Question		Expected Answers	Marks	Additional Guidance
1	(a)	little / very little, increase up to 1850 all have increases ; coal from around 1850 ; petroleum from 1920 / gas from late 1940s ; coal reached a peak in 1990s ; coal only one showing decrease ; oil decreased in 1970s ; steep increase in use from 1950s ; comparative data quotes ;;	[max 5]	
	(b)	*hydrocarbons to max 3* produce carbon dioxide ; greenhouse gas ; carbonic acid / acid rain ; smoke / particles ; *compounds of sulfur* produce sulfur dioxide ; sulfuric acid / acid rain ;	[max 4]	**allow** acid rain once in answer
	(c)	fossil fuels are, non-renewable / AW ; conserve for future generations ; more efficient ways of using them in the future ; alternatives are, expensive / not reliable ; AVP ;	[max 2]	
			[Total: 11]	

2	**(a)**	**(i)**	amylase **A** carbohydrase		[1]	**Ig** odd spelling
		(ii)	**1** **2** **3** **4** **5**	starch is not soluble / large /complex fungus does not, secrete / produce, amylase for absorption (of glucose) / AW ref to, respiration / growth, (of fungus) as nutrient, for fungus / fermentation / AW	[max 2]	Mpt 2 **A** ecf from (i) / carbohydrase / enzyme to digest starch
	(b)	**1** **2** **3** **4** **5**	other fungi / bacteria / virus / other microorganisms compete for nutrients reduce productivity / yield / quality contaminate the product / produce toxic *or* harmful product / ORA stop the process (early) and sterilise fermenter		[max 2]	**R** contaminate unqualified

2	(c)		energy is lost, between / within, trophic levels / along food chain		**Ig** ref to healthy diet
		2	animals are, at second trophic level / primary consumers OR plants are, autotrophs / producers / first trophic level		
		3	(energy lost) in animal respiration / heat / (named) metabolic process / movement		ref to 100→10→1
		4	ref to (more) material that is inedible / not digestible (in longer food chains)		
		5	ref to 10% energy transfer / ORA		
		6	less pollution (from farm animal waste)	[max 3]	Mpt 6 **A** plants use CO_2
	(d)	**1**	cheaper		**Note:** Use list rule
		2	requires less energy as less is lost along food chain		
		3	mycoprotein can be made anywhere / less land (in fermenters)		
		4	less (animal) waste		
		5	better for animal welfare / more ethical		
		6	lower in fat **/** lowers risk of heart disease		
		7	suitable for, vegetarians / vegans		**R** longer shelf life, help food shortages, more protein, more nutrients, easier to digest
		8	AVP e.g. quicker, contains fibre, disease free	[max 3]	
	(e)	**1**	mycoprotein / fungus production requires supply of corn (starch)		
		2	this comes from crop plants		
		3	(fungus) still need to be grown		
		4	(manufacture) requires energy		
		5	rate of food supply cannot keep up due to overpopulation		
		6	AVP e.g. does not contain all nec nutrients, may be consumer resistance to eating mycoprotein foods / needs flavourings / unbalanced diet	[max 3]	**R** required machinery
			[Total: 14]		

3	(a)	(i)		(80 – 30 = 50) 50 / 30 x 100 OR max – min / original x 100 = 167 / 166.7 (%)	[2]	*two marks for the correct answer (167)* *if answer incorrect, allow one mark for the correct working / formula* **R** 166, **lg** sig figs
		(ii)	**1** **2** **3** **4** **5** **6** **7** **8**	increase in human population / more people to feed more crops being grown / higher yield less land available for farming (land lost to housing etc) farming has become more intensive / technological / less subsistence / AW less use of crop rotation / less land left fallow / monoculture / less use of legumes prevents soil becoming depleted of nitrogen (compounds) new varieties of crop plants have high demand AVP e.g. cheap, easy	[max 3]	
	(b)	(i)	**1** **2** **3** **4** **5** **6** **7** **8**	protein (in manure) broken down / decompose to amino acids by (named) decomposers, in context amino acids / proteins, deaminated deamination described urea converted to ammonia ammonia / ammonium ions, to nitrite / nitrate ions nitrite to nitrate ions nitrification / nitrifying bacteria, in context	[max 4]	
		(ii)	**1** **2** **3** **4** **5** **6** **7** **8**	legumes contain nitrogen-fixing bacteria / rhizobium in root nodules nitrogen fixation / convert nitrogen (in atmosphere) to ammonia / amino acids / organic forms of N transferred to legume for making protein increases N (in soil) for next crop reduces need to use chemical fertilisers legumes are good source of protein crop rotation reduces effects of, pests / diseases	[max 3]	

3	(c)		*waters*		
		1	<u>eutrophication</u>		
		2	growth of algae / algal bloom		
		3	light blocked / toxic substances released by algae		
		4	(fixed) water plants die		
		5	algae / plants, decayed by bacteria		
		6	aerobic respiration		
		7	oxygen concentration decreases in context		
		8	animals / fish, migrate / die, in context		
			land		
		9	reduction in organic content of soil		
		10	soil / fertilizer, blown / washed / leached, away **A** erosion of soil		
		11	increase in soil acidity		
			atmosphere		
		12	increases loss of nitrous oxide / NO_x to the atmosphere		
		13	nitrous oxide / NO_x, is a greenhouse gas		
		14	carbon dioxide from combustion of fossil fuels / in production of fertilisers		**Mpt 15** linked with mpt 13 or 14
		15	greenhouse effect / global warming, in context		
			humans		
		16	qualified health effect on humans / livestock	[max 5]	e.g. blue baby syndrome, accumulation in dioxins
				[Total: 17]	

Question			E Answers	Marks	Additional Guidance
4	(a)		*Gallirallus* ;	[1]	**R** *Galliralus calayanensis*
	(b)		*(clearing land for)* agriculture ; roads / transport ; housing ; fuel ; timber qualified ; e.g. for building material AVP ; e.g. mining / industrialisation	[max 3]	**A** furniture manufacture / paper
	(c)		*decrease* habitat loss ; fewer nesting sites ; less reproduction ; ref to, camouflage / exposed to predation ; less food / food chain disrupted ; more competition ; higher temperature / more exposure to storms / AW ; *increase* fewer predators ; more food ; fewer competitors ; simpler food web ;	[max 3]	**No credit for** 'decrease' / 'extinction' / 'increase' without qualification

4	**(d)**	*Question asks for reasons why conserving species is important – answers must be in this context* *ecological* ref to food chain / food web **;** interdependence / AW **;** *aesthetic* species are unique / AW **;** (eco)tourism **;** ref to biodiversity **;** retain genes / maintain gene pool / AW **;** qualified potential use for humans **;** AVP **;** e.g. ethical considerations for future generations to appreciate	[max 2]	**R** 'become extinct' without further qualification **A** maintain / balance ecosystem **A** 'knock-on' effects / possible example / AW
			[Total: 9]	