



Exampro GCSE Biology

B1 Chapter 5 Biomass
Higher tier

Name:

Class:

Author:

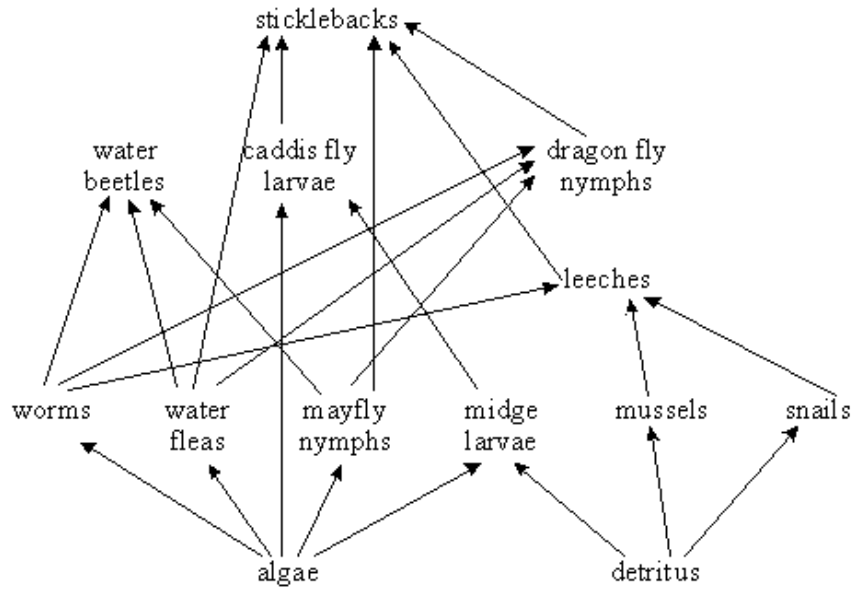
Date:

Time: 102

Marks: 102

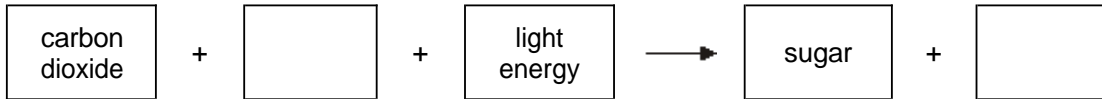
Comments:

Q1. The diagram below shows a food web for some of the organisms which live in a pond.



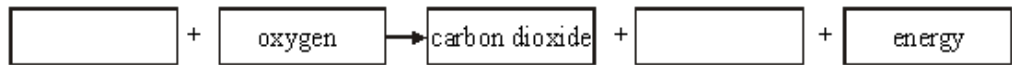
You may need to use information from the food web to help you to answer the following questions.

(a) The algae photosynthesise. Complete the equation for photosynthesis.



(2)

(a) Complete the equation for plant respiration.



(2)

(b) (i) Calculate the mass of carbon removed from the atmosphere each year. (*Show your working.*)

Answer billion tonnes

(1)

(ii) Calculate the percentage of this total which is removed by the photosynthesis of land plants. (*Show your working.*)

Answer %

(2)

(iii) Calculate the net gain of carbon by the atmosphere in one year. (*Show your working.*)

Answer billion tonnes

(2)

(Total 7 marks)

Q3. A gardener pulled up weeds and used them to start a compost heap. The compost heap soon became colonised by large numbers of earthworms and slugs. The gardener then noticed a hedgehog rooting through the compost heap, eating the earthworms and slugs. Every so often the hedgehog stopped to scratch itself. This was because it had large numbers of fleas which fed by sucking the hedgehog's blood.

(a) Use **only** information from the passage to answer the following.

Construct and label a pyramid of **biomass** for your food chain.

(2)

- (b) Gardeners put plant material onto compost heaps so that it will decay. They then put the decayed compost onto soil where they are growing their plants.

Give **three** conditions which are needed for plant material to decay rapidly.

1

2

3

(3)
(Total 5 marks)

Q4. The photographs show four different species of bird.

Great tit



© JensGade/iStock

Blue tit



© Marcobarone/iStock

Coal tit



© MikeLane45/iStock

Long-tailed tit



© Andrew Howe/iStock

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

(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)

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

.....

(1)

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

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.....

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(2)

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

.....

.....

