

ASSESSMENT GUIDELINES

Unit 21560

Demonstrate knowledge of agrichemicals.

Level 3, Credit 6, Version 1

Demonstrate knowledge of agrichemicals

Unit standard 21560
Level 3, Credit 6, Version 1

Level of performance required for this unit standard

This is a level 3 unit standard. At this level trainees are expected to demonstrate the following abilities when completing assessment tasks:

- To work under general supervision, with some independence; with significant responsibility for the standard of the outcome achieved.
- To apply technical skills and knowledge to complete the task to the specified standard, in a familiar context.
- To interpret available information, and use discretion and judgment.

Workplace assessment:

For guidelines on Workplace Assessment, please refer to the NZHITO Workplace Assessors Manual, and for further information, please contact: NZHITO, P O Box 8638, Christchurch. Ph 03 9644 735, Fax 03 9644 737, Website: www.hortito.org.nz

Special notes:

1. Legislation and relevant regulations relevant to this unit standard include but are not limited to – Agricultural Compounds and Veterinary Medicines (ACVM) Act 1997; Hazardous Substances and New Organisms Act 1996, and relevant regulations; Health and Safety in Employment Act 1992; Resource Management Act 1991. New Zealand Labelling Guide for Toxic Substances 2001, available from <http://www.moh.govt.nz>.
2. Definitions
environmental fate – a generic term describing the interaction of the product, or substance concerned, with the environment, including descriptions of:
 - a. the various pathways by which a substance may enter the environment;
 - b. the possible interactions with the environment;
 - c. the consequences of these interactions, especially where there is potential for adverse environmental effect;

agrichemical – any substance, whether inorganic or organic, man-made or naturally occurring, modified or in its original state, that is used in any agriculture, horticulture or related activity, to eradicate, modify or control flora and fauna. It includes agricultural compounds, fertilisers, vertebrate pest control products and oral nutrition products (this definition differs to that in NZS 8409:2004, where agrichemicals exclude fertilisers, vertebrate pest control products and oral nutrition products);

pests – an undesirable organism injurious to humans or plants.

Acknowledgement

At the back of this assessment guide is an *Agriculture ITO* endorsed question paper, with answers attached, which has been developed for this unit standard. The attached question paper may be used by the Workplace Assessor to carry out assessment and marking of this unit standard on-job.

If you do decide to use the question paper as your method of assessment we only require you to submit the completion form to the NZHITO once the student is deemed to be competent, as is our normal practice.

**Unit 21560: Demonstrate knowledge of agrichemicals.
(Apprentice copy)**

ELEMENT	Competent	Range of evidence an assessor should consider
<p>Element 1 Describe modes of action of agrichemicals.</p>	<p>Yes/No</p>	<ul style="list-style-type: none"> ▪ Describe invertebrate pesticides in terms of their modes of action. Range: contact, ingestion, systemic, fumigant, ovicidal. ▪ Describe fungicides and bactericides in terms of their modes of action. Range: protectant, eradicant, curative, systemic. ▪ Describe herbicides in terms of their modes of action. Range: translocated, selective, non-selective, residual hormone-type, pre-emergence, post-emergence, contact, desiccant. ▪ Describe plant growth regulators in terms of their modes of action. Range: dormancy breaker, growth regulator, crop load regulator, ripening agent.
<p>Element 2 Describe the constituents, advantages and disadvantages, and potential incompatibilities, of agrichemical formulations. Range: includes but is not limited to – emulsifiable concentrates, soluble concentrates, wettable powders, water dispersible granules, suspension concentrates, prills, granules, pellets, dusts, gases, aerosols, baits; evidence is required for at least five.</p>	<p>Yes/No</p>	<ul style="list-style-type: none"> ▪ Describe agrichemical formulations in terms of their constituents. ▪ Describe agrichemical formulations in terms of their advantages and disadvantages. ▪ Describe agrichemical formulations are described in terms of potential incompatibility issues between formulations.
<p>Element 3 Describe the uses of spray additives and adjuvants. Range: surfactants, buffers, spray drift reducers, penetrants, markers, stickers, bulking agents, carriers, stenching agents, emetics, dyes, buffers; evidence is required for at least six.</p>	<p>Yes/No</p>	<ul style="list-style-type: none"> ▪ Describe spray additives and adjuvants in terms of their uses.

