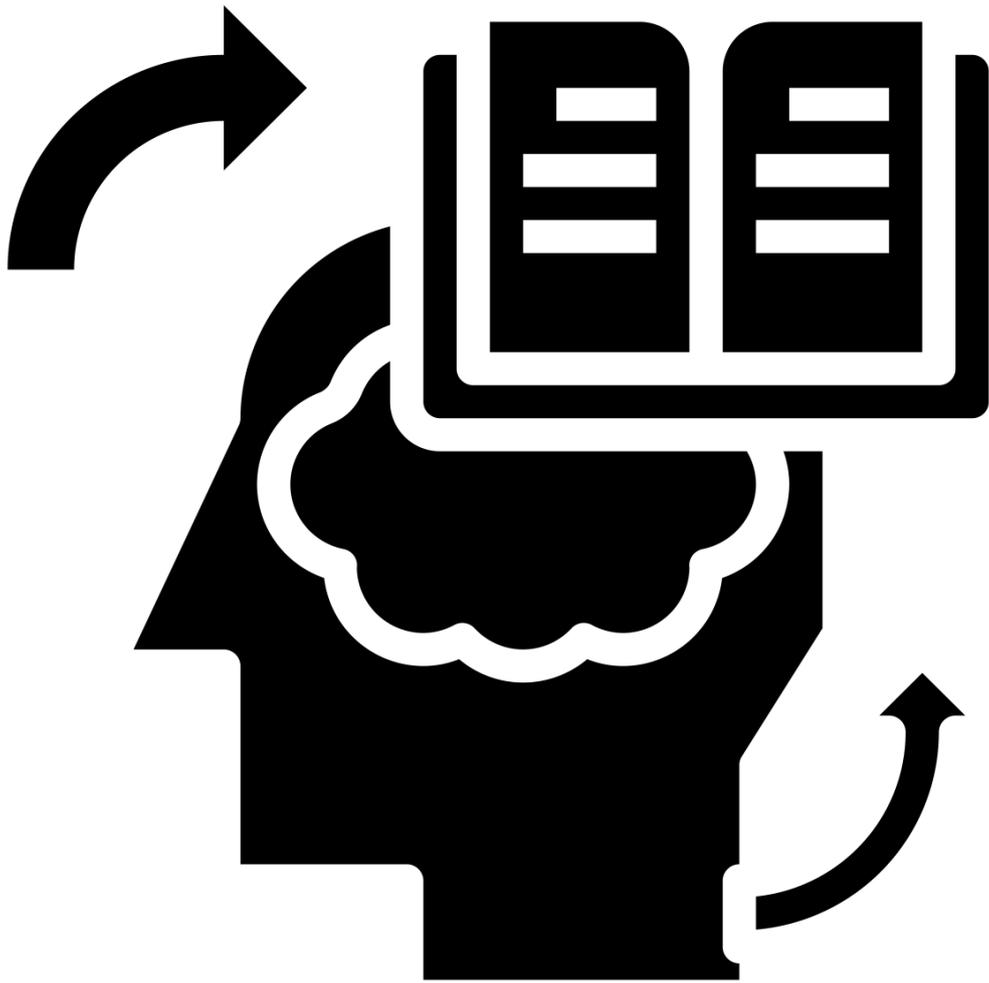


Learning How to Learn



Compiled by Simon Flynn

Study Smarter, Not Harder

Begin by asking yourself...

How do you study?

Then...

Why do you study this way?

And finally...

Does it work (and how do you know?)

Because...

If your study methods feel easy, then they're not working.

For example...

Simply reading notes is not an effective learning method

and...

Neither is highlighting or underlining.

This is because...

They don't require much effort.

Instead...

More effortful strategies, like the ones covered in this booklet, produce greater long-term learning gains.

It's important to realise that...

Difficulty is *desirable* even if it's not always *desired*.

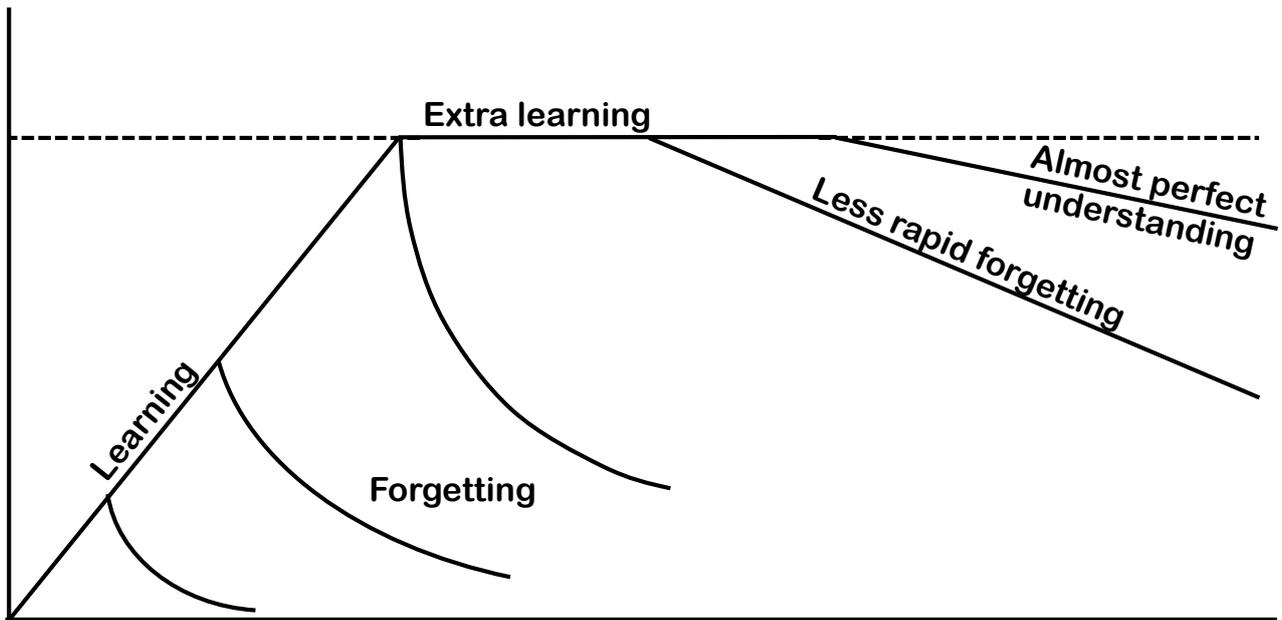
Successful Learning Takes Place Over Time



