were successful in gaining excellence for that question. They were also able to describe uses as required by Explanatory Note 4.

### Science: Describe geological processes affecting New Zealand (90731)

#### National Statistics

Number of Results	Percentage			
	Not Achieved	Achieved	Merit	Excellence
857	47.1%	33.5%	14.9%	4.4%

#### Assessment Report

Candidates gaining Achievement in this standard had learnt and understood the geological processes affecting New Zealand. They were also able to apply their knowledge of these processes directly to the contexts given in the assessment. This showed that they had also carefully read and understood the questions, and had answered the questions accurately.

### Science: Describe properties and applications selected from EMR, radioactive decay, sound and ultrasound (90732)

#### National Statistics

Number of Results	Percentage			
	Not Achieved	Achieved	Merit	Excellence
1,083	47.1%	36.7%	14.3%	1.9%

#### Assessment Report

Candidates gaining Achievement in this standard had learnt and understood the aspects covered in the standard as determined by Explanatory Note 2. They also recognised that the context of a question was important, and answered the questions taking this into account. Candidates gaining Achievement with Merit and Achievement with Excellence were able to link the science required with the context.

Candidates gaining Achievement had also had competent calculation skills.

## Assessment Schedule

### Science: Describe genetic processes (90729)

#### Evidence Statement

Question	Evidence contributing to Achievement Describe genetic processes	Evidence contributing to Achievement with Merit Explain genetic processes	Evidence contributing to Achievement with Excellence Discuss genetic processes
1(a)(i) 1(a)(ii) 1(a)(iii)	deoxyribose cytosine, guanine, adenine, thymine (2 of) hydrogen (bonds) (3/4 correct from i–iii)		
1(b)	Single valid idea.  Adds new nucleotides to the (3' end of) growing chain / by complementary base pairing/error checking.	Any two valid ideas linked.  Eg Adds new nucleotides to the (3' end of) growing chain by complementary base pairing.	
1(c)	Single Valid Idea  DNA carries Genetic blueprint/code. To ensure resulting cell is functional. To prevent incorrect reading of code.	Valid Ideas linked  DNA carries <b>genetic blueprint or code</b> , replication must be exact to prevent mutations / incorrect reading of code / ensure cell is functional.	Full Explanation  DNA carries genetic blueprint or code:, replication must be exact to prevent mutations meaning that incorrect or no proteins are made / code read incorrectly / ensure cell is functional : incorrect amino acid /protein/ polypeptide : will be coded/made.
2(a)	To amplify / increase the amount of DNA / identically copy DNA.	To amplify / increase the amount of (identical) DNA: so that there is enough for genetic testing / specific genetic test may be named / other valid use.	
2(b)	Anything involving DNA that needs amplifying (not forensics).  Examples: Gene Therapy Stem cell research Profiling (Non forensic) GE Copying DNA Breeding line analysis  Not: Generalised Research or PCR of <i>fossilised</i> remains.		

Question	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
2(c)	<p>A Valid Idea</p> <p>Can trace <b>genetic</b> material at crime scene back to its origins from victim(s) or suspect(s) (key word genetic, gene, DNA or chromosome) / PCR can amplify tiny amounts of DNA / PCR very accurate / may amplify wrong DNA / suspect or victim DNA can become contaminated with DNA not belonging to victim or suspect.</p>	<p>One benefit or risk linked to key idea of tracing genetic material.</p> <p>Can trace <b>genetic</b> material at crime scene back to its origins from victim(s) or suspect(s) (key word genetic, gene, DNA or chromosome) : PCR can amplify tiny amounts of DNA / PCR very accurate / may amplify wrong DNA / suspect or victim DNA can become contaminated with DNA not belonging to victim or suspect.</p>	<p>Both benefit and risk linked to key idea of tracing genetic material.</p> <p>Can trace <b>genetic</b> material at crime scene back to its origins from victim(s) or suspect(s) (key word genetic, gene, DNA or chromosome) : PCR can amplify tiny amounts of DNA / PCR very accurate : may amplify wrong DNA / suspect or victim DNA can become contaminated with DNA not belonging to victim or suspect.</p>
3(a)	<p>1. AGA 2. AUG 3. GCU 2/3</p>		
3(b)	<p>One Valid Idea</p> <p>To help in recognising the correct amino acid / the means by which tRNA joins onto (the relevant codon) mRNA / AUG start Codon.</p>	<p>Two Linked Valid ideas</p> <p>To help in recognising the correct amino acid :which the tRNA can take to mRNA and join onto the relevant codon via the anticodon.</p>	
3(c)	<p>Any single valid use.</p> <p>A polypeptide that becomes part of a protein / an enzyme which catalyses cell reactions / part of cell structure eg cell wall / any other use of a protein.</p> <p>Not: Energy source or unexplained growth and repair.</p>		
3(d)	<p>One valid role.</p> <p>To transfer the code for a gene from DNA / threads through the ribosome / enables the tRNA anticodon to match up with the correct codon.</p>	<p>Two roles <b>linked</b>.</p> <p>To transfer the code for a gene from DNA : threads through the ribosome / enables the tRNA anticodon to match up with the correct codon.</p>	<p>Process fully described</p> <p>To transfer the code for a gene from DNA : threads through the ribosome : enables the tRNA anticodon to match up with the correct codon – answer must show the continuity of the process.</p>

