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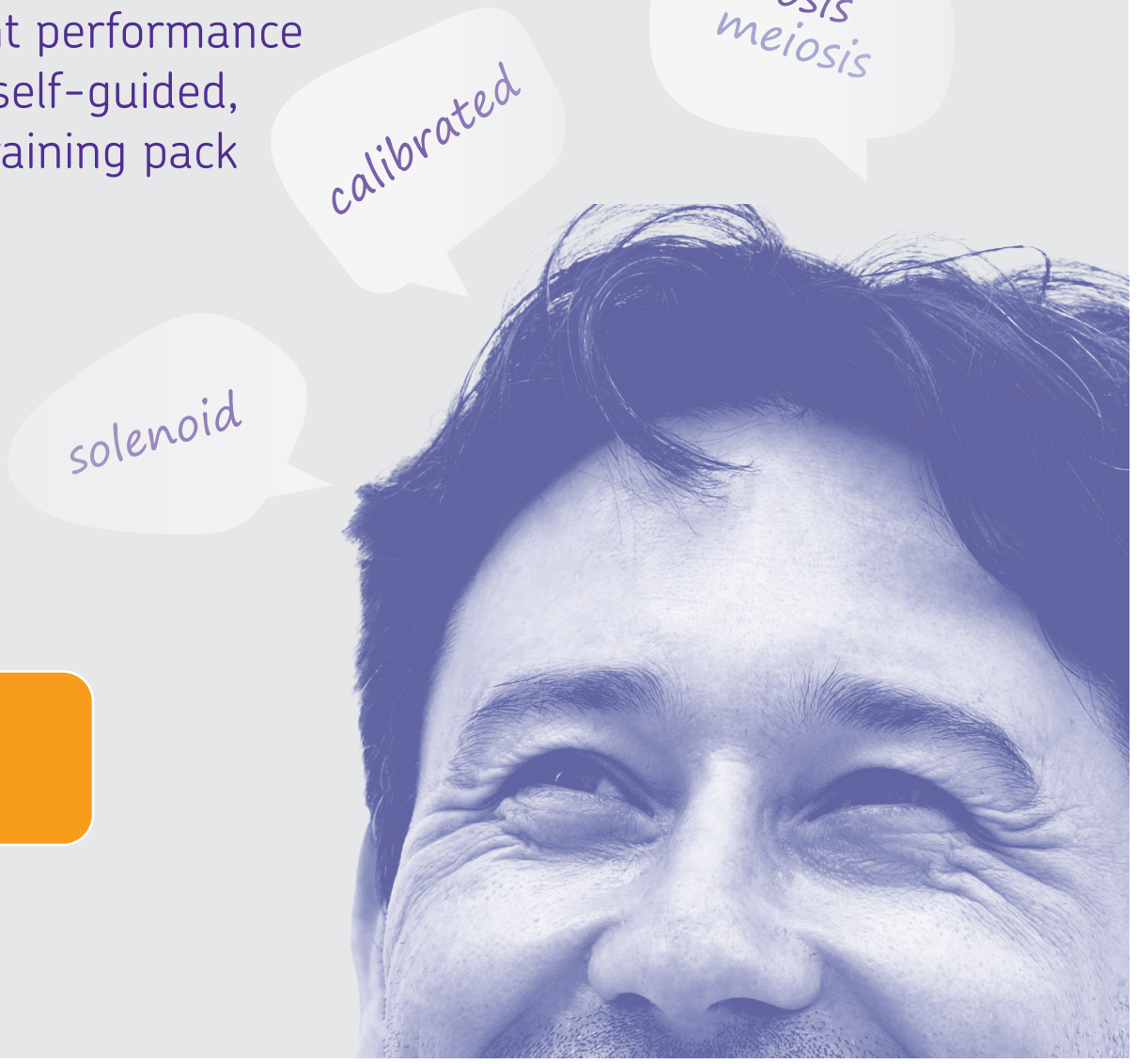

Appendix booklet

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Activity 3a: Misconceptions

The table below shows some examples of topics that include **energy** across the GCSE Trilogy specification and the sentences that exemplify **energy** terms in bold.

Specification reference	Topic	Link to	Example sentences
Biology			
4.1.3.3	Active transport	6.5.2	Active transport moves substances from a more dilute solution to a more concentrated solution (against a concentration gradient). This **requires energy** from respiration.
4.4.1	Photosynthesis	6.1, 5.5.1.1, 6.6	Photosynthesis is an endothermic reaction in which **energy is transferred** from the environment to the chloroplasts by light
4.4.2	Respiration	6.1, 5.5.1.1	Respiration in cells can take place aerobically (using oxygen) or anaerobically (without oxygen) to **transfer energy**.
4.4.2.2	Response to exercise	6.5.2	During exercise the human body reacts to the increased **demand for energy**.
4.4.2.3	Metabolism	6.5.2	The **energy transferred** by respiration in cells is used by the organism for the continual enzyme controlled processes of metabolism that synthesise new molecules.
4.7	Ecology	6.3.2	The Sun is a **source of energy** that passes through ecosystems.
Chemistry			
5.1.1.7	Electronic structure		The electrons in an atom occupy the lowest available **energy levels**
5.2.2.1	States of matter		The **amount of energy** needed to change state from solid to liquid and from liquid to gas depends on the strength of the forces between the particles of the substance.
5.2.2.8	Metals as conductors		Metals are good conductors of thermal energy because **energy is transferred** by the delocalised electrons.
5.5	Energy changes		**Energy is conserved** in chemical reactions
5.5.1.1	Energy transfer during exothermic and endothermic reactions		Reactions in which **energy is released** to the surroundings are exothermic reactions, while those that **take in thermal energy** are endothermic.
5.5.1.2	Reaction profiles		Chemical reactions can occur only when reacting particles collide with each other and with **sufficient energy**