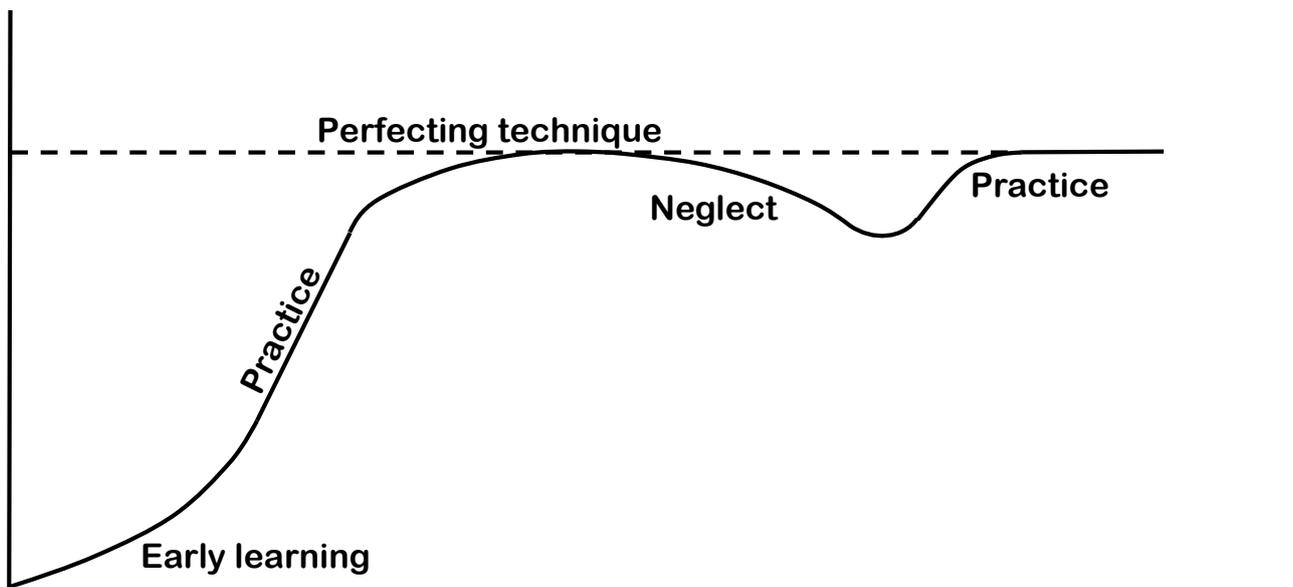
It's rare for anyone to be completely comfortable with something they learn for the first time. This could be a new piece of music, dance move, language or chemistry.

We *all* have to practice. In most instances, the aim is to be at your optimum on the day it matters, e.g. the performance, race or exam. Everything leading up to this point is part of the *process* of improving. It's about the long-term rather than the short-term, which means there are no quick fixes. During this period, it's okay to make mistakes; it's okay to feel frustrated. What matters is what you do about it.

Knowledge and understanding over time



Mastering a skill over time

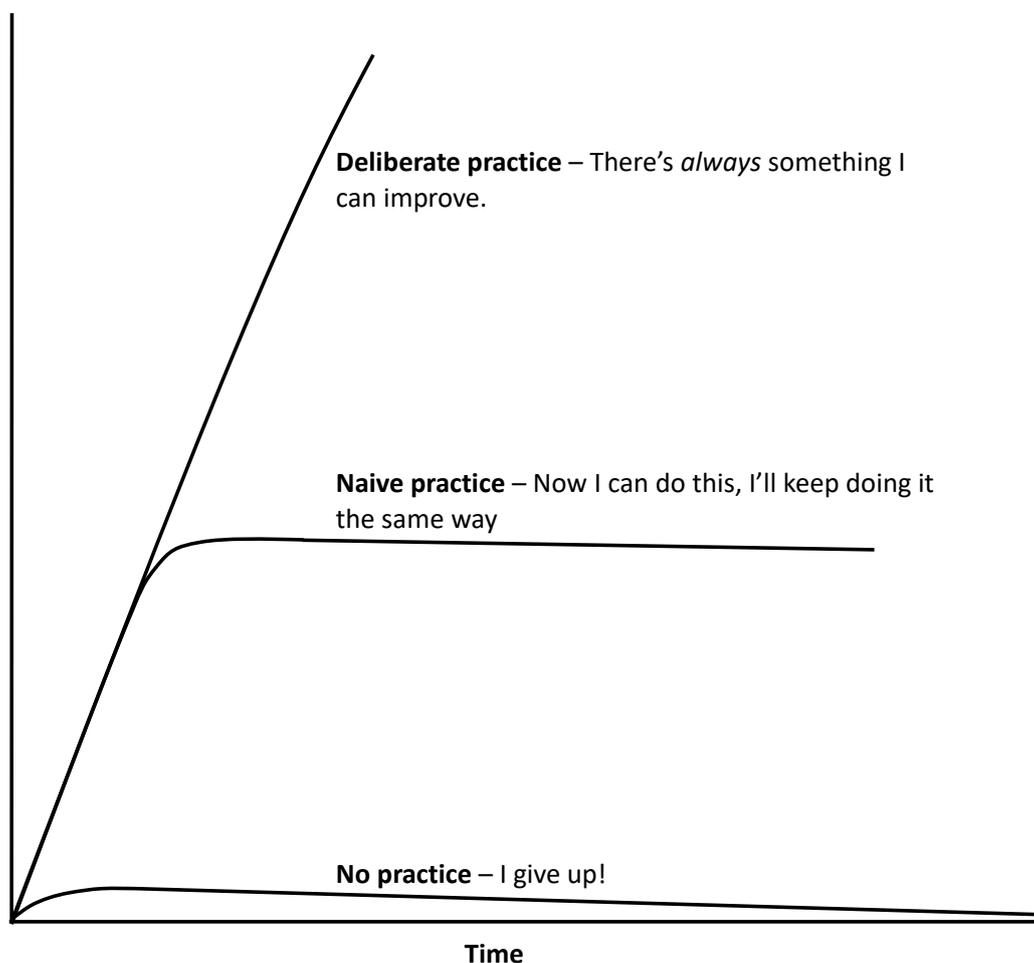


Not All Practice Is Equal!



So, practice makes perfect, right? Erm, not quite. That's because not all practice is equal. Echoing the flowchart at the beginning of this booklet, practice requires effort if it's to have an impact.

We might, for example, simply go through the motions, repeating what we've done before, including our mistakes. For instance, I've typed regularly for about twenty-five years. After an initial acceleration in my accuracy and speed, I plateaued a long time ago. Regarding progressing my typing, I've been employing what is known as naïve practice. If I want to see a real gain in my typing ability, it's deliberate practice I need to do.



Deliberate practice is always performed with a clear goal in mind, i.e. it consists of activities purposely designed to improve performance. Crucial to the success of this process is continual feedback, which is something that coaches provide elite athletes or musicians. They make suggestions for improvement and hold the person to account; they are constantly raising the bar and demanding the best. Sadly, we can't all have our own coach. We must, instead, find other ways of continually sourcing feedback.

