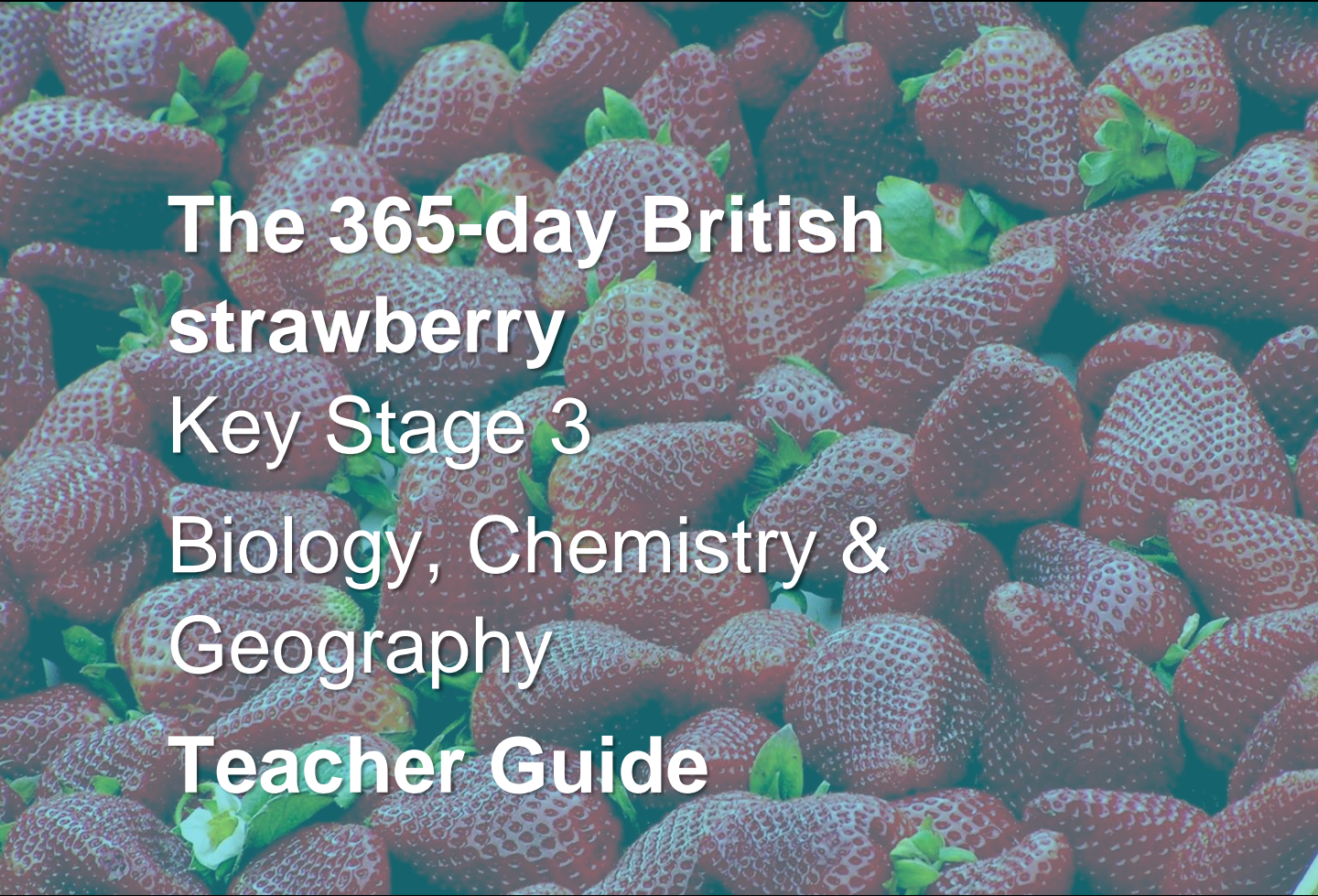


Research-Based Curricula



The 365-day British strawberry Key Stage 3 Biology, Chemistry & Geography Teacher Guide

2022

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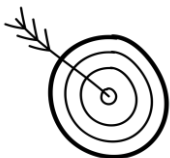
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For Teachers

