



Science lesson 5 – Answer sheet

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Sam is a dairy farmer with 100 cattle spread out in 20 fields. Each field is 10 acres in size. Sam's farm produces milk for a large supermarket chain. Sam does not grow crops on his land even when the cows are in sheds during the cold winter months. In the last few years, Sam has been losing money as the supermarket have told him that they have started to buy from farms that are promoting themselves as 'sustainable', 'green' and 'environmentally friendly'.

Sam needs to make changes to his business to survive. He has printed off the data from the milking parlour computer which informs him how many pints per day his cows produce on average during the months of the year. Sam also asked for his costs versus profit information from his accountant and has researched some information on the internet. Sam has also emailed the National Farmers Collective for advice, and they have sent him a reply.

You are a business consultant working for a large accountancy firm. Sam has approached your company for advice on how to improve his business. You need to produce a 5-step sustainability plan to report to the supermarket. The report will potentially help save his farm from bankruptcy. Use all of the information provided on this worksheet to make notes in each of the sections of Sam's 5-stage plan. You will be feeding back later in the lesson.

You may want to think about:

1. What are the problems Sam is facing on his farm?
2. Should he grow crops?
3. Should he keep the cattle?
4. Should he do anything with his land in the winter when the cows are in the shed?
5. What could he say to the supermarket to show he is becoming more sustainable?
6. How carbon dioxide and methane levels are connected to his farm.
7. How he can reduce costs and so increase profit.

8. How do plants affect the concentration of carbon dioxide in the atmosphere?

5-step sustainability plan notes

Each group could feedback 1 suggestion for one part of the plan.

- | | |
|---|---|
| 1-What are Sam's problems? | <ul style="list-style-type: none"> a) Graph 5 shows the farm has been losing money since 1990 as costs are higher than profits. b) The supermarket he sells to have started to buy from more sustainable farms. c) Sam only has cattle on the farm- they produce methane which is a greenhouse gas - so is not sustainable. Graph 2 shows how methane production from cattle has increased. d) He has lots of fields with only cows, so he has no other source of income apart from milk sales. e) Money is spent in the spring on fertiliser for the grass, so the cows have food when they come out for the summer. f) Graph 4 shows that milk yield during the winter is lower than the summer so he makes less money. g) Yield of milk (amount made per cow) decreases in winter also, so he has less to sell (graph 4). |
| 2-Identify solutions | <ul style="list-style-type: none"> a) NFC email point 4) said the recommended number of cows per acre is 1. His cows are spread out over all his fields. He has 10 x 20 fields = 200 acres. He has 100 cows so if he puts 10 cows per field in 10 fields - he has room for his 100 cattle (10x10=100). This means he will still have 100 acres of land on which he could grow crops. 200 acres in total -100 for cows. b) Graph 4 shows less milk is produced in winter when cows are in the shed as it is cold. NFC email point 5) said he could do green cover - which uses less fertiliser and protects soil so he needs to spend less on fertiliser in the spring. c) Green cover also produced food that he can sell for extra money. d) Green sheds save money as they heat the cow sheds during the winter, so they produce more milk. |
| 3-Explain how Sam could implement the solutions you | <ul style="list-style-type: none"> a) Get free seeds for green cover from the government's Sustainable Farming Incentive plant this winter. b) Apply for 'funding for farmers' incentive point 1) on email. c) Use fields freed up to plant other crops e.g., wheat. |

have identified
(what should he
do?)

d) Re-plant trees and hedges (agroforestry (point 2 on email)).

4-Explain to Sam
why it is
improving
sustainability

- a) More trees etc. increases biodiversity.
- b) Green cover protects soil and reduces the need for artificial fertiliser.
- c) More plants mean more carbon dioxide removed from the atmosphere.
- d) Green sheds reduce the amount of methane from the farm in winter.

