

Question		Marks	Additional Guidance
1 (a) (i)	<p>1 concentration of PCBs increases up the food chain/ ora; 2 concentration is much higher in larger organisms/ ora; 3 big(gest) increase between herring and porpoise; 4 (only) herring/ porpoise/ animals at top of food chain, have a range of concentrations; 5 use of figures (arbitrary units) to make a comparison between two, trophic levels/ organisms;</p>	max 3	<p>MP4 must be a qualitative statement, not just statement of figures MP5 – must be a comparison not just figures unqualified, e.g. use of ‘but’, ‘and’, ‘only’, etc. and accept $\times 1.8/2$, $\times 4$, $\times 30$, $\times 384$, $\times 1900$</p>
	(ii) animals at higher trophic levels live longer; eat many of the animals below them in the food chain; PCBs cannot be, excreted/ eliminated/ removed/ broken down; so build up in the body (tissues); <u>bioaccumulation/ biomagnification</u> ;	max 3	
(b) (i)	<p><u>mutation</u>/ change in DNA; any mutagen; gene(s) code for, AHR/ protein; any sensible suggestions about change to protein molecule; fish susceptible to PCB poisoning died; fish with changed protein survived and reproduced; passing on mutant <u>allele</u>; reference to (natural) selection;</p>	max 5	<p>A ref to genetic variation R AHR/ protein, mutates e.g. radiati e.g. different amino acid sequen</p>
	(ii) fish with mutant allele not at an advantage/ no selection for PCB resistance; PCB resistant fish may not compete well with others/ ora ; so less successful at breeding/ ora ; leave fewer offspring/ ora ; idea that mutant allele is diluted as fish interbreed;	max 2	A ‘the altered AHR protein is of less/ no use’

Question		Marks	Additional Guidance
1 (c)	<p>1 persistent / does not breakdown / accumulates;</p> <p>2 fill up / takes up space in, landfill sites / rubbish dumps;</p> <p>3 suffocate / choke, animals;</p> <p>4 kills animals that get trapped in it;</p> <p>5 release, toxins / poisons;</p> <p>6 AVP;</p>	<p>max 3</p>	<p>MP1 A 'can't get rid of them' / takes a long time to breakdown</p> <p>MP3 and MP4 do not allow kill unqualified</p> <p>MP5 maybe in context of leaching out, burning or eating</p> <p>I references to recycling</p> <p>I pollution unqualified</p> <ul style="list-style-type: none"> • (fill with water to become) breeding grounds for mosquitoes • blocks light for, photosynthesis • negative effect on tourism / visual pollutant • blocks drains • blocks flow of water in, rivers / streams • reduces soil, drainage / aeration • interferes with water treatment <p>allows spread of alien species in the oceans</p>
		[Total: 16]	

2	(a)	(i)	L = (primary) producer(s) ; N = secondary consumer(s) ;	[2]	ignore (green) plant ignore carnivore
		(ii)	energy, of / at, each trophic level ; A shows that energy, decreases / is lost (at each trophic level) e.g. 'L has more energy than M'	[1]	R biomass / numbers R 'production of energy' ignore energy passed on – shown by the arrows not the boxes
		(iii)	<p><i>idea that</i></p> <p>1 no, energy left ;</p> <p>2 use figures from Fig. 2.1 to show that all energy to O is already</p> <p>3 little / not enough, energy available from eating, tertiary consumers / O / AW ;</p> <p>4 loss of (90%) energy, at / between, each trophic level / AW ;</p> <p>5 would be very small population of predators of O ;</p> <p>6 (population of) predators of O unlikely to survive ;</p> <p>7 AVP ; e.g. <i>idea that</i> difficult to be a predator of O because O is likely to be 'large and fierce'</p>	[max 3]	<p>A 'needing to eat a lot to get enough energy'?</p> <p>MP4 <i>no need to use the term trophic level if idea is implied</i></p>
		(iv)	<p>1 loss of energy (from, each / all, trophic level(s)) ;</p> <p>2 (by) <u>respiration</u> ;</p> <p>3 (to the) environment / atmosphere / surroundings ;</p> <p>4 as, heat / thermal energy ;</p>	[max 2]	<i>accept once only</i>
	(b)	<p><i>M is the herbivore</i></p> <p>1 more (biomass of / energy in), producers / L ;</p> <p>2 as fewer / no, herbivores / primary consumers / predators (to eat L) / M ;</p> <p>3 fewer / extinction of, carnivores / secondary consumers / N ;</p> <p>4 fewer / extinction of, tertiary consumers / O ;</p> <p>5 as less, food / energy ;</p> <p>6 more competition ;</p>	[max 3]	<p>ignore any changes to decomposers / recycling</p> <p>A the argument that more primary consumers will migrate into the ecosystem</p> <p>ignore predators / organisms unqualified</p>	

