DIXONS
SIXTH FORM
BRADFORD

SUMMER WORK

BTEC APPLIED SCIENCE DIPLOMA

2026

STUDENT NAME:

BTEC Level 3 Diploma in Applied Science

Summer Work

Name ....

Welcome to Applied Science

Subject outline

Congratulations on choosing a course through which you will develop a set of knowledge and skills which will allow you to successfully move on to your next step in your journey, whether that is to university, an apprenticeship, or into employment.

BTEC Applied Science is, at its heart, all about giving you as a learner the best opportunity to show off your skills through a combination of examination and coursework units, across a range of scientific topics which are applicable to science as it is used and applied in industry. Through your hard work and determination not only will you come out of the next two years with a fantastic qualification which will allow you to access a range of opportunities, you will also have developed skills which will allow you to quickly adapt to the demands of further education/apprenticeship/employment. These skills include: organisation, research, communication – both verbal and written, time management, practical investigation, and taking initiative and independent working.

By the end of this course you will have built up a portfolio of work which you can feel proud of, knowing that it shows your journey and development as a learner and a scientist.

Good luck, and we hope you enjoy your course.

Careers & Higher Education

One of the main career paths for applied science students is the healthcare sector. The study of applied science helps develop skills which are valuable for this sector – written communication skills, practical lab-based skills, teamwork as part of lab-based work, organisation and time management through the coursework report writing, and problem solving. There is a shortage of skilled workers for the healthcare sector in Bradford and Yorkshire, so a background in science is a real advantage to help you get into this field.
As well as the healthcare sector, single applied science can be used as a means to apply for foundation courses such as foundation engineering, and foundation science which can lead to degrees in areas such as pharmacy.
If there is a particular career that you are interested in pursuing the best thing you can do to support your application is to look for work experience; that in conjunction with an applied science qualification helps boost applications to science-based university courses.

Links to key information:

https://qualifications.pearson.com/en/qualifications/btec-nationals/applied-science-aaq.html

2 Structure

Qualification structure

Pearson BTEC Level 3 National Diploma in Applied Science

Mandatory units

There are six mandatory units, three internal and three external. Learners must complete and achieve at Near Pass grade or above in all mandatory external units and achieve a Pass or above in the mandatory internal unit in group A. Learners must complete both mandatory units in group B and achieve a pass or above in at least one unit.

Optional units

Learners must complete a 2 optional units.

Pearson BTEC Level 3 National Diploma in Applied Science				
Unit number	**Unit title**	**GLH**	**Type**	**How assessed**
	Mandatory group A units – learners complete and achieve all units			
1	Principles and Applications of Science I	**90**	**Mandatory**	External
3	Science Investigation Skills	**120**	**Mandatory and Synoptic**	External
5	Principles and Applications of Science II	**120**	**Mandatory**	External
6	Investigative Project	**90**	**Mandatory and Synoptic**	Internal
	Mandatory group B units - learners complete all units			
2	Practical Scientific Procedures and Techniques	**90**	**Mandatory**	Internal
4	Laboratory Techniques and their Application	**90**	**Mandatory**	Internal

	Optional units – learners complete 2 units			
8	Physiology of Human Body Systems	**60**	**Optional**	Internal
21	Medical Physics Applications	**60**	**Optional**	Internal

External assessment

This is a summary of the type and availability of external assessment, which is of units making up 46% of the total qualification GLH. See *Section 5* and the units and sample assessment materials for more information.

Unit	Type	Availability
Unit 1: Principles and Applications of Science I	• Written examination set and marked by Pearson. • 2 hours. • 90 marks.	**Jan and May/June** **First assessment May/June 2017**
Unit 3: Science Investigation Skills	• A task set and marked by Pearson and completed under supervised conditions. • Part A and B are taken in a single session timetabled by Pearson. • Learners will have 45 minutes to review Part A before they complete Part B. • Part B will be one session lasting one hour and 30 minutes. • 60 marks.	**Jan and May/June** **First assessment May/June 2017**
Unit 5: Principles and Applications of Science II	• Written examination set and marked by Pearson. • 2.5 hours. • 120 marks.	**Jan and May/June** **First assessment January 2018**

Why this booklet matters?

This booklet has been designed to help you successfully transition from **GCSE Science** to **BTEC Applied Science**, and to prepare you for the demands of **Unit 1, 3 and Unit 5 external exams**.