Chemistry			
5.5.1.3	The energy changes of reactions		**energy must be supplied** to break bonds in the reactants **energy is released** when bonds in the products are formed.
5.6.1.3	Collision theory and activation energy		The **minimum amount of energy** that particles must have to react is called the activation energy.
5.6.1.4	Catalysts		Catalysts increase the rate of reaction by providing a different pathway for the reaction that has a **lower activation energy**.
5.7.1.3	Properties of hydrocarbons		The combustion of hydrocarbon fuels **releases energy**
5.10	Using resources		Finite resources from the Earth, oceans and atmosphere are processed to **provide energy** and materials
Physics			
6.1.1.1	Energy stores and systems		There are changes in the way **energy is stored** when a system changes
6.1.2.1	Energy transfers in a system		**Energy can be transferred** usefully, stored or dissipated, but cannot be created or destroyed.
6.2.4	Energy transfers		Everyday electrical appliances are designed to bring about **energy transfers**.
6.3.2.1	Internal energy		Heating changes the **energy stored** within the system by **increasing the energy** of the particles that make up the system.
6.4.1.1	The structure of the atom		The electrons are arranged at different distances from the nucleus (different **energy levels**)
6.5.3	Forces and elasticity		A force that stretches (or compresses) a spring does work and elastic potential **energy is stored** in the spring.
6.6	Waves		Waves **carry energy** from one place to another and can also carry information.
6.6.1.2	Properties of waves		The wave speed is the speed at which the **energy is transferred** (or the wave moves) through the medium.
6.6.2	Electromagnetic waves		Electromagnetic waves are transverse waves that **transfer energy** from the source of the waves to an absorber.

Activity 3b: Complex ideas

Mark scheme 2018 Chemistry 1H Q7.3

07.3	hydrogen chloride is made of small molecules	allow hydrogen chloride is simple molecular	1	AO1 4.1.2.6 4.2.1.4
	(so hydrogen chloride) has weak intermolecular forces	do **not** accept reference to bonds breaking unless applied to intermolecular bonds	1	4.2.2.4
	(intermolecular forces) require little energy to overcome		1	

Comments and marks for chemistry examples

Student A: 0 marks

The student is talking about bonds between hydrogen and chlorine (intramolecular bonds) and not about the bonds between the hydrogen chloride molecules in the gas (intermolecular bonds) so gains no marks.

Student B: 2 marks

'Simple molecular covalent structure' gains the first mark. 'Weak intermolecular forces' gains the second mark. The student then displays some confusion between forces and bonds, going on to talk about bonds breaking. This would be allowed in this case because they're talking about bonds breaking, but for the third mark there must be reference to energy, which this student has not given. The last sentence is ignored as it's not relevant here although the student is talking about the bonding within the HCl molecule.

Activity 5: Command words

Below are a number of further student responses for each exercise around the command words for you to look at and discuss with colleagues or use as learning activities with your students.

Remember, these are **not** exercises in allocating marks. For each example, you're looking at how what the student has written matches the requirements of the command word – eg have they written an explanation/evaluation (even if it's wrong)?

Activity 5a: Describe

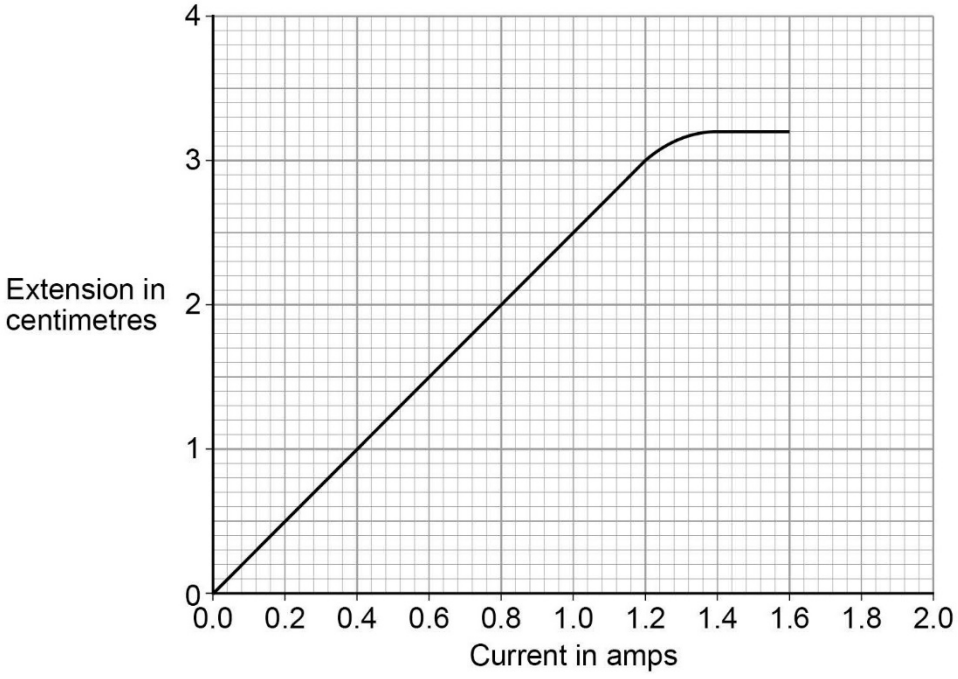
- Look at student responses A, B and C
- Have the students matched the requirements of the command word?
- What about their response makes you think this?

Student A: 2019 GCSE Physics 2F question 3.8

The student measured how much further the spring extended with different values of current in the coil.

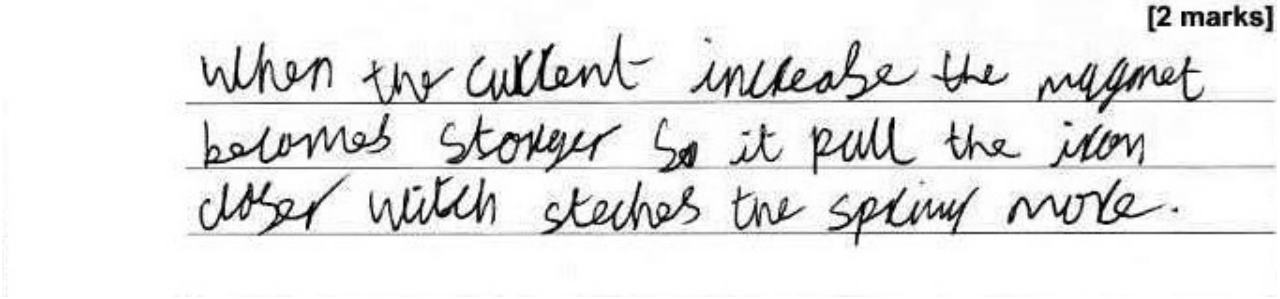
Figure 10 shows the results.