5-Measure
progress (how
will you measure
this?) and review

- a) Milk production will increase in winter months.
- b) The quality of soil will improve- Sam could test it before his plan starts and then 6 months after, so he can see if the quality has improved.
- c) Less methane will be released.
- d) Profit vs costs will improve so Sam will start making money again.
- e) He can get another report from his accountant to compare with the one he has now in 12 months.

National Farmers Collective email reply

Dear Sam,

We are sorry to hear that you are struggling with the farm. Please consider the following when you think about making changes:

1. The department of environment are offering money incentives to farms through the government's 'funding for farmers' scheme - where farmers can show they are trying to be more sustainable.
2. It is useful to increase the number of hedges and trees as this creates spaces for other animals e.g., birds and insets to live and therefore increases biodiversity. This is called agroforestry.
3. If you decide to grow crops, crop rotation (where the same crop is not grown in the same field each year) is a way of keeping the soil fertile, so it reduces fertiliser costs.
4. The recommended number of cattle is 1 cow per acre. It might be worth looking at how many cows you have per acre to see if you can free any land up for crops.
5. Have you heard of green cover? This is where you plant crops that grow in the winter which covers the soil and protects it. Examples include winter peas and beans and cabbage. Free seeds are available for this Under the Sustainable Farming Incentive. They are a great way of improving the soil and producing food.
6. Green sheds will soon be available that extract methane from the sheds the cows are kept in during the winter. The methane does not go into the air but is used to heat the shed - keeping the animals warm and so more energy goes into milk production.

Feel free to contact us again if you need any more advice.

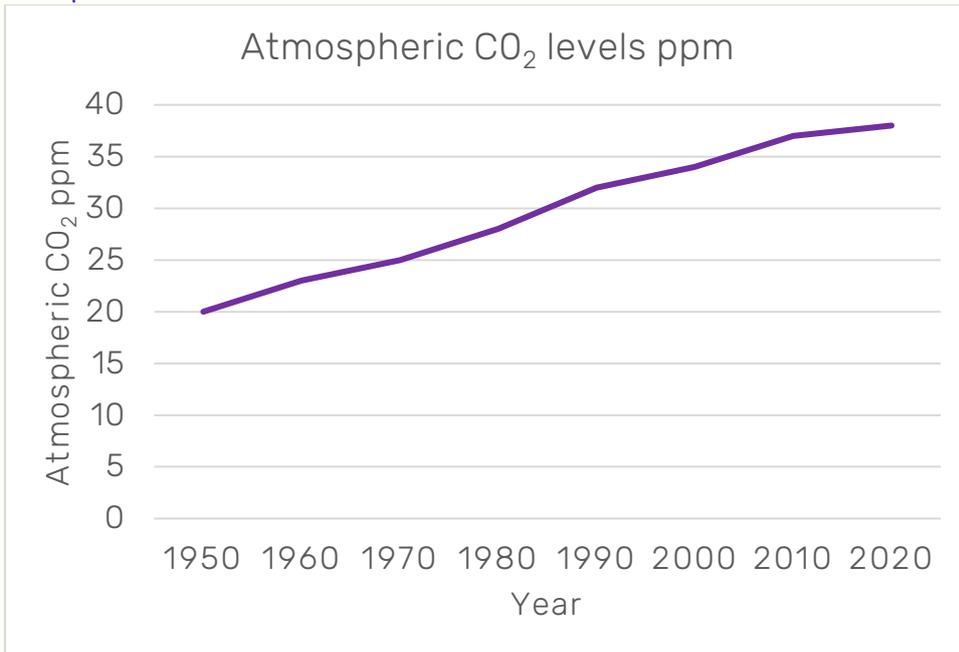
Wishing you luck in your endeavours.