At GCSE, many students are able to **recognise topics and recall facts**, but examiners consistently report that students often struggle to:

- apply their knowledge in **new or unfamiliar situations**
- **explain their answers clearly**
- interpret **data, graphs and experiments**
- evaluate methods and draw **reasoned conclusions**

These are exactly the skills that are essential for success in BTEC Applied Science.

The aim of this booklet

The aim of this booklet is to help you:

- **revisit key GCSE topics** that are essential for Unit 1,3 and Unit 5
- strengthen your understanding so you can **apply knowledge, not just recall it**
- practise using **scientific reasoning and explanation skills**
- develop confidence in working with **data, graphs and calculations**
- avoid the **common mistakes identified by examiners**

A key message

You may feel like you “already know this content” from GCSE.
However, in BTEC you will need to go further:

✓ Not just *what* happens
✓ But *why it happens*
✓ And how to apply it in new situations

How to use this booklet

To get the most out of it:

- Take your time to **think about your answers**
- Always try to **explain your reasoning** fully
- Use **key scientific vocabulary accurately**
- Check your **working and units in calculations**
- Learn from mistakes — this is where real progress happens

Final focus

This booklet is not about learning *more* science.
It is about becoming better at **thinking like a scientist**.

That is what will help you succeed in **Unit 1, Unit 3, and Unit 5**.

What you want to do in the future?

Use this section to describe what you want to do in the future and explain how studying Applied Science is going to help you on the decision?

Key things students often struggle with (Unit 1,3 & Unit 5)

Before you move on, read this carefully — these are the areas that *regularly stop students from achieving their target grades*.

Applying your knowledge (not just recalling it)

- You may *recognise* a topic, but you often struggle to:
    - apply it to a **new situation**
    - adapt your answer to match the question
- You must avoid giving:
    - **generic "textbook" answers**
- Instead, always:
    - **link your answer to the context in the question**

Using data, graphs and information properly

- Many students:
    - describe trends (e.g. "it increases")
    - but do NOT explain them
- You must:
    - use numbers from the graph or table
    - explain *why* the trend happens

Explaining, not describing

- A very common mistake is:
    - describing what happens instead of explaining why
- For example:
    - ❌ "The rate increases"
    - ✅ "The rate increases **because** particles have more energy and collide more frequently"

Linking ideas together

- Strong answers link ideas into a chain:
    - cause → effect → outcome
- Weak answers:
    - list facts with no connection

Understanding practical science

- Students often struggle to:
    - identify variables correctly
    - explain how to improve an investigation
- Avoid:
    - vague answers like "human error"
- Instead:
    - be **specific about what went wrong and how to fix it**

Evaluation (Unit 3 especially)

- Many students:
    - state problems
    - but do NOT explain their impact
- You must:
    - explain how errors affect results
    - make a **clear judgement**

Calculations and maths in science

- Common issues:
    - not showing working
    - incorrect or missing units
    - not rearranging equations
- Always:
    - write the formula
    - show each step
    - include units

Extended writing (longer questions)

- Many students:
    - write short or unstructured answers
- To access higher marks:
    - write in full sentences
    - use connectives:
        - **because, therefore, so**
    - develop your ideas clearly

Command words

- You must understand what the question is asking:
    - **Describe** = what happens
    - **Explain** = why it happens
    - **Evaluate** = strengths, weaknesses, and judgement
    - **Compare** = similarities **and** differences

Using the question properly

- A major reason students lose marks:
    - ignoring the information given
- You must:
    - use the data, diagrams or context provided
    - avoid copying the question

Final message

If you improve these areas, you will:

- access **higher-level marks**
- feel more confident with unfamiliar questions
- significantly improve your performance in **Unit 1 and Unit 3**

Key science content you must be secure in (Unit 1 & Unit 3)

These are the **specific topics** that regularly cause problems for students.
If you are unsure on any of these, you are likely to struggle in Unit 1 or Unit 3.

For each of these topics create a Mind Map to show clear understanding of the content?

