Decay processes

Carbon cycle

B1.5 Energy in biomass

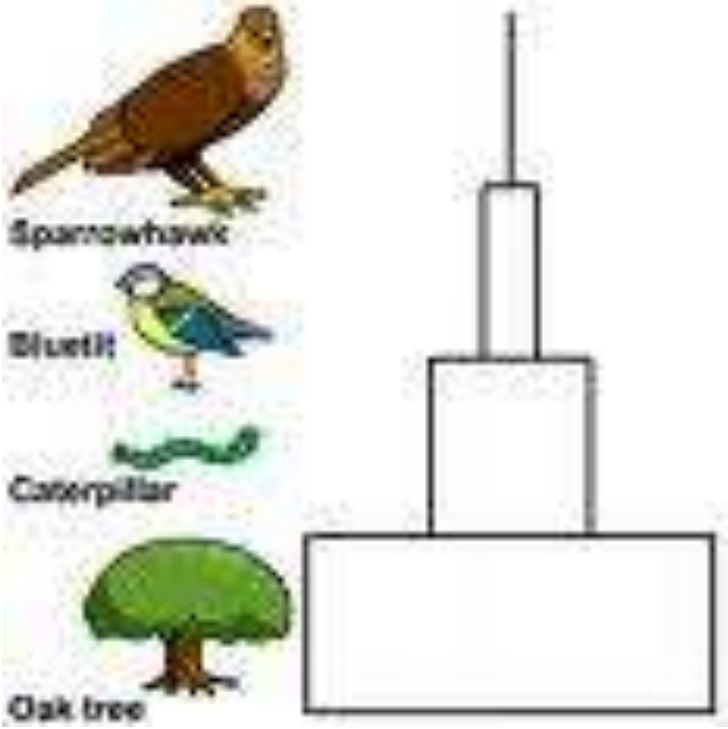
Recycling organic waste

Pyramids of biomass

Energy transfers

Pyramids of biomass

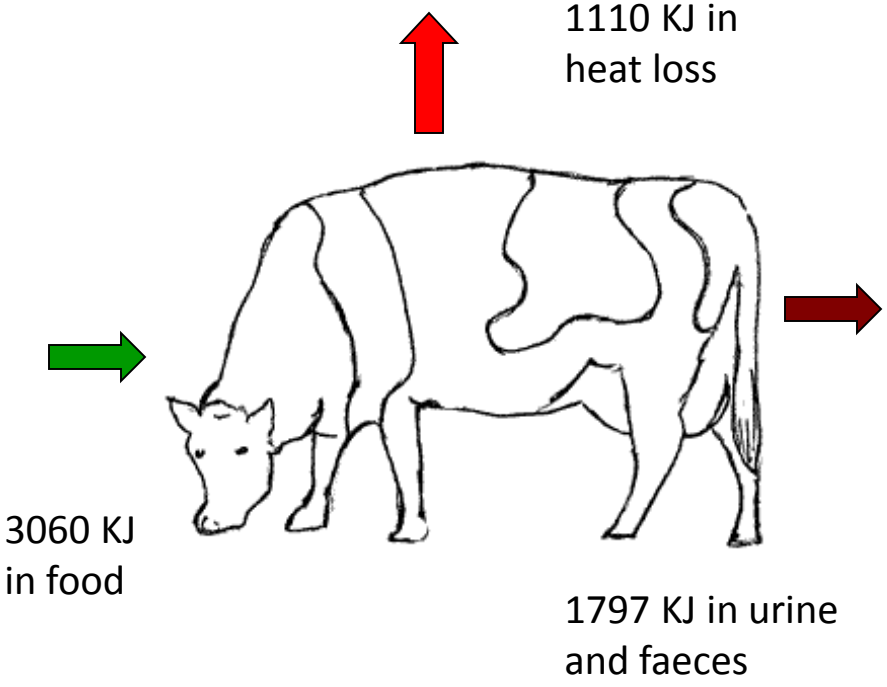
- Biomass is the amount of living thing available to the next level in a food chain – *the mass of material in living organisms*
- It is the total mass without the mass of water *(dry mass in grams)*
- Pyramids of biomass show how much energy is available at levels in a food chain