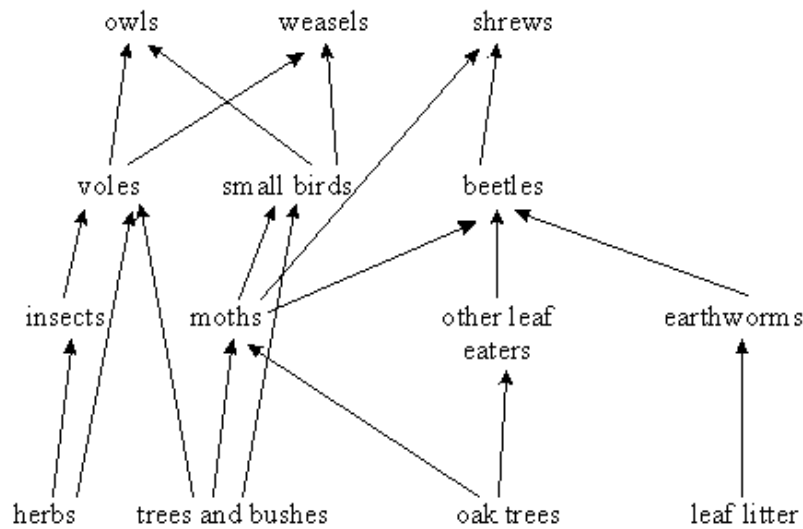
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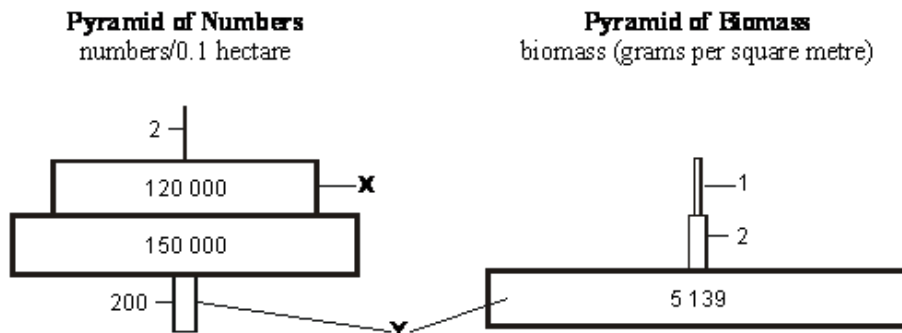
(2)

(Total 7 marks)

Q5. The diagram below shows a food web for a wood.



(a) The diagrams below show a pyramid of the numbers and a pyramid of the biomass for 0.1 hectare of this wood.



(i) Name **one** organism from the level labelled X.

.....

(1)

(ii) Explain, as fully as you can, why the level labelled Y is such a different width in the two pyramids.

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(3)

(b) Explain, as fully as you can, what eventually happens to energy from the sun which is captured by the plants in the wood.

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(10)

(Total 14 marks)

Q6. An oak wood contained the following:

200 oak trees

150 000 primary consumers

120 000 secondary consumers

(a) Draw and label a pyramid of biomass for **this** wood. (Your pyramid does **not** have to be drawn to scale.)

(2)

(b) A scientist estimated the total amount of energy flow through each level of the pyramid per year.

The results were:

Energy absorbed by oak trees 4 600 000 kJ per m² per year

Energy in sugar produced by trees 44 000 kJ per m² per year

Energy transferred to primary consumers 2 920 kJ per m² per year

Energy transferred to secondary consumers 700 kJ per m² per year

(i) Calculate the percentage of the energy absorbed by the trees that is transferred to sugar by photosynthesis. Show your working.

Answer %

(2)

(ii) Suggest **two** reasons why a large proportion of the energy is not transferred to sugar.

1

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2

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(2)

(iii) Give **three** reasons why some of the energy in the primary consumers is not passed on to the secondary consumers.