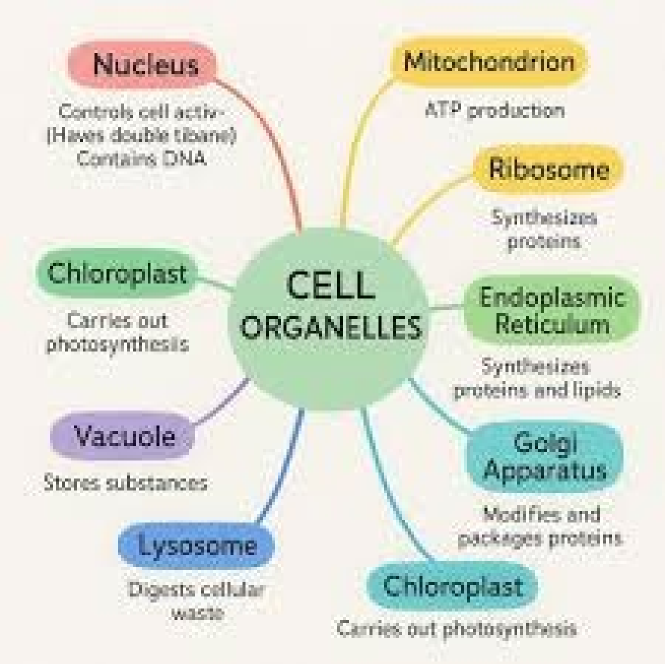
Below is an example for the Cell structure and function:

🧬 Biology

🔬 Cell structure and function

- You need to know:
    - organelles (nucleus, mitochondria, ribosomes, membrane)
- You must also be able to:
    - **explain the function** of each structure
    - apply this knowledge to unfamiliar cells or diagrams

👉 Many students can recall parts of a cell but cannot explain *how they work*



🔗 Cell transport

- Diffusion, osmosis, active transport
- Surface area to volume ratio

👉 You must be able to:

- **apply these ideas to real biological systems**
- explain how they affect rates (not just define them)

🧪 Enzymes

- Lock-and-key model
- Effect of temperature and pH
- Enzyme graphs

👉 Common issue:

- Students describe graphs but cannot explain **why the rate changes**

🫁 Exchange surfaces (lungs, gut, etc.)

- Structure of alveoli
- Link surface area → diffusion rate

👉 You must:

- link structure → function → outcome

❤️ Human systems (Unit 1 key area)

- Heart structure and blood flow
- Blood vessels and their functions

👉 Don’t just label diagrams — you must **explain processes and movement**

⚗️ Chemistry

⚛️ Atomic structure

- Protons, neutrons, electrons
- Electronic structure

👉 This causes problems more than you think — weak understanding affects everything else

🔗 Bonding and structure

- Ionic, covalent, metallic bonding
- Properties (melting point, conductivity)

👉 You must:

- explain properties using bonding
- NOT just state facts

⚖️ Quantitative chemistry

- Moles
- Concentration
- Rearranging equations

👉 This is a **major weakness area**:

- many students cannot complete multi-step calculations

🔥 Energy changes

- Exothermic vs endothermic
- Reaction profiles

👉 You must:

- explain energy transfers, not just identify them

⚗️ Chemical reactions

- Rates of reaction (factors affecting rate)
- Collision theory

👉 Students often:

- describe changes but don’t explain **why rate changes**

⚡ Physics

📐 Equations and calculations

- Using formulas correctly
- Rearranging equations
- Units

👉 One of the biggest issues:

- students do not show working or use correct units

⚡ Electricity

- Current, voltage, resistance
- Series and parallel circuits

👉 You must:

- explain relationships (not just definitions)

🌊 Waves

- Wave properties (frequency, wavelength, speed)
- Wave behaviour

👉 Students struggle to:

- apply wave ideas to unfamiliar situations

🔥 Energy

- Energy stores and transfers
- Efficiency

👉 Weak understanding affects:

- both calculations and explanations

✅ How to Answer the Questions in This Booklet

This booklet is designed to help you improve the skills needed for **BTEC Unit 1 and Unit 3**.
To get the most out of it, you must approach the questions in the right way.

🎯 1. Always read the command word carefully

Every question tells you what to do. You must match your answer to the command word.

- **Describe** → say what happens
- **Explain** → say *why* it happens (use **because**)
- **Compare** → give similarities **and** differences
- **Calculate** → show working AND give units
- **Evaluate** → give strengths, weaknesses, and a final judgement

👉 If you ignore the command word, you will lose marks even if your knowledge is correct.

✍️ 2. Write full, clear explanations

- Do NOT just write short answers or lists
- Use full sentences
- Use connectives:
    - **because**
    - **therefore**
    - **so**

✅ Good answer:

"The rate increases **because** particles have more energy and collide more frequently"

🔗 3. Always explain cause and effect

In science, you need to show a chain of reasoning:
cause → process → result
Avoid giving isolated facts. Link your ideas together clearly.