Many learning strategies in this booklet provide explicit feedback on what you do and don't know, allowing you to focus on future strategies better. They are all proven to deliver tangible gains in our learning.

Summarising



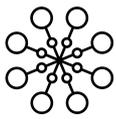
You'll likely provide a summary when asked a question such as 'what have you done today?'. This involves selecting, organising and integrating the critical moments of your day. Taking a similar approach to your studies can have a powerful effect on your learning. What is vital is that you use your own words and don't mindlessly copy your notes or revision guide.

Self-testing



Research has shown that every time you bring a memory to mind, you strengthen it. And the more challenging you make this retrieval, the greater the benefit. Self-testing improves the recall of information, transfer of knowledge and making inferences between information. Equally, there are many indirect effects, such as a greater appreciation of what you do and don't know, which helps you plan your next steps.

Mapping



Mapping is a brilliant way of organising and learning information, demonstrated on various pages in this booklet. It helps you break down complex information, memorise it, and see the connections between different ideas.

Drawing



This involves turning text into some form of drawing. Doing so involves selecting, organising and integrating the information that matters, which forces you to think. This approach can be incorporated into the three strategies above too.

Self-explaining



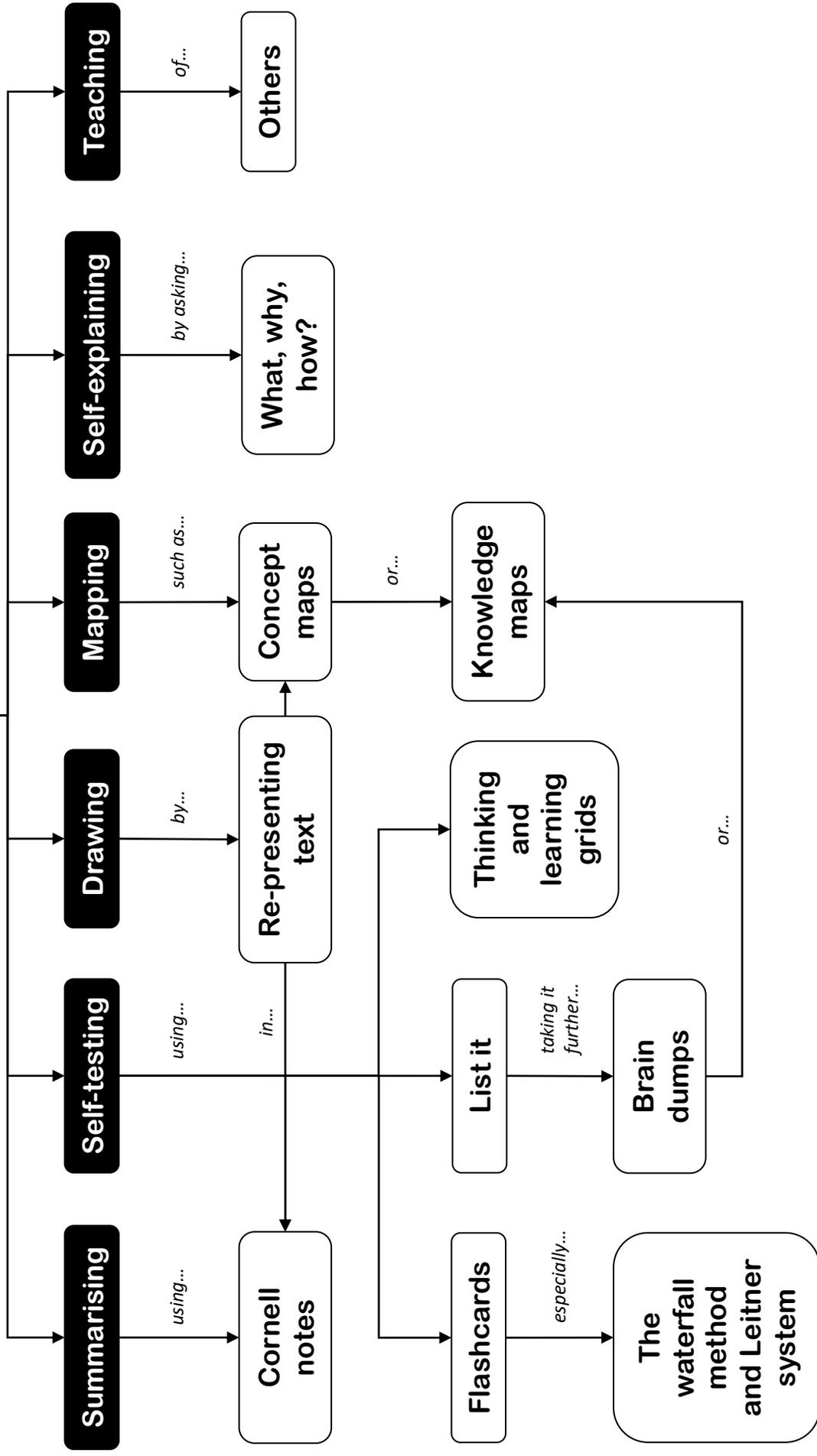
Continually ask yourself 'How?' and 'Why?' when studying a topic and then try to answer these questions. Doing so helps you to see connections and differences between ideas. Self-explaining can also involve you saying the steps you're taking when solving a problem out loud. For example, a recent analysis of 64 research studies showed that 'it is better to ask a student to see if they can explain something to themselves, than for a teacher or book to always explain it to them'.

Teaching



Einstein is supposed to have said, 'if you can't explain it simply, you don't know it well enough'. This strategy works best when you know beforehand that you will teach someone. As with self-explaining, you're forced to select and organise what's important so that your teaching is as straightforward as possible. Having someone to interact with and ask you questions strengthens your learning.