RBC Guide

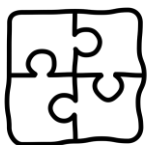
Learner Aims



The Research-Based Curriculum is resources based on cutting-edge research, tailored for KS3, KS4 or KS5. The resources:

- *Support student attainment and progression*
- *Promote intellectual curiosity in students of all prior attainment*
- *Build understanding for more accessible 'stretch' beyond the curriculum*
- *Develop core academic skills that aid progression, including critical thinking, metacognition, and written and verbal communication*
- *Encourage students to see these subjects as engaging, worthwhile and inspiring for continued study*

Content



The RBC packs contain four chapters (resources) suitable for Key stage 3 study. The resources span a range of exciting and interdisciplinary topics related to STEM (Science, Technology, Engineering and Maths), Social Sciences or Arts & Humanities. Each pack includes roughly 6 hours of teaching and practical, student-led activity content.

Each RBC pack contains 1) Four resources that function as subject 'lessons'; 2) Activities at the end of each resource for students to test their learning; 3) Further Reading links related to the subject; 4) Final Reflection Activity as the final assignment; and 5) Teacher Guide and model activity answers (this document).

For Teachers

Using RBC packs

Suggested School Use



Teachers can use these resources flexibly. Students can complete the resources individually or in groups, in or out of the classroom. These packs help teachers:

- *Use research-based learning to engage whole classes, not just as a 'stretch' for the most able*
- *Support more students earlier in high academic achievement*
- *Improve all-school enrichment strategies by providing opportunities and resources*
- *Increase motivation and subject interest*

To do this, we encourage the 'supported use' approach. In other words, teachers provide some guidance and support to students in their independent use of the RBC packs.

Delivery Options



To ensure all students can benefit from these materials, we recommend they are delivered with 'supported use.'

Supported Use means this resource is designed to be used partially with teacher introduction or instruction. While not marked, each chapter and the final reflection activity are set up so a teacher can help ease the students into the subject area or use the resource in class.

More ideas for using these packs in your school:

1. Research Challenge

The resources can ignite curiosity about new topics and encourage independent research. Schools could hold a research challenge across a class or year group to submit a work based on the resources. Pupils could submit individually or in small groups, with a final celebration event.

For Teachers

Using RBC packs

Delivery Options [cont.]



2. “STEM”, “Social Sciences” or “Arts & Humanities” Morning/ Day

We know class time can be tight, so some schools ‘launch’ these packs and have students start them as part of a special subject day. This can be great for all-staff engagement too.

3. After School Club

The resources can be completed in small groups (4-8 pupils) across weekly lunch clubs or after-school clubs. Groups can reflect on their learning by presenting a talk or poster on the subject matter at the end of the course.

4. Classroom Debate/ Discussion if a written Final Reflection Activity isn’t possible

Resource packs can function as ‘transition’ projects over the summer, serving as an introduction to the next level of study between KS3 and KS4, or KS4 and KS5. Students could present their reflections on the experience in a journal.

Origin and Evaluation



The RBC programme builds on the University Learning in Schools programme (ULiS), which was successfully delivered and evaluated through the London Schools Excellence Fund in 2015. The project was designed in a collaboration between Achievement for All and The Brilliant Club, the latter of which is the sister organisation of AccessEd. ULiS resulted in the design and dissemination of 15 schemes of work based on PhD research for teachers and pupils at Key Stage 3.

LKMCo evaluated the project. Overall, pupils made higher-than-expected progress and felt more engaged with the subject content.

For Teachers

Why RBCs and EAL support

Target Pupils



Using an RBC coursebook to provide EAL support benefits your school and the individual students.

1. Increased academic achievement

When students feel supported and are helped to understand and use the language of topics that support their curriculum learning, they are more likely to achieve at the expected level (or above). EAL students with appropriate support often do well alongside monolingual students in school due to their perseverance and higher-level abstract thinking skills from speaking more than one language.

2. Higher self-esteem

A consequence of feeling supported and properly included in lessons is higher self-esteem and self-confidence for the student.

3. Helping to eliminate inequality

RBC coursebooks support teachers in tackling achievement gaps and building life chances. EAL resources which support classroom learning help students to have equal opportunities and achieve well.

