A-level

ENVIRONMENTAL SCIENCE

7447/1

Paper 1

Mark scheme

June 2020

Version: 1.0 Final Mark Scheme

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Qu	Part	Marking guidance	Comments	Total marks	AO
01				5	**AO1 1a**

Gas	**Mean residence time / yrs**	**Human activity that increases atmospheric concentrations of greenhouse gas**	**Global warming potential / relative to CO_2**	**Method to reduce atmospheric concentrations of greenhouse gas**
Methane/CH_4				
				Named substitution materials/ actions/correct disposal methods /Ban use
N_2O/nitrous oxide [**A**] NOx				
			1	
(Tropospheric) ozone				

Qu	**Part**	**Marking guidance**	**Comments**	**Total marks**	**AO**
02	1	0.43 mm yr^{-1} A 0.40 – 0.43	24 % of 1.8 mm = 0.432 = 0.43 mm yr^{-1}	1	**AO2**
02	2	**One** mark for volume of ice 11.5 x 10^6 km^3	Total volume of ice (0.5 +3 + 8) x 10^6 km^3 = 11.5 x 10^6 km^3	1	**AO2**
		One mark for sea level rise 29 m	$\frac{11.5 \times 10^6}{395}$ = 0.0291139 x 10^6 mm = 29m	1	**AO2**
02	3	Any **one** from • thermal expansion of seawater • decrease in land water storage		1	**AO1b**
02	4	Any **one** named remote sensing system from • Lidar scanners • Gravity recovery and climate experiment (GRACE) • Satellite altimetry • Other named suitable example		1	**AO2**

Qu	Part	Marking guidance	Comments	Total marks	AO
03	1	**One** mark for difference in energy needed 2000 GJ A answers based on 580 - 600 and 180 - 190 **One** mark for difference in CO_2 emitted: 133 tonnes of CO_2 A correct calculation based on answer for first part	**0.5% ore grade**: 580 x 5 = 2900 GJ **2% ore grade:** 180 x 5 = 900 GJ **Difference** = 2000 GJ $\frac{2000}{42} = 47.62$ 47.62 x 2.8 = 133.3	2	**AO2**
03	2	**One** mark for technique **One** mark for how it works Direct detection • Geiger counter • detects beta particles/gamma rays/radioactive emissions • Scintillation counters • measures ionising radiation • Trial drilling • produces rock samples for confirmation of ore presence/ concentration Remote sensing using satellites/aerial surveys • Magnetometry • variations in magnetic fields • Gravimetry • variations in gravitational fields • (Gamma ray) Spectroscopy • radiation detected used to identify presence of ore • Seismic surveys • reflected sound waves give information about the depth, density, and shape of deposit Other correct technique and how it works		1 1	AO1a AO1b

03	3	Any **two** from • • Use of radiation absorbing materialset dose limits/dosemeters/photographic film • maximum time for exposure • dust suppression/ventilation/monitoring of air/dust/surfaces • remote handling of material (tailings/ore) • minimum distance from source/inverse square law • clothing/respiratory protection • use of radioactive detection equipment • decontamination procedures • other correct method	2	**AO1b**
03	4	Indicative content	9	AO1=4 *AO1 1a =2* *AO1 1b =2* AO2=3 AO3=2 *AO3 1c=2*

Named example	**Description of technology**	**Reduced environmental impacts**
Bioleaching	Micro-organisms such as bacteria and fungi that produce acids to dissolve metals. Metals extracted from solution using carbon filters/electrolysis	Less energy intensive/ less emissions than smelting. Reduced global warming/acid rain. Reduced acid seepage. Bacterial population reused and recycled
Phytomining	Plants absorb metals from soil or water and concentrated in leaves. Plants then harvested, burned and metals extracted from ash by dissolving in acids, electrolysis, or iron displacement	Less energy intensive/ Less emissions than smelting. Reduced global warming/acid rain. Decontaminates polluted ground
Leachate collection	Draining leachate recirculated through spoil heaps increases concentration of metal ions in solution	Use of waste spoil heaps. Reduces problem of leachate drainage, eg into water ways
Iron displacement	Copper extracted from copper sulphate solution by displacement by scrap iron	Less energy intensive /less emissions than smelting. Reduced energy needed for recycling scrap metal
Polymer adsorption	Metal ions adsorbed onto polymer surface. Natural polymers used, eg shells & shrimp chitin	Use of aquaculture waste. Adsorbent fibres reusable. Less equipment needed re mining – less emissions

	eg uranium	- low energy method of obtaining U – reduced emissions - used alongside desalination plants as U concentrated in brine discharge - less radioactive waste/impact on the environment compared to land based deposits, eg no leachate from tailings, no potential groundwater contamination - faster method
Phosphate mining (uranium)	U a by-product. Separated from phosphate deposits	Less energy intensive
Extraction from coal ash (uranium)		Less ash to landfill

Examiners are reminded that AO1, AO2 and AO3 are regarded as interdependent. When deciding on a mark all should be considered together using the best fit approach. In doing so, examiners should bear in mind the relative weightings of the assessment objectives. More weight should therefore be given to AO1 than AO2 and AO3.

