



General Certificate of Secondary Education
2015–2016

Centre Number

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Candidate Number

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Double Award Science: Biology

Unit B1
Higher Tier

[GSD12]

MV18

TUESDAY 17 MAY 2016, AFTERNOON

Time

1 hour, plus your additional time allowance.

Instructions to Candidates

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Complete in blue or black ink only.

Answer **all nine** questions.

Information for Candidates

The total mark for this paper is 70.

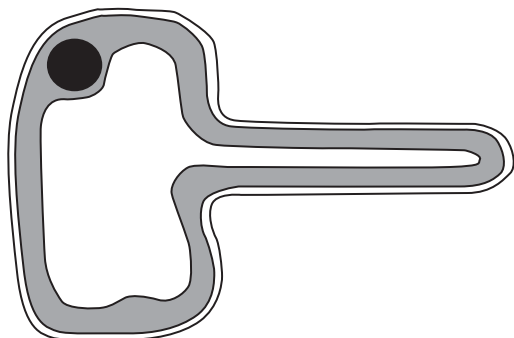
Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question **4(b)**.

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1 (a) Plants take up minerals from the soil using specialised cells.

The drawing shows one of these specialised cells.



(i) Name this specialised cell. [1 mark]

(ii) Use the drawing to describe and explain how this cell is adapted for its role in mineral uptake. [2 marks]

(b) Farmyard manure is a natural fertiliser.

The table shows the mass of three minerals in farmyard manure and in an artificial fertiliser.

Fertiliser	Mass of mineral/kg/tonne		
	Nitrate	Phosphate	Potassium
Farmyard manure	6.0	3.5	8.0
Artificial fertiliser	200.0	100.0	100.0

(i) Plants use nitrates to make a substance needed for growth.

Name this substance. [1 mark]

(ii) There is an advantage in using artificial fertiliser rather than farmyard manure.

Give **data** from the table that supports this statement. [1 mark]

(iii) Give **three** advantages of using farmyard manure rather than artificial fertiliser. [3 marks]

1. _____

2. _____

3. _____

2 (a) When coal and oil are burned, they produce air pollutants.

Sulfur dioxide is one of these air pollutants.

Coal and oil are the main fuels burned for heating homes in Belfast.

Natural gas is another fuel that has become recently available for heating homes in Belfast.

The table shows sulfur dioxide levels in Belfast city centre from 1990 to 2010.

Year	Sulfur dioxide level/ $\mu\text{g}/\text{m}^3$
1990	65
1995	47
2000	18
2005	7
2010	5

Use the table and the information given to answer the following.

(i) Which **10 year** period showed the greatest decrease in sulfur dioxide levels? Give this decrease.

[2 marks]

Show your working.

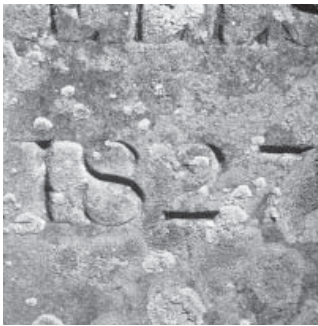
- 10 year period: _____ to _____
- Decrease: _____ $\mu\text{g}/\text{m}^3$

- (ii) Explain why sulfur dioxide levels have decreased.
[1 mark]

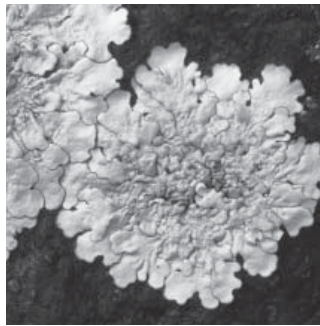
Lichens are small organisms that are found living on rocks, walls and trees.

They are sensitive to air pollution, especially sulfur dioxide.

The photographs show three types of lichen, a crusty, a leafy and a shrubby lichen.



Crusty lichen



Leafy lichen



Shrubby lichen

- Crusty lichens can survive in levels of sulfur dioxide up to $70 \mu\text{g}/\text{m}^3$.
- Leafy lichens can survive in levels of sulfur dioxide up to $59 \mu\text{g}/\text{m}^3$.
- Shrubby lichens only survive in levels of sulfur dioxide below $19 \mu\text{g}/\text{m}^3$.