1

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2

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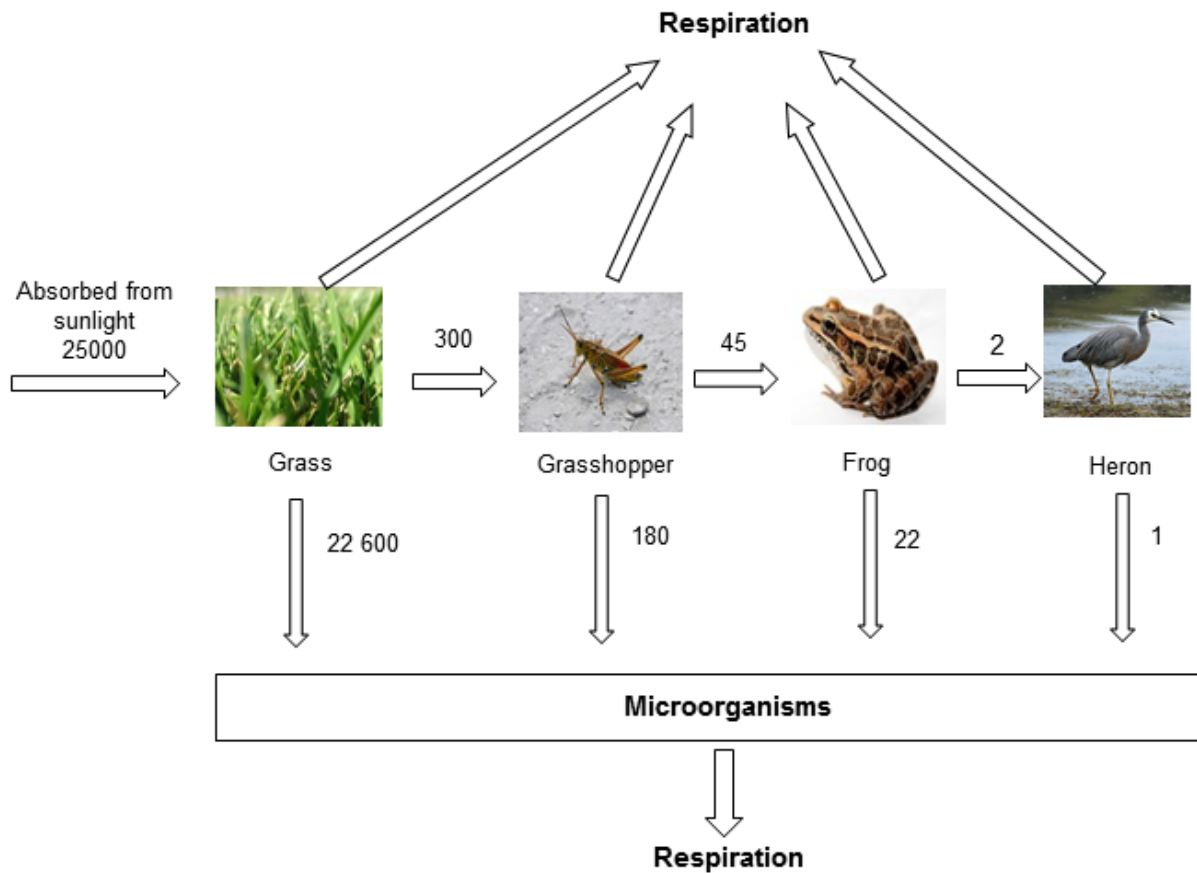
3

.....

(3)
(Total 9 marks)

Q7. The diagram shows the annual energy flow through 1 m² of a habitat.

The unit, in each case, is kJ per m² per year.



(a) Calculate the percentage of the energy absorbed by the grass from sunlight that is transferred to the frog.

Show clearly how you work out your answer.

.....

Answer %

(2)

(b) All of the energy the grass absorbs from the sun is eventually lost to the surroundings.

In what form is this energy lost?

.....

(1)

(c) Food chains are usually **not** more than five organisms long.

Explain why.

To gain full marks you must use data from the diagram.

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(2)

(d) In this habitat microorganisms help to recycle materials.

Explain how.

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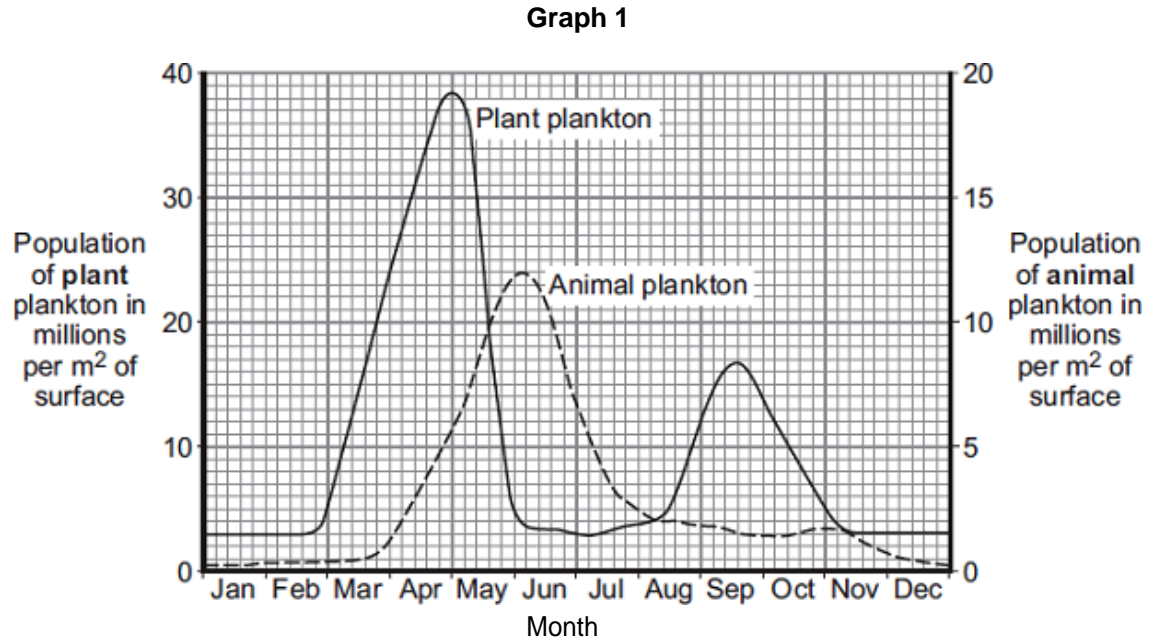
(3)

(Total 8 marks)

Grass by Catarina Carvalho from Lisboa, Portugal (Flickr) [CC-BY-2.0], via Wikimedia Commons. Grasshopper by Daniel Schwen [GFDL, CC-BY-SA-3.0], via Wikimedia Commons. Frog by Brian Gratwicke (Pickere! Frog) [CC-BY-2.0], via Wikimedia Commons. Heron by Glen Fergus (Own work, Otago Peninsula, New Zealand) [CC-BY-SA-2.5], via Wikimedia Commons.