Energy transfers

Much of the energy lost in:

- ***Movement*** (muscles contracting)
- ***Heat***
- ***Keeping a constant body temperature*** (energy needed to keep warm or cool down)
- ***Waste*** (herbivores can't digest all they eat, excess protein passed out as urea)



Decay processes

Detritus feeders (e.g. Maggots, worms) start the process by eating dead animals and producing waste material

↓

Decomposers (microorganisms) digest everything, using some of the nutrients to grow and reproduce

↓

They produce waste products – CO_2, water and nutrients

↓

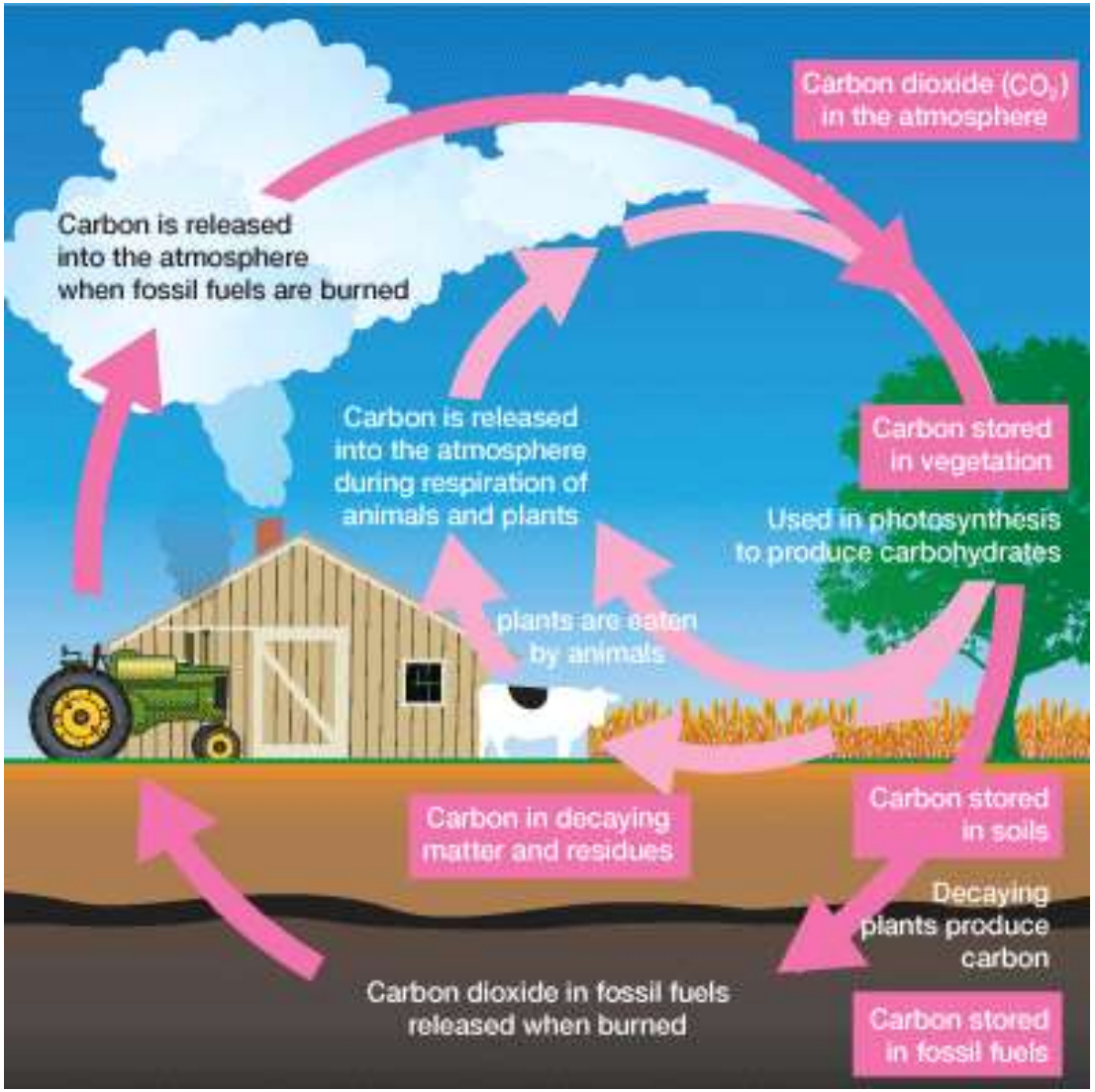
This recycling means the soil contains mineral ions plants need to grow and cleans up dead organisms