📊 4. Use the information given in the question

- Use:
    - values from tables
    - data from graphs
    - details from the scenario

❌ Do NOT:

- ignore the data
- give a memorised answer that doesn't fit the question

🧮 5. Show all working in calculations

For every calculation:

- Write the **formula**
- Show each step clearly
- Include the **correct units** (e.g. mol, J, m/s)

👉 Marks are often awarded for method — you can still gain marks even if the final answer is wrong.

📈 6. When using graphs and data

- Describe the trend:
    - e.g. "as temperature increases, rate increases"
- THEN explain the trend:
    - **why does this happen?**
- Use numbers where possible

🧪 7. Be specific in practical and evaluation questions

Avoid vague answers like:

- "human error"
- "repeat the experiment"

Instead:

- explain exactly what the problem is
- suggest a clear, realistic improvement

🌐 8. Use online resources to support your learning

If you do not understand a topic:

- Research it using:
    - BBC Bitesize
    - Cognito / FreeScienceLessons
- Make notes before attempting the question again

👉 This booklet is not just a test — it is a **learning tool**.

🔄 9. Learn from your mistakes

- Check your answers carefully
- Redo questions you got wrong
- Improve your explanations

This is where real progress happens.

🔗 10. You will be assessed on this when you join the College in September

- Ensure you revise this content
- The assessment will take place within the first couple of weeks of the term
- Revising this will benefit you when you have your exams in January

🧬 BIOLOGY Questions (Unit 1 and 3 Topics)

Section 1: Cell structure and function (AO1 → AO2)

Q1. Label and explain (6 marks)

A cell diagram is shown.

a) **Name** 4 organelles? (4)

b) **Explain** the function of 2 of them? (2)

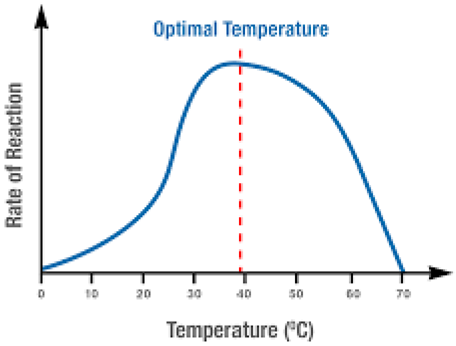
Q2. Application (3 marks)
A cell has many mitochondria.

Explain why this cell is likely to require large amounts of energy?

👉 Must include **cause** → **effect**

Section 2: Enzymes and graphs (AO2 → AO3)

Q3. Graph interpretation (8 marks)
A graph shows enzyme activity vs temperature.



a) **Describe** the trend? (2)

b) **Explain why** the rate increases at first? (3)

c) **Explain why** the rate decreases at high temperature? (3)

Q4. Evaluation (4 marks)
A student investigates enzyme activity but does not control temperature properly.

Explain how this affects the results and suggest **two improvements?**

Section 3: Transport in cells (AO2)

Q5. Application (4 marks)
Explain how surface area to volume ratio affects diffusion in cells?

Q6. Problem-solving (4 marks)
A large organism requires specialised exchange surfaces e.g. the lungs.
Explain why diffusion of oxygen through the skin alone is not enough?

Section 4: Human systems (AO1 → AO2)

Q7. Cardiovascular system (4 marks)
Explain how the structure of arteries is adapted to their function.

Q8. Gas exchange (4 marks)
Explain how alveoli are adapted for efficient gas exchange?

👉 Must link:

- structure → diffusion → outcome

🧬 BIOLOGY Questions (Unit 5 Topics)

Focus: **diffusion, heart, gas exchange, kidneys — all GCSE-based but extended in Unit 5**

🔬 Section 1: Diffusion & transport

Q1 (3 marks)
Explain how a concentration gradient affects the rate of diffusion?

👉 Common issue: students describe, but don't explain

Q2 (4 marks – application)
A cell is very large.

Explain why it would struggle to exchange materials efficiently?

👉 Must link:

- surface area
- diffusion
- volume

❤️ Section 2: Cardiovascular system

Q3 (3 marks)
Explain how the structure of arteries is adapted to their function?

Q4 (4 marks – application)
A person has high blood pressure.