Figure 10



0 3 . 8 Describe what happened to the strength of the electromagnet as the current in the coil increased from 1.2 A to 1.6 A

[2 marks]



Comments on Student A

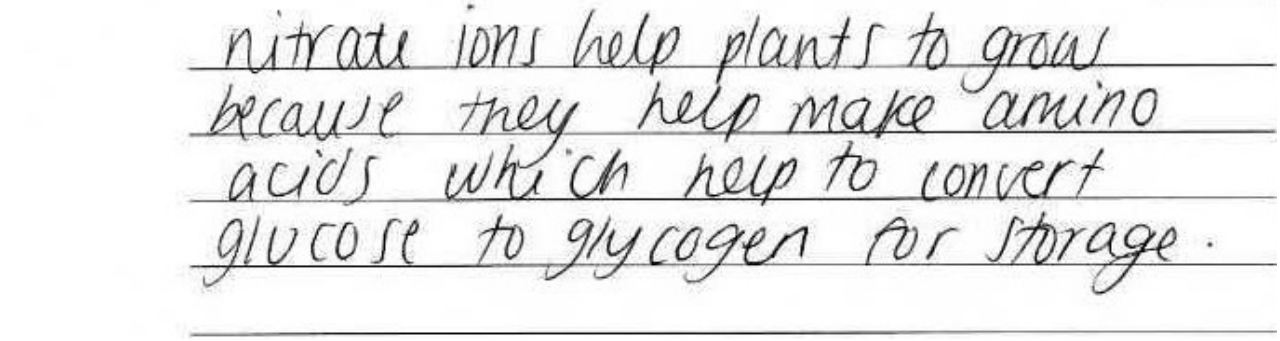
There are 2 marks for this question, so the student should be expecting to write two facts about what the graph is telling them. To give a full description, they need to identify that the strength increases, and then reaches a maximum amount/plateau/doesn't increase any further. This student has given the first observation but hasn't gone any further, giving only a partial description.

Student B: 2019 GCSE Combined Science Trilogy Biology 1H question 5.5

0 5 . 5 Nitrate ions are essential for plants to grow.

Describe how nitrate ions are used in a plant to help the ~~plant grow~~.

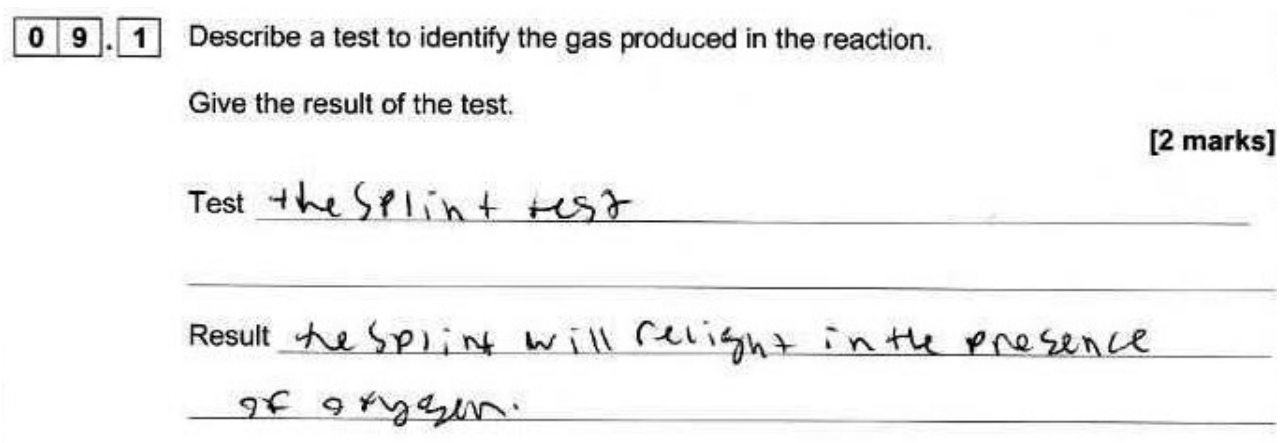
[3 marks]



Comments on Student B

Students need to make a link here with what plants need to grow: proteins. A full description would be that (1) nitrate ions are used with glucose to (2) form amino acids, which in turn are (3) used to produce proteins. This student has identified that nitrate ions are used to form amino acids but has gone no further, so this description is not complete.

Student C: 2019 GCSE Chemistry 2H question 9.1



0 9 . 1 Describe a test to identify the gas produced in the reaction.

Give the result of the test.

[2 marks]

Test the splint test

Result the splint will relight in the presence of oxygen.

The test for oxygen is to insert a glowing splint into the tube, and the result, if oxygen is present, is that the splint will relight.

Comments on Student C

The student has simply given a name for the test and not attempted to describe it. Although the description of the positive result is correct, this student hasn't described a correct test.

Activity 5b: Explain

- Look at student responses D, E and F.
- For each response, has the student written an explanation?
- What in their language makes you think this?

Student D: 2019 GCSE Combined Science Trilogy Chemistry 1H question 4.4

Table 2 shows the boiling points of fluorine, chlorine and bromine.

Table 2

Element	Boiling point in °C
Fluorine	–186
Chlorine	–34
Bromine	+59

0 4 . 4 Explain the trend in the boiling points in **Table 2**.

[3 marks]

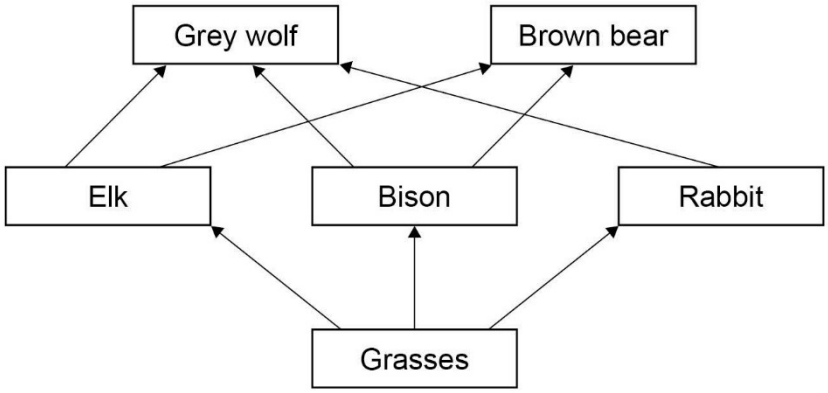
They are all increasing in temperature.

Comments on Student D

The student has simply given a (weak) description of the trend in the data. So they've not addressed the requirements of the command word.

Student E: 2019 GCSE Combined Science Synergy 1F question 8.4

Figure 8



0 8 . 4 Look at **Figure 8**.

Explain how killing all the grey wolves could affect the populations of the other organisms.

