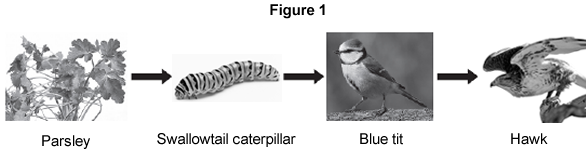
**Q1.Figure 1** shows how energy and biomass pass along a food chain.



(a)    The parsley shown in **Figure 1** carries out photosynthesis.

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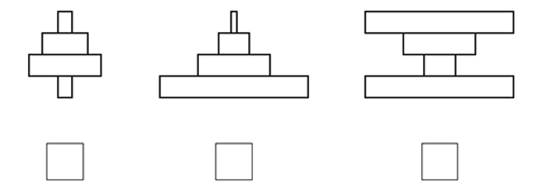
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**(2)**

(b)    Which diagram shows the pyramid of biomass for the food chain in **Figure 1**?

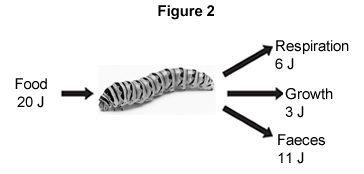
Why is photosynthesis important in the food chain?

Tick (✔) **one** box.



**(1)**

(c)    **Figure 2** shows the ways a swallowtail caterpillar transfers 20 J of energy from food.



What percentage of the energy in the caterpillar’s food is used for growth?

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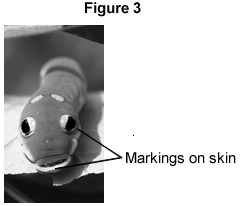
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Percentage = ...................................................

**(2)**

(d)    The organisms in the food chain are adapted for survival.

(i)     **Figure 3** shows a swallowtail caterpillar seen from the back.



Suggest how the swallowtail caterpillar shown in **Figure 3** is adapted to reduce the chance of being eaten by blue tits.

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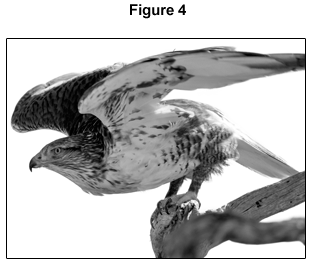
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**(2)**

(ii)     **Figure 4** shows a hawk.



Suggest **two** ways that the hawk is adapted to catch and kill blue tits.

1 ................................................................................................................

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2 ................................................................................................................

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**(2)**

**(Total 9 marks)**

Blue tit: ©JensGade/iStock  
Parsley: © Warren\_Price/iStock  
Caterpillar ©prettyzhizhi/iStock  
Hawk: © kojihirano/iStock  
Swallowtail caterpillar: © Anna\_Po/iStock

**Q2.**The figure below shows the amount of forest cover on an island in Asia, in 1973 and in 2010.



(a)     (i)      Deforestation has decreased the amount of forest cover on the island.

Describe the change in the pattern of forest cover on the island.

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**(2)**

(ii)     Give **two** possible reasons why the amount of forest has decreased between 1973 and 2010.

1 ................................................................................................................

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2 ................................................................................................................

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**(2)**

(b)     Scientists are concerned about the effects of a decrease in forest cover on ecosystems.

Give **two** possible negative effects of the decrease in forest cover on ecosystems.

1 ..........................................................................................................................

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2 ..........................................................................................................................

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**(2)**

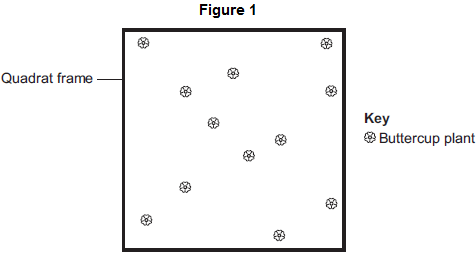
**(Total 6 marks)**

**Q3.**A grassy field on a farm measured 120 metres by 80 metres.

A student wanted to estimate the number of buttercup plants growing in the field.

The student found an area where buttercup plants were growing and placed a 1 m × 1 m quadrat in one position in that area.

**Figure 1** shows the buttercup plants in the quadrat.



The student said, 'This result shows that there are 115 200 buttercup plants in the field.'