Element 4 Describe resistance to agrichemicals.	Yes/No	<ul style="list-style-type: none"> ▪ Describe agrichemical resistance in terms of how it develops. ▪ Describe agrichemical resistance in terms of the management strategies required to prevent, and mitigate its occurrence.
Element 5 Describe agrichemical degradation, and environmental fate.	Yes/No	<ul style="list-style-type: none"> ▪ Describe agrichemicals are described in terms of the ways in which they degrade in the environment. Range: includes but is not limited to – hydrolysis, photodegradation, microbial, oxidation. ▪ Describe agrichemicals are described in terms of their environmental fate. Range: absorption, adsorption, leaching, breakdown products, soil residues, crop residues, surface run-off, food-chain accumulation.

_____ (Name of Apprentice)

is **Competent / Not yet competent** in Unit Standard 21560, version 1

Signed (Assessor): _____

WPA Registration Number: _____ Date: _____

**Unit 21560: Demonstrate knowledge of agrichemicals.
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<p style="text-align: right;">_____ (Name of Apprentice)</p> <p>is Competent / Not yet competent in Unit Standard 21560, version 1</p> <p>Signed (Assessor): _____</p> <p>WPA Registration Number: _____ Date: _____</p>		

Please send this page to your NZHITO Regional Manager, who will forward it to National Office to register the credits on your NZQA Record of Learning.

Unit 21560: Demonstrate knowledge of agrichemicals.

(Name of Apprentice)

is Competent in Unit Standard 21560. (version 1)

Signed (Assessor):

WPA Registration Number: _____

Date: _____

Demonstrate Knowledge of Agrichemicals

Instructions:

1. Write your name, address and the date you hand in this Assessment in the box below.
2. Answer all questions. Use more paper if required.
3. All answers must be in your own words.
4. You must show that you have achieved the standard in all elements of the unit standard.
5. If you do not attain the standard you will have an opportunity to attempt part or all of the assessment again either orally or written, after some further study.
6. If there are any questions you don't understand, or if you have any difficulty reading the questions, please ask your tutor or supervisor for some help.
7. This is an Open book assessment. Students should have access to agrichemical labels, safety data sheets and product manuals.

Student To Complete:

Student Name:	
Address:	
Date Handed In:	
Declaration:	This assessment is all my own work (Your signature)

Assessor To Complete:

Course Number/Name:	
Standard Achieved:	Yes / No (Delete One)
Assessor's Name & Signature:	
Date:	
Comments:	
Questions to Resit:	

Assessment Retake Date:	
Standard Achieved:	Yes / No (Delete One)
Assessor's Name & Signature:	

Demonstrate Knowledge of Agrichemicals

Unit 21560

Level 3

Credits 6

1. Agrichemicals have different modes of action. Describe these in the tables below.
 - (a) Invertebrate Pesticides (e.g. these are mainly insecticides, miticides, and molluscicides)
- include an example of an agrichemical and its target pest.

Mode of Action	Description (what does it mean? How does it work?)	Example of a Product and it's Target Pest
Contact		
Ingestion		
Systemic		
Fumigant		
Ovicidal		

(b) Fungicides & Bactericides - include example product and target disease.

Mode of Action	Description (What does it mean, How does it work?)	Give an Example of a Product and it's Disease
Protectant		
Eradicant		
Curative		
Systemic		

(c) Plant Growth Regulators - include example product that achieves the stated job.

Mode of Action	Description (What does it mean?)	Give an example of a product and what it used for.
Dormancy Breaker		
Growth Regulator		

Crop Load Regulator		
Ripening Agent		

(d) Herbicides - include an example agrichemical.

Mode of Action	Description	Give an Example of a Product that works in this way and a weed it controls
Translocated		
Selective		
Non-Selective		
Residual		

Pre-Emergence		
Post-Emergence		
Contact		
Desiccant		

2. There is a range of different agrichemical formulations. Select at least five of the following formulations and describe their formulations plus advantages and disadvantages. One has been done for you – choose five others.