Conditions for decay:

- Warm
  - Chemical reactions in microorganisms work faster when warm
  - Reactions slow down and stop if too cold, enzymes denatured if too hot
- Moist
  - Easier to dissolve food, prevents drying out
- Plenty of oxygen
  - Decomposers respire, need oxygen to release energy

Uses: *sewage treatment works, compost*

Carbon cycle



The amount of carbon is fixed

- ***Photosynthesis***: green plants and algae remove CO2 from the atmosphere – passed on when plants are eaten

Carbon dioxide + water → glucose + oxygen

- ***Respiration***: living organisms use oxygen to break down glucose CO2 is a waste product. Decomposers respire too

Glucose + oxygen → carbon dioxide + water

- ***Combustion***: fossil fuels contain carbon , when we burn then CO2 is produced

Fuel + oxygen → carbon dioxide + water

Recycling organic waste

- ***Organic waste*** – (e.g. Vegetable peelings) doesn't rot easily in landfill, it forms a liquid that can pollute waterways and methane gas which contributes to global warming

Making compost:

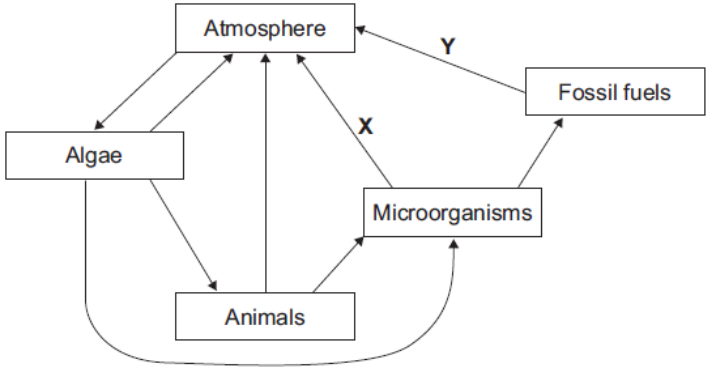
To speed up the process:

- Mixing regularly helps oxygen get in
- Warmer conditions (up to about 70C)
- Moist conditions

Methods: compost heap, black bag, compost bin, council composting

Exam questions

2 The diagram shows part of a carbon cycle in a habitat.



2 (a) Name the processes shown by arrows **X** and **Y**.

X .....

Y .....

(2 marks)

2 (b) Describe the part played by algae in this carbon cycle.

.....

.....

.....

.....

.....

.....

(3 marks)

2 (c) In tropical rainforests process **X** is much faster than in most other habitats.

Suggest why.

.....

.....

.....

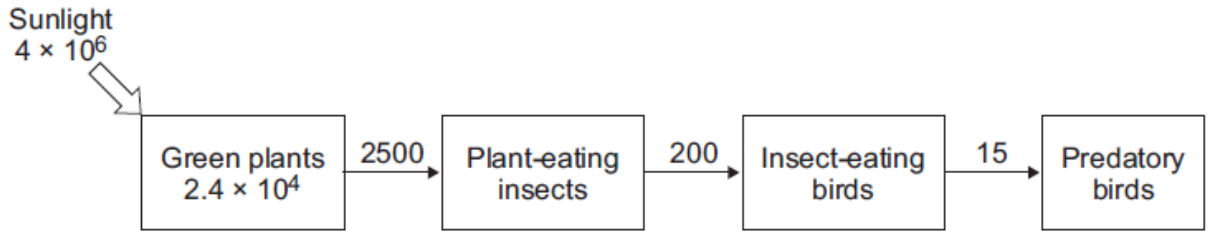
.....