- Q8.** Plankton live in the sea.
Animal plankton eat plant plankton.

Graph 1 shows how the populations of the plankton change through the year in the seas around the UK.

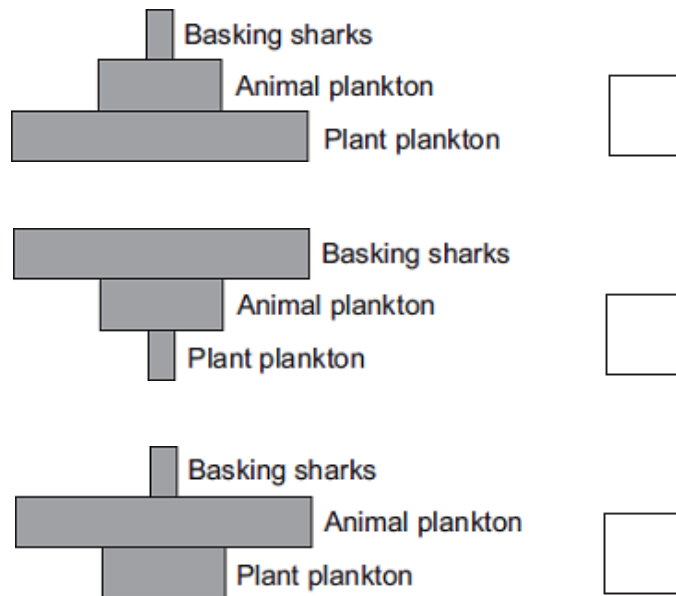


- (a) Basking sharks eat animal plankton. Basking sharks grow up to 8 metres long.

Look at the diagram and **Graph 1**.

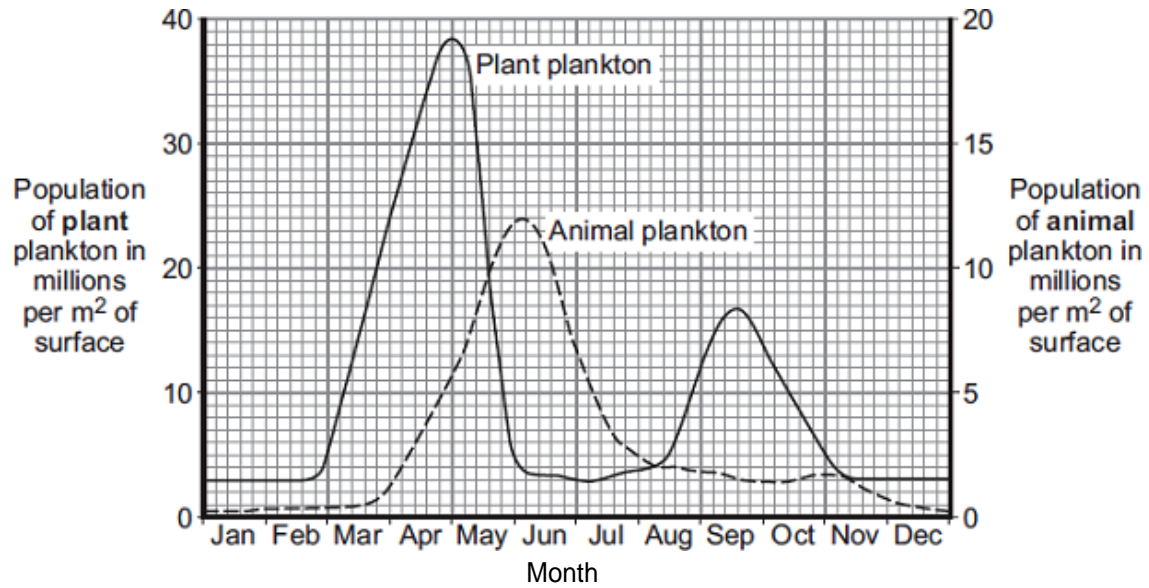
Which is the correct shape for the pyramid of biomass to show the relationship between plant plankton, animal plankton and basking sharks, in June?

Tick (✓) **one** box.