Level	Marks	Descriptor
3	7–9	A comprehensive response to the question, with the focus sustained. A conclusion is presented in a logical and coherent way, fully supported by relevant judgements. A wide range of knowledge and understanding of natural processes/systems is applied. The answer clearly identifies relationships between environmental issues. Relevant environmental terminology is used consistently and accurately throughout, with no more than minor omissions and errors.
2	4–6	A response to the question which is focussed in parts but lacking appropriate depth. A conclusion may be present, supported by some judgements, but it is likely not all will be relevant. A range of knowledge and understanding of natural processes/systems is shown. There is an attempt to apply this to the question, but there may be a few inconsistencies, errors and/or omissions. The answer attempts to identify relationships between environmental issues, with some success. Environmental terminology is used, but not always consistently.
1	1–3	A response to the question which is unbalanced and lacking focus. It is likely to consist of fragmented points that are unrelated. A conclusion may be stated, but it is not supported by any judgments and is likely to be irrelevant. A limited range of knowledge and understanding of natural processes/systems is shown. There is an attempt to apply this to the question, but there are fundamental

		errors and/or omissions. The answer may attempt to identify relationship between environmental issues, but is rarely successful. Limited environmental terminology is used, and a lack of understanding is evident.
	0	Nothing written worthy of credit.

Qu	Part	Marking guidance	Comments	Total marks	AO
04	1	88%	77 - 9.5= 67.5 $\frac{67.5}{77}$ x 100 = 87.7%	1	**AO2**
04	2	Any **two** marks from • noise monitoring stations • systematically located **OR** • transects of suitable length • transects radiating from runway (point of origin)/transects along points of compass Any **one** mark from Number of sample sites/monitoring stations • 10 or more sampling sites • suitable intervals - 1 km **One** mark from Equipment • calibrated/standardised sound level meters Any **two** marks from Timing • data collection related to flight schedules Reliability • repeat max level readings to obtain mean • avoidance of other noise sources • avoidance of structures affecting noise transmission • same wind direction		Max 4	AO2 PS=4
04	3	Any **two** named design changes Any **two** linked explanations how design changes reduces noise emissions eg • high bypass - ratio engines/engine hush kits/chevron nozzles • smooth mixing of exhaust gases and surrounding air **OR** • improved brakes • reduced use of reverse thrusters **OR** • more aerodynamic surfaces/blended wing aircraft/fairings – undercarriage/wing flaps • less turbulence/vibration/thrust/power needed **OR** • engine acoustic liners • absorbs/dissipates engine noise		2 2	AO1 1b

04	4	Any **one** from • change flight paths to avoid urban areas • lower altitude flights restricted over urban areas • steeper take-off angle for rapid ascent to a higher altitude • constant descent angle reduces periods of high engine thrust • restricted flight times, eg to reduce noise exposure at night • noisy aircraft banned/charged • fines for exceeding noise limits/restrictions • quota count system to encourage use of quieter aircraft • other correct operational change	1	AO1 1a KIN

Qu	Part	Marking guidance	Comments	Total marks	AO
05	1	(No power output as wind speed) not strong enough~~)~~ to turn turbine blades/overcome inertia/overcomes friction		1	**AO2**
05	2	2.5 : 1 [**A**] 5 : 2 , 1:04 and other	Figures from graph: 3000 and 1200 $\frac{3000}{1200}$ and $\frac{1200}{1200}$ = 2.5 : 1	1	**AO3**
05	3	Any **three** from: • rotor blades positioned at same height • length of time same for each wind speed tested • same number of measurements at each wind speed • same temperature/air density • same (range of) wind velocities • same precipitation		3	**AO2**
05	4	Advantages of off-shore compared to on-shore Up to **three** from Greater distance from populated areas leading to • reduced noise pollution • reduced visual pollution • reduced land use conflicts eg not close to urban areas, not near areas of high scenic value eg National Park • correct data from map Up to **three** from Generate more electricity per annum due to • higher average wind speeds • greater numbers • larger sized turbines • greater height allows access to higher wind speeds • greater blade diameter • correct use of data from table		Max 5	AO3 1c