Question	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
4(a)	To transfer a foreign gene / act as a vector / bacterium able to make multiple copies of plasmid / bacteria easy to grow and multiply/ Plasmid can be altered.	Two linked ideas.  To transfer a foreign gene / act as a vector : bacterium able to make multiple copies of plasmid / bacteria easy to grow and multiply/ plasmid can be altered.	
4(b)	Any Valid Scientific Idea  Gene could be taken up / transferred by other species of plants / if animals eat this plant, the gene or protein the gene makes may unfavourably affect animal, gene spread by pollen / plant may spread beyond these areas / the redness may affect the photosynthesis ability of plant.	Implication of scientific Idea Explained  eg the plant may be spread by pollen, hence spreading the transgene as well.	Any well-discussed paragraph that elaborates on at least one implication, eg the plant may be spread by pollen, which will only be a problem if it is an aggressive weed. This could be prevented by making the plant sterile, so that it cannot reproduce.

## Judgement Statement

### Achievement

Total of SEVEN opportunities answered at Achievement (or higher).

7 × A

### Merit

Total of EIGHT opportunities answered with FOUR at Merit level and FOUR at Achievement level.

4 × M + 4 × A

### Excellence

Total of NINE opportunities answered with TWO at Excellence level and THREE at Merit level and FOUR at Achievement level.

2 × E + 3 × M + 4 × A

## Assessment Schedule

### Science: Describe selected chemical substances and their uses (90730)

#### Evidence Statement

Question	Evidence contributing to Achievement Describe alcohols, carboxylic acids and esters and their uses	Evidence contributing to Achievement with Merit Explain alcohols, carboxylic acids and esters and their uses	Evidence contributing to Achievement with Excellence Discuss alcohols, carboxylic acids and esters and their uses
1(a)(i)	Butyl ethanoate		
1(a)(ii)	Circle around $\begin{array}{c} -C-O- \\    \\ O \end{array}$ only.		
1(b)(i)	Butanol : CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> OH / CH <sub>3</sub> (CH <sub>2</sub> ) <sub>3</sub> OH (or full structural formula)		
1(b)(ii)	ethanoic acid : CH <sub>3</sub> COOH (or full structural formula)		
1(c)(i)	<b>concentrated</b> sulfuric acid / <b>conc</b> H <sub>2</sub> SO <sub>4</sub>		
1(c)(ii)	Acts as a catalyst / speeds up the reaction rate / removes water just leaving the ester / helps to prevent the reverse hydrolysis reaction.	Acts as a catalyst / speeding up the reaction rate : removing the water just leaving the ester / helps to prevent the reverse hydrolysis reaction.	Acts as a catalyst : speeding up the reaction rate : dehydrating agent / removing the water / that the reverse hydrolysis reaction cannot happen, which would reduce the amount of ester formed.
1(d)	Neutralises the unreacted or excess acid.	Neutralises the unreacted or excess acid (which has an unpleasant smell) : just leaving the ester smell.	
2(a)	Glycerol / propane-1,2,3 triol / (1,2,3) propan-triol		
2(b)(i)	Having one or more double carbon to carbon bonds / C=C.		
2(b)(ii)	Greater unsaturation lowers the melting / boiling point / has bends or kinks in the structure (structure more spread out).		
2(c)(i)	The higher the iodine number, the more unsaturated the fat or oil is.	Elaboration of achievement. eg The higher the iodine number, the greater the number of C=C bonds in the fat or oil / correct use of values from the table.	