Formulation & Recognised Abbreviation	Description (What are the characteristics of this form of agrichemical?)	Advantages of this type of Formulation	Disadvantages of this type of Formulation	Give an example of a chemical that has this formulation and a situation where it would be suitable to use it.
Suspension Concentrates, SC or Flowables				
Emulsifiers Concentrates, EC				
Soluble Concentrates, SL				
Wettable Powders, WP				
Water Dispersible Granules, WDG				
Granules, GR, or Prills	Solid formulation that is applied in the same form i.e. it is not diluted or mixed. Applied through shakers, spinners, seed drills or other granule applications	e.g. No mixing required	e.g. often difficult to calibrate application equipment	

Formulation & Recognised Abbreviation	Description (What are the characteristics of this form of agrichemical?)	Advantages of this type of Formulation	Disadvantages of this type of Formulation	Give an example of a chemical that has this formulation and a situation where it would be suitable to use it.
Pellets				
Dusts				
Gases				
Aerosols				
Baits				

3. How is the amount of active ingredient in a formulation expressed?

4. The term “formulation” suggests that the formulated product is made-up or put together from several ingredients, something along the lines of a recipe. Listed below is a range of common formulation ingredients. Describe the purpose of at least six (6) and give an example for each.

Formulation Ingredient	Describe The Purpose	Give an Example
Active Ingredient		
Adjuvants (Varying Types)		
Bulking Agents		
Emetic		
Stenching Agent		
Foam Breakers		
Drift Retardants		
Carriers		

5. Where would you find guidelines on the compatibility of a specific product formulation with other products?

6. In order to reduce possible compatibility problems between agrichemical concentrates there is a recognised order of mixing for different formulation types. Describe this procedure.

7. The following is a list of additives that may be incorporated into a formulated product or added to the application mix. Briefly describe the function and give a practical example of when it would be used.

Additive	Function and Use
Surfactant	
Buffer	
Drift Retardent	
Penetrant	
Dyes / Marker	
Sticker	

8. (a) What is agrichemical resistance?

- (b) Why does agrichemical resistance develop?

- (c) Describe four methods or techniques recommended reducing the development of, or managing agrichemical resistance. You may use actual examples in your description.

i.

ii.

- iii. _____

- iv. _____

10. (a) Briefly describe three (3) processes by which agrichemicals degrade in the environment.

- i. _____

- ii. _____

- iii. _____

(b) Listed below are the terms used to describe the possible fate(s) of an agrichemical after it has been applied. Describe what the listed terms mean in relation to what happens to the chemical in the environment. You may use actual examples to help explain your answers.

Term	Environmental Fate
Absorption	
Adsorption	
Leaching	
Degradation & Breakdown Products	
Soil Residues	
Crop Residues	

Surface Run Off	
Food-Chain Accumulation	

MARKING SCHEDULE

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Credits 6

- In the table below underlined words in the expected answers are considered key words.
- Trainees have access to course material, product manuals etc so finding the examples is a necessary part of the demonstrating the understanding.
- Assessors may alternatively make the assessment closed book and delete the necessity to find examples in questions 1, 2 and 4.