Learning Strategies



Flashcards



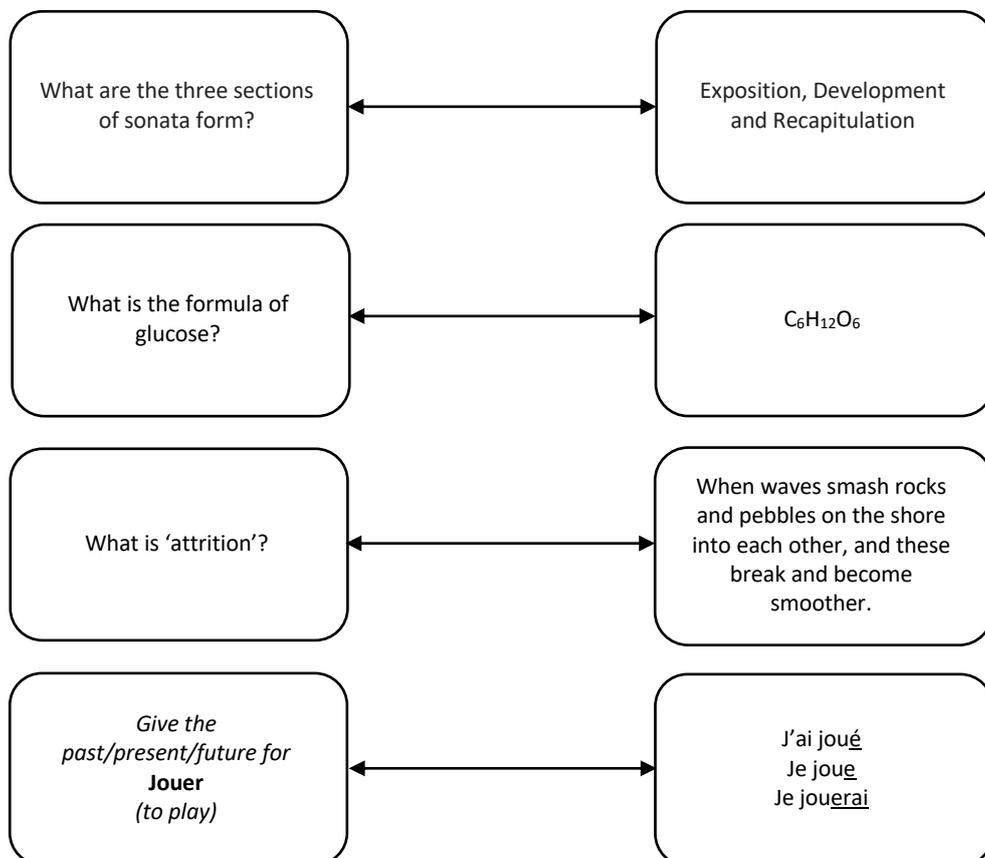
Flashcards have the potential to be a powerful learning aid. However, how successful this is will depend on the thought you put into making them and how they're used. It's vital to remember that they're for testing, not summarising.

Making good flashcards

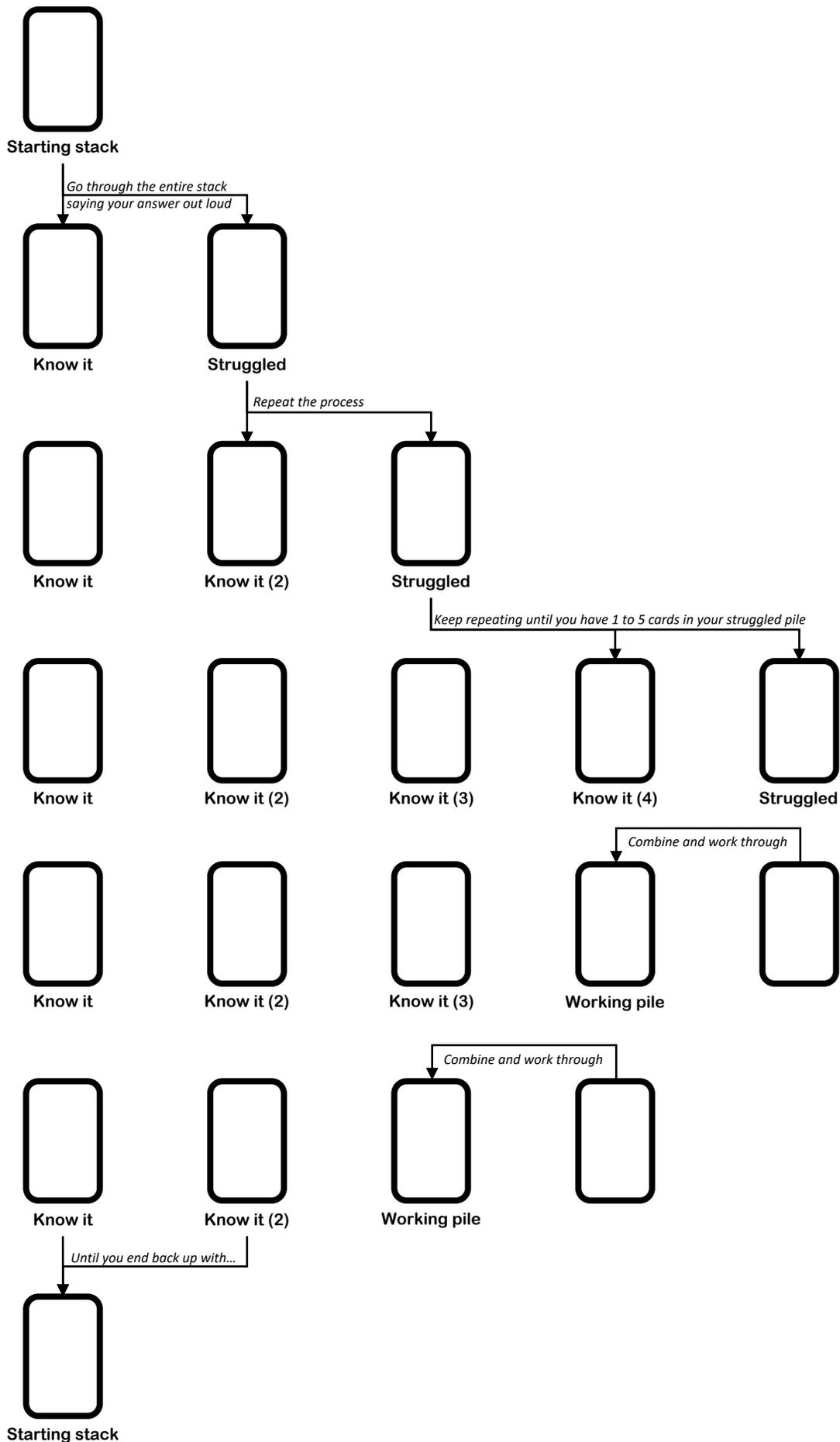
- One side of the flashcard should be a single question, and its answer on the reverse.
- Select the essential information to go on each flashcard. You could use topic checklists or bolded terms in your study guide to help you choose.
- Break complex concepts down so that they cover multiple cards.
- Use drawings to illustrate answers.

Using flashcards

- Say your answer out loud and not just in your head. You must be fully committed to your response. Even better would be to write your answer as you would have to do in an exam.
- Use them both ways – look at the answers and say what the question is.