Question	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
2(c)(ii)	Sardine oil value of 185 makes the oil highly unsaturated.	Relating to the environment of the sardine, eg Sardine lives in a cold environment so must have a highly unsaturated oil / oil with a low melting point. NB Can use the general term 'fat'.	As for merit, as well as, allows sardine to be more flexible in the cold.
3(a)(i)	Typical zigzag hydrophobic / non-polar tail and round hydrophilic / polar head. Labelled. 		
3(a)(ii)	Hydrophobic / non-polar end of soap attracted to grease.	<b>Description OR labelled diagram.</b> Hydrophobic / non-polar end of soap attracted to grease : hydrophilic / polar end dissolves in the water, grease lifted off.	Hydrophobic / non-polar end of soap attracted to grease : hydrophilic / polar end dissolves in the water, grease lifted off : must have correct diagram as well.
3(b)(i)	Calcium and Magnesium only / $\text{Ca}^{2+}$ and $\text{Mg}^{2+}$ (must be correct if using formulae).		
3(b)(ii)	Soap combines with the ions to form a scum / ions precipitate out in hard water.	Soap combines with the ions to form a scum in hard water : therefore soap will only lather / clean, when all the ions are used up.	
3(c)(i)	Circle around $\text{CH}_3(\text{CH}_2)_{11}\text{OSO}_3^-$		
3(c)(ii)	(Detergent where the polar head) has a negative charge.		

## **Judgement Statement**

### **Achievement**

Total of NINE opportunities answered at Achievement (or higher), including one from Q2(c), 3(a)(ii), 3(b), 3(c) (uses).

$$9 \times A$$

### **Merit**

Total of THIRTEEN opportunities answered with FOUR at Merit level and NINE at Achievement level.

$$4 \times M + 9 \times A$$

### **Excellence**

Total of FIFTEEN opportunities answered with TWO at Excellence level and TWO at Merit level and ELEVEN at Achievement level.

$$2 \times E + 2 \times M + 11 \times A$$

## Assessment Schedule

### Science: Describe geological processes affecting New Zealand (90731)

#### Evidence Statement

Question	Evidence contributing to Achievement Describe geological processes affecting New Zealand	Evidence contributing to Achievement with Merit Explain geological processes affecting New Zealand.	Evidence contributing to Achievement with Excellence Discuss geological processes affecting New Zealand.
1(a)(i)	Slightly sticky magma / medium viscosity / intermediate silica levels / 50% – 65% Si / mixture from melting continental and basaltic magmas.		
1(a)(ii)	Pacific plate / oceanic crust sinking under Indo-Australian (or just Australian) plate / continental crust / crust melts due to increase in temperature as the plate sinks more deeply / sea water or wet sediments subduct as well / the water lowers the melting point of the crustal rocks. (Friction between plates causes melting accepted for achievement only.)	Pacific plate / oceanic crust sinking under Indo-Australian (or just Australian) plate / continental crust : crust melts due to increase in temperature as the plate sinks more deeply / sea water or wet sediments subduct as well : the water lowers the melting point of the crustal rocks.	
1(b) consider diagram in marking	Andesite lava doesn't travel very far / stickier lava / cools quickly or basalt lava travels a long way / runny lava / cools slowly. (Either one valid comparison between andesite and basalt volcanoes or a good description of either one.)	Andesite medium viscosity / stickier lava / medium Si / cools relatively quickly / lava doesn't travel very far – cone shape but basalt low viscosity / runny lava / low Si / lava travels a long way – shield shape. (Must show valid link between two of these for each type of volcano.)	Andesite medium viscosity / stickier lava / medium Si / cools relatively quickly / lava doesn't travel very far – cone shape but basalt low viscosity / runny lava / low Si / lava travels a long way – shield shape. (Must show valid interrelationship between 3 of these for each type of volcano.)
2(a)	Point on <u>surface directly</u> above the focus or hypocentre / where the waves from the focus of the earthquake <u>first meet the surface</u> . (underlined points essential)		
2(b)	Accurate subduction, Indo-Australian (or Australian) and Pacific plates accurately labelled.		
2(c)	Fiordland is made up of lighter / less dense continental crust than the subducting oceanic crust. (Must show that Fiordland is on continental crust.)	Fiordland is made up of continental crust which is lighter / less dense than the subducting oceanic crust and so, when subduction occurs, the lighter crust rides up over the subducting crust.	

Question	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
2(d)(i)	P longitudinal, waves arrive first / travel faster / travels through solids and liquids: S waves transverse, arrive second / travel slower / travel through solids only. Both required.		
2(d)(ii)	P waves arrive first / S waves second.	Achievement plus the distance between the P and S waves indicates the distance of the seismograph from the epicentre.	Merit plus: By using seismographs placed at different points on the Earth's surface, drawing circles from each with radius equal to the distance, earthquake is where the 3 circles intersect.