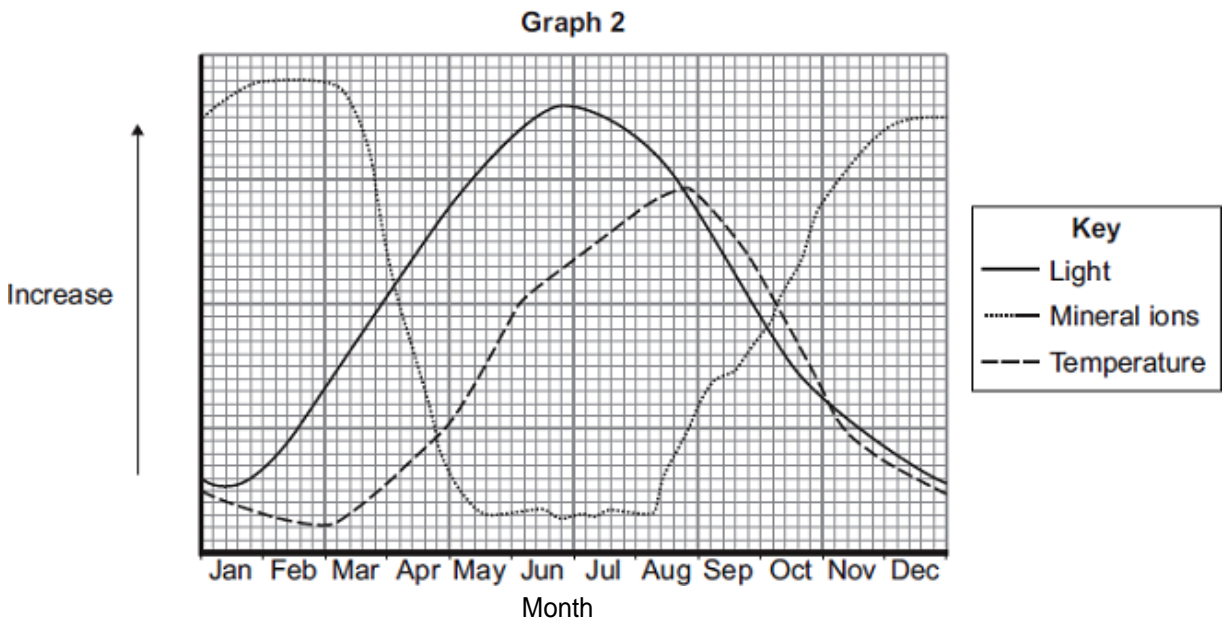


(1)

Graph 1 is repeated here to help you answer the following questions.



Graph 2 shows changes in some of the conditions in the upper layers of the sea around the UK.



(b) The population of plant plankton increases between February and April.

Suggest **one** reason for the increase.

Explain your answer.

.....

.....

.....

.....

(2)

(c) The population of animal plankton changes between April and July.

Suggest explanations for the changes.

.....

.....

.....

.....

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(2)

(d) The concentration of mineral ions changes between February and December.

Suggest explanations for the changes.

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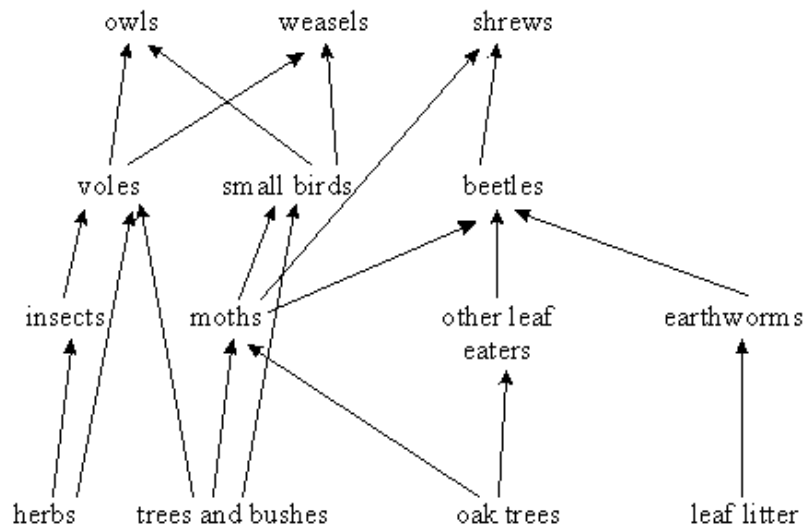
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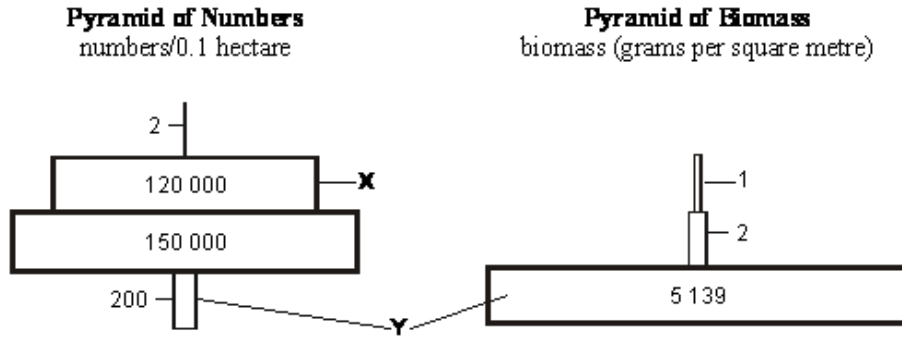
(3)

(Total 8 marks)

Q9. The diagram below shows a food web for a wood.



