

FOOD, FUEL AND THE HUMAN BODY



Introduction

This lesson refers to three core KS3 Science content areas: the seven nutrient groups and their biological functions, calculations of energy requirements in a healthy daily diet and lastly, it touches on the consequences of imbalances in the diet. Plant-based nutrition provides a real-world context for students to apply to their learning. They build scientific knowledge through teacher input and paired investigation and then construct their own argument in a misconception clinic that asks them to evaluate common claims against evidence.

Developed by The Vegan Society, this lesson is part of a wider World Vegan Day resource pack including a further KS3 Science lesson. The British Dietetic Association supports the position that a well-planned plant-based diet can meet all human nutritional requirements at any age.

Relevant Links

Nutrients – [The Vegan Society](#)

[Nutrition and Health: Life stages] 11–18-year-olds – [The Vegan Society](#)

Teen Hub – [The Vegan Society](#)

Eat well: Information and guidance about eating a healthy, balanced diet – [NHS](#)

Vegan and Thriving Campaign – [The Vegan Society](#)

Play Fair with Plant Milk – [The Vegan Society](#)

Fuelling an active lifestyle – [The Vegan Society](#)

Vitamin B12 – [The Vegan Society](#)

Pregnancy and breastfeeding – [The Vegan Society](#)

Nutrition sorted – [The Vegan Society's YouTube channel](#)

LESSON OVERVIEW

Timing

60 minutes

Setting

classroom

National Curriculum – KS3 Science

Nutrition and Digestion:

- “Content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed”
- “Calculations of energy requirements in a healthy daily diet”
- “The consequences of imbalances in the diet, including obesity, starvation and deficiency diseases”

Working Scientifically:

- “Apply mathematical concepts and calculate results”
- “Present reasoned explanations including relating data to predictions and hypotheses”

What you'll need

Nutrient matching sheet; student worksheet.

Additional resources

Exercise book, pens, glue, scissors, calculator, screen/IWB for slides.

Before the lesson

- Print nutrient matching sheet and cut in half (two to a page) – one half per student
- Print student worksheet – one per student
- Print support writing frames – print as required for the class
- Ensure access to scissors and glue
- Open slide deck



Learning Objectives

1. Identify the seven nutrient groups and describe their primary biological functions.
2. Use data to calculate and evaluate whether a diet meets daily energy and nutrient requirements.
3. Use scientific evidence to assess common claims about plant-based nutrition.

Starter – Claims and instinctive verdicts (8 minutes)

Part 1: Essential nutrients

- I do – Seven nutrient groups (6 minutes)
- We do – Cut and stick matching activity (10 minutes)

Part 2: Food energy

- I do – Kilojoule and respiration (5 minutes)
- We do – Energy calculations and food menu (14 minutes)

Part 3: Misconception clinic

- We do – Cloze word task (5 minutes)
- You do – Scientific response (6 minutes)

Plenary – If this is the answer... (6 minutes)

THE LESSON

Timings are a guide – adjust to suit your class.

Slide 1 – Title page

Slide 2 – Learning objectives and key terms

Starter - [8 minutes]

Resources: Mini whiteboards or scrap paper

Slide 3

The activity

- There are four claims about plant-based nutrition displayed on the screen.
- Students read each one and write their instinctive verdict in their exercise book – true, false or not sure, and one sentence explaining their response. The misconceptions are visited throughout the lesson using scientific explanation and reasoning.
- Students are working independently and silently.

Potential script

- On the board, there are four claims about plant-based nutrition. I want you to read each one and write your verdict in your exercise book – true, false, or not sure, and one sentence explaining why you think that. Don't discuss with anyone yet, just go with your instinct.
- [After 4 minutes] Don't worry if you weren't sure about some of those because by the end of this lesson, you're going to have the science to give a proper verdict on every single one.

Part 1 – Essential nutrients

I do – 6 minutes

Slide 4

The activity [6 minutes]

- This is a short, teacher-led segment covering the key biological framework of the lesson: the seven essential nutrients, including what they do chemically and their primary biological function.
- Include reference to the key term (absorption) during the explanation about minerals/vitamins.
- Students are actively listening in preparation for a matching task which follows straight afterwards.

Potential script

- Before we can evaluate any claims about nutrition, we need to know our science. I'm going to give you a quick overview of the seven nutrient groups and what they actually do inside your body. Listen carefully because after I've introduced them to you, you'll work in pairs to match the nutrients to their biological function.
- Introducing absorption – the process by which nutrients are taken up from food into the bloodstream is called absorption. Absorption rates vary between different forms of the same nutrient and this variation matters scientifically. For example, eating a food that contains iron doesn't automatically mean your body takes all of it up; for the highest absorption rate, our body needs vitamin C at the same time to help it.