Best wishes,
NFC

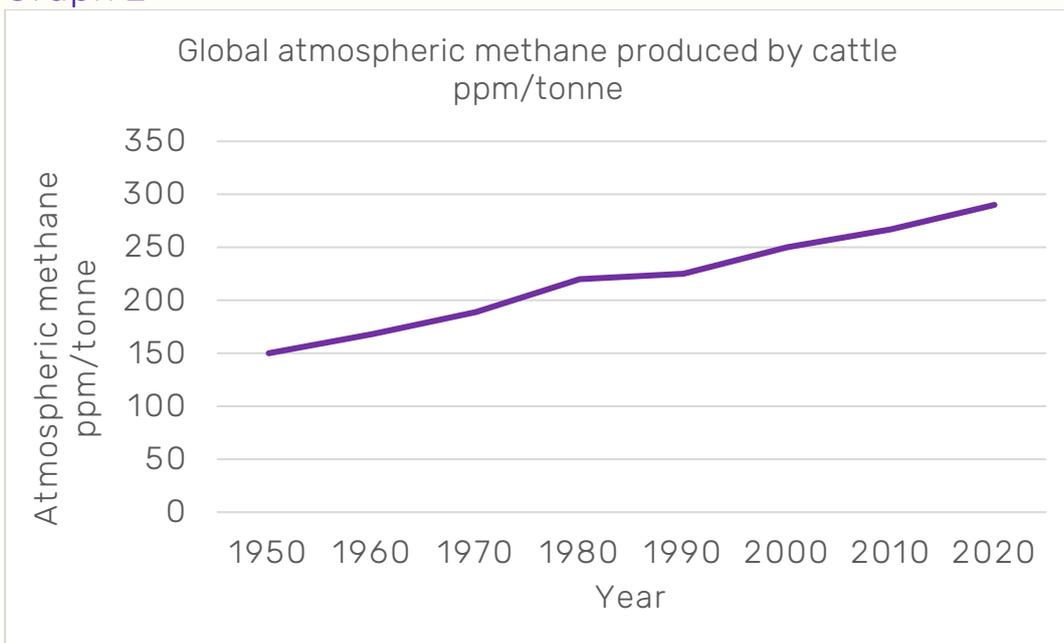
Sam's researched data from the internet

Sam researched carbon dioxide and methane levels data because he knows they are both greenhouse gases that are contributing to global warming.