[6 marks]

Grey wolfs eat Elk, Bison and rabbit
whic they eat the grass. If th grey wolf was
to be killed the populations of Elk, Bison
and Rabbit would increase then increases
the brown bear Population. However there
is no predator controling the Rabbit populatio
meni they will breed alot. This intern
decrease the amount of grass due to the
Rabbit needing more food this means the Elk
and Bison start to die out due to lack
food and cause the brown bear dies of due to
lack of food. The bear eat all the elk and
Bison so he go extinct then with
no food so do the bears

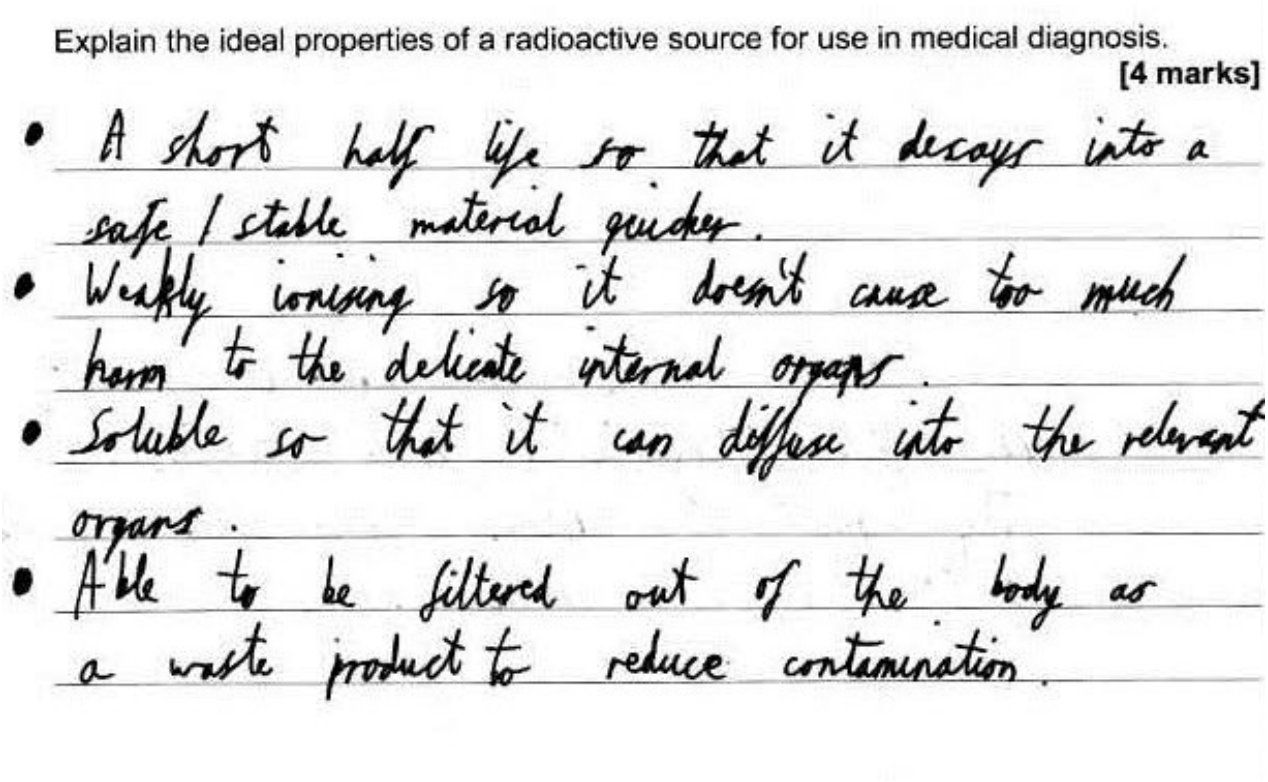
Comments on Student E

This student clearly understands the relationships in the food web.

In lines 1–4, they've identified that elk, bison and rabbits are predated by the wolves and clearly linked that statement to the effect on the populations if wolves are killed. In lines 4–5, they then link the increase in populations of elk and bison to an increase in the brown bear population ('this then increases …'). In lines 5–7, they link the fact that no predator for the rabbits will allow them to breed and reduce the amount of grass and go on to explain how this will affect the elk, bison and, ultimately, the brown bear populations. In the last sentence, they link bears killing their own food source to their own ultimate decline in population.

Throughout, they're using clear linking words ('meaning they will'; 'This in tern decreases'; 'due to the rabbit'; 'this means that'; 'due to lack of food'; 'so they go extinct') to produce a comprehensive and detailed explanation of the effects of killing the grey wolves on all the other populations.

Student F: 2018 GCSE Physics 1H Question 6.5



Explain the ideal properties of a radioactive source for use in medical diagnosis.

[4 marks]

- A short half life so that it decays into a safe / stable material quicker.
- Weakly ionising so it doesn't cause too much harm to the delicate internal organs.
- Soluble so that it can diffuse into the relevant organs.
- Able to be filtered out of the body as a waste product to reduce contamination.

Comments on Student F

The student has listed a number of properties they consider ideal and has linked each one to a reason why it would be an ideal property using 'so' and 'so that', in clear attempts at explanation. They've clearly understood the requirements of the command word.

The response did not include sufficient correct or relevant points to gain full marks, but it's a clear attempt to address the command word.

