

GCSE Combined Science: Trilogy

Worksheet: The carbon footprint and its reduction

TIME 30 min	TOTAL 28 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
-----------------------	--------------------------	------------------------------	-----------------------------------

Topics: The carbon footprint and its reduction

NAME	CLASS	DATE
-------------	--------------	-------------

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

0 1 . 1

Which action would most directly reduce a household's carbon footprint from home heating?

Tick (✓) **one** box.

Turning the thermostat up

☐

Installing loft and wall insulation

☐

Leaving windows open in winter

☐

Using more electrical appliances

☐

[1 mark]

0 1 . 2

Give **one** example of 'carbon offsetting'.

.....

.....

[1 mark]

0 2

0 2 . 1

What is meant by the carbon footprint of a product?

.....

.....

[1 mark]

0 2 . 2

Give **two** ways of reducing emissions of carbon dioxide.

.....

.....

.....

.....

[2 marks]

0 2 . 3

Which action would reduce emissions of methane?

Tick (✓) **one** box.

Building more landfill sites

☐

Driving electric cars

☐

Eating less meat from cattle

☐

Using more fertiliser

☐

[1 mark]

0 3

Table 1 shows the carbon footprint for each passenger for every kilometre travelled by different types of transport.

Table 1

Type of transport	Carbon footprint per passenger per km in kg of carbon dioxide equivalent
Car with one person	0.17
Bus	0.10
Train	0.035
Aeroplane (short flight)	0.25

0 3 . 1

A student travels 400 km by train.

Calculate the carbon footprint of the journey.

.....

.....

.....

Carbon footprint = kg

[1 mark]

0 3 . 2

Calculate how much larger the carbon footprint would be if the student made the same journey alone by car.

.....

.....

.....

.....

Difference = kg

[2 marks]

0 3 . 3

Suggest why the carbon footprint per passenger for a car journey is much lower when four people share the car.

.....

.....

[1 mark]

0 3 . 4

Give **two** reasons why people may not choose the type of transport with the lowest carbon footprint.

.....

.....

.....

.....

[2 marks]

0 4

An airline advertises ‘carbon-neutral flights’ because it plants trees to offset the estimated emissions from each flight.

0 4 . 1

Evaluate whether this claim means the flights have no effect on climate change.

.....

.....

.....

.....

.....

.....

[3 marks]

0 5

A government plans to reduce its country's carbon footprint by building wind farms and introducing a carbon tax.

0 5 . 1

Explain how a carbon tax could reduce emissions of carbon dioxide.

[2 marks]

0 5 . 2

Explain how building wind farms could reduce the country's carbon footprint.

[1 mark]

0 5 . 3

Give **three** reasons why actions to reduce a country's carbon footprint may be limited.

[3 marks]

0 6

Table 2 shows the approximate carbon footprint of producing 1 kg of four foods.

Table 2

Food	Carbon footprint in kg CO ₂ e per kg of food
Beef	27
Cheese	11
Chicken	7
Lentils	0.9

0 6 . 1

A family replaces 2 kg of beef in their weekly shopping with 2 kg of lentils.
Calculate the reduction in carbon footprint from this single change.

.....

.....

.....

.....

Reduction = kg CO₂e

[2 marks]

0 6 . 2

Suggest one reason why beef has a much higher carbon footprint than lentils.

.....

.....

[1 mark]

0 7

A household's carbon footprint from its electricity use is currently 1800 kg CO₂e per year. Installing solar panels would reduce this electricity-related footprint by 70%, but manufacturing and installing the panels has a one-off carbon footprint of 950 kg CO₂e.

0 7 . 1

Calculate the reduction in carbon footprint from electricity use during the first year after installing the panels.

.....

.....

.....

Reduction = kg CO₂e

[1 mark]

0 7 . 2

Taking into account the one-off footprint of manufacturing the panels, calculate the overall change in the household's total carbon footprint in the first year.

.....

.....

.....

.....

