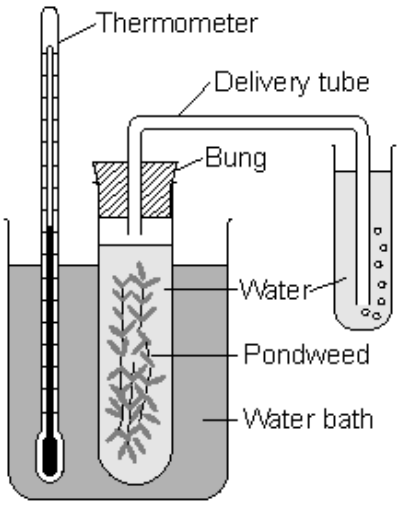
Q1. Plants produce food by photosynthesis.

(a) Complete the equation for photosynthesis.

carbon dioxide + ... (+ light energy) → glucose + ...

(2)

Some students investigated the effect of temperature on the rate of photosynthesis in pond weed. They set up the apparatus and altered the temperature using ice and hot water. They counted the number of bubbles given off in a minute at different temperatures.



(b) Why did the students use a water bath?

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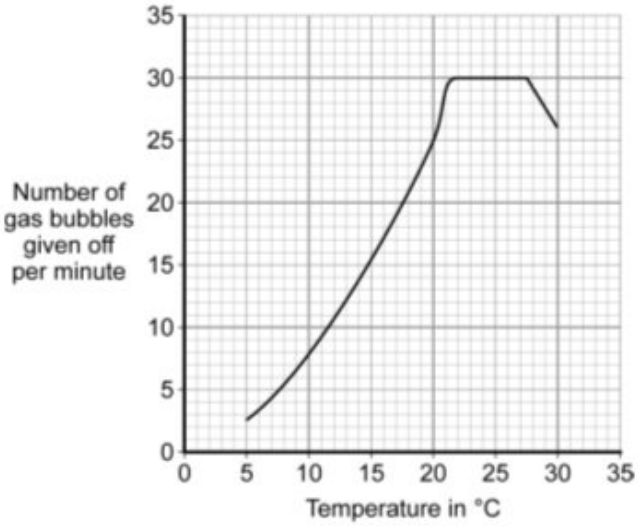
.....

(1)

The graph shows the students' results.



(c) Explain the shape of the graph between 22 °C and 27 °C.

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(2)

(d) A farmer wants to grow lettuces as quickly and cheaply as possible in winter.

(i) At what temperature should he keep his greenhouse to grow the lettuces as quickly and cheaply as possible?

..... °C

(1)

(ii) Explain the reason for your answer.

.....

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(2)

(Total 8 marks)

Q2. (a) Photosynthesis is a process that takes place in green plants.

(i) What type of energy is needed for this process?

.....

(1)

(ii) What substance in the plant absorbs this energy?

.....

(1)

(iii) In which part of the plant cell does photosynthesis take place?

.....

(1)

(iv) Write a balanced chemical equation for photosynthesis.

..... → .....

(3)

(b) Describe **two** ways you could speed up photosynthesis.

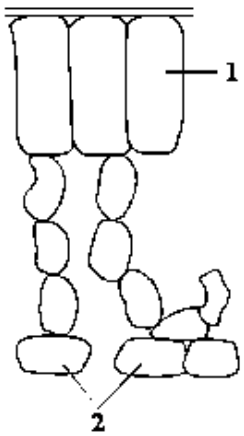
.....

.....

.....

(2)

(c) The diagram shows the outline of a cross-section of a leaf. Name cells **1** and **2** and describe how they are involved in photosynthesis.



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(4)
(Total 12 marks)

Q3. Photosynthesis takes place the leaves of green plants.

(a) Write a balanced chemical equation for the formation of glucose by photosynthesis.

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(3)

(b) Describe **two** ways that the rate of photosynthesis can be decreased without lowering the temperature.

.....

.....

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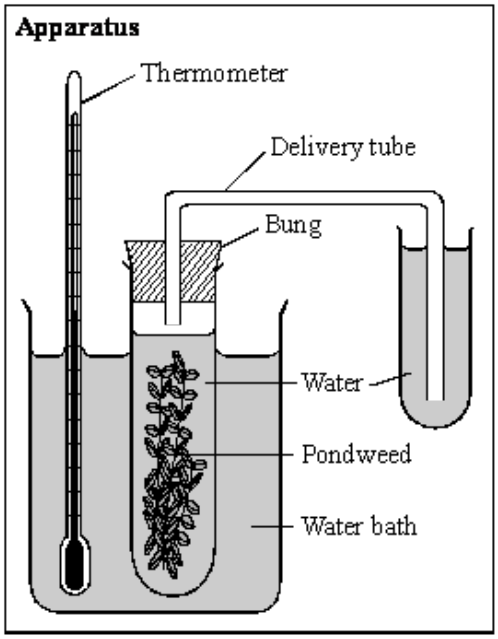
.....