(b) Use this information and the table on page 6 to give the type of lichen that would have been found in Belfast city centre in 1990. [2 marks]

Type of lichen: _____

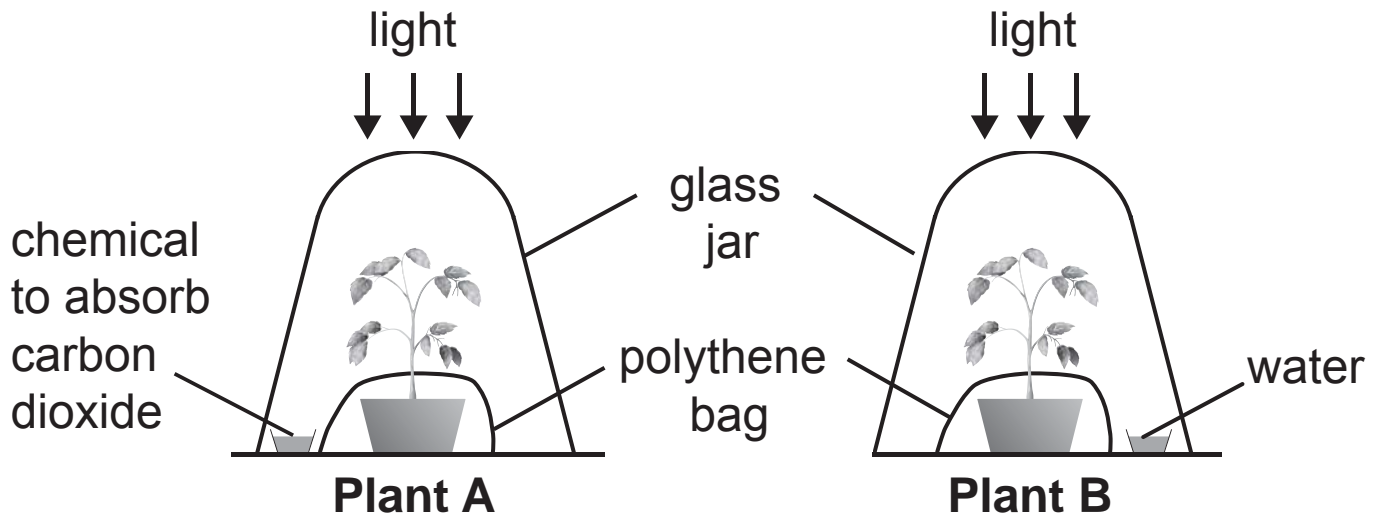
Reason for choice: _____

(c) Sulfur dioxide levels in Belfast city centre are now low. Explain why it is still important to continue monitoring the level of sulfur dioxide. [1 mark]

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(Questions continue overleaf)

3 (a) The diagram shows an experiment to investigate if carbon dioxide is needed for photosynthesis.



Both plants were destarched before the experiment. They were **then** left in warm, sunny conditions for 24 hours.

(i) How were the plants destarched? [1 mark]