4. Stronger learning environments

Bilingual and multilingual students often have strong working memories and attention spans (see Adescope, Lavin, & Thompson, 2010). This helps build a robust learning environment and encouragement amongst the rest of the class. Students in diverse groups have an enhanced ability to think creatively and to use higher-order cognitive thinking skills.

For Teachers

Why RBCs and EAL support

Target Pupils [cont.]



5. Different perspectives

Students with different language skills bring diverse cultural experiences to the classroom, supporting all students to understand other perspectives better. Additional learning resources can help all students feel valued in the classroom, with diversity of all kinds being celebrated.

Meeting the needs of EAL learners



Various strategies can be used to meet the differing needs of EAL learners and help them achieve at and above age-related expectations. Below are some suggestions on how to use these packs with EAL learners.

1. Classroom organisation

- Place EAL learners in pairs or groups with supporting pupils who are language role models. This is important for developing language and understanding new subject-related words.
- Make available and encourage learners to use age-appropriate bilingual and English dictionaries and thesauruses for clear definitions, pronunciation, and translation.

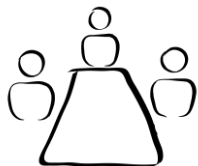
2. Differentiation

- Repeatedly check understanding of the topic, learning aims and objectives and what to do in a task.
- Provide learners with subject-specific vocabulary and structures, and check understanding of the language involved in carrying out activities.

For Teachers

Why RBCs and EAL support

Meeting the needs of EAL learners [cont.]



- Provide learners with instructions they are likely to encounter in their subject and ask them to translate them into their language. For example, common instructions in Science could include: what do we want to find out, what equipment do we need, how can we show our results, what is the conclusion, etc.
- Encourage EAL learners to research new words and create their vocabulary lists using the bilingual word list templates provided for each chapter in the Student packs.
- Provide model answers, gap-fills, or speaking and writing frames for students to complete with or without word banks for extra support.

Support and stretch responses



Look out for stickers throughout this coursebook which indicate different model answer responses to cater for varied student levels and attainment. These include:

- **Support** – Responses and techniques for students who might require further support.
- **Stretch** – Responses and techniques for students to be further challenged and stretched in the activities they do and responses that they give.

Tips for delivering activities and model answers



Throughout this coursebook, you will see stickers with ‘tips’ for engaging students and strategies to support them in answering questions and completing activities. Stickers include:

- **Use visual aids** - Visual learning can be helpful for EAL students struggling to process the spoken language. Use labelled images and videos to illustrate the answers, so everyone understands the references.

For Teachers

Why RBCs and EAL support

**Tips for delivering
activities and model
answers
[cont.]**



- **Try as group work** - Group work can increase student engagement and allow EAL learners to practice speaking in a less intimidating context. This will enable learners to learn from one another.
- **Students use their first language** – Using first language can be a valuable foundation to build on – it allows students to compare words and sentence structures and understand more quickly. Particularly with new subject content, this can help students relax and engage with concepts at a higher level.
- **Give additional thinking time** – Allow extra time or space for processing new or more complex topics where required.

Try as group
work

Use visual
aids

Students use
their first
language

Give
additional
thinking time

Further resources



Questions

For more resources, visit:

- https://www.learningvillage.net/more_info
- <https://www.bell-foundation.org.uk/>

For more information, contact: hello@access-ed.ngo.