Cover each row of the table during your explanation:

Nutrient	What is it?	Primary biological function
Carbohydrates	Sugars and starches	Primary energy source for cells.
Lipids (fats and oils)	Fatty acid chains	Energy store; cell membrane structure; absorption of fat-soluble vitamins.
Proteins	Chains of amino acids	Growth, repair and maintenance of body tissues; enzyme production.
Vitamins	Organic compounds	Regulate biological processes including immune function, bone development and nerve function.
Minerals	Inorganic elements	Iron for oxygen transport in blood; calcium for bone and muscle function. Include reference to key term: absorption.
Dietary fibre	Indigestible plant material	Supports digestive function; feeds beneficial gut bacteria.
Water	Molecule H ₂ O	Solvent for all biochemical reactions; temperature regulation; nutrient transport.

We do – 10 minutes

Resources: nutrient matching sheet (one half per student), scissors, glue.

Slide 4-5

The activity [10 minutes]

- After listening to the explanation of the seven nutrient groups, students now match the nutrient group name to the biological function cards. Leave on slide 4.
- Students need to cut the columns and rows up and order them correctly.
- Slide 5 has the correct answers which students can self-mark their responses against before sticking them into their exercise book.

Potential script

- You will now work in pairs to match the seven nutrients to their biological functions.

- Don't stick anything down until you've self-assessed your ordering!

Part 2 – Energy and nutrient investigation – I Do/We Do [17 minutes]

Slide 6

The activity

- A short 'I do' segment to explain food energy, referring to the key terms of the lesson: kilojoule and (aerobic) respiration.

Potential script

- So what is food energy? I'm going to talk through two of today's key terms before modelling the task that you and your partner will work through.
- When scientists measure the energy stored in food, they use a unit called the **kilojoule** (kJ). One kilojoule is 1,000 joules. You'll also see kilocalories on food labels,



often just called calories, but in science, kilojoules are our standard unit. Every time you see a number on a food label with kJ next to it, that's telling you how much energy is stored in that food.

- Different bodies need different amounts of energy. An elephant needs around 200,000 kJ every day. A cat needs about 800 kJ. For humans, requirements depend on age, sex, body size and activity level, and on specific biological events. An elite athlete needs far more than someone with a desk job. A pregnant woman needs more because her body is simultaneously running all of its own processes and building an entirely new human being.
- But how does your body actually use that stored energy? The answer is **respiration**. During digestion, food is broken down into glucose which passes into the bloodstream. Your cells then take up that glucose and break it down in the presence of oxygen – this process is respiration. It provides energy that your body can use, for example for movement, for growth, for keeping warm and essentially for every biological process happening inside you right now.

Slides 7–10

Resources: student worksheet, exercise book, calculator.

The activity

- The teacher-led explanation finishes by modelling the worked example in the slide deck which shows a meal plan and whether it meets Individual A's daily energy requirement.
- As you're working through the example, reference 'fortification' and its purpose.
- This is the second 'we do' of the lesson. Students work in pairs to calculate whether the meal plan reaches the daily energy intake for each individual (B–F). They then use the menu to bring everyone's intake as close to the daily requirement as possible.
- At the end of the task, have a class discussion about what happens when people continually have too much or too little food. Frame this around the individuals in the task as though they hadn't added/removed the meal plan items.

Worked example: overview

Slide 7 – Work out the total energy provided from the daily meal plan.

Slide 8 – Using individual A as an example throughout (they have a table of individuals on the student worksheet – see appendix 1), follow the tasks:

Step 1. Calculate the percentage by which the meal plan provides for their daily energy requirement – $8,400 \div 9,000 \times 100 = 93.3\%$

Step 2. State whether each individual is under, over or meets their requirement – 93.3% is below 100% so the meal plan is **under** the daily recommendation.

Step 3. Work out the difference by which the energy requirement is over or under – Individual A needs approximately 600 kJ more ($9,000 - 8,400 = 600$ kJ).

Slide 9 – Continue step 3. Students are expected to get as **close** as possible to the daily recommended amount using the Menu items table on the slide. This may not reach exactly 100% in this task but reflects real-life patterns of eating. Example 1: Individual A should have an extra portion of brown rice (590 kJ). Example 2: banana (440 kJ) and a medium plum (130 kJ) = 570 kJ. There are further examples which you could refer to if needed.

Slide 10 – Leave this on the screen while the students are completing the task.