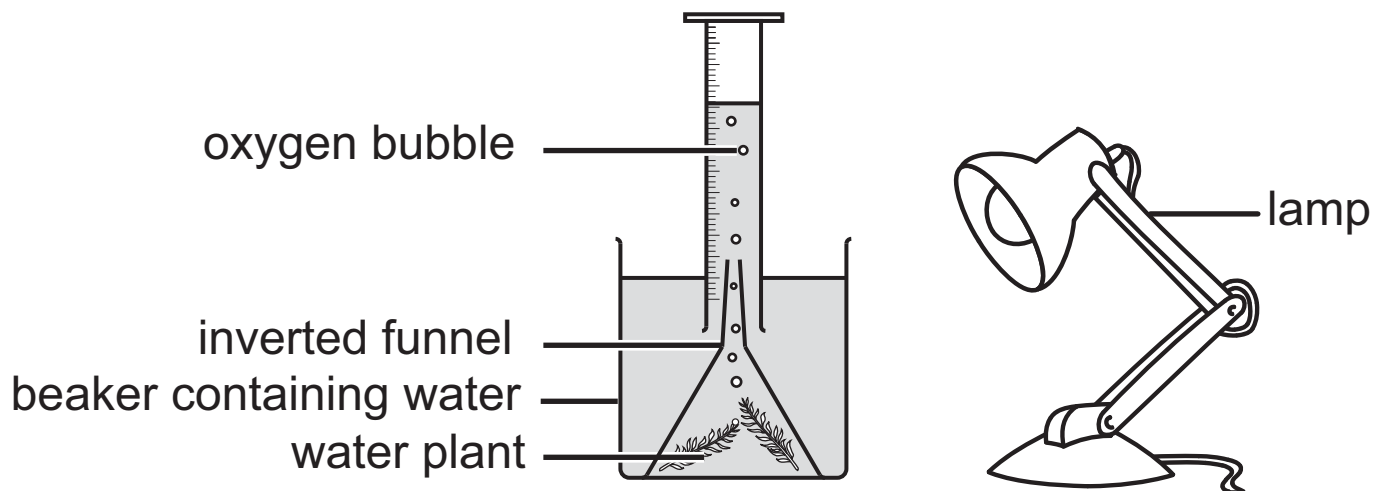
(ii) Why were the plants destarched? [1 mark]

(iii) Bacteria are living organisms present in the soil in the plant pots. Suggest why the plant pots are covered with polythene bags. [2 marks]

(iv) After 24 hours in warm, sunny conditions, a leaf from plant **A** and a leaf from plant **B** were tested for starch using iodine solution. Describe and explain the results you would expect for the leaf from plant **A** and the leaf from plant **B** after testing with iodine solution. [3 marks]

(b) Jude carried out an experiment to measure the rate of photosynthesis in a water plant at different light intensities.

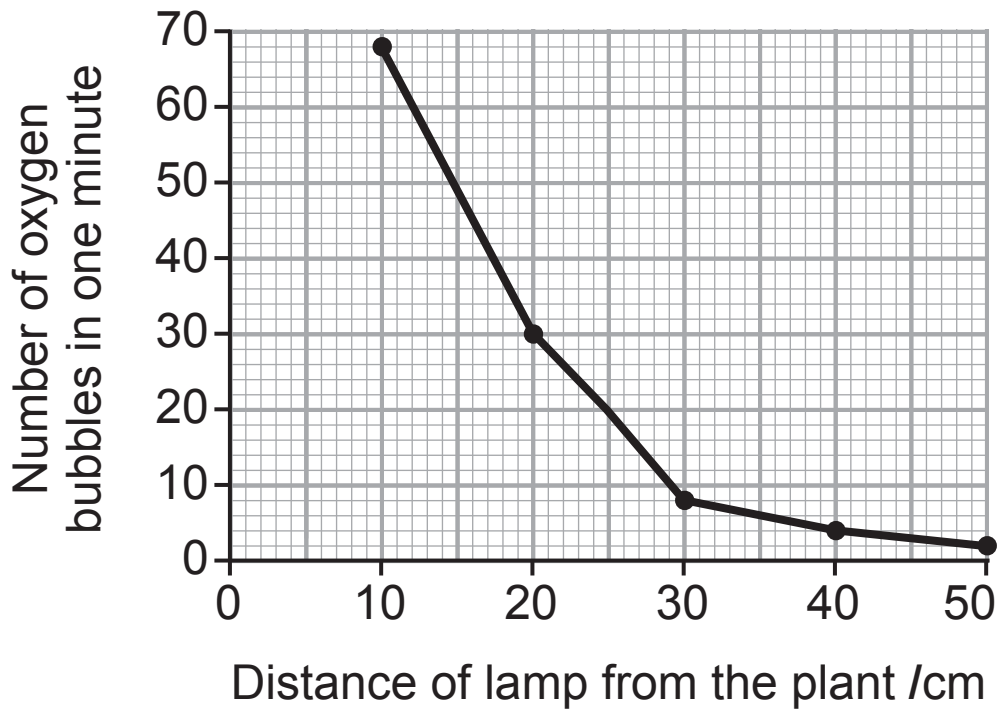
The diagram shows the apparatus he used.