Activity 5c: Compare

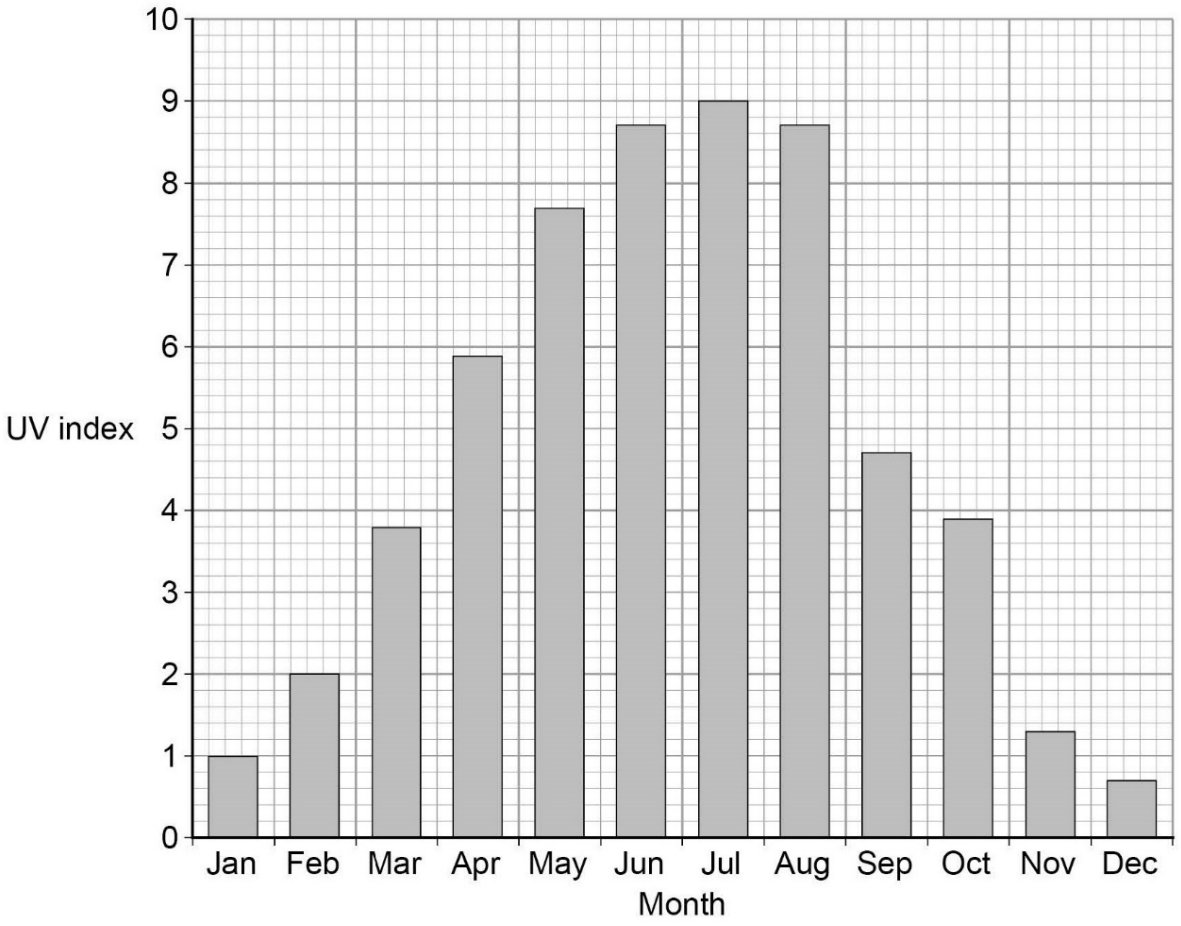
- Look at student responses G, H and I.
- Each response gained full marks.
- Can you identify the features that make these good responses to the command word?

Student G: 2019 GCSE Combined Science Trilogy Physics 2F Question 5.5

The amount of UV radiation that reaches the surface of the Earth can be measured on a scale called the UV index.

Figure 8 shows the average midday UV index in the UK for 1 year.

Figure 8



0 5 . 5 Compare the risk from UV radiation at different times of year in the UK.

Use data from **Figure 8**.

[2 marks]

The risk of UV radiation reaches its peak in the month of June to May but specifically in July at UV 9 as it is summer the rays of sun tend to be stronger than the winter months of October and December with UV rates ranging from 4 to 1.

Comments on Student G

The student refers to the risk being highest ('reaches its peak') in the summer and compares the UV index in the summer (June to August) with that in the winter (October and December) using correct readings from the table to support their comparison. They've addressed the requirements of the command word.

Student H: 2018 GCSE Biology 1H Question 3.5

0 3 . 5 Compare the structure of an artery with the structure of a vein.

[3 marks]

An artery has thick walls and a small lumen as it carries oxygenated blood at high pressure. Whereas a vein has a larger lumen and thinner walls as the blood is at a lower pressure. The other main difference between the two is that the vein has valves to prevent the blood flowing the wrong way, arteries do not.

Comments on Student H

The student has used comparative language throughout. In the first sentence, they give statements about the lumen and wall thickness of an artery. The second sentence gives statements about the lumen and wall thickness of a vein, starting with 'whereas' and using comparative words such as 'larger', 'thinner', 'lower pressure' to clearly indicate a comparison. The final sentence then gives a third comparison of the structure of the two types of blood vessel, again using comparative language.

Student I: 2018 GCSE Chemistry 2F Question 6.4

0 6 . 4 **Table 4** gives some information about disposable cups.

Table 4

	Coated paper cups	Poly(styrene) cups
Source of raw materials	Wood	Crude oil ✓
Energy to make 1 cup in arbitrary units	550	200
Biodegradable	Yes	No
Recyclable	No	Yes

Compare the advantages and disadvantages of using coated paper and poly(styrene) to make disposable cups.

Use **Table 4** and your knowledge and understanding of life cycle assessments (LCAs).

[4 marks]

Coated	Poly(styrene)
+ It is made out of wood, which is renewable, so doesn't run out	+ It is made out of crude oil, which is non-renewable, so does eventually run out
- It takes 350 more energy units to make, so would cost more to produce	+ Takes 350 less energy units to make, so would cost less to produce
+ It's biodegradable meaning, it won't be churned on a landfill and won't harm the earth	- It's not biodegradable, so it will pollute the earth and stay on the landfill

Comments on Student I

This student has presented their comparison in the form of a table, which is a perfectly acceptable format. For each type of cup, they've given three properties and described why the property is an advantage or a disadvantage. In the table format, they've carefully lined up their comments about the renewable/non-renewable nature of the raw materials, energy used in manufacture and biodegradability for each type of cup, which shows clear comparison of these features and their advantages/disadvantages.

Activity 5d: Evaluate

- Look at student responses J and K, which are taken from 2018 GCSE Combined Science Synergy 4H, question 2.6
- Which of the two responses more closely meets the requirements of the command?
- What are the features of that response that make it better than the other?

Student J

Table 1 shows data from a life cycle assessment (LCA) for the two types of carrier bag.

Table 1

	Disposable bag	**Bag for life**
Type of polymer	HD poly(ethene)	LD poly(ethene)
Raw material from which polymer is made	Crude oil	Crude oil
Mass of waste material per bag from production in grams	0.42	0.17
Mass of carbon dioxide emitted per bag during production and transport in grams	1.6	6.9
Mean number of times used	1	6
Possible disposal methods	Landfill Incineration Recycling	Landfill Incineration Recycling

Evaluate the use of each type of carrier bag.

Use data from **Table 1** and your own knowledge.