Question	Element	Evidence (Examples of expected answers)	Judgement
1 (a)	1.1	<p>Insecticides</p> <ul style="list-style-type: none"> ▪ Contact – A chemical which <u>kills</u> primarily <u>upon contact with pest</u> organism e.g. a fly killer such as Raid. ▪ Ingestion – An insecticide which <u>must be eaten directly by the pest</u> in order to be effective e.g. Larbait or Mesurol for control of slugs and snails. ▪ Systemic – A chemical which is <u>absorbed or translocated into the internal system of a plant</u> to either a) kill the plant if a herbicide or b) <u>kills pests organisms living off the plant</u> if an insecticide or fungicide e.g. include Confidor Supra (Thrips in onions) ▪ Fumigant – A chemical that <u>produces a gas vapour, fumes or smoke to kill the pest organisms</u> ▪ Ovicidal – A chemical which <u>kills insect or mite eggs</u> e.g. Frontline for fleas. 	<p>All correct. Must mention key words (or similar) for each term.</p> <p>Gives an example product for each and a pest controlled by that insecticide (examples do not necessarily have to come from primary industry so long as they are valid).</p>
1 (b)	1.2	<p>Bacteriacides and Fungicides</p> <ul style="list-style-type: none"> ▪ Protectant – A <u>product applied to the healthy plant surface</u> prior to disease attack to <u>prevent infection occurring</u>. E.g. Bacseal Super – painted onto plant wounds to protect against fungal infection. ▪ Eradicant - A product that has the ability to <u>kill</u> disease pathogens <u>after infection of the host has occurred</u>. e.g. Sportak for cereal diseases, antracnose in avocado and terminal Crook in Radiata Pine). ▪ Curative – A product which can <u>kill or inhibit a disease organism after it has become established in a host</u>. ▪ Systemic – A product that is taken into the <u>internal plant system to control infections as they occur</u> e.g. Alliete a systemic fungicide for the control of phytophera in apples. 	<p>All correct Must mention key words (or similar) for each term.</p> <p>Gives a valid example of a product and disease it controls for each.</p>

Question	Element	Evidence (Examples of expected answers)	Judgement
1 (c)	1.3	<p>Plant Growth Regulators</p> <ul style="list-style-type: none"> ▪ Dormancy Breaker – Designed to <u>break dormancy</u> of a plant to encourage <u>even bud-break or flowering</u> and more predictable growth. ▪ Growth Regulator – <u>Regulates plant growth in one or more ways</u> e.g. stem shorteners, flowering promoters, root promoters, thinning agents. These all work through hormonal action on the plant. e.g. Ethrel to ▪ Crop Load Regulator – A plant growth regulator specifically designed to have a controlling effect on crop load e.g. <u>thinning agents, flowering promoters e.g. Ethrel as a bloom thinner in apples</u> ▪ Ripening Agent – A plant growth regulator that <u>promotes or retards ripening of a crop</u>. E.g. Ethrel <u>regulates ripening in tomato crops</u>. 	<p>All correct Must mention key words (or similar) for each term.</p> <p>Gives a valid example of a product and a situation in which it would be used.</p>
(d)	1.4	<p>Herbicides:</p> <ul style="list-style-type: none"> ▪ Translocated – Often called systemic herbicides. These are <u>applied to one part of the weed and are trans-located</u> to the site of activity, maybe foliage absorbed or roots absorbed depending on the type of herbicide used. e.g. Asulox – see below ▪ Selective – Selective in its action of what plants it will kill e.g. Hormones herbicides active against broadleaf weeds & not grasses or <u>kills some plant types but not others</u>. E.g. Asulox : A selective, translocated herbicide for dock and bracken control. ▪ Non – Selective – likely to kill all plant types e.g. any glyphosate product such as Roundup. Could be used for any weed ▪ Residual – Leaves a <u>residue in the soil</u> that is active over a period of time e.g. Tordon Gold – controls range of broadleaf weeds ▪ Hormone-Type – <u>Simulate plant hormones</u> and upsets the metabolism of the weed causing death. Active only on broadleaf plants. e.g. Pasture Kleen, Baton etc, Kill broadleaf weeds in pasture. ▪ Pre-Emergence – A particular form of <u>residual or soil active herbicide that kills germinating seedlings</u>. i.e. must be applied “pre-emergence” weed. Foresite – used around woody ornamentals or fruit crops or Ronstar G used in home gardens to control annual weeds and grasses. ▪ Post-Emergence – A term used to describe any herbicide that has an effect on seedling plants but does not kill the desired plants. Applied after germination of the weeds. e.g. Combine which is used against broadleaf weeds in cereals. 	<p>All correct Must mention key words (or similar) for each term.</p> <p>Gives a valid example of a product for each and a weed it could be used for.</p>