(a)     (i)      How did the student calculate that there were 115 200 buttercup plants in the field?

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**(2)**

(ii)     The student’s estimate of the number of buttercup plants in the field is probably not accurate. This is because the buttercup plants are not distributed evenly.

How would you improve the student’s method to give a more accurate estimate?

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**(2)**

(b)     Sunlight is one environmental factor that might affect the distribution of the buttercup plants.

(i)      Give **three other** environmental factors that might affect the distribution of the buttercup plants.

1...............................................................................................................

2...............................................................................................................

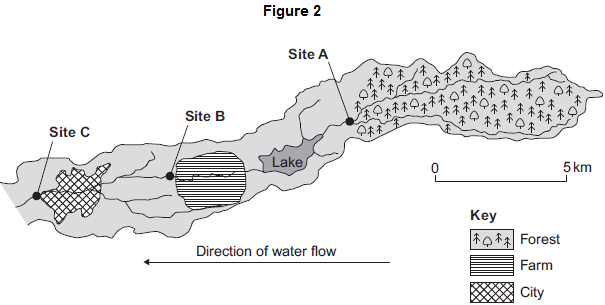
3...............................................................................................................

**(3)**

(ii)     Explain how the amount of sunlight could affect the distribution of the buttercup plants.

**(3)**

(c)     **Figure 2** is a map showing the position of the farm and a river which flows through it.



Every year, the farmer puts fertiliser containing mineral ions on some of his fields.When there is a lot of rain, some of the fertiliser is washed into the river.

(i)      When fertiliser goes into the river, the concentration of oxygen dissolved in the water decreases.

Explain why the concentration of oxygen decreases.

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**(5)**

(ii)     There is a city 4 km downstream from the farm.

Apart from fertiliser, give **one** other form of pollution that might go into the river as it flows through the city.

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**(1)**

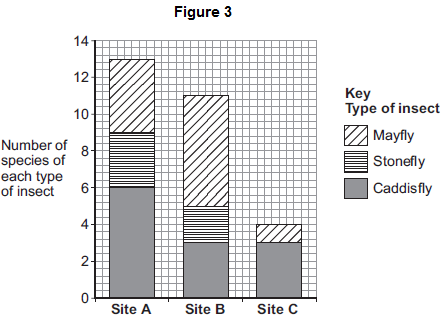
(d)     Three sites, **A**, **B** and **C**, are shown in **Figure 2**.

Scientists took many samples of river water from these sites.

The scientists found larvae of three types of insect in the water: mayfly, stonefly and caddisfly. For each type of insect the scientists found several different species.

The scientists counted the number of different species of the larvae of each of the three types of insect.

**Figure 3** shows the scientists’ results.



(i)      How many more species of mayfly were there at Site **B** than at Site **A**?

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**(1)**

(ii)     Suggest what caused this increase in the number of species of mayfly.

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**(1)**

(iii)    The scientists stated that the number of species of stonefly was the best indicator of the amount of oxygen dissolved in the water.

Use information from **Figure 3** to suggest why.

**(1)**

**(Total 19 marks)**

**Q4.**          Animals in a habitat compete with each other.

(a)     Give **two** factors for which animals may compete.

1 ......................................................................................................................

2 ......................................................................................................................

**(2)**

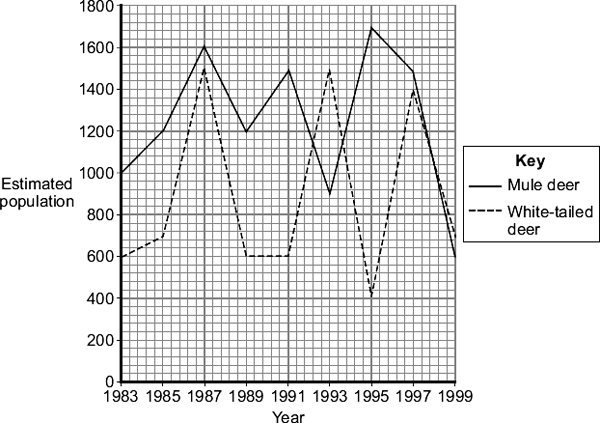
(b)     The photographs show a mule deer and a white-tailed deer.