### Judgement Statement

#### Achievement

Total of FOUR opportunities answered at Achievement (or higher).

$$4 \times A$$

#### Merit

Total of FIVE opportunities answered with TWO at Merit level and THREE at Achievement level.

$$2 \times M + 3 \times A$$

#### Excellence

Total of FIVE opportunities answered with ONE at Excellence level and TWO at Merit level and TWO at Achievement level.

$$1 \times E + 2 \times M + 2 \times A$$

## Assessment Schedule

### Science: Describe properties and applications selected from EMR, radioactive decay, sound and ultrasound (90732)

#### Evidence Statement

Note: Minor computational errors will not be penalised. A wrong answer will be accepted as correct provided there is sufficient evidence that the mistake is not due to a lack of understanding. Such evidence includes:

- the last written step before the answer is given has no unexpanded brackets or terms and does not require rearranging.

Question	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
1(a)	Wavelength is the distance from crest to crest / trough to trough / diagram showing this.		
1(b)	Correct substitution with correct answer in m / km $v = f\lambda$ $\lambda = v / f$ $= \frac{3.0 \times 10^8}{0.935 \times 10^6}$ $= 3.2086 \times 10^2 \text{ m}$ $= 320.86 \text{ (m) or } 0.320\text{km}$ 320 / 321 m – sensible use of s.f.		
1(c)	Constructive interference / peaks add to peaks / troughs add to troughs.	Waves in phase add constructively so that peaks add to peaks / troughs to troughs / 2 waves add in phase.	
1(d)	Indicates the wavelength of FM is shorter than the AM wavelength / AM wavelength longer than FM.	Wavelengths of AM longer so they are diffracted more than FM waves.	Answer compares the wavelengths of the two radio waves and <b>links</b> (this to the increased diffraction of the AM waves as hill size similar to AM $\lambda$ ): linked to reception of radio signal at house.

Question	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
2(a)(i)	Amplitude correctly indicated and labeled.		
2(a)(ii)	Graph is drawn with the same wavelength and increased amplitude, phase doesn't matter.		
2(a)(iii)	Correct arrangement of formula and substitution $v = d / t$ $t = d / v$ $t = 75 / 300$ $(t = 0.25)$	Correct answer $v = d / t$ $t = d / v$ $t = 75 / 300$ $= 0.25 \text{ s} \times 2$ $= 0.5 \text{ s}$	
2(b)	A valid idea  Ultrasound waves reflect differently off different surfaces / ultrasound waves are scattered/ difference in densities noted. (Not gap between fish.)	Absorption of more energy by the fish mentioned as reason for less reflection / more reflection off solid rock bottom.	Comparison of fish to rocks discussed.  Ultrasound waves reflect off both the hard bottom and the softer fish. More energy is absorbed by the less dense fish than the more dense lake bottom. Less energy can reflect back to the fish finder than from the lake bottom.
3(a)(i)	$x = 237$ $y = 93$		
3(a)(ii)	Low penetrating power / absorbed easily by surrounding air / don't travel very far in air.	Low penetration linked to consequence due to high ionisation.	
3(a)(iii)	Alpha particles have a <b>positive</b> charge / electrons removed from molecules in the air / alpha particles give electrons energy.	Alpha particles have a positive charge : electrons removed from molecules in the air / alpha particles give electrons energy.	Alpha particles have a positive charge : electrons removed from molecules in the air : air positively charged / alpha particles give electrons energy : air positively charged.
3(b)(i)	Half-life is the time taken for half the <b>atoms/nuclei</b> in a sample to decay.  Not: half mass decayed away.		
3(b)(ii)	9 700 yrs $\pm$ 500 years		
3(b)(iii)	The count rate has fallen to 1/4 of the original value 39 / 155 which is two half-lives.	The count rate has fallen to 1/4 of the original value 39 / 155 which is two half-lives. So half-life is $7/2 = 3.5 \text{ min}$ (210 s).	
3(b)(iv)	Random process.	Random Process for each atom : half-life is average decay for a sample.	

## **Judgement Statement**

### **Achievement**

Total of NINE opportunities answered at Achievement (or higher), with at least ONE opportunity from each section of EMR, Sound, and Nuclear Decay.

$$9 \times A$$

### **Merit**

Total of TEN opportunities answered with FOUR at Merit level and SIX at Achievement level.

$$4 \times M + 6 \times A$$

### **Excellence**

Total of ELEVEN opportunities answered with TWO at Excellence level and THREE at Merit level and SIX at Achievement level.

$$2 \times E + 3 \times M + 6 \times A$$