Graph 1



Graph 2

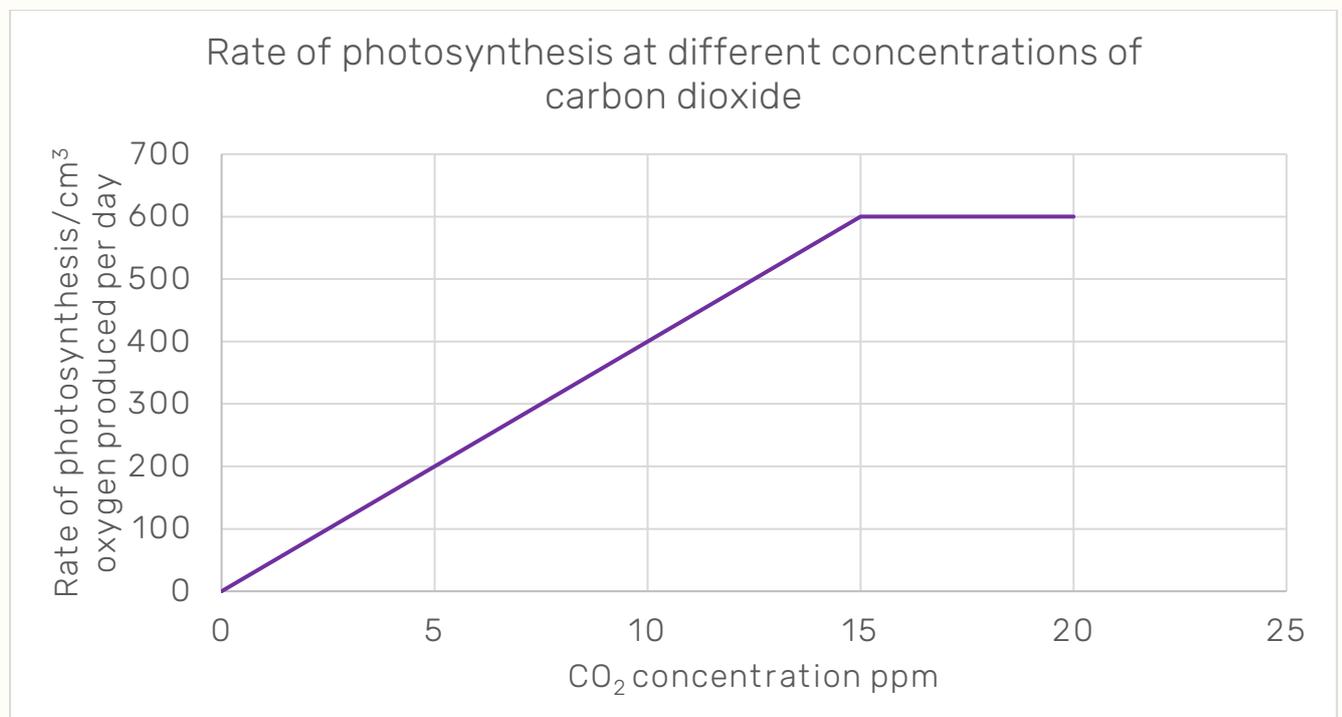


Further findings

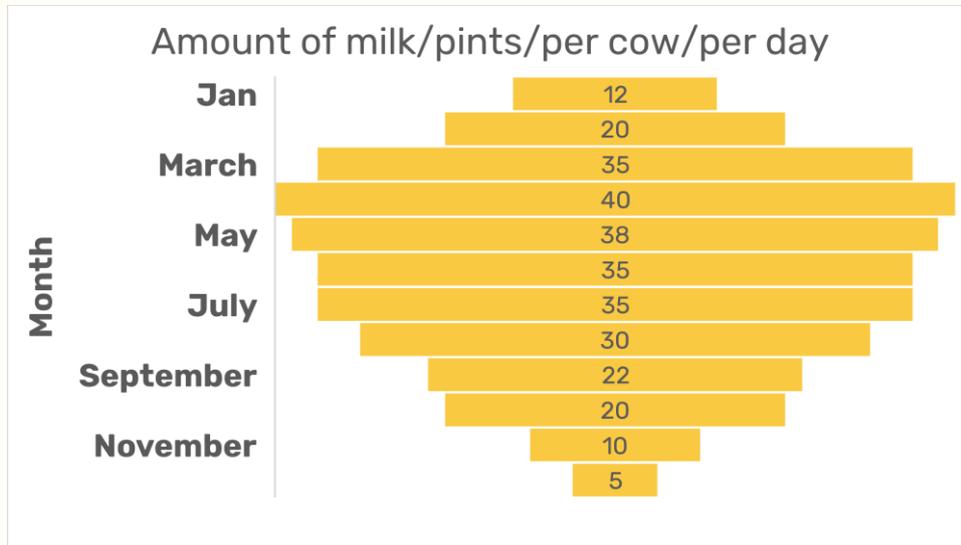
Sam found a graph on the internet about the impact of increased carbon dioxide, which makes plants photosynthesise faster, up to a point. He then researched photosynthesis and found out the information below.

Photosynthesis is how plants make food for themselves so they can grow. The food they make is glucose, a type of sugar but at the same time they make oxygen which they release into the atmosphere. To do this, they need carbon dioxide from the air, water from the soil, sunlight and chlorophyll which a green chemical found in the leaves. If one of these is missing or in short supply, photosynthesis will slow down. Carbon dioxide is a greenhouse gas.

Graph 3



Graph 4



Graph 5 – Data from Sam’s accountant

