Question			Answer	Marks	Guidance
1	(a)		**1** $\frac{\text{herbivore / primary consumer,energy}}{\text{producer energy}}$ x 100 **;** **Plus any 3 of the following:** **2** (a sample of) producers collected **;** **3** (a sample of) herbivores /primary consumers collected; **4** (collected from) the same area **;** **5** **(**measure) biomass / dry mass (of individual or population) **;** **6** energy content calculated of producer **and** herbivore **;** **7** use of calorimeter / described;	**4 max**	**1 CREDIT** $\frac{\text{trophic level 2 energy}}{\text{trophic level 1 energy}}$ x 100 ; **CREDIT** sample figures. e.g. if producer energy 20 000 kJ m^{-2} and herbivore 2000 kJ m^{-2} calculation is 2000 / 20000 x 100 = 10% **CREDIT** $\frac{\text{Energy available after transfer}}{\text{Energy available before transfer}}$ x100 **IGNORE** ref to productivity **CREDIT named examples for 2 and 3** **ACCEPT '**organisms at each trophic level collected' for **1 mark** **5 ACCEPT** wet / fresh,mass **5 IGNORE** mass unqualified / pyramids of biomass **6 ACCEPT** expressed as J/KJ/MJ, per gram **IGNORE** calories per gram **7** e.g. burn sample, in oxygen / in measure temperature increase **ACCEPT** use of published tables for energy values of, fresh /wet, mass

Question			Answer	Marks	Guidance
1	(b)			6	**Mark the first answer in each box.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**

Goal	Letter	
improving soil that is low in nutrients for the growing of wheat	F	;
preventing the spoilage of fruits after picking	E	;
reducing the impact of a fungal disease on yields from cucumber plants	A / B	;
producing strawberry plants that grow quicker and fruit earlier	A / B	;
making sugar syrup from waste starch	D	;
producing large amounts of a fungus for food	C	;

ACCEPT A / B

ACCEPT C

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td>(c)</td><td></td><td>
<table>
<tr><th>Description</th><th>Name</th><th></th></tr>
<tr><td>Sparrows initially fly away from fruit bushes on which shiny CDs are hung, particularly when the CDs move in the wind.</td><td>escape reflex</td><td>;</td></tr>
<tr><td>After a few days the sparrows start visiting the fruit bushes again, and do not fly away even when the CDs move.</td><td>habituation</td><td>;</td></tr>
<tr><td>Carrot flies move towards chemicals released by carrot plants.</td><td>(positive chemo-) taxis</td><td>;</td></tr>
<tr><td>Raccoons learn to remove lids from containers of grain in a barn.</td><td>operant conditioning / trial and error (learning)</td><td>;</td></tr>
<tr><td>A line of young chicks follow their mother into a cornfield.</td><td>imprinting</td><td>;</td></tr>
</table>
</td><td>5</td><td>Mark the first answer in each box. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks

IGNORE innate / instinctive / learnt (as stated in Q)

DO NOT CREDIT negative chemotaxis
ACCEPT taxes

CREDIT insight (learning) / latent (learning)/ intelligent learning / observational learning</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>15</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td>
<table>
<tr><th>biological principle</th><th>letter</th></tr>
<tr><td>artificial selection</td><td>E</td></tr>
<tr><td>predator-prey interaction</td><td>G</td></tr>
<tr><td>apical dominance</td><td>B</td></tr>
<tr><td>nitrogen fixation and nitrification</td><td>D</td></tr>
<tr><td>reproductive cloning</td><td>A / F</td></tr>
<tr><td>positive chemotaxis</td><td>H</td></tr>
<tr><td>decomposition</td><td>C / D</td></tr>
<tr><td>commercial use of plant hormones</td><td>F</td></tr>
</table>
;
</td><td>8</td><td>Award 1 mark per row.