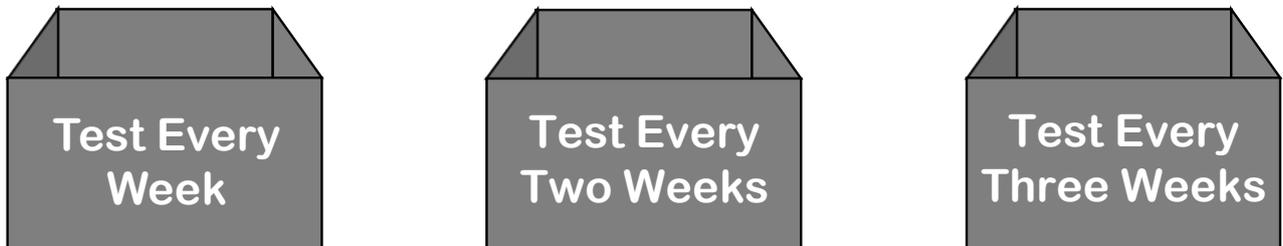


Flashcards – The Waterfall Method

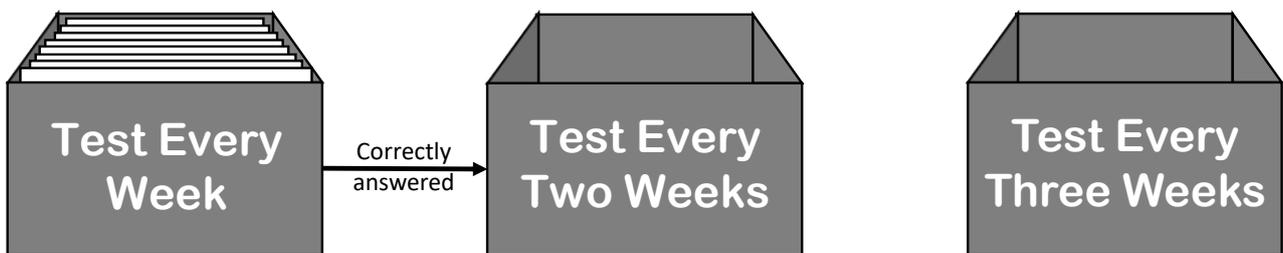


Flashcards – The Leitner System

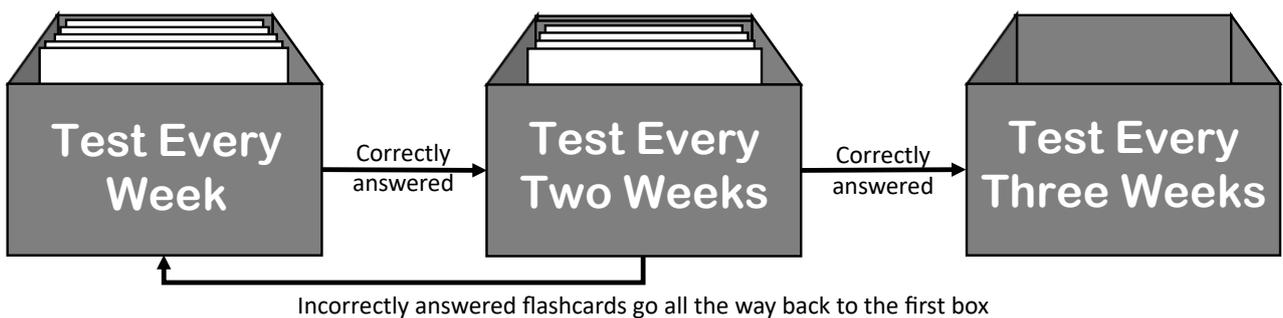
This is an excellent method of using flashcards over a sustained period of time and requires serious commitment. However, there can be a great return to your effort as the Leitner system allows you to see clearly that your learning is improving. Begin by finding three boxes that your flashcards can go in. Each box will determine the frequency you test yourself on the flashcards it contains (note: you decide how many boxes and the frequency you look at them). For example:



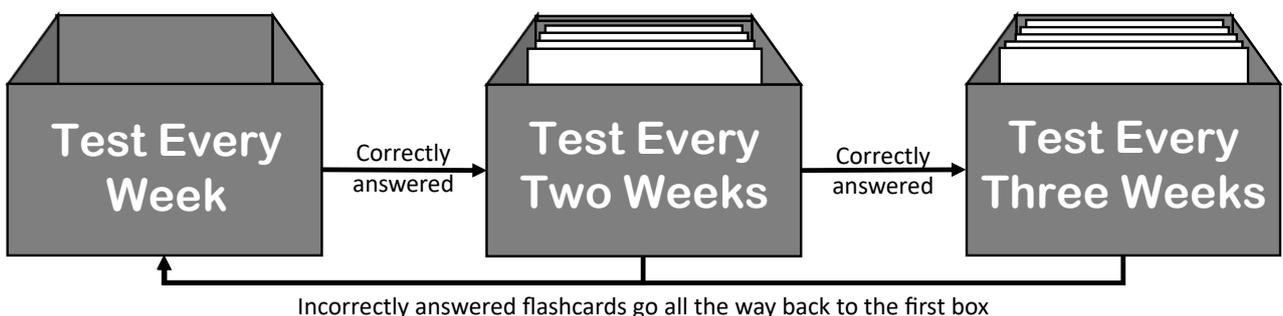
Place ALL your flashcards in the first box and test yourself. If you get a card right, move it to the second box. If you get it wrong, it remains in the first.



You test yourself on the card in the first box the following week and the second in two weeks. When you get a card right, move it to the next box. However, if you get it wrong, move it back to the first book. You must be strict about this.



Continue testing yourself according to each box's frequency.



When you start, all the cards are in the first box. Hopefully, these will move to the later boxes as you use the system, measuring your progress. To help make things as straightforward as possible, here's the schedule based on the boxes' labelled frequencies above.

Week	Box 1	Box 2	Box 3
1	✓		
2	✓		
3	✓	✓	
4	✓		
5	✓	✓	✓
6	✓		
7	✓	✓	
8	✓		✓
9	✓	✓	
10	✓		
11	✓	✓	✓
12	✓		
13	✓	✓	
14	✓		✓

You can see that there is a clear routine from week 6 onwards. The underlying idea is that the better your mastery, the less frequent the practice. However, if it's important to retain, it will never disappear entirely from your set of practice boxes.

Taking things further: making meaning with flashcards

- Ask yourself questions about individual cards. Then, once you can remember the information on the back associated with the prompt on the front, raise questions such as, 'What else is this related to?', 'Why is this important?' and 'How would I apply this information?'



- Group cards together in themes. Taking this additional step forces you to ask yourself, 'Which cards have something in common with others?'. This also serves as a form of chunking, which helps you remember information together instead of separately.
- Create a mind map with the cards. Explain all the connections you see between individual cards and between groups of cards. A related strategy is to use yarn or string to connect cards.

List It



This is a simple free recall task that is very versatile. It can feel challenging, but this is a good thing, and it provides clear feedback on what you do and don't know. Choose a topic, set yourself a time limit and...

- List as many keywords as you can
- List as many facts as you can
- List as many key events/quotes/individuals as you can
- List as many causes of X as you can
- List as many consequences of Y as you can

Brain Dumps



Brain dumps can be incredibly effective as an extension of 'list it' above. Spend, say, fifteen minutes with a blank piece of paper and write down everything you know about a topic. Once finished, look at your class notes, textbook and/or revision guide and check that what you've written is correct. Then look at what you've forgotten and focus on this. Finally, date the sheet and store it away. Later, do the exercise again and compare the sheets – hopefully, you will remember more the second (third, fourth etc.) time and will be able to see the improvement you've made.