- (a) The diagrams below show a pyramid of the numbers and a pyramid of the biomass for 0.1 hectare of this wood.



- (i) Name **one** organism from the level labelled X.

.....

(1)

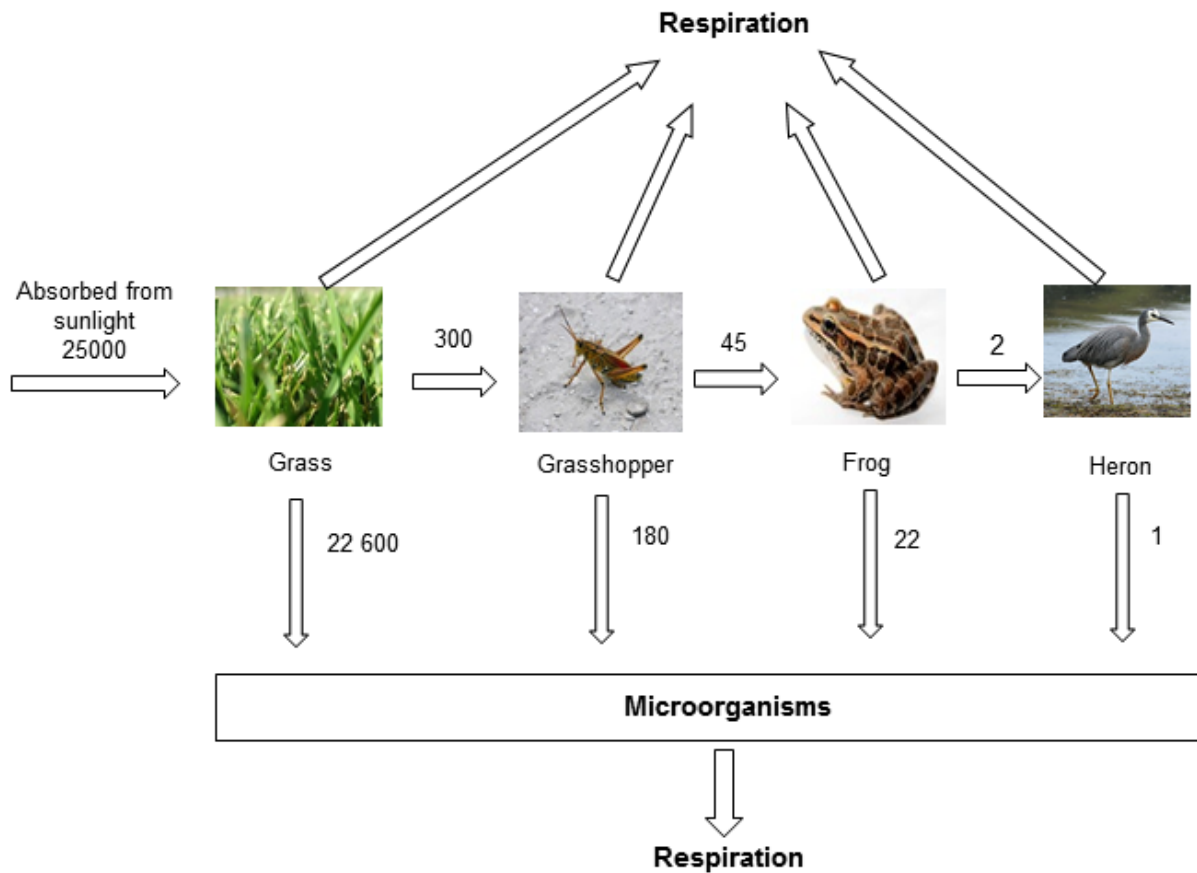
- (ii) Explain, as fully as you can, why the level labelled Y is such a different width in the two pyramids.

.....

(3)

Q10. The diagram shows the annual energy flow through 1 m² of a habitat.

The unit, in each case, is kJ per m² per year.



(a) Calculate the percentage of the energy absorbed by the grass from sunlight that is transferred to the frog.

Show clearly how you work out your answer.

.....

Answer %

(2)

(b) All of the energy the grass absorbs from the sun is eventually lost to the surroundings.

In what form is this energy lost?

.....

(1)

(c) Food chains are usually **not** more than five organisms long.

Explain why.

To gain full marks you must use data from the diagram.

.....

.....
.....
.....

(2)

(d) In this habitat microorganisms help to recycle materials.

Explain how.