  Mule deer by Dcrjsr (Own work) [CC-BY-3.0], via Wikimedia Commons. White-tailed deer by  
                            Clay Heaton (Own work) [CC-BY-SA-3.0], via Wikimedia Commons

Mule deer and white-tailed deer live together in the same national park in the USA.

The graph shows changes in the populations of the two deer species between 1983 and 1999.



(i)      Describe the changes in the population of white-tailed deer between 1991 and 1995.

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**(2)**

(ii)     Use information from the graph to suggest an explanation for changes in the population of white-tailed deer between 1991 and 1995.

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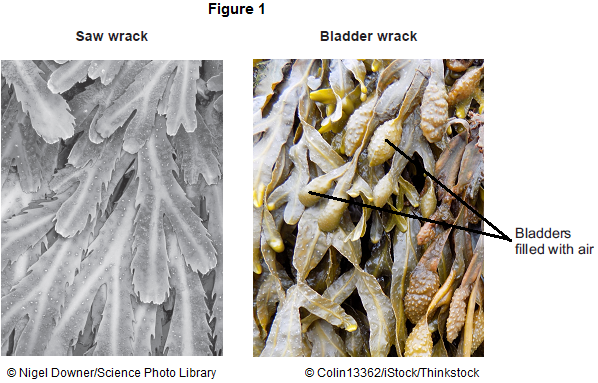
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**(2)**

**(Total 6 marks)**

**Q5.**Organisms compete with each other.

(a)     **Figure 1** shows two types of seaweed which live in similar seashore habitats.



Most of the time the two seaweeds are covered with water.

Bladder wrack has bladders filled with air.

Bladder wrack grows more quickly than saw wrack.  
Suggest an explanation why.

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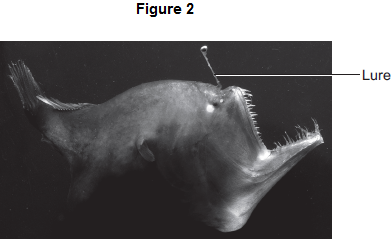
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**(3)**

(b)     **Figure 2** shows an angler fish.



© Dante Fenolio/Science Photo Library

Angler fish live at depths of over 1000 m.

In clear water, sunlight does not usually reach more than 100 m deep.  
Many angler fish have a transparent ‘lure’ containing a high concentration of bioluminescent bacteria.  
Bioluminescent bacteria produce light.

Suggest an advantage to the angler fish of having a lure containing bioluminescent bacteria.

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**(2)**

**(Total 5 marks)**

**Q6.**          Desert plants are adapted for survival in a dry climate.

(a)     Joshua trees live in deserts.



                                     By nyenyec [CC BY-SA 3.0], via Wikimedia Commons

Joshua trees have two different types of root:

•    a system of shallow roots spread out over a large area•    roots about 1 m in diameter, shaped like bulbs, deep in the soil.

Explain the advantage to the Joshua tree of having:

(i)      shallow roots spread out over a large area

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**(2)**

(ii)     large, bulb-like roots deep in the soil.

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**(1)**

(b)     Creosote bushes also live in deserts.



                          By Sue in az (Own work) [Public domain], via Wikimedia Commons

The leaves of creosote bushes:•    are covered with a layer of wax  
•    fold together during the day.

Explain how the leaves of the Creosote bush help it to survive in deserts.

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**(3)**

**(Total 6 marks)**

**Q7.**On a rocky shore, when the tide goes in and out, organisms are exposed to the air for   
different amounts of time.

(a)     On hot, windy days when the tide is out the concentration of the salt solution in rock pools may become very high.

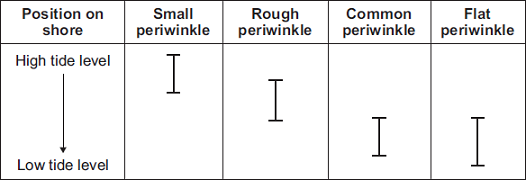
What term is used to describe organisms that can survive in severe conditions such as very high concentrations of salt solution?

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**(1)**

(b)     Periwinkles are types of snail.   
Students surveyed the different types of periwinkle living on a rocky shore.

The diagram shows the results of the students’ survey.  
The highest position that the sea water reaches on the shore is called the high tide level.   
Each bar represents the range of habitats for each type of periwinkle.