Potential script: pre-task

- You've got a plant-based meal plan with approximate kJ values and a reference table for five further individuals. Your job is to calculate whether this meal plan meets each person's daily energy requirements.
- Once you've calculated whether they're over, they've met or they're under their daily requirement, you'll need to look at the menu to see what you could add or subtract from their daily plant-based meals.
- Let's go through the worked example on the screen for Individual A... use this method as you and your partner continue.



Potential script: post-task

- What would happen if the individuals ate below their daily energy requirements over a prolonged period of time? [starvation].
- What did you notice about Individual F? Why was he different from the other examples? [if he continued to eat above his daily energy requirements, he could become overweight and eventually obese].

Part 3 – The Misconception Clinic
We do/You Do [10 minutes]

Resources: continue with the student worksheet (cloze word task) – 1 per student.

Slide 11

The activity

- This final part ties up the claims from the starter now that they have the scientific knowledge to respond.
- Students act as a sports nutritionist to debunk misconceptions about plant-based eating by completing the cloze word task.
- Use your judgement here – if the class is able, then feel free to do the whole of part 3 as 'You do', working independently. Though if needed, keep students working in pairs for the cloze word task, only moving to independent work on the next slide.
- For the answers, see appendix 2.

Potential script

- You'll remember at the beginning of the lesson I asked you to respond to four claims. Now we've got scientific context to respond to these claims. We're responding as though we're a sports nutritionist and we have patients who have come to see us with a specific concern.
- The first step is to fill in the gaps at the bottom of your worksheet using the word bank on the slide. These address the first three claims.
- Afterwards, you'll be responding to the fourth claim by yourself, using scientific evidence to back up your answer.
- Stretch option: look at the additional claim that you need to respond to with your sports nutritionist hat on – read the patient's concern and then offer your scientific verdict backed up by evidence and a recommendation.

Slide 12

The activity

- Students now work independently to answer the final claim from the starter – "a well-planned plant-based diet can meet all your nutritional needs at any age".
- There are some sentence starters on the slide as well as key terms to include.

Potential script

- We started this lesson with four claims and you wrote your instinctive verdict on each one. The last claim – "a well-planned plant-based diet can meet all your nutritional needs at any age" – is the one true claim and what you're going to focus on now.
- It's supported by the UK's registered body of professional dietitians, the British Dietetic Association, which states that you can get all the nutrients you need from a plant-based diet, no matter your age or level of physical activity.
- You have all the science you need to respond to this claim, so write your final scientific response in your exercise book.

Plenary [6 minutes]

Slide 13

The activity

- A short game of 'if this is the answer' – where students are given five terms as the answers and have to work in pairs to come up with questions to match to the answers.
- This can be done in books or as a paired or class discussion.

Potential script

- There are five terms on the slide. For each one, I want you to come up with a question that this term is the answer to.

Differentiation

Support

- The cut and stick essential nutrient sheet provides a concrete, physical matching activity – offering pre-cut sheets for students with fine motor difficulties.
- The food energy segment includes a worked example



on screen throughout the investigation. Students can focus on fewer individuals where required.

- The misconception clinic includes a cloze word task as well as sentence starters and key terms on the screen.

Stretch

- For the essential nutrients section, there is an optional stretch question – choose one nutrient group and write two sentences explaining what would happen to the human body if it received none of that nutrient over a long period of time.

- The food energy investigation includes a stretch question – what is fortification and why is it an important part of UK diets?

- For the final part, the misconception clinic, there is a further stretch claim to respond to. Additionally, the final, independent claim should be written without sentence starters, synthesising evidence from all three parts of the lesson.

- During the plenary, encourage students to frame questions that reveal deeper scientific understanding rather than simple definitions.

Appendix 1

	Description	Daily energy (kJ)	Daily requirement (%)	Under, over, meets?	Item (+ or –)
A	13-year-old female	9,000			
B	13-year-old male	10,000			
C	Adult female (aged 30)	8,400			
D	Adult male (aged 30)	10,500			
E	Pregnant female (aged 33)	9,200			
F	Sedentary male (aged 70)	8,000			

Table: Individuals A & B ([BBC Bitesize](#)), Individuals C–E ([Public Health England](#)).

Appendix 2 Cloze word task responses

Claim 1: “You can’t get enough protein from plants”

1. protein
2. amino acids
3. plant-based

Claim 2: “A plant-based diet can’t give you enough energy to be active”

1. carbohydrates
2. lipids
3. respiration
4. energy requirements

Claim 3: “Plant milk isn’t as nutritious as cow’s milk”

1. fortified
2. fortified
3. calcium
4. vitamin B12