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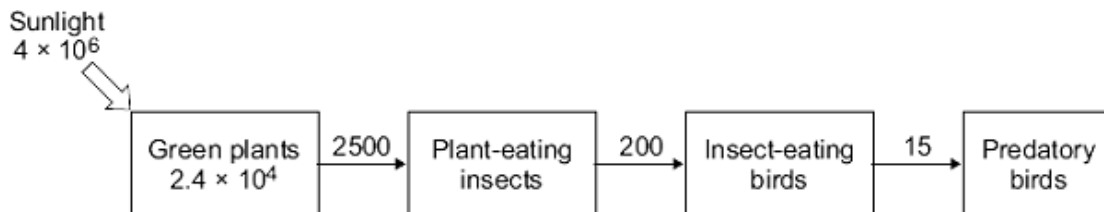
(3)

(Total 8 marks)

Grass by Catarina Carvalho from Lisboa, Portugal (Flickr) [CC-BY-2.0], via Wikimedia Commons. Grasshopper by Daniel Schwen [GFDL, CC-BY-SA-3.0], via Wikimedia Commons. Frog by Brian Gratwicke (Pickere! Frog) [CC-BY-2.0], via Wikimedia Commons. Heron by Glen Fergus (Own work, Otago Peninsula, New Zealand) [CC-BY-SA-2.5], via Wikimedia Commons.

Q11. The diagram shows the annual flow of energy through a habitat.

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



(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.

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.....
.....
.....

Answer =

(2)

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

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.....

(2)

(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.

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(3)

(Total 7 marks)

##

The diagram shows the flow of energy through a forest. The figures are in kilojoules of energy per square metre per year.



(a) What percentage of the energy in the trees is passed on as food for the carnivores? Show clearly how you work out your final answer.

.....
.....

..... per cent

(2)

(b) Give **three** reasons why so little of the energy in the trees is passed on to the carnivores.

1

.....

2

.....

3

.....

(3)
(Total 5 marks)

M1.	(a) water <i>gains 1 mark</i>			
	oxygen <i>gains 1 mark</i>			
			2	
	(b) e.g.: some materials/energy lost in animals' waste materials respiration releases energy some materials/energy used in maintenance/repair some energy used for movement much lost as heat to surroundings some organisms die (rather than eaten) reference to detritivores reference to microbes <i>each for 1 mark</i>			
			8	[10]
M2.	(a) glucose/sugar water <i>for 1 mark each</i>			
			2	
	(b) (i) 204 <i>for 1 mark</i>			
			1	
	(ii) 49 gains 2 marks <i>(incorrect answer, but correct method gains 1)</i>			
			2	
	(iii) 3 gains 2 marks <i>(incorrect answer, but correct method gains 1)</i>			
			2	[7]
M3.	(a) pyramid correct shape labelled			
			2	
	(b) warm moist oxygen			
			3	[5]

- M4.** (a) (i) 5.2
award 2 marks for correct answer, irrespective of working or lack of it
award 1 mark for $62.4 \div 12$ only with incorrect or no answer 2
- (ii) the smaller the (mass of the) bird the more energy is needed (per gram of body mass)
allow converse
ignore figures 1
- (iii) smaller bird has larger surface area : volume / mass ratio
allow converse 1
- so heat / energy lost more quickly
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
- (b) larger birds spend less time feeding
accept converse
allow the less energy they need per day the longer they spend feeding 1
- since they need less food per gram of body mass (to satisfy energy needs) 1
- [7]
- M5.** (a) (i) vole/small bird/beetle
gains 1 mark 1
- (ii) oak trees are large organisms;
 therefore their biomass is large; but their numbers are small
each for 1 mark 3

- (b) 8 of:
 energy stored in chemicals in cells/tissues/growth;
 passed up food chain;
 less energy stored at each stage in food chain/pyramid level;
 because only part of energy taken in used for growth;
 some lost in waste;
 some used for repair;
 used to main body systems;
 some lost in respiration;
 some converted into other forms of energy;
 e.g. movement;
 much lost as heat;
 by time detritus feeders have used remains;
 all returned to environment

each for 1 mark

8

c1 → animals

c2 → decomposers

2 marks for sequencing and organising the information

2

[14]

- M6.** (a) levels in correct order
 sizes correct

for 1 mark each

2

- (b) (i) working
 0.96% (correct answer = 2)
for 1 mark each

2

- (ii) 2 of e.g.
 heat up leaves
 absorbed by non-photosynthetic parts
 transmitted through leaves

any 2 for 1 mark each

2

- (iii) 3 of e.g.
 respiration of primary consumers
 movement of p.c.
 waste from p.c.
 repair/growth of p.c.; heat losses to surroundings

any 3 for 1 mark each

3

[9]

M7. (a) 0.18

*award both marks for correct answer irrespective of working
if no answer or incorrect answer
allow 1 mark for $45 \times 100 / 25000$*