Brain dumps made easier

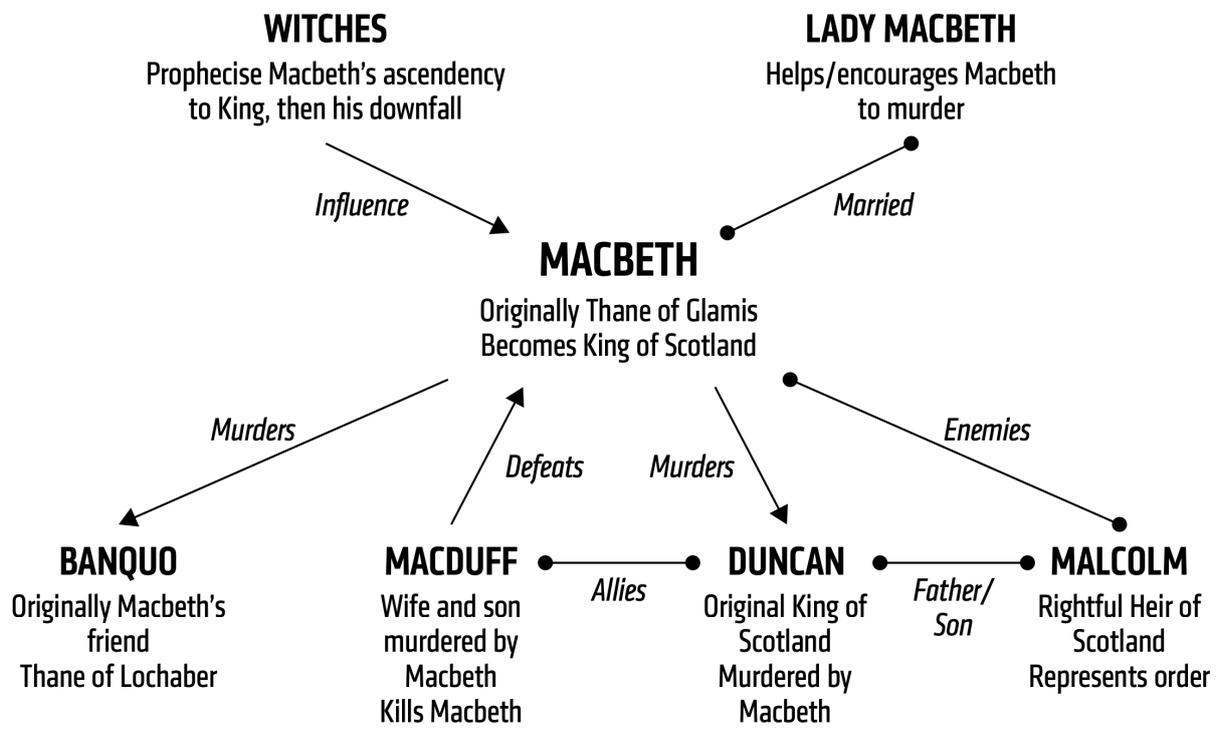
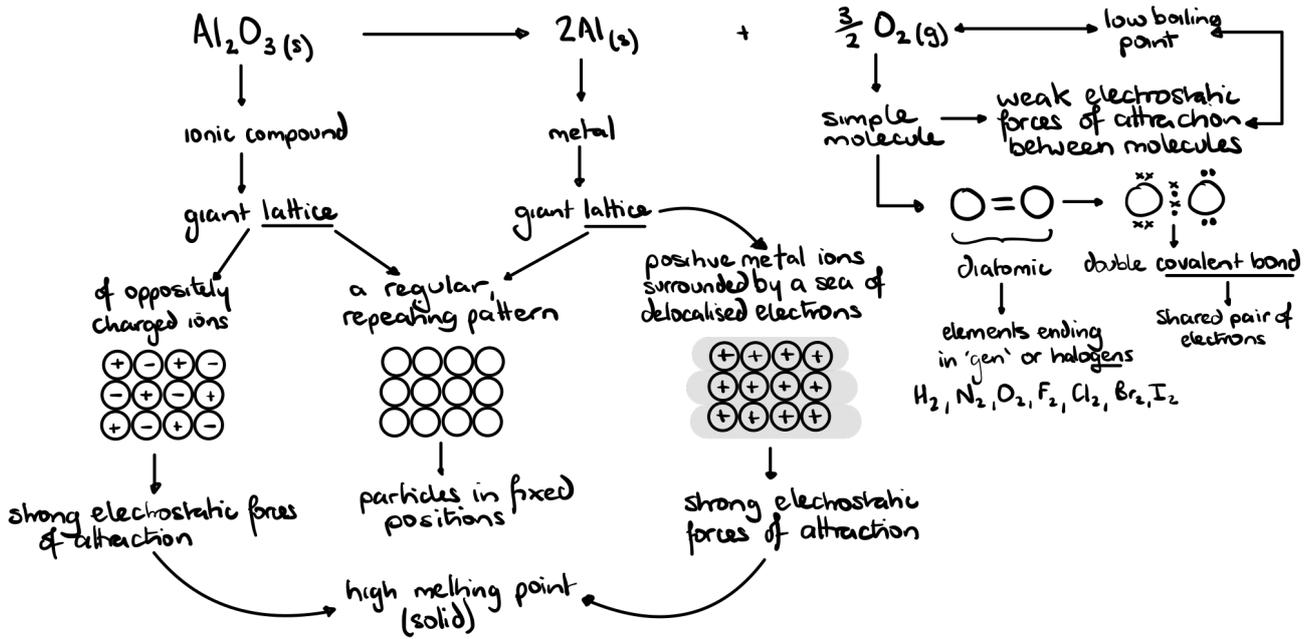
Brain dumping can be a terrifying exercise. To create a gentler, if less effective, version, compile a list of keywords, terms, people, countries etc., connected with a topic and write uninterrupted for fifteen minutes using these as prompts. For example, if your brain dump was on the 'Energy' topic in Physics, your prompts could be:

$= \frac{1}{2} mv^2$ = W/t = $F \times s$ = $mc\Delta T$ = **mgh** biofuel **chemical** conduction
conservation of energy dissipate **distance** efficiency **elastic potential** electricity
electrostatic force **fossil fuels** friction **geothermal** gravitational potential **heating**
hydroelectric **insulation** Joule (J) **kilogram (kg)** kinetic **lubricant** magnetic
metre (m) Newton (N) **non-renewable** nuclear **power** renewable **Sankey diagram**
solar **specific heat capacity** store **thermal** tidal **transfer** useful energy
wasted energy water waves **Watt (W)** waves **wind** work done