Question	Element	Evidence (Examples of expected answers)	Judgement
		<ul style="list-style-type: none"> ▪ Contact – An <u>herbicide that kills what it touches</u> e.g. paraquat. These are non-selective and will “knockdown: all foliage”. Can be used in perennial crops such as clover to remove grasses letting the clover regrow from underground portions of the plant. Often only kills foliage and not the whole plant. ▪ Desiccant – A contact herbicide that quickly burns off and dessicates foliage e.g. paraquat, agent orange 	
2	2.2	<ul style="list-style-type: none"> ▪ Suspension Concentrates, SC or Flowables – Active ingred is <u>suspended in water</u> Advantages – Safer, easier to mix than WP. No phytotoxicity. Disadvantages – Agitation required during use. Difficult to rinse measuring vessels ▪ Emulsifiers Concentrates, EC a.i dissolved in <u>organic solvent</u> Advantages – Effectively absorbed by plant, easily measured and mixed Disadvantages – Can cause phytotoxicity easily absorbed through skin, flammable. ▪ Soluble Concentrates, SL – a.i. is <u>dissolved in water</u> Advantages – Easy to mix and measure, no agitation required once dissolved. ▪ Wettable Powders, WP a.i. combined with inert solid materials. <u>Does not dissolve but is suspended in the tank.</u> Advantages – often cheapest form of a.i. Disadvantages – Difficult to mix, nozzle wear. ▪ Water dispersible Granules, WDG Similar to WP, but has finer granules so easier to mix. Advantages - Easy to mix & handle. Disadvantages –leaves visible residues, causes nozzle wear, may require agitation. Pellets ▪ Dusts Active ingredient is in a powder form Advantages: no mixing required for application Disadvantages: potential inhalation of dust particles Gases Aerosols ▪ Baits – active ingredient is mixed with edible things like grains, bran etc or something else attractive which the pest will eat. e.g. Larbait, Mesurol for slug and snail control. 	Must have 5 correct (key words mentioned or similar) with one advantage or one disadvantage for each and a chemical or situation in which it would be used.

Question	Element	Evidence (Examples of expected answers)	Judgement
3	2.1	Either g of a.i. / kg formulation, mL of a.i. / L formulation, or g of a.i./L formulation	Any one Correct
4	2.1	<ul style="list-style-type: none"> ▪ Active ingredient – The part of the formulation that is active against the pest organism (i.e. the bit that kills it) e.g. Glyphosate is the active ingredient in Round-Up ▪ Adjuvants (varying types) – An ingredient of the formulation designed to <u>improve the biological performance of the a.i.</u> e.g. surfactants, penetrants. e.g. Partner ▪ Bulking agents – A formulation ingredient used to “<u>bulk up</u>” the a.i. <u>to make it easier to measure and handle safely</u> and efficiently. ▪ Emetic – a formulation ingredient added to <u>cause vomiting if accidentally swallowed.</u> ▪ Stenching agent – <u>A strong smelling (stench) ingredient to discourage accidental swallowing. Stenching agents are added to hormone herbicides such as Tordon.</u> ▪ Foam breakers – An ingredient of formulations that <u>reduces the foaming action when mixing or agitating.</u> ▪ Drift retardants – An ingredient added to increase size and weight of droplets produced thereby reducing spray drift. ▪ Carriers – The inert material added to a formulation to “carry” other ingredients and allow easy mixing and handling. Similar to bulking agents. 	Any 6 Correct with appropriate example given.
5	2.3	Product label and Safety Data Sheet	Correct
6	2.3	<u>Read labels first</u> for specific directions otherwise mix in the following order: wettable powders, agitate, flowables, other liquids, E.C's last. (WALE)	Correct
7	3.1	<ul style="list-style-type: none"> ▪ Surfactant – To improve <u>spray coverage</u> & therefore <u>effectiveness</u> by reducing the surface tension of the spray mix often called wetters. ▪ Buffer – <u>Adjusts the pH of the spray mix</u> to the optimum to improve effectiveness and reduce chemical degradation in the tank. e.g. <u>Very important with high pH water from limestone country.</u> ▪ Penetrants – Usually organo-silicone based these are “super-wetters” where the surface tension has been reduced so much that spray is drawn into pores (stomata) in leaves and <u>improving uptake and rain fastness. Helps chemical get absorbed quicker and can be used ahead of likely rain.</u> ▪ Dyes / Markers – Used in association with hand application (knapsacks & guns) to make visible treated areas or plants by dyeing them a different colour. <u>ie you can see where you have sprayed.</u> 	All correct Key words or similar mentioned and gives valid example of when it would be used.