(2)

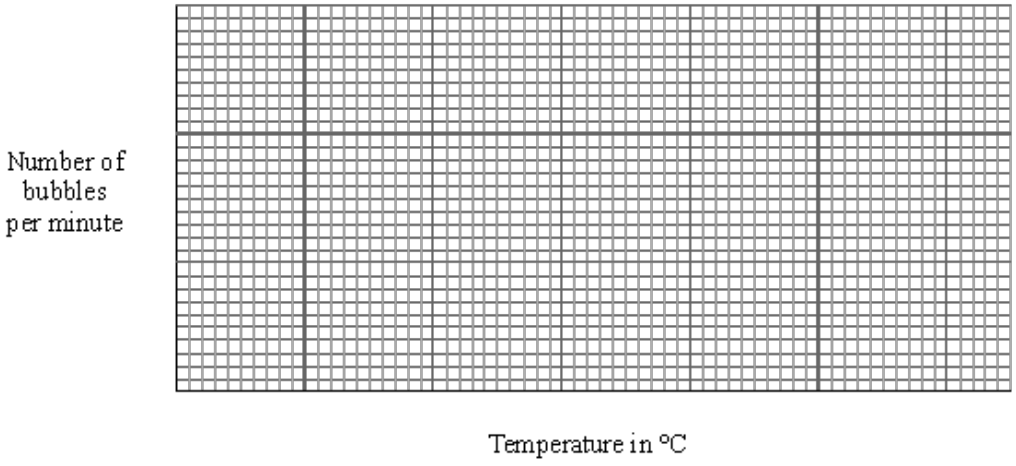
(c) Some students decided to investigate the effect of temperature on the rate of photosynthesis in pond weed. They set up the apparatus and altered the temperature using ice and hot water. The counted the number of bubbles given off in a minute at different temperatures. They obtained the following results.



Results

Temperature in °C	Number of bubbles per minute
10	6
20	15
30	21
40	23
50	19

(i) Plot the points on the graph.



(3)

(ii) Use your graph to predict the number of bubbles per minute at 25 °C.

.....

(1)

(iii) Suggest a reason why the rate of photosynthesis seems to decrease in this pondweed after 40 °C.

.....

.....

(1)

(Total 10 marks)

Q4. Students used quadrats to sample the distribution of plants in a field.

(a) Why should the students place the quadrats randomly in the field?

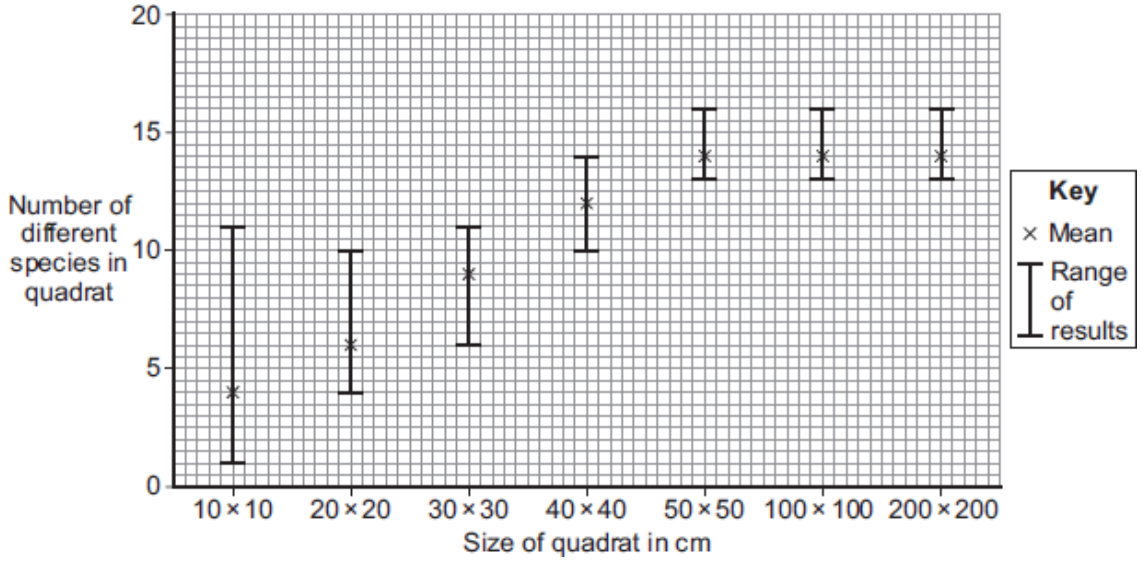
.....

.....