(2 marks)

question	answers	extra information	mark
2 (a)	X respiration	correct order only allow decay / decomposition / rotting ignore breakdown / disintegrate	1
	Y combustion / burning		1
2 (b)	any **three** from:		3
	• photosynthesise / absorb carbon dioxide	accept are producers **or** produce / make biomass / glucose / other named do **not** accept photosynthesis releases CO_2	
	• release carbon dioxide / respire		
	• eaten by animals		
	• fed on / decayed by microorganisms	ignore eaten by microorganisms	
2 (c)	any **two** from: (in tropical rainforest conditions are)		2
	• warm(er) / hot		
	• damp / moist / wet / humid	ignore rain	
	• a lot of microorganisms		
	• a lot of material to decay		
		allow warm(er) so enzymes work faster for **2** marks	
Total			7

8 The diagram shows the annual flow of energy through a habitat.

The figures are in $kJ\,m^{-2}$.



8 (a) (i) Calculate the percentage of the energy in sunlight that was transferred into energy in the green plants.

Show clearly how you work out your answer.

.....

.....

.....

.....

Answer = ... %

(2 marks)

8 (a) (ii) Suggest reasons why the percentage energy transfer you calculated in part **(a)(i)** was so low.

.....

.....

.....

.....

(2 marks)

8 (b) Compare the amount of energy transferred to the insect-eating birds with the amount transferred to the predatory birds.

Suggest explanations for the difference in the amount of energy transferred to the two types of bird.

.....

.....

.....

.....

.....

.....

.....

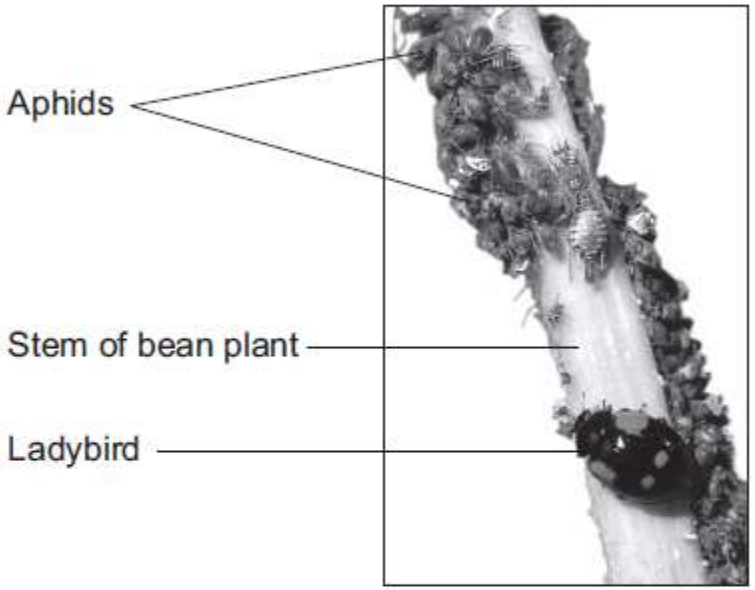
.....

(3 marks)

8 (a)(i)	0.6 or 6×10^{-1}	for correct answer if no / incorrect answer $\frac{2.4 \times 10^{4}}{4 \times 10^{6}} \times 100$ or 0.006 or 6×10^{-3} gains **1** mark	2
8 (a)(ii)	any **two** from: • reflected • not absorbed or misses chloroplasts / chlorophyll • wrong wavelength • photosynthesis inefficient • allow some lost through respiration / as heat (from respiration)	 ignore some of light is green allow transmitted or passes through leaves allow hits other plant parts accept other limiting factors / named	2
8 (b)	energy lost via faeces / not digested / waste / excreted (of insect-eating birds) energy loss via respiration / movement / muscle contraction / heat (by insect-eating bird) some of (insect eating) bird not eaten <u>but</u> all / most / more of insect is eaten	 accept examples of muscle contraction do **not** accept energy used for respiration 	1 1 1

3 Students investigated a food chain in a garden.

The students found 650 aphids feeding on one bean plant.
Five ladybirds were feeding on the aphids.