Mark the first answer in each box. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</td></tr>
<tr><td></td><td>(b)</td><td></td><td>respiration / decomposition / decay / ripening ;

<u>interspecific competition</u> ;

(positive) <u>phototropism</u> ;

<u>succession</u> ;</td><td>4</td><td>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks

ACCEPT metabolism / metabolic reactions

DO NOT CREDIT negative phototropism
DO NOT CREDIT trophism (as ambiguous with trophic)</td></tr>
</table>

Question			Answer	Marks	Guidance
	(c)		*animals = primary consumers* **1** keep animals, warm / indoors **;** **2** reduce animal movement **;** **3** feed animals high, protein / energy, food **;** **4** vaccination / (routine) antibiotics, for animals **;** **5** selective breeding / genetic engineering**,** for improved animals **;** **6** slaughter just before, mature / full size **;**	3	**2 ACCEPT** zero grazing idea **3 ACCEPT** growth-enhancing food additives **4 IGNORE** hormones **5 ACCEPT** description of improvement, e.g. disease resistant, faster-growing, higher yielding
			Total	**15**	

Question			Answer	Marks	Guidance
3	(a)		*producer* (leaves / plants) fix carbon / photosynthesise / make food / autotroph(ic) / convert light energy to chemical energy / convert inorganic, C / CO_2, to organic molecules **;** *consumer* (bird) eat / derives energy from / feeds on **,** other organisms **or** heterotroph(ic) **;** *trophic level* stage / position / place / level **,** in a food **,** chain / web **;**	3	**IGNORE** 'first level in a food chain' **DO NOT CREDIT** 'produces energy' **IGNORE** 'consumes' **IGNORE** named levels / organisms e.g. eats producers **ACCEPT** animals, and / or, plants **IGNORE** step, feeding level
	(b)	(	number of quadrats (per area) **;** method of placing quadrats (randomly) **;** time waiting **,** after solution added / for worms to rise **;** volume of solution **;** concentration of solution **;** AVP **;**	2	**CREDIT** any two correct answers **IGNORE** ref to quadrats being the same size (as given in Q) **IGNORE** amount e.g. method of applying solution length of time spent counting time of day / light intensity soil moisture / rainfall / humidity method to ensure no double counting

Question			Answer	Marks	Guidance
3	(b)	(ii)	means different / mean less in soil with plants removed ; (but) error bars overlap ; (could have) mean trend reversed / equal numbers in some pairs of results ; difference, not / less , valid ;	2	**DO NOT CREDIT** if difference in mean stated to be valid **IGNORE** average **ACCEPT** cross (over) e.g. in any pair of results you could find that the number of earthworms in the cleared soil could be higher than in the uncleared soil **ACCEPT** introductory statement ' No it is not'.
3	(b)	(iii)	number / abundance , of earthworms varies , from year to year / from 2004 to 2006 / over the two years / over time ; number / abundance , of earthworms varies , before and after plant clearance / as vegetation changes / during succession ;	2	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ACCEPT** change described e.g. more worms in 2006 than 2004 If neither mark point awarded **ACCEPT** numbers of earthworms constantly , changing / fluctuating for **1 mark**
			Total	**9**	

Question			Answer	Mark	Guid
4	(a)	(	succession **;**	1	**FA** **IGNORE** primary / secondary
		(ii)	mineral content **;** acidity / pH **;** water depth**;**	2	**FA**
	(b)		*similarity* chlorophyll breaks down / leaves change colour **;** *differences* (bog) minerals stay in plant / (forest) minerals in soil **; ora** decomposers / fungi / bacteria **,** not**,** present **/** active in bog **;** **ora for forest**	1 2	**FA for similarity** **Mark first two answers for differences** **ACCEPT** named mineral ions in words or correct symbols **ACCEPT** decomposers / fungi / bacteria, break down leaves in forest
	(c)		decomposers / named decomposers, not, present / active **;** waterlogging reduces, air / oxygen **;** acidity / low pH **,** stops (decay) enzymes working **;**	2 max	**ACCEPT** (soil), bacteria / fungi / microbes can't survive or few can survive **CREDIT** waterlogging produces anaerobic conditions
	(d)		bog / habitat / ecosystem, takes a long time to form / hard to replace **;** loss of, biodiversity / rare species **;**	2	**ACCEPT** peat bogs maintain biodiversity
			Total	**10**	