The light intensity decreases as the lamp is moved further away from the plant.

Jude counted the number of oxygen bubbles given off by the plant in one minute at different distances of the lamp from the plant.

The graph opposite shows the results of Jude's experiment.



- (i) Use the information given on page 12 and the graph to describe what happens to the number of oxygen bubbles given off by the plant as the light intensity decreases. [1 mark]

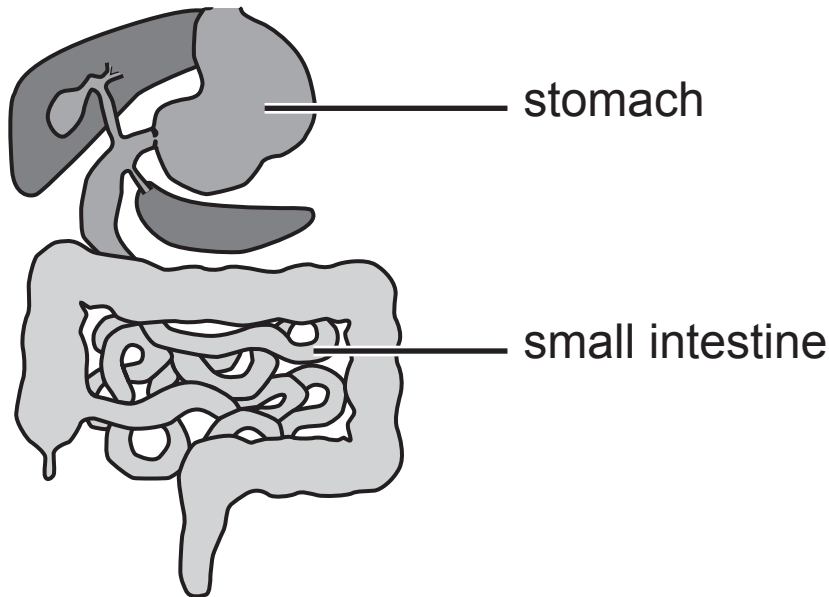
- (ii) At what distance of the lamp from the plant did the plant produce **24 oxygen bubbles** in one minute? [1 mark]

_____ cm

- (iii) When Jude moved the lamp to a different distance, he waited for two minutes before counting the number of oxygen bubbles.

Explain why he did this. [1 mark]

4 The diagram shows part of the digestive system.



(a) State **two** ways in which the small intestine is adapted for digestion. [2 marks]

1. _____

2. _____

(b) Meat is a major source of protein in our diet. Digestion of meat starts in the stomach and is completed in the small intestine.

As George got older, he produced less hydrochloric acid in his stomach.

After eating any meal containing a lot of meat, George felt his stomach remaining full for longer, compared to when he was younger.

- Describe and explain the effect of reduced acid production on digestion of meat in the stomach of an older person like George.
- Describe the digestion of meat in the **small intestine**.
- Describe what happens to the products of digestion of meat in the small intestine.

5 (a) The photographs show a bat and an owl.

Bat



Owl



Read the passage and use the information and your knowledge to answer the questions that follow.

Owls feed on bats.

While flying, bats eat large numbers of small flies that feed on a few trees.

(i) Draw a pyramid of numbers for the organisms given in the passage.

Label the organisms. [3 marks]

(ii) As well as feeding on trees, the small flies feed on crops like wheat.

Give **one** advantage to a crop farmer of having bats living nearby his fields. [1 mark]

(b) Fish also eat small flies.

Ponds have large numbers of small flies. This makes ponds good habitats for both bats and fish.

If there is a sudden increase in the fish population, their waste substances can lead to a build-up of nitrates in the pond.

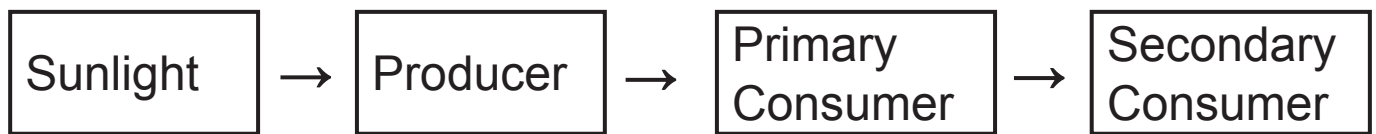
This can cause eutrophication.