Resource One

Model Answers

Try as group work

- Answers**
- A – **Pistil**

B – **Stigma**

C – **Style**

D – **Ovary**

E – **Stamen**

F – **Anther**

G – **Filament**

H – **Ovule**

I – **Sepal**

J – **Stem**

K – **Petal**

L – **Receptacle**

Give additional thinking time

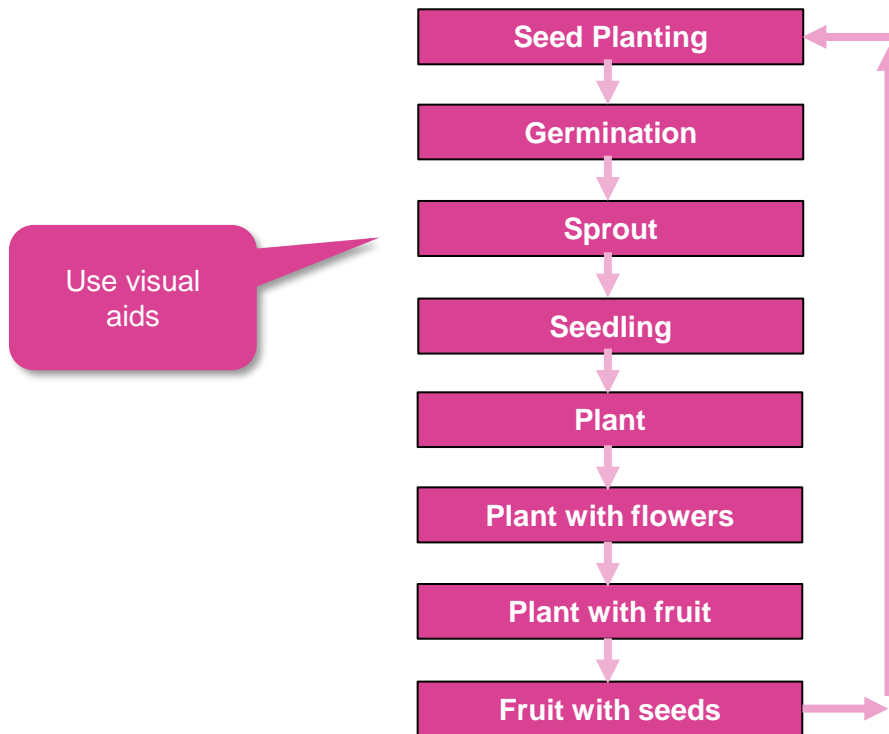
2. See the plant structure and function table below:

Structure	Function
Filament	Protects the unopened flower.
Style	Holds up the anther.
Sepal	May be brightly coloured to attract insects.
Ovule	Female gamete containing the egg cells.
Ovary	Top of the female part of the flower, which collects pollen grains.
Anther	Allows the pollen to travel from the stigma to the ovary for fertilisation.
Petal	Produces the female sex cells.
Stigma	Produces the male sex cells.

Resource One

Model Answers

Answers 3. See the life cycle flow diagram below:



Use visual aids

Give additional thinking time



4. Asexual reproduction refers to the formation of daughter plants genetically identical to single-parent plants (clones). This process does not require flowers since no gamete fusion is involved. The two structures that can facilitate asexual reproduction in strawberries are branch crowns and runners.

To support students when answering Question 4, encourage them to refer to the stages of asexual reproduction, budding, fragmentation, vegetative propagation and spore formation in their response.

5. Male gametes in plants are called pollen whilst female gametes in plants are called ovules

Resource One

Model Answers

Answers 6. See examples answers below:

Students use
their first
language

- Self-pollination is where pollen transfer occurs on one plant, whereas cross-pollination involves pollen transfer between two plants.
- Self-pollination is where pollen is transferred from the anther to the stigma of the same or a different flower on the same plant. On the other hand, cross-pollination involves two different plants of the same species and is where pollen is transferred from the anther of one flower on a plant to the stigma of a flower on the second plant.

7. Wind and insect pollination.

8. Strawberry growers add beehives to their strawberry crop to facilitate insect pollination since cross-pollination produces higher quality fruit and stronger plants.



Stretch answers may include a reference to increased hybrid vigour.

Resource **Two**

Model Answers

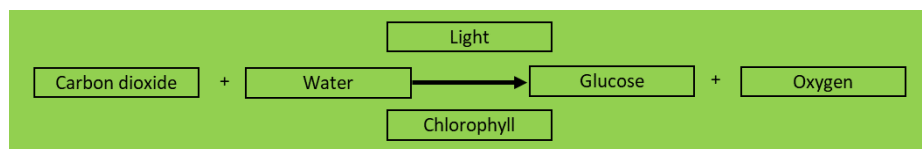
Answers



1. Photosynthesis is the process by which plants, algae and some bacteria produce oxygen and glucose. It occurs in the leaves of plants where chlorophyll absorbs light energy allowing carbon dioxide from the atmosphere and water from the roots to be converted into photosynthetic products.