Qu	Part	Marking guidance	Comments	Total marks	AO
06	1	B		1	**AO2**
06	2	Any **two** from • removes unreliability/intermittency • energy can be stored/peak shaving of surplus energy for later use • more useful chemical energy/more named applications, eg vehicles • higher energy density		2	**AO2**
06	3	**One** mark for **2.2** and **4.8** **One** mark for difference 2.6^{O} C min^{-1} A answers based on 100 – 77 = 23	Cylinder A 100 – 78 = 22 22/10 = $2.2^{O}C\ min^{-1}$ Cylinder C 100 – 52 = 48 48/10 = $4.8^{O}C\ min^{-1}$ 4.8 – 2.2 = $2.6^{O}C\ min^{-1}$	2	**AO3 1b**
06	4	30 kJ	Cylinder C = 100 cm^3 After 60 min – temp drop = $72^{O}C$ Total energy lost: 4200 x 0.1 x 72= 30240 J 30 kJ	1	**AO3 1b**
06	5	Any **two named** environmental conditions eg temperature air flow humidity sources of heat gain/loss		2	**AO2**
06	6	• use container with the lowest SA:vol ratio/minimise SA:vol ratio/lowest rate of heat loss • less of the volume in contact with the outer surface		2	AO3 1c

Qu	Part	Marking guidance	Comments	Total marks	AO
07	1	Any **three** from: • systematic/random sampling/grid area and sample from each square/W sampling • multiple samples (at each sampling location) • from same depth • same volume/use of soil auger/same mass • timing to allow for fluctuations/change/named factor that may cause change • named storage method to prevent water gain/loss • other correct answer		3	AO3 1c PS=3
07	2	Any **two** from: • dry known volume of soil • weight/mass of dry soil • divided by volume		2	AO1 PS=2

Qu	Part	Marking guidance	Comments	Total marks	AO

08	1	**Two** marks max for describing location of samples either random or systematic
		One mark reference to number of samples to be taken
		Location of sample
		• random sampling
		• set up a gridded area and use random numbers:
		  • as coordinates and choose the tree on/closest to that coordinate
		  • to number each tree (within the plot area) and use the random numbers to select trees
		OR
		• systematic sampling
		• set up a gridded area and sample tree at the same chosen interval, eg every 5th square along
		Number of samples
		• (same) large number of trees sampled in each plantation
				3	AO2

08	2	**AGC** at 30 years • **95.83** 40 years • **90.74** **Change** • **-5.1** t ha $^{-1}$ ecf	230 x 50/100 x 5/6 225 x 50/100 x 4.17/5.17 Credit each equation above if answer not worked through 95.83 – 90.74	1 1 1	AO3 1a

08	3	**One** mark for: • harvest at 30 years Any **one** from: • max biomass/little/no further increase in biomass after 30 years • decrease in AGC after 30 years as ratio drops to 4.17 after 30 years • less C stored above ground after 30 years		2	AO3 1b 1c

08	4	• if kept as wood, eg furniture/construction/ preserved wood = carbon stored • if used as a fuel/used where it will rot = carbon released to atmosphere		2	AO2

Qu	Part	Marking guidance	Comments	Total marks	AO
09	1	D		1	AO3 1a
09	2	Any **three** from the following: • large sample size/high frequency of collection • random locations (for collection of samples) • samples from, eg different regions/parts of the UK/imported • large range of food items (tested) • large range of food • large range of outlets • other correct answer	Allow suitable description, eg from a range of different suppliers, eg supermarkets, wholesalers	3	AO2
09	3	Systemic pesticides will be retained within the food	Allow converse for contact pesticides	1	AO2
09	4	Different amounts of pesticides applied because • types of pest may vary • seasonal changes/species life cycles affect abundance (requiring different application rates) • different methods/timing of application affect concentrations • numbers of predators vary (requiring different application rates) Variation after application • rainfall • time before harvest • increase in mass causes dilution • storage/treatment method Other correct answer		4	AO2
09	5	Any **three** from: **Advantages** • does not remain in the environment for a long period of time/low persistence • (as it) degrades quickly		3	AO11b

		• not liposoluble/do not bioaccumulate/ biomagnify • high specificity/high insect toxicity/low mammal toxicity /fewer non-target species are killed • insoluble in water/low mobility • not carcinogenic other correct answers			

09	6	Any **three** from: Loss of one species affects others by: • loss of potential food source/decrease in the populations of other inter-dependent species • loss of an ecosystem service, eg less pollination/seed dispersal • some species become more abundant as competing/predator species have been killed • removal of habitat		3	AO1b