(i) Describe and explain how eutrophication can result in a lack of oxygen in the pond. [4 marks]

(ii) The lack of oxygen can lead to the death of fish in the pond.

Describe and explain how this may affect the bat population living near the pond. [2 marks]

6 The diagram shows the flow of energy through a grassland ecosystem.



(a) At what trophic level are producers found? [1 mark]

(b) The amounts of energy in a food chain for a Northern Ireland beef cattle farm are given below. Figures are in $\text{kJ/m}^2/\text{year}$.



(i) Name the secondary consumer in this food chain. [1 mark]

(ii) Calculate the percentage of energy that is transferred between the grass and the beef cattle.

Show your working. [2 marks]

_____ %

(iii) Give **two** reasons for the loss of energy between the grass and the beef cattle. [2 marks]

1. _____

2. _____

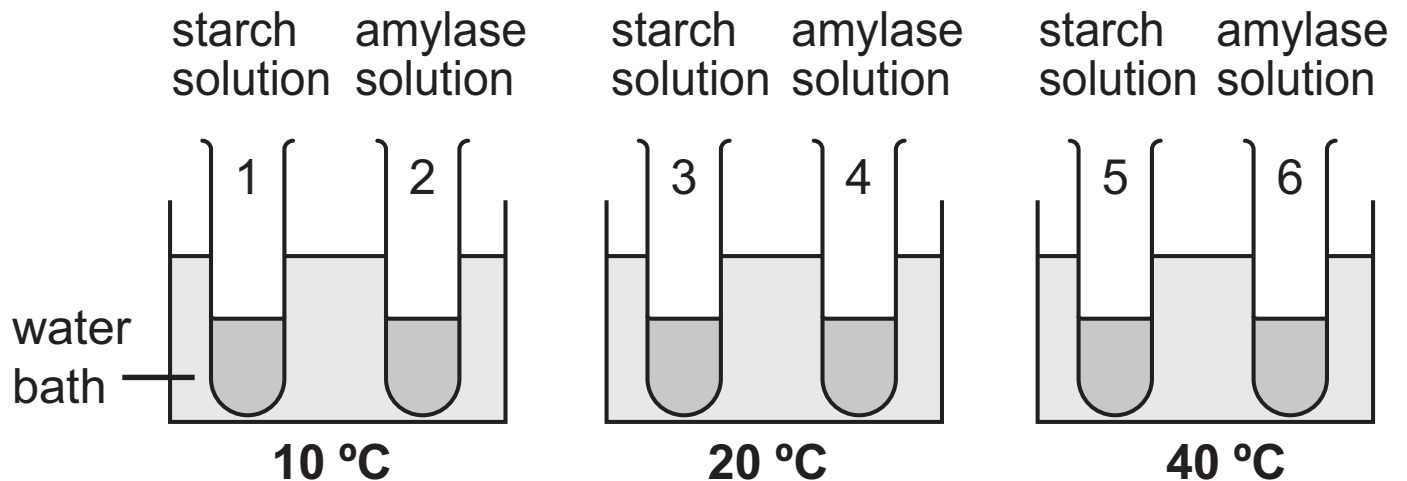
(iv) The farmer decided to keep the beef cattle in a shed.

The beef cattle do not have much space to move around in the shed.

Suggest why keeping the beef cattle in the shed is more profitable for the farmer. [2 marks]

7 Amy carried out an experiment to investigate the effect of three different temperatures on the activity of the enzyme amylase.

The diagram shows the set-up at the start of the experiment.



Amy kept the starch and amylase solutions separate in their water baths for five minutes.

She then added the contents of test tubes 1 and 2 together, 3 and 4 together and 5 and 6 together and placed them back in their water baths.

After mixing, she took a small sample from each of the three mixed solutions and tested it with iodine solution immediately and at one minute intervals, **until no blue/black colour was seen.**

The table shows her results.