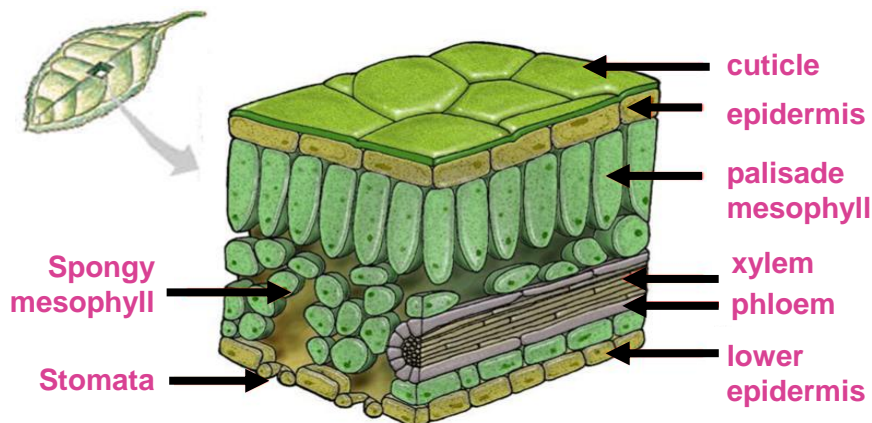
Stretch answers may include the following:

- Glucose is an essential food source for these organisms and can be converted to other compounds. For example, starch for energy storage.
 - Photosynthesis is essential for producing oxygen, allowing animals to respire, and maintaining the Earth's atmosphere's CO₂/ O₂ balance.
 - Factors affecting photosynthetic rate including light, CO₂ and temperature.
2. See the photosynthesis equation below:



3. See the plant leaf below:

Try as group work



Resource **Two**

Model Answers

Answers

4. Stomata are small pores (holes) in the epidermis (on the surface) of a leaf which control gas exchange and water loss in the leaves. Stomata allow carbon dioxide to diffuse into a leaf and oxygen to diffuse out into the atmosphere when they are open, often during the day.



Stretch answers may include the following:

- Mechanism of opening and closing by the action of guard cells based on water/ osmotic pressure.
- Role in transpiration.
- More are found on the lower epidermis/ leaf surface to control water loss.

Try as group work

5. See the plant nutrients and function table below:

Plant nutrient	Function
Nitrogen (N)	Energy metabolism and makes up part of chlorophyll.
Sulphur (S)	Energy metabolism and carbohydrate transport and forms part of the cell membrane and roots.
Phosphorus (P)	Active transport and enzyme activity and helps to maintain water balance inside plants.
Calcium (Ca)	Contributes to the cell wall, mitochondria and nucleus.
Potassium (K)	Formation of proteins and nucleic acids.
Magnesium (Mg)	Enzyme activity and makes up part of amino acids.

Resource **Two**

Model Answers

Answers 6. See mineral deficiencies below:



Ca



N



Mg

7. Strawberry growers need to be able to recognise mineral deficiencies as if untreated, they could result in reduced strawberry yields and quality and potential loss/ death of plants in severe cases. The sooner the signs of deficiencies are noticed, the sooner a grower can correct this by altering the ingredients in their strawberry feed to help the plants to meet their required mineral levels.
8. Macronutrient uptake in strawberries:
- 1 – Magnesium (Mg)
 - 2 – Flowering
 - 3 – Potassium (K)