(1)

(b) The students wanted to find the best size of quadrat to use. The students used quadrats of different sizes.
For each quadrat the students recorded the number of different species in the quadrat.

The graph shows the mean and the range of results of using ten quadrats of each size.



(i) Describe the relationship between the size of the quadrat and the range of results.

.....

.....

.....

.....

(2)

(ii) Which size quadrat should the students use to investigate the plants in the field?

Explain your answer.

.....

.....

.....

.....

(2)

(c) The students used a quadrat to sample the plants in a different field along a *transect*.

(i) What is a *transect*?

.....

.....

(1)

(ii) The students found different plant species at different points along the transect.

Suggest **one** physical factor that might affect which plant species grow in different parts of the field.

.....

.....

(1)
(Total 7 marks)

Q5. A manufacturer is trying to improve the quality of the biological detergent he produces.

Scientists at his company carried out the following experiments on enzymes:

- Samples of lipase were collected from five different types of bacterium, **A**, **B**, **C**, **D** and **E**.
- The samples were diluted to give the same concentration of lipase.
- Agar jelly containing a lipid was prepared in a dish. This forms a cloudy mixture which becomes clear when the lipid is digested.
- Five small holes were cut into the agar.
- Two drops of lipase solution from bacterium **A** was added to hole **A**.
- This process was repeated for each sample of lipase.

Diagram 1 shows the appearance of the dish.

Diagram 1

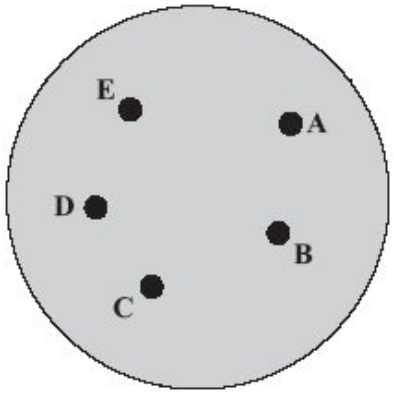
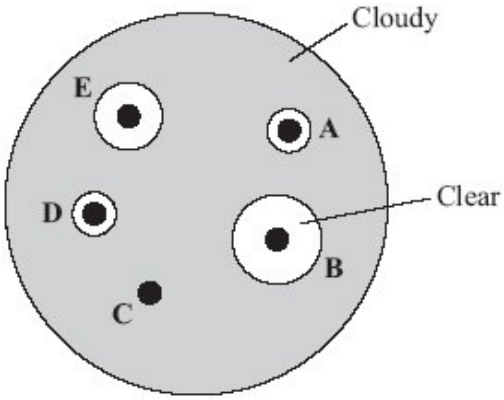


Diagram 2 shows the appearance of the dish 24 hours later.

Diagram 2



(a) (i) Which type of bacterium, **A**, **B**, **C**, **D** or **E**, produced the most effective lipase in this investigation?

Write your answer, **A**, **B**, **C, D** or **E**, in the box. ☐

(1)

(ii) Explain your answer.

.....

.....

(1)

(b) The manufacturer plans to add the most effective lipase to the washing powders he produces.

Suggest **two** other factors he should investigate before deciding which lipase is the most effective.

1 .....

.....

2 .....

.....

(2)

(c) Many biological detergents cannot be used at high temperatures.

Explain why.

.....

.....

(1)

(Total 5 marks)

Q6. (a) A food contains protein. Describe, in as much detail as you can, what happens to this protein after the food is swallowed.

.....

.....

.....

.....

.....

.....

.....

.....

(4)

(b) The table shows the activity of lipase on fat in three different conditions.

CONDITION	UNITS OF LIPASE ACTIVITY PER MINUTE
Lipase + acid solution	3.3
Lipase + weak alkaline solution	15.3
Lipase + bile	14.5

Explain, as fully as you can, the results shown in the table.

.....

.....

.....

.....

.....

.....

(3)

(Total 7 marks)

Q7. (a) Respiration is a process which takes place in living cells. What is the purpose of *respiration*?

.....

.....

(1)

(b) (i) Balance the equation for the process of respiration when oxygen is available.

$C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$

(1)

(ii) What is the name of the substance in the equation with the formula $C_6H_{12}O_6$?

.....

(1)

(c) Oxygen is absorbed through the alveoli in the lungs.

(i) How are the alveoli adapted for this function?

.....

.....

.....

(2)

(ii) Name the gas which is excreted through the alveoli.

.....

(1)

(d) (i) What is the name of the process of respiration when oxygen is **not** available?

.....

(1)

(ii) Describe the process of respiration which takes place in human beings when oxygen is **not** available and give an effect.

.....

.....

.....

.....

.....

.....