Temperature/°C	Time taken until no blue/black colour was seen/minutes	Speed of reaction
10	17	
20	8	
40	3	

- (a) Explain why Amy kept the starch and amylase solutions separate in their water baths for five minutes before adding them together. [1 mark]

- (b) Complete the table above to describe the speed of the starch/amylase reaction at the three temperatures. Choose from the words **fast**, **medium** and **slow**. [1 mark]

- (c) What colour would the iodine solution be if added to the mixed solution after 18 minutes at 10 °C? [1 mark]

(d) The results may not show the best temperature for amylase activity.

Suggest how the experiment could be modified to find the best temperature for amylase activity. [1 mark]

(e) Describe and explain how the results of this experiment would differ if Amy had used boiled amylase solution.

[3 marks]

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(Questions continue overleaf)

8 Animals and plants contain protein.
Nitrogen is present in protein.

(a) Describe how the nitrogen in protein is **released** into the soil when animals and plants die. [2 marks]

Waterlogged soil contains very little oxygen compared to normal soil.

The photograph shows a crop growing in waterlogged soil.



The crop is not growing well.

(b) Use your knowledge of the **nitrogen cycle** to explain why the crop is not growing well in the waterlogged soil. [3 marks]

- 9 The table shows the sources and masses of carbon dioxide emissions between 1990 and 2013 in the United Kingdom (UK).

Source	Mass of carbon dioxide emissions/millions of tonnes	
	1990	2013
Electricity generation	241.5	178.5
Transport	119.6	116.7
Business	113.7	75.4
Residential	79.0	76.9
Other	37.3	16.8
Total	591.1	464.3

Use the table and your knowledge to answer the following questions.

- (a) Suggest **two** reasons for the decrease in the amount of carbon dioxide emissions caused by **electricity generation**. [2 marks]

1. _____

2. _____

(b) The total mass of carbon dioxide emissions in the UK from all sources has decreased between 1990 and 2013. Suggest **two** reasons why **global** emissions of this gas continue to rise. [2 marks]

1. _____

2. _____

(c) A hectare is an area of land.
The total land area available to plant trees in the UK is 23 million hectares.
A one hectare area of trees absorbs, on average, 11 tonnes of carbon dioxide in one year.

(i) Use the **data** in the table on page 28 to calculate the **area of trees** that would need to be planted to absorb the total mass of carbon dioxide emissions in the UK in 2013. Give the units. [3 marks]

Show your working.

Area of trees _____

(ii) Planting trees is only part of the solution in reducing the mass of carbon dioxide emissions in the UK. Use your calculated area from **(c)(i)** and the information given to explain why this statement is true. [1 mark]

THIS IS THE END OF THE QUESTION PAPER

SOURCES

Q1(a)Source: Principal Examiner

Q2(a)Table - sulfur dioxide levels in Belfast city centre 1990 to 2010, © Crown Copyright. Air pollution in Northern Ireland by Alison Loader and Paul Willis. Department of Environment. ISBN: 978-1-907053-39-9

Q2(b)Image - Crusty lichen, © Dr Jeremy Burgess / Science Photo Library

Image - Leafy lichen, © Claude Nuridsany & Marie Perennou / Science Photo Library

Image - Shrubby lichen, © mtreasure / iStock / Thinkstock

Q3(a)Source: Principal Examiner

Q3(b)Source: Principal Examiner

Q4.....Diagram of a Digestive System, © GCSE Biology for CCEA, Rose Mcllwaine and James Napier (ISBN-9780340858257).

"Reproduced by permission of Hodder Education".

Q5(a)Image - a bat, © KirsanovV / iStock / Thinkstock

Image - an owl, © Andy Harmer / Science Photo Library

Q7.....Source: Principal Examiner

Q8(b).....Image - a waterlogged corn crop, © photosbyjim / iStock / Thinkstock

Q9.....Table - the mass of carbon dioxide emission between 1990 and 2013 in the UK, © Crown Copyright. 2013 UK greenhouse gas emissions. Department of Energy & Climate Change, National Statistics

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For Examiner's use only	
Question Number	Marks
1	
2	
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Total Marks	
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Examiner Number

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