Question	Element	Evidence (Examples of expected answers)	Judgement
		<ul style="list-style-type: none"> ▪ Stickers – Increases <u>rain fastness and improves uptake</u> on difficult to wet plants by adhering the spray to the plant. These often contain latex type substances as a sticking agent. <u>Useful for plants with hairy or shiny leaf surface, or plants with little leaf area or if rain likely.</u> 	
8 (a)	4.1	This is genetic trait that a pest inherits that allows it to survive an agrichemical application that most other individuals in the population cannot survive. This becomes a problem as the proportion of resistant individuals in a population increases.	Correct or similar answer
8 (b)	4.1	The selection pressure that results from repeated exposure to a single chemical (or class of chemicals) or exposure to sub-lethal doses means that any surviving pest individuals can only breed with other resistant individuals. Eventually most individuals develop genetic resistance.	Correct or similar answer
8 (c)		<p>May include: -</p> <ol style="list-style-type: none"> 1. Apply pesticides/drugs/chemicals only when necessary 2. Use resistant cultivars/animals reducing the need use the chemicals. 3. Use a range of control measures (e.g. manual, cultural control) - not just chemical. 4. Maintain and apply chemicals only once thresholds have been exceeded. 5. Alternate chemical groups. 6. Use short-lived, non-residual chemicals if possible. 7. Use selective chemicals if possible. 8. Spot – treat populations if possible. 9. Follow IPM principles and practices which encompasses all of those described above. 	Any 4 valid strategies described (o t h e r strategies than those listed may also be correct).
9 (a)	5.1	<ol style="list-style-type: none"> 1. Photo degradation – breakdown induced by sunlight 2. Microbial activity using enzymes can degrade organic chemicals using them as a source of energy and carbon. 3. Hydrolysis – Chemical reactions of the agrichemical with water to form smaller more water soluble compounds. 4. Oxidation –Reduction – This involves the transfer of electrons from one chemical to another. One loses electrons and one gain electrons. Chemicals are thereby broken down into different compounds. <p>(Note if answer is chemical reaction then that is the same as 3 and 4 above)</p>	3 correct degradation mechanisms given.

Question	Element	Evidence (Examples of expected answers)	Judgement
9 (b)	5.2	<ul style="list-style-type: none"> ▪ Absorption – <u>Dissolved chemical absorbed</u> with water <u>into plant and animal tissue</u> where the chemical may then be affected by other mechanisms described below. ▪ Adsorption – <u>Attachment of chemical molecules to soil</u> and organic matter particles. Strength of this binding can vary e.g. Paraquat adsorbs very tightly to soil. ▪ Leaching – Movement of chemical out of the soil profile with water ▪ Degradation and Breakdown Products - Chemical degraded by various processes such as photolysis, hydrolysis, oxidation/reduction, microbial activity on the original agrichemical. Break down to products may no longer toxic or hazardous ▪ Soil Residues – Potentially active <u>agrichemical that persists in the soil</u> usually due to non-solubility and adsorption to soil particles and organic matter. ▪ Crop Residues – Agrichemical that remains active in plant tissue and is removed to another location in crop residues or harvested crop where it can cause a new set of problems e.g. versatile removed with lawn clippings causing major residue problems and bioaccumulation, or accumulates in fruit etc that is harvested. ▪ Surface Run Off – gets washed off soil by surface water. This can also include chemical absorbed to soil particles in the runoff/erosion. ▪ Food-chain accumulation – Bioaccumulation in successive steps of the food chain can cause problems e.g. DDE accumulation in microbial organisms eaten by small invertebrates, eaten by larger invertebrates and so on so that by the time large mammals or fish eat the smaller ones the concentration is high in the fat tissue. 	All correct – key words mentioned or example given that indicates understanding of the concept/process.