(i)      Which **two** types of periwinkle are likely to compete with each other to the greatest extent?

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**(1)**

(ii)     Explain your answer to part (b)(i).

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**(1)**

(iii)    The small periwinkle can survive much nearer to the high tide level than the flat periwinkle.

Suggest **two** reasons why the flat periwinkle cannot survive near to the high tide level.

1.............................................................................................................

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2.............................................................................................................

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**(2)**

**(Total 5 marks)**

**Q8.**          The photograph shows a lionfish. Lionfish are normally found in the Pacific Ocean.



                                                         By Albert Kok at nl.wikipedia [Public domain], from Wikimedia Commons

In 1992 six lionfish escaped from an aquarium into the Atlantic Ocean.

Now there are thousands of lionfish in the Atlantic Ocean. Numbers of the native Atlantic fish have gone down because the lionfish have eaten many native Atlantic fish.

Suggest explanations for the large increase in the number of lionfish in the Atlantic Ocean.

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**(3)**

**(Total 3 marks)**

**M1.**(a)     any **two** from:

•        *idea of* absorption of light / energy

•        transfer to chemical energy

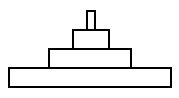
*allow produce sugars / glucose / starch / carbohydrate / food / biomass*

•        provides food / energy for animals / caterpillar

•        releases oxygen

**2**

(b)



**1**

(c)     15(%)

*allow* ***1*** *mark for  with no answer or incorrect answer*



***or***

*allow* ***1*** *mark for 0.15*

**2**

(d)     (i)     any **two** from:

•        markings look like eyes / face / mouth of much larger animal

•        looks fierce / scary / dangerous

*allow it looks like a snake*

•        to frighten blue tit / bird

max 1 if reference to camouflage

**2**

(ii)     any **two** from:

•        sharp / long / big claws

*ignore strong*

•        sharp / hooked beak

*ignore strong / big*

•        large wings **or** flies quickly

*allow streamlined / aerodynamic*

*ignore powerful wings*

•        good eyesight

**2**

**[9]**

**M2.**(a)     (i)      forest at the edges (of the island) has been removed

*allow centrally the forest remains*

**1**

an appropriate area on the island is identified eg south east **or** bottom right

**1**

(ii)     any **two** from:

•        (to provide land) for farming / agriculture

•        (to provide land) for quarrying

•        (to provide land / wood) for building

*allow to provide timber*

•        to provide fuel

•        to produce paper

*allow forest fires*

**2**

(b)     any **two** from:

•        decreased biodiversity

•        loss of habitats

•        increased carbon dioxide (concentration)

•        global warming

*allow effects of global warming eg flooding / rise in sea level*

*allow soil erosion*

**2**

**[6]**

**M3.**(a)     (i)      counts / 12

**1**

× 120 × 80 / × 9600  
**or**

× area of field

**1**

(ii)     (more) quadrats / repeats

**1**

placed randomly

*ignore method of achieving randomness*

**1**

(b)     (i)      any **three** from:

•        temperature / warmth / heat

•        water / rain

•        minerals / ions / salts (in soil)

*allow nutrients / fertiliser / soil fertility*

*ignore food*

•        pH (of soil)

•        trampling

•        herbivores

*ignore predators*

•        competition (with other species)

•        pollution qualified e.g. SO2 / herbicide

•        wind (related to seed dispersal).

*ignore space / oxygen / CO2 / soil unqualified*

**3**

(ii)     light needed for photosynthesis

**1**

for making food / sugar / etc.

**1**

effect on buttercup distribution eg more plants in sunny areas / fewer plants in shady areas

**1**

(c)     (i)      fertiliser / ions / salts cause growth of algae / plants

**1**

(algae / plants) block light

**1**

(low light) causes algae / plants to die

**1**

microorganisms / bacteria feed on / break down / cause decay of organic matter / of dead plants

*do* ***not*** *allow germs / viruses*

**1**

(aerobic) respiration (by microbes) uses O2

*do* ***not*** *allow anaerobic*

**1**

(ii)     sewage / toxic chemicals / correct named example eg metals / bleach / disinfectant / detergent etc

*allow suitable named examples eg metals such as Pb / Zn / Cr / oil / SO2 / acid rain / pesticides / litter*