	Answer	Marks	Guidance for Examiners
3 (a)	segments ; antennae / 'feelers' ; projections over whole of the body / AW ; <i>idea of heads / tails ;</i> A not parasitic / free living / AW ;	max [3]	A 'sections' / 'divisions' / 'rings' / 'parts' / 'sub-parts' A bristles / chaetae / hairs R feet / legs / AW
(b)	genus / generic (name) ;	[1]	A 'genus part of species name'
(c) (i)	(all the) organisms / community ; in a given area / AW ; and non-living factors / abiotic factors AW ; <i>idea of interacting together ;</i>	max [3]	A place / location / region / habitat R ecosystem i.e. physical factors / nam e.g. feeding (ignore feeding on each other)
(ii)	arrows point from food → feeder ; organisms in correct sequence ; plankton → annelid / named → wading bird(s) → bird of prey = 2 marks	[2]	
(iii)	shows complex feeding relationships / AW ; all organisms in the ecosystem ; A (many) more / part of / wide range of each species has more than one food source / AW ; each species has more than one predator / AW ; AVP ; e.g. shows possible chain reaction to an animal's population change	max [2]	A all possible connections

3 (d)	<p>many, sperm and eggs / gametes, released at the same time ; increases chances of gametes fusing ; (many individuals so more genetic) variation ; may occur at a time when food is available ; for development of, young / offspring ; or when there are currents to disperse young ; smaller proportion of, eggs / zygotes / embryos, eaten by predators ; AVP ;</p>	max [3]	R fewer predators
(e)	<p><i>assume answer is about meiosis unless told otherwise mark differences between meiosis and mitosis to max 3</i></p> <ol style="list-style-type: none"> 1 two divisions ; 2 four, cells / nuclei / gametes, produced ; 3 halves chromosome number ; 4 (diploid to) haploid ; 5 variation (between cells / nuclei / gametes) ; 6 gametes have different <u>alleles</u> ; 7 gives (more) variation in offspring ; 8 so chromosome number remains the same in next generation ; 	max [4]	<p>ignore quoted numbers of chromosomes</p> <p>R genes</p> <p>A number does not double with each generation / full pairs of chromosomes when fertilized / AW A ora for mitosis</p>
[Total:18]			

4	(a)	group of organisms of the <u>same species</u> ; in the same area / at the same time ;	[2]	A 'of a kind' / <u>a</u> species A same habitat / ecosystem / community
	(b) (i)	greater predation by owls / more predators / more owls; lack of food / starvation / more competition for food ; adverse (named) weather condition (s) ; disease / sickness / illness; emigration ; AVP ; habitat destruction	max [3]	R climate change
	(ii)	1 owl population increases, after / AW, vole population increases ; 2 owl population crashes (in year 7) ; 3 immediately after crash in vole population ; 4 vole population crashes / decreases (in year 6) ; 5 when there are most owls ; 6 if owls ate (much) other prey there would not be a close relationship / AW ; 7 ref to numbers of owls from the graph ;	max [2]	if MP1 and MP2 not given accept the idea that 'owl population follows changes in vole population' if answer does not refer to the increase or decrease
			[Total:7]	