Qu	Part	Marking guidance	Comments	Total marks	AO
10	1	**Water deficit in 1 year** • 600×10^6 m^3	$(-700 + 100) \times 10^6$ m^3 Credit equation above if answer not worked through	1	AO3 1a 1b
		Water level drop in 10 years • 8.6 m	0.857 m drop in 1 year, 8.57m in 10 years	1	
		OR	**or**		
		Water deficit in 10 years • 6000×10^6 m^3	$(-7000 + 1000) \times 10^6$ m^3 Credit equation above if answer not worked through	1	
		Water level drop in 10 years • 8.6 m A. 8.57, 9	-6000/-7000 x 10m **or** 10 – (1000/7000 x 10) / 10 – 1.4285	1	

Qu	Part	Marking guidance	Comments	Total marks	AO
10	2	Any **one** from the following: • named change in weather patterns, eg increased temperatures could increase rate of evaporation (of surface water) • named change in demand of water from human activities, eg water for irrigating crops		1	AO2

10	3	**One** mark for named method of desalination **One** mark for how method works eg reverse osmosis water filtered at very high pressure through partially/selectively permeable membranes/tubes **OR** Distillation salt water boiled/evaporated (by heating or reduced pressure) and steam produced condensed **OR** multi-stage (MSF) flash distillation/flash distillation vaporisation of water sea water due to reduced pressures and steam produced condensed		2	AO1 1a

10	4	**Two** marks for choice of equipment and description of method: • Secchi disc/turbidity bottle/turbidity tube with light and dark segments/cross/degrees of shading • measure the depth when segments/cross disappear/density of cross hatching obscured **OR** • light source and light meter/turbidimeter/nephelometer/colourimeter • measurement of transmission/scatter/reflection Up to **three** marks for description of standardisation of method • same volume of water tested/collected • same container/dimensions/depth of container used For turbidity meter • same light source/light intensity /levels/wattage • same distance of light source to water container • calibrate light meter • repeats for reliable mean • repeat turbidity test over time/named time interval (to detect changes)		5	AO1 1b =2 AO2 = 3

Level	Marks	Descriptors
5	21–25	A comprehensive response with a clear and sustained focus. Content is accurate and detailed. Relationships are identified, reflecting the holistic nature of environmental science and the answer as a whole is coherent. A wide range of relevant natural processes/systems and environmental issues are described and articulated clearly. These are applied systematically to the question, with clear relevance to the context. Where conclusions are made, these are fully supported by judgements and presented in a logical and coherent way. Relevant environmental terminology is used consistently and accurately throughout. If there are errors, these are very minor indeed and not sufficient to detract from the answer.
4	16–20	A response in which the focus is largely sustained, with content that is mainly accurate and detailed. Relationships are identified and the answer is largely coherent. A range of natural processes/systems and environmental issues are described and articulated clearly. In most cases, these are applied appropriately to the question but, in some, it is less clear why they are relevant. Where conclusions are made, these are supported by judgements which are mostly coherent and relevant. Relevant environmental terminology is used consistently and throughout, with no more than minor errors.
3	11–15	A partial response which is focused in parts. The content is mostly accurate but not always detailed. There is an attempt at identifying relationships, but the answer as a whole is not fully coherent. A range of natural processes/systems and environmental issues are described, most are articulated clearly. In some cases, these are applied appropriately to the context but, in most, it is less clear why they are relevant. Where conclusions are made, it is not always clear how they relate to the judgments given and are likely to contain errors. Relevant environmental terminology is used, but not consistently and there may be errors.
2	6–10	An unbalanced response, lacking in focus. The content may be inaccurate and lacking detail. There is some attempt at identifying relationships, but the answer is not coherent. A limited range of natural processes/systems and environmental issues are described but not articulated clearly and likely to contain errors and/or omissions. There is a limited attempt to apply them to the context. Any conclusions are likely to be asserted, with no supporting judgements and fundamental errors. Environmental terminology is used, but not always appropriately and sometimes with clear errors.
1	1–5	Fragmented points, whose relevance to the question and relationships to each other are unclear. A few natural processes/systems and environmental issues are listed, but unlikely to be described and many may be irrelevant. There is no clear attempt to apply them to the context. It is unlikely that a conclusion will be present. There is an attempt to use environmental terminology, but seldom appropriately.
	0	Nothing written worthy of credit

Qu	Part	Marking guidance	Comments	Total marks	AO

Qu 11	Part 11.1	AOs: AO1 = 10 AO2 = 10 AO3 = 5

Students need to appreciate that there have been improvements at local and regional levels w.r.t air pollution but problems still exist re numbers of vehicles on the road, globally, countries that do not have access to new technology or fast developing countries, eg China