(3)

(Total 10 marks)

M1. (a) water

1

oxygen

1

in this order

(b) keep temperature constant

1

(c) a factor other than temperature is limiting

*do **not** accept water*

1

eg carbon dioxide

1

(d) (i) 21/22

1

(ii) rate of photosynthesis is at maximum

1

for the least heating cost

1

[8]

M2. (a) (i) light **or** solar

*do **not** credit sun's energy*

*do **not** credit radiant*

1

(ii) chlorophyll

1

(iii) chloroplast

1

(iv) CO_2 **+** H_2O

reactants identified (accept words)

1

$C_6H_{12}O_6 + O_2$

products identified (accept words)

1

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

balanced equation

1

(b) any **two** from:

increased CO_2 concentration

increased water supply

increased temperature (up to a point)
increased light intensity
*do **not** accept heat or warmth*

altered light quality by less green **or**
increasing other colours

2

(c) any **four** points

- palisade (mesophyll)
- lots of chloroplasts **or** chlorophyll
  or main site for photosynthesis
  or absorb maximum amount of light
- guard cells
- CO_2 in **or** O_2 out **or** water vapour out
- controls size of stoma **or** pores in leaf
  ***allow** stomata*

4

[12]

M3. (a) reactants: $CO_2 + H_2O$

1

products: $C_6H_{12}O_6 + O_2$

1

balance:

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

1

(b) **1** mark each for any of the following ideas:

lower CO_2 concentration

lower light intensity

decrease water availability

alter light wavelength **or** colour

accept more green light

2

(c) (i) scales correctly constructed

i.e. equal intervals along each axis

1

points plotted correctly

1

appropriate line correctly drawn

*accept dot to dot **or** line of best fit*

cancel if line extends through zero or beyond 50°C

1

(ii) 18 – 19 (bubbles per minute)

1

(iii) heat denatures enzymes **or** destroys membranes **or** ruptures cells **or** destroys cells

do not accept kills enzymes

1

[10]

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

ignore reference to fair test / reliability / accuracy

- to avoid bias

allow to get valid results

- to obtain a representative sample

allow to ensure whole of field is sampled

1

(b) (i) as the size of the quadrat increases the range decreases

ignore reference to mean

1

and levels off at 50 × 50(cm)

allow levels off above 40 × 40(cm)

1

(ii) 50 × 50(cm)

1

(as) allows identification of greatest number of species or smallest range

allow larger size would give same mean / range (but unwieldy to use)

1

(c) (i) line / tape placed across area (of possible change in environment)

allow series of quadrats next to each other

allow line / tape to sample the plants

1

(ii) any **one** from:

ignore biotic factors eg herbivores

- temperature
  ignore weather unqualified
- (availability of) (named) nutrients / minerals
  ignore pollution
- light (intensity)
- (availability of) water
- soil type / pH

1

[7]

M5. (a) (i) B

1

(ii) any **one** from:

- largest area of / most digestion (of lipid)
  allow agar / jelly / mixture broken down / digested
  *do **not** allow digestion of bacteria / lipase*
  *ignore digestion **by** bacteria*
- largest clear area

1

(b) any **two** from:

- effect of pH / pH described
- effect of temperature
- effect on different types of lipid / fat
- cost **or** allergic reactions **or** effect on skin / fabrics / **or** environment **or** interaction with other chemicals in powder **or** shelf life

2

(c) enzymes / named enzyme denatured / destroyed

allow active site(of enzyme) altered

1

[5]

M6. (a) digested / broken down / made soluble by protease enzyme
in stomach in small intestine / from stomach / from pancreas
into amino acids
amino acids / small molecules absorbed into blood

any four for 1 mark each

4

(b) *ideas that*
lipase / enzyme works best in alkaline / neutral conditions
acid denatures or inactivates enzyme / inhibits enzyme activity
bile emulsifies fat / bile produces larger surface area of fats / bile alkaline
<u>for</u> enzyme to work on / which increase activity of enzymes

any three for 1 mark each

3

[7]

M7. (a) to transfer / provide / give release energy

or *production of ATP / adenosine triphosphate (molecules)*

accept to give heat

1

(b) (i) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

accept any other

n : 6n : 6n : 6n ratio

do not credit if any other changes have been made

1

(ii) glucose

do not credit sugar / sucrose

1

(c) (i) any **two** from

large surface

thin (surface)

moist (surface)

(with a good) blood supply

2

(ii) carbon dioxide

accept water vapour

do not credit just water

1

(d) (i) anaerobic (respiration)

1

(ii) any **three** from

in mitochondria

glucose decomposes / breaks down / reacts

or *glucose → lactic acid for (2) marks*

to give lactic acid

or *breathing hard*

or *lactic acid → CO2 + water*

causing pain

(leaving an) oxygen debt

(quick) source of energy

(but) less efficient than aerobic respiration

accept less efficient than with oxygen

3

[10]