Explain how this can damage blood vessels and affect health?

👉 GCSE issue:

- weak link between structure and consequences

🌬️ Section 3: Gas exchange

Q5 (3 marks)
Explain how alveoli are adapted for efficient gas exchange?

Q6 (3 marks – data style)
A patient has reduced lung surface area.

Explain how this affects oxygen uptake?

👉 Forces real Unit 5 thinking using GCSE diffusion

💧 Section 4: Water balance

Q7 (3 marks)
Explain the role of the kidney in removing waste from blood?

Q8 (3 marks – higher thinking)
Explain how changes in water levels in the body affect urine concentration?

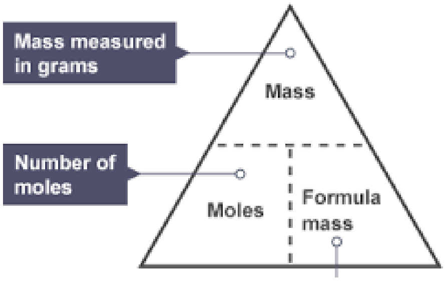
CHEMISTRY Questions

Section 1: Atomic structure and bonding (AO1 → AO2)

Q1. Explanation (3 marks)
Explain why ionic compounds have high melting points?

Q2. Application (4 marks)
A substance conducts electricity when molten but not when solid.
Explain what type of bonding it has and **explain why** it is able to only conduct electricity when molten?

Section 2: Moles and calculations (AO2)



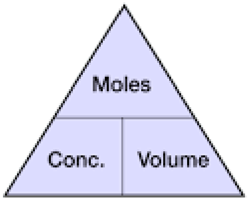
Q3. Calculation (4 marks)
Calculate the number of moles in 20g of $CaCO_3$?
(Ar: Ca=40, C=12, O=16)

👉 Must show:

- formula
- working
- answer with units

Q4. Multi-step calculation (2 marks)

A student prepares a solution of concentration 2 mol/dm^3.



Calculate how many moles are in 0.5 dm^3?

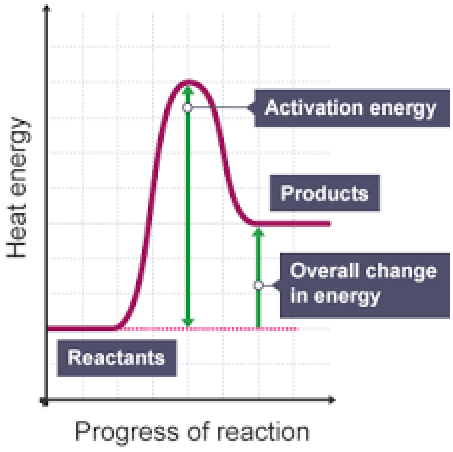
Section 3: Energy changes (AO2)

Q5. Explanation (3 marks)

Explain what happens in an exothermic reaction in terms of energy transfer?

Q6. Graph question (6 marks)

A reaction profile diagram is shown.



a) **Identify** if exothermic or endothermic? (2)

b) **Explain why** you believe your answer to be correct? (3)

Section 4: Rates of reaction (AO2 → AO3)

Q7. Application (4 marks)
Explain how increasing temperature increases reaction rate using collision theory?

Q8. Evaluation (4 marks)
A student investigates how concentration affects rate.

The student put some acid into a flask and then added different amounts of another solution to change the concentration. They started a timer and observed how fast the reaction happened. They repeated the experiment a few times and wrote down the results.

Evaluate the method and suggest **two improvements?**

CHEMISTRY Questions (Unit 5 Topics)

Focus: **bonding, electrolysis, organic basics, energy**

Section 1: Bonding & properties

Q1 (3 marks)
Explain why ionic compounds have high melting points?

👉 Must include:

- electrostatic attraction
- energy needed

Q2 (3 marks – application)
A substance does not conduct electricity when solid but does when molten.

Explain why?

Section 2: Electrolysis

Q3 (3 marks)
Explain what happens during electrolysis of molten aluminium oxide?

Q4 (4 marks – application)
Explain why electrolysis is used to extract aluminium rather than carbon reduction?

🔬 Section 3: Organic chemistry

Q5 (3 marks)
Explain the difference between alkanes and alkenes?

Q6 (3 marks – trends)
Explain why boiling point increases as hydrocarbon chain length increases?