Topic areas	Technological improvements	Details of impact reduction (local, regional and global scales)	Spec ref
Smoke/smoke smogs Incomplete combustion of coal, diesel, wood, crop waste	Diesel particulate filters (DPV) CMA road surfaces (London) Electrostatic precipitators in coal fired power stations Cyclone separators Bag filters Scrubbers Smokeless coal More efficient combustion technology in diesel engines	Trap smoke particles. Reduce particulates in cities Particulates stick to surface – not resuspended Fly ash collected – reduced regional particulate pollution Suspended particles collected in chamber Suspended particles washed out Tar removed Reduced regional impacts Reduced respiratory disease Reduced albedo of atmosphere Reduced smoke smogs during temperature inversions	3.4.3.2.1
Photochemical smogs SOx: sulfurous and sulfuric acids • NOx: nitric acid • ozone involved in production of secondary pollutants.	Catalytic converters Vapour collection at petrol stations	Reduced damage to non-living objects: damage to limestone buildings, metal structures • Living organisms • Direct effects of acids • Damage to proteins • Damage to exoskeletons • Respiratory effects in humans Reduction of NOx and oxidation of hydrocarbons Reduced regional impacts	3.4.3.2.3 3.4.3.2.4
Acid rain	Desulfurisation of fossil fuels FGD, Dry FGD, Wet FGD Control of NOx – low temp combustion, catalytic converters, urea sprays	Reduced acidification of soil, water bodies, mobilising of heavy metals. Reduced impacts on biodiversity Transboundary pollutant	3.4.3.2.2
Tropospheric ozone	Catalytic converters	Reduced impacts on health Local impacts	3.4.3.2.4
Carbon monoxide	Catalytic converters	Reduced health impacts	3.4.3.2.5

Qu **11**	**Part** **11.2**	**AOs:** **AO1 = 10 AO2 = 10 AO3 = 5**

Topic areas	**Soil management strategies**	**Details/impact reduction (local, regional and global scales)**	**Spec ref**
How human activities affect soil fertility	Activities that control soil conditions and affect fertility: • aeration of soil by ploughing and drainage • addition of soil nutrients • irrigation • soil compaction, increasing bulk density • pH control		3.2.5.1
Causes of soil degradation and erosion	Human activities that cause soil erosion and degradation: • ploughing vulnerable soils • vegetation removal • overgrazing • reducing soil organic matter • reducing soil biota • cultivating steep slopes • soil compaction by machinery or trampling		3.2.5.2
	The environmental impacts of soil erosion: • reduced productivity • sedimentation in rivers and reservoirs • downstream flooding • coastal sedimentation • increased atmospheric particulates • desertification • landslides		
Soil management strategies to increase sustainability	Methods that can be used to reduce soil erosion: • long-term crops • contour ploughing • tied ridging • terracing • windbreaks • multicropping • strip cropping • mulching • increasing soil organic matter		3.2.5.3

The carbon cycle including human influences	Sustainable management of the carbon cycle: methods of counteracting human activities that alter the natural equilibria of the carbon cycle	• Carbon sequestration • Carbon Capture and Storage (CCS) • Matching afforestation to deforestation • Increasing soil organic matter • Conservation of peat bogs	3.2.4.2
The nitrogen cycle including human influences	The processes in the nitrogen cycle that are affected by human activities	• The Haber Process fixing nitrogen in ammonia, mainly to produce agricultural fertilisers • Land drainage increases nitrogen fixation and reduces denitrification • The growth of legume crops increases nitrogen fixation in plant proteins	3.2.4.3
	Consequences of changes in nitrogen reservoirs:	• eutrophication • global climate change	
	Sustainable management of the nitrogen cycle and methods of counteracting human activities that alter the natural equilibria of the nitrogen cycle	Methods of counteracting anthropogenic nitrogen movements: • use of natural nitrogen fixation processes instead of the Haber process • methods of reducing soil nitrate leaching	
The phosphorus cycle including human influences	The processes in the phosphorus cycle that are affected by human activities	Phosphorus compounds in agricultural fertilisers Eutrophication	3.2.4.4
	Sustainable management of the phosphorus cycle and methods of counteracting human activities that alter the natural equilibria of the phosphorus cycle	• the use of biological wastes as fertilisers • breeding of crops that absorb phosphates more efficiently • providing suitable conditions for soil mycorrhizal fungi increases phosphate uptake	
Issues that may be developed The extent to which these management strategies have been successful Difficulties in applying these strategies/reasons for lack of success New developments being made/that need to be made			