2

(b) heat / thermal

allow heat from respiration

1

(c) energy / mass / biomass lost / not passed on **or** energy / mass / biomass is used **or** not enough energy / mass / biomass left

ignore reference to losses via eg respiration / excretion / movement / heat

1

a sensible / appropriate use of figures including heron

eg only 2 from frog / to heron

ignore units

1

(d) any **three** from:

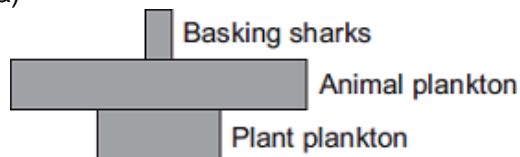
accept marking points if candidate uses other terms for microorganisms

- (microorganisms) decay / decompose / digest / breakdown / rot
ignore eat
- (breakdown) releases minerals / nutrients / ions / salts / named
ignore food
- (microorganisms) respiration
ignore other organisms respiring
- (microorganisms / respiration) release of carbon dioxide

3

[8]

M8. (a)



if more than one box is ticked award no mark

1

(b) increasing / higher light / temperature

*ignore references to months other than February – April
do **not** accept mineral / ions increase*

1

more / increased photosynthesis

*for both marks there must be a reference to 'more' at least once
(e.g. 'more light for photosynthesis' gains 2 marks)*

*allow 1 mark for reference to light **and** photosynthesis without an
idea of 'more'*

1

(c) increase due to increase in plant plankton / food

ignore references to months other than April – July

1

decrease due to fall in plant plankton / food **or** decrease as eaten by (basking) sharks

allow decrease as eaten by predators / animals / fish

1

(d) fall due to use / intake by plant (plankton)

ignore ref to no change section of graph

for fall allow March / April

ignore May / February

1

increase due to decay / decomposition / breakdown

for increase allow any month in range August to November

ignore December

1

of dead (plant / animal) plankton

allow of dead organisms / waste

1

[8]

M9. (a) (i) vole/small bird/beetle

gains 1 mark

1

(ii) oak trees are large organisms;
therefore their biomass is large; but their numbers are small

each for 1 mark

3

- (b) 8 of:
 energy stored in chemicals in cells/tissues/growth;
 passed up food chain;
 less energy stored at each stage in food chain/pyramid level;
 because only part of energy taken in used for growth;
 some lost in waste;
 some used for repair;
 used to main body systems;
 some lost in respiration;
 some converted into other forms of energy;
 e.g. movement;
 much lost as heat;
 by time detritus feeders have used remains;
 all returned to environment

each for 1 mark

8

c1 → animals

c2 → decomposers

2 marks for sequencing and organising the information

2

[14]

M10. (a) 0.18

*award both marks for correct answer irrespective of working
 if no answer or incorrect answer
 allow 1 mark for $45 \times 100 / 25000$*

2

(b) heat / thermal

allow heat from respiration

1

(c) energy / mass / biomass lost / not passed on **or** energy / mass / biomass
 is used **or** not enough energy / mass / biomass left

*ignore reference to losses via eg respiration / excretion /
 movement / heat*

1

a sensible / appropriate use of figures including heron

eg only 2 from frog / to heron

ignore units

1

(d) any **three** from:

accept marking points if candidate uses other terms for microorganisms

- (microorganisms) decay / decompose / digest / breakdown / rot
ignore eat
- (breakdown) releases minerals / nutrients / ions / salts / named
ignore food
- (microorganisms) respiration
ignore other organisms respiring
- (microorganisms / respiration) release of carbon dioxide

3

[8]

M11.

(a) (i) 0.6 **or** 6×10^{-1}

for correct answer

if no / incorrect answer $\frac{2.4 \times 10^4}{4 \times 10^8} \times 100$

or

0.006 or 6×10^{-3} gains 1 mark

2

(ii) any **two** from:

- reflected
ignore some of light is green
- not absorbed **or** misses chloroplasts / chlorophyll
allow transmitted or passes through leaves
allow hits other plant parts
- wrong wavelength
- photosynthesis inefficient
accept other limiting factors / named
- allow some lost through respiration / as heat (from respiration)

2

(b) energy lost via faeces / not digested / waste / excreted (of insect-eating birds)

1

energy loss via respiration / movement / muscle contraction / heat
(by insect-eating bird)

accept examples of muscle contraction
*do **not** accept energy used for respiration*

1

some of (insect eating) bird not eaten but all / most / more of insect is eaten

1

[7]

M12. (a) $1.67 / 1\frac{2}{3}$
accept 1.6 to 1.7

ignore working or lack of working $\frac{400 \times 100}{24000}$ for 1 mark

2

(b) any **three** from:

deduct only 1 mark for any mention of in carnivore

lost as heat **or** keeping body warm

lost in metabolic functions is not enough

lost in respiration

*do **not** accept 'used for respiration*

movement

not eaten parts or individuals / non-edible parts / dead leaves / wood /
bones / faeces / urine

ignore 'waste'

ignore references to growth / reproduction

3

[5]