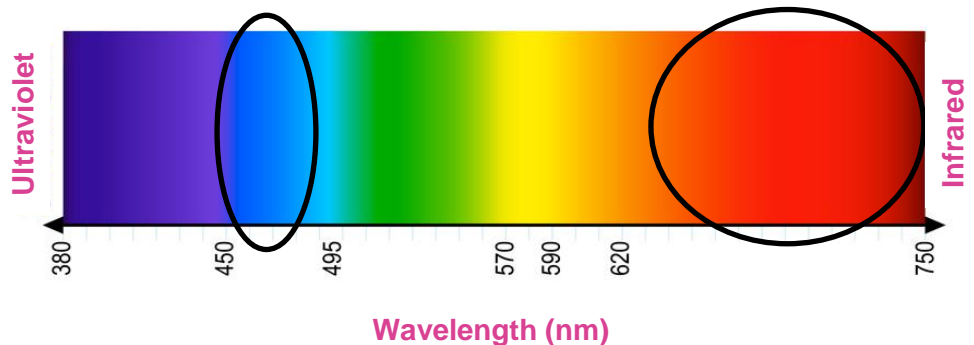
Resource **Three**

Model Answers

Answers

1. Light, photoperiod, temperature and CO₂.
2. It is important that commercial strawberry growers understand how strawberry plants respond to different environmental conditions to predict their fruit yields accurately. This helps improve relationships with supermarkets and consumers, ensuring a more consistent and reliable supply. This also leads to further benefits of improved pricing and reduced wastage.
3. See the light spectrum graph below:

Give additional thinking time



4. Refer to the LED Light Graph.

Try as group work

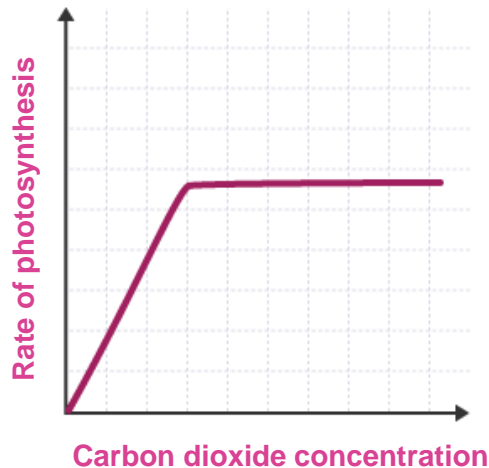
- 1 - Dependent variable - Fruit yield (g/plant⁻¹); Independent variable - Light wavelength (type of LED light).
- 2 - Blue and Red.
5. 1 – True
2 – False
3 – True

Resource Three

Model Answers

Answers

6. The optimum temperature for strawberry plant growth **changes** depending on the plant growth stage. Generally, **warmer** temperatures increase leaf growth, whereas **cooler** temperatures are needed for fruit production. Strawberry plants exposed to higher temperatures during fruiting tend to produce **less** uniformly shaped and **smaller** fruit.
7. Effect of CO₂ on the rate of photosynthesis



8. Any two of the following are correct:
- Use a polytunnel/ glasshouse.
 - Artificial heating during early stages of plant growth.
 - Cooling/ venting systems during later plant growth stages.
 - Increase light levels during flowering and fruiting through artificial/ supplementary lighting.
 - Use artificial/ supplementary lights emitting blue and red light. As an example, LEDs.
 - Add CO₂ into a polytunnel/ glasshouse to raise the concentration above atmospheric levels.

Resource **Four**

Model Answers

- Answers**
1. Food security is when there is enough safe, **nutritious** and **healthy** food **available** and **accessible** to all people within a **population** both nationally and globally. The available food should be produced **sustainably** enabling a continuous supply without concerns over shortages of healthy food that can meet people’s needs to maintain healthy and active lifestyles.
 2. The development of glasshouses has allowed for the strawberry season to be extended for it has allowed other technological developments to be used in strawberry growing. This includes LED lighting to increase light levels, photoperiod extension lighting to increase daylight duration and artificial heating systems to increase the temperature during the winter and addition of supplementary CO₂.
 3. See the advantages and disadvantages table below:

Try as group work

Advantages	Disadvantages
Protection from weather and changing climate.	Higher initial costs.
Uniform, controlled environment helps to improve yield prediction.	Higher running cost. For example, lighting, heating and CO ₂ .
Protection from some pests and diseases.	Greenhouse gas emissions from fossil fuel burning contribute to global climate change.
Out-of-season production.	May create ideal conditions for some pests and diseases to thrive, such as increased humidity levels.
Higher yields.	
Improved fruit quality.	
Potential to grow more plants in a tiered system.	

Resource Four

Model Answers

Answers

4. Answers could state any of the reasons in the table below to justify whether a grower should or should not add CO₂ to their strawberry crop.



Stretch answers may include reasons for both for and against adding CO₂ before reaching a justified conclusion.