[6 marks]

The bag for life is the more popular bag but emitts alot of carbon dioxide when being made. Where as the less popular disposable bag emits less carbon dioxide but has a high waste percentage compared to the bag for lye. Also the bag for lye is more expensive compared to the disposable bag but lasts alot longer. Disposable bags dont last as long and aren't as strong but they are alot cheaper than a bag for life.

Student K

Evaluate the use of each type of carrier bag.

Use data from **Table 8** and your own knowledge.

[6 marks]

Disposable bag ~~pass~~ this produces alot of waste material per bag at 0.42g as the bag for life only produces 0.17g per bag from production. So this is 0.25g less then the mean number of times its used is 6. in comparison the disposable bag is used once. So in terms 6x0.42 = 2.52 6 usese of disposable = 2.52g of waste material 6 uses of Bag for life = 0.17g of waste materiel 6uses of disposable = 9.6g of carbon dioxide 6 uses of Bag for life = 6.9g of carbon dioxide

So in sumary a Bag for life is alot kinder to the enviroment than a disposable bag. There is still the problem with both going to landfill or recycel but a bag for life has a higher probabalit of being recyled due to supermarkets replacing your bag for a new one

Comments on students J and K

Student J has carried out a good comparison of several features of the bag for life and the disposable bag, using comparative language ('emits a lot of carbon dioxide … whereas … emits less carbon dioxide'; 'has a high waste percentage compared to …'; 'more expensive compared to …'). They've used a little of the data from the table in their talk about carbon dioxide emissions, although they've used rather vague language ('a lot' and 'less') rather than quoting data. They've also used some of their own knowledge about the cost and popularity of the different bags. However, the student has made no judgement or conclusion, which means that the answer doesn't fully meet the requirements of the command word.

In contrast, **Student K** does give a conclusion ('So in summary, a bag for life is a lot kinder to the environment than a disposable bag'), indicating that they have addressed the command word. They've supported this conclusion with data from the table and their own knowledge (a small amount used in the last sentence, but sufficient to support their evaluation). The language of comparison can be seen in lines 3–4, where they compare the amount of waste in the production of each bag, and in lines 5–7, where they briefly compare the mean number of uses of each bag. This response more fully addresses the 'evaluate' command than that of Student J.

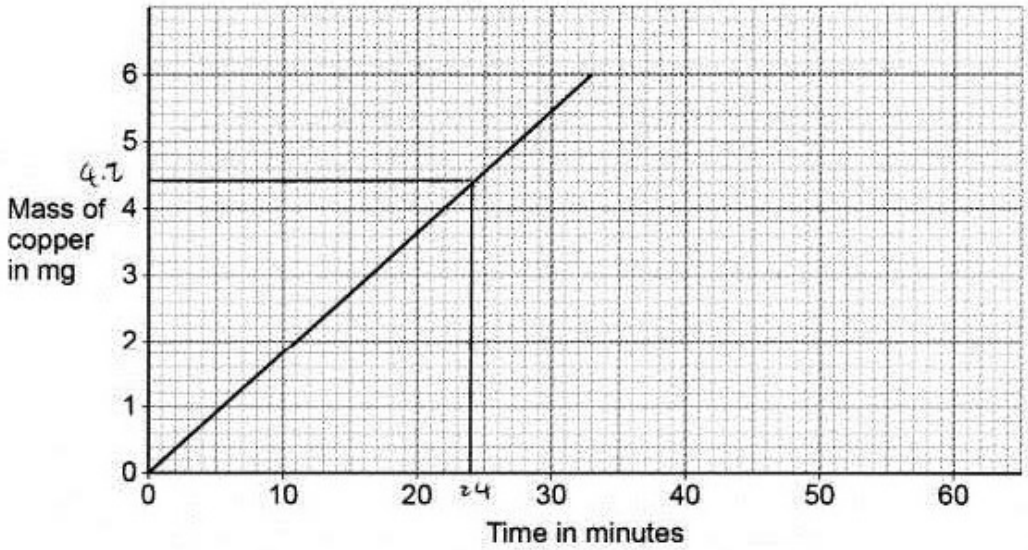
Activity 5e: 'Determine'

- Student responses L and M are from the 2019 Combined Science Trilogy Chemistry paper 1H (Question 5.5).
- To answer this question, a student needs to realise that they can't read the required value directly from the graph: they must choose a particular time on the graph (eg 30 minutes), read the mass at this time and then multiply it up correctly to give the value at 24 hours.
- This is a high-demand question and there's no indication as to the values students should be using, merely that they must use Figure 5.
- Discuss how well each student has addressed the requirements of the command word.

Student L

0 5 . 5 **Figure 5** shows the expected mass of copper produced each minute.

Figure 5



Determine the expected mass of copper after 24 hours.

Use **Figure 5**.

[3 marks]

Mass = 4.2 mg

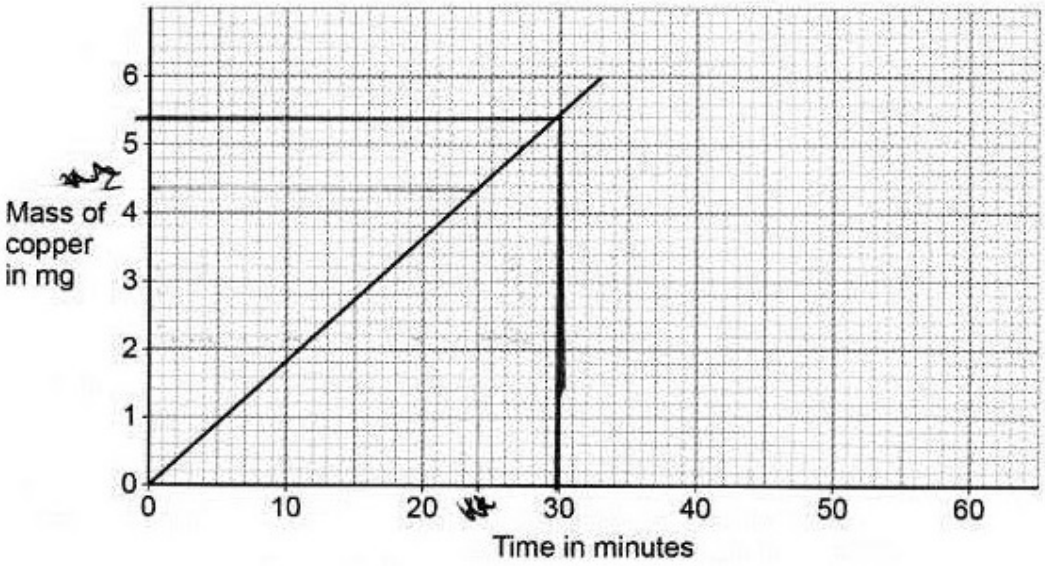
Comments on Student L

The student has understood that they need to use information from the graph in their answer but doesn't seem to have understood that the number of marks available indicates they need to do more than simply read a value straight from the graph as the answer. They appear to have misread or ignored the label on the *x*-axis and chosen a value on the *y*-axis that corresponds to 24 minutes, not 24 hours.

