Question	E Answers	Marks	Additional Guidance
1 (a)	*animals written in the correct boxes in the food web* (Ruppell's) vulture ; cheetah ; mice / mouse ;	[3]	
(b)	(primary) <u>producer</u> ; <u>primary</u> / <u>first</u> <u>consumer</u> ;	[2]	
(c) (i)	Sun / sunlight / light ;	[1]	
(ii)	(lost) to the atmosphere / (lost as) infra red (radiation) / heat / AW ;	[1]	**R** reflect **R** 'lost' only – needs qualifying
(d) 1 2 3 4 5 6 7 8 9 10	*idea that* **small** percentage of energy from sun is 'fixed' by photosynthesis ; most energy from sun not available / reference to wrong wavelength / AW ; energy is lost, between / within, trophic levels / along food chain ; ref. to 10% energy transfer / ORA ; ref. to material that is, inedible / not digestible ; energy lost, in respiration / heat / (named) metabolic process / decomposers ; ref. to (small) total percentage reaching fourth trophic level ; not enough energy in fourth trophic level to support another level ; except parasites ; ref. to another problem of animal that would prey on, top carnivores / scavengers ;	[max 3]	**NB**: **MP3** is for loss with no reference to magnitude, also award **MP4** if magnitude given e.g. '90% lost between trophic levels' is marks **MP5 A** ref to faeces examples for **MP10** animal would have to be very large, would need much energy to catch a cheetah, there would be very small populations

Question	E	Answers	Marks	Additional Guidance
1 (e)	1 2 3 4 5 6 7 8 9 10 11	feed is expensive / fish is sold at high price ; more energy efficient to feed humans on, crops / producers / animals used to make the fish food ; waste from salmon / excess feed, causes eutrophication ; diseases / parasites, spread easily in (high density of) salmon ; diseases spread to, wild fish / other organisms ; chemicals used to control disease also pollutants ; escapees breed with wild fish ; *idea of* genetic pollution of wild fish ; escapees compete with wild fish ; extinction of wild fish ; AVP ;	[max 3]	No credit for energy losses along the chain as already given in Question 1d AVP e.g. chemicals / antibiotics / hormones in feed passed on e.g. less waste if humans could eat hi protein 'fish food' instead e.g. low quality stock compared with wi (less competition)
			[Total : 13]	

Question		E	Answers	Marks	Additional Guidance
2	(a)		group of organisms / individuals, of same species ; can interbreed ; live in same area / habitat (at same time) ;	 max 2	R 'people'

	(b)	1
		
		2
		3
		4
		5
			numbers of brown plant hoppers remain low, up to 40
			          days / day 40 ;
			low numbers when spraying occurs (days 15 to 38) ;
			rapid increase when spraying stopped / AW ;
			then, crash / decrease ;
			any population figure with unit ;
			          e.g. to maximum of over 1000 per m^2
				
				max 3
					ignore ref. to resistance

	(c)		pesticide absorbed by the plants ; transported through the plant in the phloem ; ingested / AW, by insect when it, eats / sucks ; toxic / poisonous, to insect ;	 max 2	 A 'eats the plant'
	(d)	1 2 3 4 5 6 7 8 9 10	no population explosion / AW ; effective at reducing the numbers / AW ; ref. to comparative figures from the graph ; no pollution / damage to environment ; no killing of harmless species ; no concentration of pesticide in food chain ; no pesticide left in foods / no harm to humans from the spray ; no development of resistance to pesticide ; less cost / economic benefits ; AVP ; e.g. accept part of natural food chain	 max 3	

Question		E		Answers	Marks	Additional Guidance
2	(e)	1		decreased rainfall **;**		
		2		flooding **;**		
		3		erosion / loss of (top)soil **;**		
		4		desertification **;**		
		5		silting of rivers **;**		
		6		loss of (plant) nutrients / soil fertility **;**		
		7		disruption to food chain **;**		
		8		loss of habitat **;**		
		9		extinction / loss of biodiversity **;**		**A** species become, rare / endangered
		10		effect on carbon dioxide in the atmosphere **;**		**A** increase or decrease if justified e.g. leading to global
		11		justification for effect **; A** unproductive forest / productive crop		warming
		12		AVP **;**	max 4	
					[Total : 14]	