For CO ₂	Against CO ₂
Increase photosynthesis which could increase yields and fruit quality.	Fossil fuel burning contributes to global climate change.
Could help plants to flower and yield fruit earlier.	May not increase photosynthesis/ fruit yield if there are other limiting factors.
Additional heat provided from gas burners reduces the need for additional heating in Winter.	Expensive to set up and maintain.
Reduce water loss and improve water use efficiency, reducing irrigation requirements.	Potential toxicity to plants and humans if levels are too high.

Students use their first language

5. Strawberries are a low-**calorie**, healthy food containing mainly water and carbohydrates in the form of simple sugars. For example, **glucose**, fructose and sucrose and fibre. Fibre is important for helping to maintain stable blood **sugar** levels. Strawberries are rich in vitamins, including vitamins C and B9 and **minerals**, such as potassium and manganese. Vitamin C promotes healthy **immune** function and skin health whilst vitamin B9 is essential for normal **tissue** growth and cell function.

Resource **Four**

Model Answers

Answers

6. Any **three** of the following are correct:

- Anti-inflammatory
- Reduced cancer risk
- Reduced risk of heart disease
- Reduced stroke risk
- Reduced bad cholesterol
- Reduced blood pressure
- Reduced risk of type 2 diabetes
- Better immune system
- Improved eye health
- Increased control of blood sugars
- Fight bad cholesterol

Give additional thinking time

7. Buying local, sustainable produce has many individual, national and global benefits. For you as a consumer, it can be healthier because local produce can be picked at the peak time of ripeness, whereas imported food is picked early so that it can be preserved during transportation which results in a loss of nutrients. For this reason, local produce also tends to be tastier. On a national scale, buying local can help food security, UK self-sufficiency and employment opportunities. Globally, local production reduces food miles which could help reverse the current climate change crisis.



Support answers may bullet point a few reasons why buying local produce is important.



Stretch answers may involve writing ideas in well-structured paragraphs that persuade the reader to buy local produce.

8. Examples of human activities include:

- Burning fossil fuels
- Factories
- Transport
- Deforestation
- Heating and lighting homes

Final Reflection Activity

Further Guidance

Individual activity



Support responses should address most of the critical points in the criteria (outlined below) about the chosen fresh produce. It might be presented more as a fact sheet if the design hasn't been considered.

- Plant classification – family, genus and species name
- Origin – native country where its currently grown in the UK and when (if it is) and countries where it is now produced all year round (if any)
- Statistics – could be any relevant data. For example, changes in production/ consumption, supply/ demand, imports/ exports over time
- Methods of plant reproduction (ideally with a labelled diagram)
- Benefits of year-round production



Stretch responses may include all of the relevant information above and are presented in a more traditional poster format with thought and consideration given to design and layout using colour, bullet points, diagrams, graphs, etc. In addition, stretch responses may also show more critical thought in the information included.

- For example, specific benefits of a particular fresh produce being grown year-round rather than just general points taken from the strawberry case study example given in this course.



Final Reflection Activity

Further Guidance

Group activity

1. Suggestions might include some of the following:

- Use of glasshouses/ polytunnels
- LED lighting
- Heating and cooling/ venting systems
- Photoperiod lighting

2 & 3. Ideas might include some of the following, but it is quite open to discussion – encourage the students to justify their ideas.

	Growers	Supermarkets	Consumers
Question 2	Ability to generate an income over a longer period.	Potential increased profits from being able to sell products for a longer period of time.	Increased nutritional value of fresh food.
	Build up a good reputation as it can fulfil consumer demands.	Build a good reputation for supplying local British produce to consumers.	Unlimited access to favourite fresh tools.
		Reduced food miles.	Health benefits – fewer diseases related to malnourishment.
Question 3	Small growers might lose out to larger growers who can afford to invest in new technologies to enable year-round production.	Increased prices of fresh produce could be unpopular with consumers. This, in turn, could discourage people from shopping there.	Fresh produce being less of a treat if it's always available.
	Increased costs of production during out-of-season production time. For example, heating and lighting.		Increased food prices.
	Increased carbon footprint from glasshouse heating, lighting, etc.		



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