Student M

0 5 . 5 **Figure 5** shows the expected mass of copper produced each minute.

Figure 5



Determine the expected mass of copper after 24 hours.

Use **Figure 5**.

[3 marks]

30min = 5·2mg (×2)
60min = 10·4mg (×24)
24hr = 249·6mg

Mass = 249·6 mg

Comments on Student M

This student has understood what is required and has chosen to use the mass at 30 minutes to carry out their calculation (30 minutes is easily multiplied up to 24 hours). The line they've drawn on the graph is correct, but the student has misread the value on the *y*-axis as 5.2 (rather than 5.4) and so doesn't gain the first mark for the reading. They've then correctly multiplied this misread value up to 24 hours, so they gain the second two marks.

Activity 5f: 'Suggest'

- Look at student responses N, O and P.
- None of these responses gained full marks– why?

Student N: 2019 GCSE Combined Science Trilogy Chemistry 1H Question 5.4

0 5 . 4 Suggest **two** reasons why the mass deposited was different from the expected value.

[2 marks]

1 The copper was more reactive

2 They used a different current from power supply that affected how copper reacted.

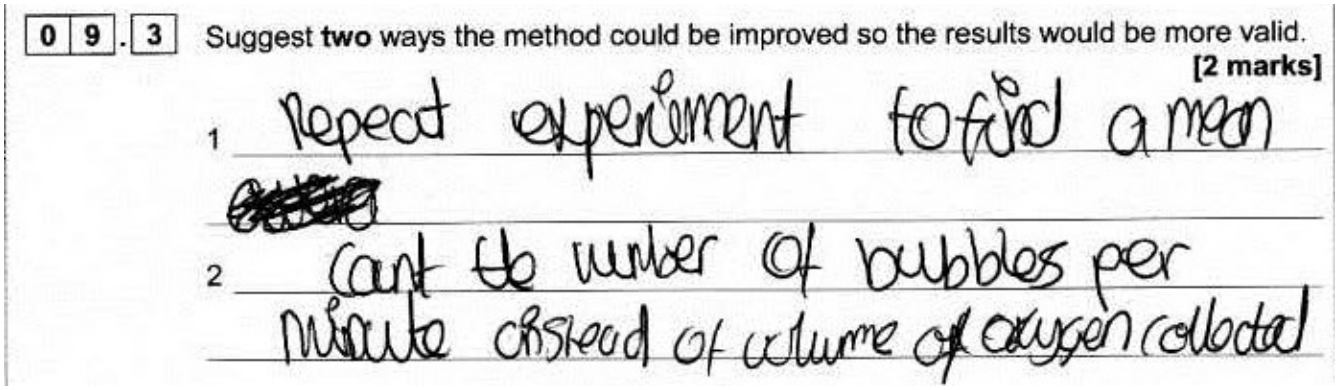
Mark scheme

05.4	any **two** from: • concentration / volume of solution was different • impurities in solution • error in timing • copper falls off (electrode) • copper removed when drying electrode • electrode not dry (when weighed) • voltage / current was different	 allow copper at bottom of beaker ignore power supply ignore recorded mass inaccurately	2	AO3 5.4.3.4

Comments on Student N

The first response doesn't make any sense. The second one gets the last bullet point.

Student O: 2019 GCSE Biology 1F question 9.3



0 9 . 3 Suggest **two** ways the method could be improved so the results would be more valid. **[2 marks]**

1 Repeat experiment to find a mean

2 Cant the number of bubbles per minute instead of volume of oxygen collected

Mark scheme

09.3	any **two** from: • repeat **and** calculate a mean **or** repeat **and** to eliminate anomalies • control the (water) temperature • control the concentration of carbon dioxide • control the distance of the bulb from the pondweed • control the mass / length / species / age of the pondweed • give pondweed time to equilibrate	ignore do a control experiment unqualified allow a method of controlling (water) temperature allow a method of controlling carbon dioxide concentration allow use the same piece of pondweed allow do experiment with the bulb off / in the dark	2	4.4.1.2 AO3

Comments on Student O

The first suggestion would improve the results and clearly matches the first bullet point on the mark scheme. The second suggestion would actually do the opposite.

Student P: 2019 GCSE Biology 2F question 5.2

0 5 . 2 Before the arrival of humans, there were no other large animals living on the island.

Suggest **two** reasons why the dodo became extinct soon after the arrival of humans.

[2 marks]

1 Humans may have got rid of them/ killed them.

2 Built buildings so they have to move.

Mark scheme

05.2	any **two** from: • humans hunted / killed / ate the dodo **or** dodo easy to catch • humans ate / collected eggs • humans ate the dodo's food • animals brought by humans ate dodo / eggs • diseases introduced by humans **or** by imported animals • humans destroyed dodo's habitat / nests	 allow examples – eg cats / dogs / pigs / rats allow deforestation	2	AO2 4.6.3.6

Comments on Student P

Students aren't expected to know anything about the dodo (they might not even have heard of it), so they need to apply what they know about factors contributing to extinction to come up with some answers for this unfamiliar context.

You'll see that all the marking points include reference to humans as it's the effect of the humans' arrival on the dodo that we are asking about. Although it isn't necessary for the response to state this, it must be strongly implied, so an answer such as 'disease' is insufficient to match bullet point 5, as the dodo will have suffered diseases before humans arrived on the island. Similarly, 'they were killed/hunted' is insufficient as there is no reference to humans. Although the question states that there were no other large animals on the island, this doesn't prevent them being hunted by (packs of) smaller animals.

The first response matches the first bullet point. The second response doesn't gain a mark because simply moving is not the same as 'loss of habitat'.

References

The Royal Society of Chemistry online CPD course *Effective pedagogy* literacy topic explores the particular literacy challenges within chemistry, and provides strategies to help teachers improve their students' confidence to tackle these challenges.