Question	scheme		Guidance
3 (a) (i)	*high temperature* denature enzymes ; kill bacteria ; to give optimum temperature (for, enzymes / bacteria) ;		**R** 'kills enzymes' **R** 'denatures bacteria'
		[max 2]	
(ii)	respiration is anaerobic ; lactic acid, produced ; **A** lactate / formula	[2]	IGNORE carbon dioxide *treat MPs independently*
(iii)	**A** named example of a food additive ; colouring ; preservative / stabiliser / emulsifier / antioxidant ; flavouring / (artificial) sweetener ; thickening agent ;	[max 1]	IGNORE international numbers / E-numbers **R** any food nutrient(s) **A** 'conservants'
(b)	*description* 1 sigmoid (growth curve) *or* lag phase + exponential/log + stationary 2 phase ; 2 little/no growth, rapid growth, no growth / 'leveling off' ; *explanation* *lag phase* 3 small number of bacteria ; 4 produce, proteins / enzymes / DNA ; **A** builds up energy/food stores *exponential phase* 5 binary fission / asexual reproduction ; 6 no limiting factors / no competition / plenty of food / plenty of resources ; *stationary phase* 7 death rate = 'birth' rate ; 8 resources / food, used up ; 9 p_ not, favourable / optimum ;	[max 5]	*marking points may be taken from labels and annotations on the graph* **R** 'adapting to the environment' 5 population doubles every time bacteria divide 6 IGNORE ref. *to* temperature 8 **A** factors now limiting / competition for food / oxygen used up / toxins built up

Question	Expected Answers	Marks	Guidance
3 **(c)**	1 conditions not favourable ; 2 cannot compete with *S. thermophilus* **; *ora*** 3 cannot increase until pH, falls / changes **; *ora*** 4 cannot increase until <u>oxygen</u> concentration decreases **; *ora*** 5 grows slower than *S. thermophilus* ; 6 takes longer to, adapt / feed ; 7 fewer *L. bulgaricus* to start with ; 8 *idea that* substance / condition, provided by *S. thermophilus* ; [2]		**R** direct feeding of *L. bulgaricus* on *S thermophilus* **8 A** *S. thermophilus* changed the environment to allow for growth of *L. bulgaricus*
		[Total: 12]	

Question		E	Answers	Marks	Additional Guidance
4	(a)	1	– producer ;		
		2	– <u>secondary</u> / <u>2nd level</u> / <u>2nd order</u> , consumer ;	[2]	
	(b)	1	*idea that* energy is lost, along the food chain / at each trophic level / between trophic levels ;		
		2	*idea that* 90% lost between trophic levels / 10% passed on ;		
		3	respiration / movement / heat loss / metabolism ;		
		4	excretion ;		
		5	food not eaten / food not digested / ref. to egestion / AW ;		
		6	tuna / top carnivores, are in smaller numbers ;		
		7	more energy available in, trophic level 2 / herbivorous fish, than in, level 4 / tuna or dolphins ;		
		8	AVP ;	[max 3]	
	(c)	1	*idea that* if not conserved they would become extinct ;		**A** 'extinguished'
		2	ref. to, maintaining numbers of other species in food web / disruption of food web / maintaining balance in food web ;		
		3	maintaining (bio)diversity ;		
		4	so increase in number of, carnivorous fish / squid / trophic level 3 ;		
		5	reduction in, herbivores / herbivorous fish / zooplankton / tropic level ;		
		6	less food available for, consumers / AW ;		
		7	would be less, tuna / food, for humans ;		
		8	aesthetic reason (for conserving) / AW ;		
		9	economic reason (for conserving) / AW ;		
		10	AVP ;		
		11	AVP ;	[max 4]	
	(d)	1	persists / not broken down / does not decay ;		
		2	eaten by animals ;		
		3	fish / turtles / mammals, get entangled / trapped / suffocate ;		
		4	AVP ;	[max 2]	