<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td>(i)</td><td>(July whale: food energy ratio =) 1:4 is worth (2)
but
if answer on line is incorrect allow 1 mark for 0.05:0.2 or 1:4 given in working</td><td>2</td><td>allow 0.05:0.2 (1)
allow 0.25:1 (2)
not 4:1
not 1:0.25</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>any three from:
(overall) more whales if more food energy (1)

whales migrate to where there is more food energy (1)

(but) in October, there is less food energy than August but more whales (1)

ratios not constant / 1:1 in September and Oct but 1:2 in Aug (1)</td><td>3</td><td>
allow idea that food limits population size

allow idea of whales following food

allow but 1:4 in July</td></tr>
<tr><td></td><td>(b)</td><td></td><td><table>
<tr><td>2</td><td></td><td>competition for limited resources</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>4</td><td></td><td>inheritance of ‘successful’ adaptations</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>1</td><td></td><td>presence of natural variation</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>3</td><td></td><td>survival of the fittest</td></tr>
</table></td><td>2</td><td>all 3 correct (2)
1 or 2 correct (1)</td></tr>
<tr><td></td><td>(c)</td><td></td><td>any two from:
layer of blubber/fat (for insulation) (1)
small SA / V ratio (1)
migratory habit to move to warmer areas (1)</td><td>2</td><td>

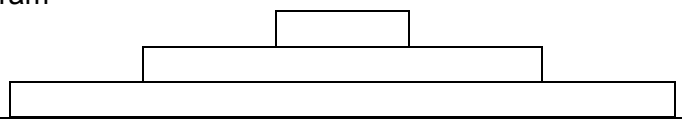
allow large volume to surface area
allow move to areas with longest day length – poles in summer as more photosynthesis for their food source/move away from poles as day length shortens (2)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>9</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
2	(a		no maggots when covered because **flies** could not get in / lay eggs (1) this shows the flies are needed to produce maggots **or** maggots develop from eggs not meat (1)	2	**allow** reverse argument: only get maggots when uncovered as **flies** can get in / lay eggs **ignore** just 'maggots don't come from meat'
	(b)		no bacteria in B because they were **killed** / bacteria **killed** in both flasks in stage 2 (1) bacteria cannot get into B / can get into A (1) BUT shape of the neck in B stops the bacteria getting in / the shape of the neck allows bacteria into flask A (2) bacteria multiply in A / in B gravy stays sterile (1)	3	 **ignore** B has no bacteria / A has bacteria **ignore** bacteria grow/develop in A (in question) **ignore** bacteria do not grow/develop in B (in question) **allow** ideas about how they reproduce as extra marking points e.g. bacteria in A feed and multiply by asexual reproduction or binary fission (1) **ignore** references to oxygen / lack of oxygen

Question			Answer	Marks	Guidance
	(c)		**any two from:** (yes) milk contains harmful bacteria/microbes (1) pasteurisation will kill these bacteria/microbes (1) **or** (no) idea that people should have a choice (1) the raw milk may taste better / pasteurisation can alter the taste (1) pasteurisation may remove some of the nutrients from the milk (1)	2	**allow** pathogens **ignore** germs **ignore** references to shelf life **allow** (no) idea that although has bacteria in they are destroyed in the stomach/acid (1) **ignore** (no) idea that bacteria are not harmful but **allow** (no) idea that bacteria are not harmful with an explanation, e.g. not harmful if drunk quickly (before bacteria can multiply) explanation must match their yes or no answer unless they are clearly giving both sides of the argument eg (no) although pasteurisation will kill harmful bacteria in the milk people should be given the choice (2)
	(d)		**any two from:** **enzymes** do not denature at high temperatures (1) can use the hydrogen sulfide to make food (1) do not need light to make food (1) tolerant to hydrogen sulfide / hydrogen sulfide does not poison them (1)	2	**allow enzymes** can work at high temperature **ignore** bacteria can withstand heat **ignore** feed on hydrogen sulfide
			Total	**9**	