🔥 Section 4: Energy

Q7 (3 marks)
Explain what happens in an exothermic reaction?

Q8 (3 marks – calculation)

$Q = mc\Delta T$

$m = 50$ g
$c = 4.18$ J/g°C
$\Delta T = 5$°C

Calculate energy transferred?

👉 Must include:

- formula
- working
- units

⚡ PHYSICS Questions

Section 1: Equations and calculations (AO2)

Q1. Calculation (2 marks)
Use the equation:

speed = distance ÷ time

A car travels 150 m in 10 s.
Calculate the speed?

Q2. Rearranging (3 marks)
Rearrange:

$V = IR$

to make R the subject, then **calculate** R when:
$V = 12V$, $I = 3A$

Section 2: Electricity (AO2)

Q3. Explanation (4 marks)
Explain the difference between current and voltage.

Q4. Circuits (4 marks)

Explain how current behaves differently in:

- series circuits
- parallel circuits

Section 3: Waves (AO2)

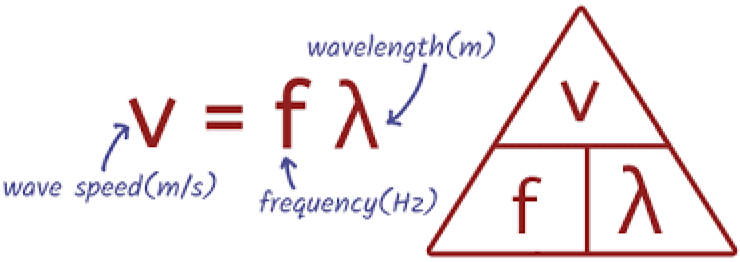
Q5. Application (4 marks)

Explain how wave speed depends on frequency and wavelength?

Q6. Data interpretation (3 marks)

A wave has:

- frequency = 5 Hz
- wavelength = 2 m



Calculate the wave speed?

Section 4: Energy (AO2 → AO3)

Q7. Explanation (3 marks)
Explain what is meant by conservation of energy?

Q8. Efficiency (3 marks)
A machine outputs 200 J of useful energy from 500 J input.

Energy Efficiency Formula:

$$\frac{\text{Energy Output}}{\text{Energy Input}} \text{ X } 100 = \text{\% Efficiency}$$

a) **Calculate** efficiency? (3)

b) **Explain why** efficiency is never 100%? (3)

⚡ PHYSICS (Questions (Unit 5 Topics)

Focus: **energy, equations, waves-level thinking applied to new contexts**

🔥 Section 1: Energy

Q1 (3 marks)
Explain the law of conservation of energy?

Q2 (6 marks – application)
Explain why energy transfers are never 100% efficient?

🧮 Section 2: Maths skills

Q3 (3 marks)
Energy = power × time

A device uses 200 W for 10 seconds

Calculate the energy transferred?

Q4 (3 marks – rearranging)
V = IR

Rearrange to find I and **calculate** when:
V = 12 V, R = 4 Ω

CROSS-SKILLS SECTION (CRITICAL FOR UNIT 3)

Data + evaluation

Q1 (7 marks total)

A student investigates how temperature affects reaction rate.

Results:

Temp (°C)	Rate
20	5
30	8
40	12
50	11

a) Describe the trend (2)

b) Explain the trend (3)

c) Identify an anomaly (2)

Reading List

Core Textbooks

- Pearson BTEC National Applied Science Student Book 1
- CGP Head Start to A-Level Biology
- CGP Head Start to A-Level Chemistry
- CGP Head Start to A-Level Physics

Unit 1: Principles & Applications of Science

- *Biology: A Very Short Introduction* – Nick Lane
- *The Chemistry Book* (DK)
- *Physics: A Very Short Introduction* – Stephen Blundell
- BBC Bitesize (GCSE & A-Level Science)
- Khan Academy (Biology, Chemistry, Physics topics)

Unit 3: Practical Scientific Procedures & Techniques

- CGP Practical Skills in Biology
- CGP Practical Skills in Chemistry
- CGP Practical Skills in Physics
- Royal Society of Chemistry (RSC) website
- Nuffield Foundation practicals
- YouTube: MaChemGuy, FreeScienceLessons

Unit 5: Foundations in Applied Science

- *Stuff Matters* – Mark Miodownik
- *Periodic Tales* – Hugh Aldersey-Williams
- Royal Society resources (materials and applications)