So, a brain dump on energy might start... *Energy cannot be created or destroyed but is only transferred from one store to another. There are eight energy stores. These are: kinetic, gravitational potential, chemical, elastic potential, internal (thermal), nuclear, electrostatic, and magnetic. Anything moving has a kinetic energy store. Anything raised a height has a gravitational potential store. Food, fuels and batteries are examples of chemical stores. Anything that can be squashed or stretched has an elastic potential store. A change in temperature means a change in the internal (thermal) store. There are four energy transfers: work done (mechanical), radiation...*

Knowledge Maps

Knowledge maps are like Brain Dumps in that you try to recall everything you know about a topic onto a blank piece of paper. The difference is that you connect ideas visually rather than in continuous prose. As with Brain Dumps, once finished, look at your class notes, textbook and/or revision guide and check that what you've written is correct. Then look at what you've forgotten and focus on this. Here are two entirely different examples:



(Taken from Sweller's Cognitive Load Theory in Action by Oliver Lovell)

SQ5R – Survey, Question, Read, Respond, Record, Recite, Review



The SQ5R study method encourages active reading, improving material comprehension and retention.

Survey

Before reading a chapter or passage, read the introduction and summary. Skim topic headings, bold-faced words, pictures, charts, and graphs to get an idea of the general structure and content before starting to read.

Question

Come up with questions from the topic and headings skimmed in the survey step. Ask who, what, where, when, why, and how questions: the best questions are general, covering main topics and important points. Doing this provides you with a purpose for your reading.

Read

Break the material into sections that take about 20 minutes to read. Look for: answers to your questions, key concepts, and supporting details. Pay attention to charts, graphs, tables, and pictures that present new information and tie together ideas from your reading.

Respond

After each section, think about the material you have just read and answer the questions you have asked. This can often be done during reading. This step aims to think about the material and notice what is important.

Record

Make summary notes – see the following sections (*Summarising and Note Taking – Delete, Substitute and Keep* and *The Cornell Note Taking Method*) for guidance on how best to do this.

Recite

Next, look away from the material and try to recite the key information and ideas in your own words. Then, reread the material until you can recall the most important points. This may be frustrating at first but it will lead to better understanding and save review time in the long run.

Review

After reading the entire chapter, scan and review the information aloud or in your head; discuss the material with a classmate if possible. Identify overall themes and relationships between concepts. Finally, edit your notes to improve them further.

(Adapted from https://www.etoyn.edu/offices/learning/SQ5R_Method.aspx)

Summarising and Note Taking – Delete, Substitute and Keep



Research has shown that summarising information is a highly effective way of making your learning more meaningful. One approach to summarising is to **delete** some information, **substitute** some information, and **keep** some information. Here's an example:

Original text (from an AQA Religious Studies textbook)	Delete, substitute, keep
<p>Bar Mitzvah can literally be translated as 'son of the commandments'. It is a recognition of the fact that a young man has reached the age by which he is personally responsible for his religious acts, and is marked by his first reading in the synagogue of the Torah. From this point on, he is regarded as an adult in all religious respects, for example, he should use tefillin in prayers and can count as one of the minyan, for example. In fact, he remains Bar Mitzvah all his life, it is not just for one day, as it refers to the duty of keeping the mitzvot, which is incumbent on all Jews. Males lead the service in an Orthodox shul and so reading from the Torah is a way showing the change in status from a child to an adult.</p> <p>Girls have different roles within Jewish life and so they have different ceremonies. Girls reach the age of maturity at twelve, and it is common to recognise that through the Bat Mitzvah ceremony. There is no special ceremony, and it is common, especially in the Orthodox community to celebrate this at home, with the girl reciting a blessing and talking about the importance of the day. In the Reform and Liberal, and many of the Conservative, traditions, in recognition of changing societal norms and a sense of equality, there are special events in the synagogue. In the Reform and Liberal traditions, a girl may read the Torah at synagogue, so the ceremony will be the same whichever gender.</p>	<p>Bar Mitzvah can literally be translated as 'son of the commandments'. It is a recognition of the fact that a young man has reached the age by which he is personally responsible for his religious acts, and is marked by his a <u>young man's</u> first reading in the synagogue of the Torah. From this point on, he is regarded as an adult in all religious respects, for example, he should use tefillin in prayers and can count as one of the minyan, for example. <u>In fact, he remains Bar Mitzvah all his life, it is not just for one day, as it refers to the duty of keeping the mitzvot, which is incumbent on all Jews.</u> Males lead the service in an Orthodox shul and so reading from the Torah is a way showing the change in status from a child to an adult.</p> <p>Girls have different roles within Jewish life and so they have different ceremonies. Girls They reach the age of maturity at twelve, and it is common to recognise that through the Bat Mitzvah ceremony. Girls reach the age of maturity at twelve and have different ceremonies, such as the Bat Mitzvah. There is no special ceremony, and it is common, especially in the Orthodox community to celebrate this at home, with the girl reciting a blessing and talking about the importance of the day. In the Reform and Liberal, and many of the Conservative, traditions, in recognition of changing societal norms and a sense of equality, there are special events in the synagogue. In the Reform and Liberal traditions, a girl may read the Torah at synagogue, so the ceremony will be the same whichever gender.</p>
<p>Summary: Bar Mitzvah is marked by a young man's first reading in the synagogue of the Torah. From this point on, he is regarded as an adult in all religious respects. Males lead the service in an Orthodox shul, so reading from the Torah shows the change in status from a child to an adult.</p> <p>Girls reach the age of maturity at twelve and have different ceremonies, such as the Bat Mitzvah. In the Orthodox community, it is common to celebrate this at home. However, in the Reform and Liberal traditions, a girl may read the Torah at synagogue, so the ceremony will be the same for whichever gender.</p>	

This approach is so effective because of the need to really analyse the information you're trying to summarise.

Here's another example.