*ignore chemicals unqualified*

*ignore waste unqualified*

*ignore human waste / domestic waste / industrial waste unqualified*

**1**

(d)     (i)      2

**1**

(ii)     more food

*allow other sensible suggestion eg more species colonise from tributary streams after forest*

**1**

(iii)    number of stonefly species decreases (from **A** to **B** / **B** to **C** / **A** to **C**) as more pollution enters river / less oxygen

*allow fewer species in more polluted water*

*ignore none are found at site C*

**1**

**[19]**

**M4.**          (a)     any **two** from:

•        food / feeding

*ignore water*

•        mates / mating

•        territory / space / land / shelter / nesting sites

*ignore homes / place to live / habitat / resources*

•        status (within group)

**2**

(b)     (i)      rises to 1480 to 1500  
**or** rises by 880 to 900  
**or** rises until 1993

*ignore incorrect figures if 1993 given*

**1**

falls to 400 to 440 **or** falls by 1040 to 1100

*if neither mark gained then allow* ***1*** *mark for rise followed by fall* ***or*** *fell by 160 to 200*

**1**

(ii)     rises because: -  
less competition from mule deer  
**or** mule deer population falling  
**or** fewer mule deer

*ignore reference to food / breeding*

*ignore reference to predation / disease*

**1**

falls because: -  
more competition from mule deer  
**or** mule deer population rising  
**or** more mule deer

*ignore more / less suited to environment*

*if neither mark gained then correct reference to competition gains* ***1*** *mark*

**1**

**[6]**

**M5.**(a)     gets more light (near surface)

*allow warmer (near surface)*

*allow bladders contain (more) carbon dioxide*

**1**

(so) photosynthesises more

**1**

(because) bladders aid floating (when tide is in)

**or**

(so) more biomass / glucose / starch produced

*ref to ‘more’ needed only once, eg gets more light for photosynthesis gains* ***two*** *marks*

*if ‘more’ not given do not award mark on the first occasion*

**1**

(b)     lets angler fish see / attract its prey / mates **or** see predators as it is dark (at 1000m)

**or**

lets angler fish see / attract prey to get food

**or**

lets angler fish see / attract mates to reproduce

**or**

lets angler fish see predators to avoid being eaten

*must be in a correct pair to gain* ***two*** *marks*

**2**

**[5]**

**M6.**         (a)      (i)     increased water uptake

*ignore nutrients / food*

*allow quicker water uptake*

*allow collects water over larger area*

**1**

(after) rain

*accept ideas in terms of more successful competitor*

**1**

(ii)     water storage **or** stability **or** safety from predators

*ignore absorption of water from soil*

**1**

(b)     reduces water loss / evaporation

*accept reduces transpiration*

*allow stops water loss*

**1**

wax protects plant **or** reflects heat **or** keeps plant cool **or** unpalatable

*ignore reflects light*

**1**

folding reduces surface area **or** folding reduces warming

*accept enclosed stomata* ***or*** *less exposure of stomata* ***or*** *increased humidity* ***or*** *less water concentration gradient*

*allow prevents burning*

*ignore less likely to be damaged*

**1**

**[6]**

**M7.**(a)    extremophile(s)

**1**

(b)     (i)      common (periwinkle) and flat (periwinkle)

*either order,* ***both*** *required*

**1**

(ii)     (common and flat) both live in the same habitat / area / named area

*allow habitats overlap the most*

**1**

(iii)    any **two** from:

•         would have wrong food

•         would otherwise be exposed to (specific) predators

•         cannot tolerate extended exposure to air **or** reduced submersion in seawater

*allow cannot tolerate temperature / dehydration*

•         cannot tolerate high salt concentration (in rock pools)

*allow low salt concentration (in rock pools)*

•         cannot compete with small periwinkle

**2**

**[5]**

**M8.**          there are no / few predators of the lionfish  
**or** spines protect lionfish from predation

*allow warning colouration / poisonous*

**or** no / fewer disease organisms

**1**

predators / prey in Atlantic do not recognise lionfish  
**or** not fished by humans

*allow high reproduction*

**1**

also there is abundant food in Atlantic  
**or** there is no / less competition in Atlantic

*ignore adaptation to new environment*

**1**

**[3]**