Question			Answer	Marks	Guidance
3	(a)		**dry** mass at each trophic level / AW (1)	1	**allow** number x **dry** mass of typical individual **ignore** dry mass of (individual) organisms **ignore** dry mass of all organisms **allow** weight as alternative to mass
	(b)	(i)	respiration (1)	1	**ignore** movement / egestion / excretion **ignore** conduction / convection / radiation
		(ii)	0.89(kJ) (1)	1	mark answer line first – if answer line blank then look for clear answer in any working
		(iii)	$\frac{0.25}{3.14}$ x 100 (1) **but** 7.96(%) (2)	2	**allow** 8 or 8.0 incorrect rounding, eg 7.9 = 1
		(iv)	energy is 'lost' at each stage / transfer at each stage is not (very) efficient (1) not enough energy for another trophic level / a long food chain requires a large energy input to sustain the top predator (1)	2	**allow** large amount of energy 'lost' **ignore** just 'energy is lost' (in previous question) **ignore** ALL energy lost **ignore** NO energy for another trophic level **ignore** sparrowhawks too fierce so nothing will attack / eat them
			Total	**7**	

Question			Answer	Marks	Guidance
4	(a)		less oxygen available (1) for the respiration (of decomposers) (1)	2	**ignore** air/temperature/acidity/light
	(b)	(i)	**any 3 from:** decomposing bacteria / fungi break down dead material (1) releasing ammonia/ammonium compounds (1) ammonia/ammonium compounds converted to nitrates (1) by nitrifying bacteria (1)	3	
		(ii)	using coconuts will not put the rare (bog) plants at risk (1) coconuts are being produced at a faster rate than peat so will not run out (1)	2	**allow** higher level answers referring to the net release of carbon dioxide from decomposing peat **ignore** references to avoiding waste /less land-fill
			Total	**7**	

Question			Answer	Marks	Guidance
5	(a)	(i)	three box pyramid correctly drawn or described (1)	1	mark the written answer line first, if correct then ignore diagram 
		(ii)	**any two from:** (for pyramid of biomass) need dry mass (1) which involved killing organisms (1) difficult to collect all parts of the plant (1)	2	
	(b)		Ixodes (1)	1	
	(c)	(i)	(idea of no link) qualitative description e.g. peaks/troughs do not coincide (1) quantitative description e.g. Lyme disease peaks in 2000 highest temperature is in 1995 (1) **OR** (idea of there is a link) qualitative description e.g. overall they are both rising (1) quantitative description e.g. both have lowest values in 1986 (1) **OR** (idea of there is a weak link) two descriptions (qualitative or quantitative) that show contradicting evidence e.g. both graphs go up (1) but they don't peak at the same time (1)	2	

Question			Answer	Marks	Guidance
		(ii)	if it is warmer then more people will go for walks in the country / wear less clothes / ticks breed more (1)	1	**allow** ticks feed more in warm weather **allow** more ticks in warm weather **ignore** ticks more active in warm weather (in question)
			Total	**7**	

Question			Answer	Marks	Guidance
6	(a)	(i)	ticks are smaller than buffalos OR idea that many ticks (feed) on small number of buffalos (1)	1	answer must refer to this example
		(ii)	lives on / off / in a host / **living** organism (1) causing it harm (1)	2	**ignore** feeding from it / kills it
	(b)		(no / little benefit having or not having oxpeckers) as average (change in) number is the same for both groups (1) reference to limitations of data: (difficult to reach a conclusion as) only three buffalos / variability of data (1)	2	**allow (**no / little benefit because overall) there is little / no difference in the (change in) numbers **(**of ticks) **allow** (no / little benefit because overall) both groups of buffalo have same (change in) number (of ticks)
	(c)	(	52.9 (1)	1	**allow** 52.88 **allow** 53 but **not** 53.0
		(ii)	buffalo with oxpeckers have more wounds (in total / that do heal / that do not heal) (than buffalo without oxpeckers) / ora (1) buffalo with oxpeckers have lower percentage of wounds that heal (than buffalo without oxpeckers) / ora (1) birds might be causing the wounds / keeping them open / feeding on the blood (1)	3	**allow** ecf from (i) **allow** reverse arguments for with / without oxpeckers and wounds that heal / do not heal (1) **allow** proportion as alternative to percentage additional marking points: **allow** more wounds heal than do not heal (regardless of whether have oxpeckers or not) (1) because wounds (naturally) heal (1) (this mark is dependent on the previous marking point)
	(d)		because they do not feed on the same thing / only one feeds on ticks / only one feeds on blood / because they do not live in the same area (1)	1	**answer must be specific to this example, e.g. ignore** have different roles **allow** only one is in a mutualistic relationship
			Total	**10**	