Literacy in science teaching | RSC Education: ideas for including more reading and writing opportunities in your science lessons.

Team | Science Journal for Kids and Teens: A science journal resource that's excellent for promoting scientific reading and writing. This is a Gates Foundation funded initiative and has some UK links. The search criteria are around the US school system but it'd be easy for UK teachers to find the appropriate level for their students.

National Strategies: Science | STEM The original teaching and learning training packs produced by the National Strategies.

The materials reproduced below are taken from the series of handouts provided in the Literacy in Science Training Materials | STEM.

Words with everyday meanings include:

Force: often used interchangeably with energy and power; will probably have everyday associations rather than the scientific concept.
Energy: often used interchangeably with force; linked to the everyday notion of energy being used up or running out, which will lead to misconceptions.
Material: although introduced with a scientific meaning in Key Stage 2, the everyday meaning often persists through Key Stages 3 and 4.
Dissolve: sometimes used interchangeably with melt, even though introduced correctly in Key Stage 2.
Tissue: has a distinct scientific meaning but also has an everyday meaning.
Other words: weight, power, mole, reflection, pure, matter, bulb, cell, current, key, plastic, circuit

Key word strategies

A key word is one that helps students communicate ideas in science clearly. Insist on the correct pronunciation and lots of practice saying the words out loud.

- **Divide vocabulary** lists into those that all students must know (the absolutely key words): words that it would be useful to know: words that are for the most able.

- **Identify** for students which key words are:
  - **names of objects/structures** eg artery, granite, hydrogen
  - **processes** eg evaporation, respiration, digestion
  - **concepts** eg energy, force, atom

Names are the simplest words to understand. Some processes cannot be seen easily so can cause problems in understanding. Concepts are largely abstract and even though they might be easy to read they are, nevertheless, difficult to understand.

- **Use the following process for introducing new vocabulary:**

    1. Introduce the word (is it a name, concept or process?).
    2. Write it on the board.
    3. Say the word.
    4. Ask students to say the word out loud.
    5. Break the word down into syllables; point out similarities with other words, use mnemonics to remember spellings if necessary.
    6. Ask students to read the word as it's used.
    7. Ask students to use the word in a description or explanation.

- **Use syllabification.** Break down the word into syllables – get them to say it, write it and read it, eg ox-y-gen, di-ges-tion, re-spir-a-tion, It is important to say the words aloud.

- **Group words:** Talk to students about words with similar patterns: eg -tion endings for processes – nutri-tion, filtra-tion, distilla-tion; eg -ic endings for acids – sulphur-ic, nitr-ic, hydrochlor-ic.

- **Make links** with words students already know: eg electrode from electron, filtration from filter.

- **Remind students of spelling rules –** check what the English department use eg 'i' before 'e' except after 'c'.

- **Encourage students to make personal dictionaries/glossaries of key words.**

- **Cued spelling:** Ask students to use mnemonics, or memory hooks, to remember troublesome words: eg diarrhoea - Down In Africa Red Riding Hood Only Eats Apples; eg laboratory - Lab or a Tory (humour); eg saying a word differently can help such as Elec-trol-Y-sis.

- **Use 'look, say, cover, write, check'.**

- **Calligrams:** Exaggerating part of the word to help illustrate its meaning is helpful, for example, making the double 'll' in parallel much longer when writing it on the board.

Scientific Vocabulary Games

Activities that have a ‘game-like’ feel can help students gain confidence with scientific vocabulary.

Consider:

- **Loop card games** – students are dealt a set of cards, each with a question and an answer to a different question. Beginning with any student reading out their question, the student with the corresponding correct answer is required to read it out. That student then reads their question for another student to answer. A loop game is constructed so that the sequence ensures that all questions and answers must be used. In a loop game the sequence always arrives back at the first question.

- **Producing key words and meanings** on separate cards which can be used in different ways:
  - Students can sort them into pairs and justify pairing. Discuss different ‘pairings’.
  - Students can sort them into threes and again justify.
  - Arrange in threes and ask students which is the odd one out.
  - Students match word and definition.
  - Teacher reads out word or definition and students find match from their set.

- **Dominoes:** Prepare the cards as a set of dominoes. Cut out each card so its question and an answer form one ‘domino’. Shuffle the cards. Students play by finding the answer to a question on a different card. Match all the questions with their correct answers and you’ll be able to form a complete loop.

- **Taboo:** The cards contain words that students aren’t allowed to use. These can be made more or less difficult depending on the number of taboo words you use. A group of students has a set of cards which are face down. One student selects a card and has to give the rest of the group clues as to what the word is without using the taboo words. The student who guesses correctly selects the next word

- **Writing words in a way that shows a characteristic**

eg **VAC UUM** Wavelength **capi | ary**

Some useful word roots

Root	Meaning	Root	Meaning
aer	oxygen	iso-	the same
allel	different	lign	wood
amphi-	both	lys	break down
ante-	before	macro-	large
anti-	against	micro-	small
arthr	joint	myc	fungus
bi (bio-, -biotic, -be)	life	-oid	resembling
bi-	two	-on	a unit
cardi	heart	-ose	a carbohydrate
chlor	green	peri-	around
cyt	cell	phot	light
derm	skin	sapr	decay
di-	two	spir	breathe
dia-	across	stoma	mouth
ecto-	outside	sym-, syn-	together with
endo-	inside	therm	heat
gam	mating	trans-	across
ge	earth	troph	feeding
graph	write	vas	vessel
gyn	female	vor	feeding
haem	blood	xyl	wood
hydr	water	zoo	animal

Word roots in naming elements and compounds

In the eighteenth century, Antoine Lavoisier was credited with the development of the modern view of elements and compounds and is sometimes dubbed the 'father of modern chemistry'. The systematic naming of compounds saw a major revolution from this time onwards.

- New metals that were discovered were to end in **-ium**.
- Acids ending in **-ic** lead to the formation of salts with names ending in **-ate** (or sometimes **-ide**).
- Acids ending in **-ous** lead to the formation of salts with names ending in **-ite**.
- The suffix **-ide** indicates a compound of two elements (except for hydroxide): the name of one of the elements in the compound takes the -ide to show this eg oxygen – oxide: sulfur – sulfide: iodine – iodide. An -ide ion is always negative
- In simple terms **-ite** and **-ate** can be related to the amounts of oxygen in a group of atoms in the salt (-ate has more oxygen than -ite).

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Notes

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