Change = kg CO₂e

[2 marks]

0 7 . 3

Explain why the panels are likely to have a much greater overall benefit if considered over ten years rather than just the first year.

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: The carbon footprint and its reduction · 28 marks

Question 1 (2 marks)

01.1 [1 mark]

Correct: Installing loft and wall insulation

01.2 [1 mark]

- planting trees to absorb carbon dioxide, or paying into a scheme that funds renewable energy / emission-reduction projects, to compensate for your own emissions (1)
-

Question 2 (4 marks)

02.1 [1 mark]

- the total amount of carbon dioxide and other greenhouse gases emitted over the full life cycle of the product (1)
-

02.2 [2 marks]

- use alternative energy sources (e.g. wind, solar, nuclear) (1)
- energy conservation (e.g. insulating homes) (1)
- carbon capture and storage (1)
- carbon taxes / licences (1)
- carbon off-setting (e.g. planting trees) (1)

Any 2 of the points above.

02.3 [1 mark]

Correct: Eating less meat from cattle

Question 3 (6 marks)

03.1 [1 mark]

Answer: 14 kg

- 14 (kg) (1)

03.2 [2 marks]

Answer: 54 kg

- $\text{car} = 0.17 \times 400 = 68 \text{ (kg)}$ (1)
- $68 - 14 = 54 \text{ (kg)}$ (1)

Notes: Allow ECF from the previous part. An answer of 54 scores 2 marks.

03.3 [1 mark]

- the emissions from the car are shared between four people (each person's share is about a quarter) (1)

03.4 [2 marks]

- cost / economic reasons (1)
- convenience / lifestyle / time (1)
- lack of public information / education about carbon footprints (1)
- the lowest-carbon option may not be available for the journey (1)

Any 2 of the points above.

Question 4 (3 marks)

04.1 [3 marks]

- carbon dioxide is still released into the atmosphere immediately when the flight burns fuel, causing warming straight away (1)
 - the trees planted will take many years to grow and absorb an equivalent amount of carbon dioxide, so there is a delay before any offsetting happens, if the trees survive that long (1)
 - 'carbon-neutral' does not mean 'no emissions'; it means emissions are balanced elsewhere, so the claim can be misleading if it suggests flying has no climate impact (1)
-

Question 5 (6 marks)

05.1 [2 marks]

- companies / people pay tax for the carbon dioxide they emit (or for fossil fuels they use) (1)
 - so they are encouraged to use less fossil fuel / switch to low-carbon energy sources (1)
-

05.2 [1 mark]

- electricity is generated without burning fossil fuels, so less carbon dioxide is emitted (1)
-

05.3 [3 marks]

- scientific disagreement over the causes and consequences of global climate change (1)
- lack of public information and education (1)
- people are unwilling to change their lifestyles (1)
- economic considerations / cost (e.g. of new technology, effects on jobs) (1)
- incomplete international cooperation (other countries may not reduce their emissions) (1)

Any 3 of the points above.

Question 6 (3 marks)

06.1 [2 marks]

Answer: 52.2 kg CO₂e

- $2 \times (27 - 0.9)$ (1)
 - 52.2 (kg CO₂e) (1)
-

06.2 [1 mark]

- cattle produce methane (a greenhouse gas) during digestion, and growing feed and managing pastureland for cattle adds further emissions, whereas growing lentils does not involve keeping livestock (1)
-

Question 7 (4 marks)

07.1 [1 mark]

Answer: 1260 kg CO₂e

- $(0.70 \times 1800 =) 1260$ (kg CO₂e) (1)

07.2 [2 marks]

Answer: a reduction of 310 kg CO₂e

- $1260 - 950$ (1)
- a reduction of 310 (kg CO₂e) in the first year (1)

Notes: Allow ECF from the previous part.

07.3 [1 mark]

- the one-off manufacturing footprint (950 kg) is only 'paid back' once, but the 1260 kg saving happens every year, so over ten years the saving far outweighs the one-off cost (1)
-