3 (a) (i) Draw a pyramid of biomass for this food chain.
Label the pyramid.

[2 marks]

3 (a) (ii) The biomass in the five ladybirds is less than the biomass in the bean plant.

Give **two** reasons why.

.....

.....

.....

.....

.....

.....

(2 marks)

3 (b) The carbon in dead bean plants is returned to the atmosphere via the carbon cycle.

Describe this part of the carbon cycle.

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

3(a)(i)	triangular pyramid with 3 layers	may be as blocks or as triangle ignore food chains and arrows	1
	layers appropriately labelled: bean / plant aphid, ladybird	labelled in food chain order must **not** contradict correct pyramid allow correctly labelled inverted pyramid for **2** marks	1
3(a)(ii)	any **two** from: (for aphid / ladybird) • not all digested / faeces • loss in urine • loss of CO_2 • not all eaten	ignore energy ignore loss of CO_2 from bean plant if none of first 3 points given then allow waste (materials) / excretion for **1** mark	2
3(b)	microorganisms / microbes / bacteria / fungi / decomposers / detritivores / named	do **not** accept germs allow mould ignore aphids	1
	decay / breakdown / digest / decompose / rot (bean plant)	ignore eat	1
	respiration (of microorganisms etc / aphids)	allow burning / combustion	1
	carbon dioxide released (from respiration of microorganisms etc / aphids)	allow carbon dioxide released / produced (from burning / combustion) ignore other parts of the carbon cycle ignore formation of fossil fuels	1

1 (c) It is important that carbon is cycled through living things.

After he has picked the peas, the gardener puts the dead pea plants onto a compost heap.

Over the next few months, the carbon in the carbon compounds from the pea plants is returned to the air.

Describe how.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

1(c)	microorganisms / bacteria / fungi / decomposers / detritus feeders / named		1
	decompose / rot / break down / decay / digest	ignore feed / eat	1
	(these organisms) respire	do **not** allow respiration by pea (plants)	1
	(decay / respiration / microorganisms etc) releases carbon dioxide	do **not** allow combustion / fossilisation	1

8 The photographs show four different species of bird.

Great tit

Blue tit

Coal tit

Long-tailed tit

The table gives information about the four species of bird in winter.

Bird species	Mean body mass in grams	Mean energy needed in kJ per day	Mean percentage of day spent feeding
Great tit	21	84.2	75
Blue tit	12	62.4	81
Coal tit	9	49.5	88
Long-tailed tit	7	42.0	92

8 (a) (i) Calculate the energy needed per day per gram of body mass for the blue tit.

.....

.....

.....

Answer = ... kJ per day per gram of body mass

(2 marks)

8 (a) (ii) Describe the trend for energy needed per day per gram of body mass for the four species of bird.

.....

.....

.....

(1 mark)

8 (a) (iii) Suggest an explanation for the trend you have described in part **(a)(ii)**.

.....

.....

.....

.....

(2 marks)

8 (b) Describe and explain the trend shown by the data for the time spent feeding in winter for the birds.

.....

.....

.....

.....

(2 marks)

8(a)(i)	5.2	award **2** marks for correct answer, irrespective of working or lack of it award **1** mark for 62.4÷12 only with incorrect or no answer	2
8(a)(ii)	the smaller the (mass of the) bird the more energy is needed (per gram of body mass)	allow converse ignore figures	1
8(a)(iii)	smaller bird has larger surface area : volume / mass ratio so heat / energy lost more quickly	allow converse allow lose more heat / energy if (a)(ii) describes a trend of more energy with increasing body mass allow **one** mark for idea of more energy needed for flight	1 1
8(b)	 larger birds spend less time feeding since they need less food per gram of body mass (to satisfy energy needs)	accept converse allow the less energy they need per day the longer they spend feeding	 1 1