Original text	Delete, substitute, keep
<p>The chemical reactions that take place in a cell are controlled by a group of proteins called enzymes. Enzymes are biological catalysts. A catalyst is a chemical which speeds up a reaction without being used up itself. It takes part in the reaction, but afterwards is unchanged and free to catalyse more reactions. Cells contain hundreds of different enzymes, each catalysing a different reaction. This is how the activities of a cell are controlled – the nucleus contains the genes, which control the production of enzymes, which then catalyse reactions in the cytoplasm:</p> <p style="text-align: center;">genes → proteins (enzymes) → catalyse reactions</p> <p>Everything a cell does depends on which enzymes it can make, which in turn depends on which genes in its nucleus are working.</p> <p>What hasn't been mentioned is why enzymes are needed at all. They are necessary because the temperatures inside organisms are low (e.g. the human body temperature is about 37 °C) and without catalysts, most of the reactions that happen in cells would be far too slow to allow life to go on. The reactions can only take place quickly enough when enzymes are present to speed them up.</p> <p>It is possible for there to be thousands of different sorts of enzymes because they are proteins, and protein molecules have an enormous range of structures and shapes.</p>	<p>The chemical reactions that take place in a cell are controlled by a group of proteins called enzymes. Enzymes are <u>proteins that are</u> biological catalysts. A catalyst is, a chemical<u>s</u> which speeds up a reaction without being used up itself. It takes part in the reaction, but afterwards is unchanged and free to catalyse more reactions. Cells contain hundreds of different enzymes, each catalysing a different reaction. This is how the activities of a cell are controlled – <u>because</u> the nucleus contains the genes, which control the production of enzymes, which then catalyse reactions in the cytoplasm:</p> <p style="text-align: center;">genes → proteins (enzymes) → catalyse reactions</p> <p>Everything a cell does depends on which enzymes it can make, which in turn depends on which genes in its nucleus are working.</p> <p>What hasn't been mentioned is why enzymes are needed at all. They are necessary because the temperatures inside organisms are low (e.g. the human body temperature is about 37 °C) and without catalysts, the body's temperature is so low (37°C) that most of the reactions that happen in cells would be far too slow to allow life to go on. The reactions can only take place quickly enough when enzymes are present to speed them up.</p> <p>It is possible for there to be thousands of different sorts of enzymes because they are proteins, and protein molecules have an enormous range of structures and shapes.</p>
<p>Summary: Enzymes are proteins that are biological catalysts, chemicals which speed up a reaction without being used up. The activities of a cell are controlled because the nucleus contains genes, which govern the production of enzymes, which then catalyse reactions in the cytoplasm:</p> <p style="text-align: center;">genes → proteins (enzymes) → catalyse reactions</p> <p>Enzymes are necessary because the body's temperature is so low (37°C) that most reactions in cells would be far too slow to allow life to go on.</p>	

Cornell Note Taking Method

This is the best way to take and review notes.

1. Write notes on the area in question using the tips below.
2. Create recall cues one or two days later.
3. After a few days, write a summary of the key points.
4. At any future point, cover the notes and summary and use the recall cues to test yourself.

Topic:	Sub-topic:	Date:
Recall cues Questions and tasks based on the notes opposite	Notes Tips <ul style="list-style-type: none">• Bullet points• Symbols and abbreviations• Write in your own words (don't mindlessly copy)• Make sure it makes sense to you What to write <ul style="list-style-type: none">• Keywords and ideas• Important dates / people / places• Diagrams / charts• Formulas• Examples / case studies• Critical analysis, e.g. strengths/weaknesses	
Summary Summarise the main points in the notes above. Think about: <ul style="list-style-type: none">• Why is this info important?• What conclusions can I draw?		

Adapted from <https://chloeburroughs.com/choose-best-note-taking-method/>

Topic: Weimar Republic (WR) in 1923 - Stresemann

Recall cues

What crisis did the WR suffer in 1923?

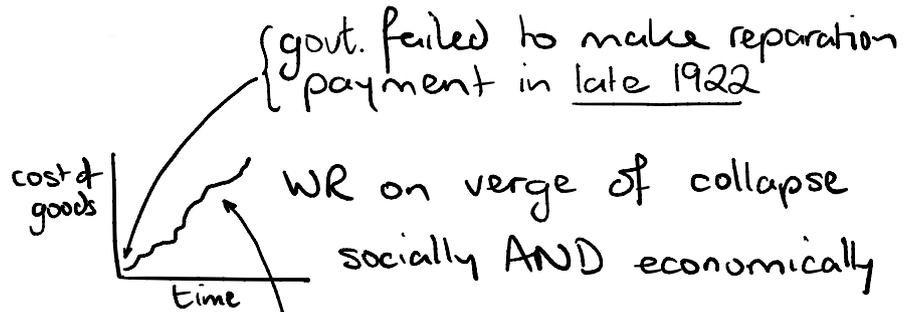
What did this mean to the average citizen?

What prompted this crisis?

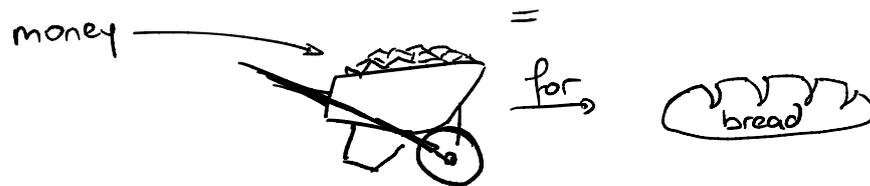
Name 4 things Chancellor Stresemann did that helped overcome this crisis?

What effect did each of these have?

Notes



HYPERINFLATION CRISIS



• Aug 1923 - STRESEMANN becomes Chancellor and over 3 months... ~~HYPERINFLATION CRISIS~~

↓ How?

- ① calls off passive resistance of workers in Ruhr ⇒ goods produced again; ends printing of (£) for workers
- ② Promises to restart reparations (Belgium & France leave Ruhr by 1925). See also: The Dawes Plan (1924) and The Young Plan (1929).
- ③ New currency, Rentenmark, introduced. Limited printing ⇒ (£) ↑ value ⇒ economic confidence ↑
- ④ Reduces government spending ⇒ budget deficit ↓

Summary

Germany fails to pay France & Belgium → invade Ruhr and seize goods

Germans go on strike = passive resistance
Govt. prints lots more money → CRISIS

Stresemann elected Chancellor

- solves crisis by

- ① Ends strikes
- ② Promises to restart reparations
- ③ New currency
- ④ Reduces govt. spending

HYPERINFLATION	Jan '22: £1 = 764 marks
	Jan '23: £1 = 71,888 marks
	July '23: £1 = 1,413,648 marks
	Sept '23: £1 = 3,954,408,000

Topic:

Covalent Bonding

Recall cues

In covalent bonding, electrons are ?

This results in each atom involved achieving a

Between what elements are covalent bonds formed?

What is a covalent bond?

How do you work out how many covalent bonds an atom has?

Draw dot-and-cross diagrams for:

- NH₃
- N₂
- CO₂
- H₂O
- CH₄

Notes

• Covalent bonding involves the sharing of electrons → each atom involved ends up with a FULL OUTER SHELL.

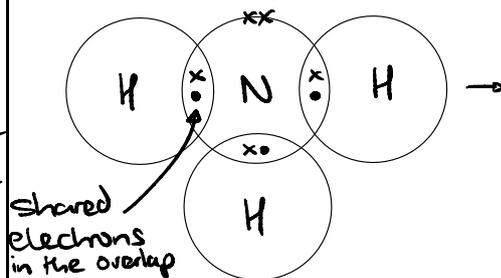
• Occurs between non-metals only

• A covalent bond is a shared pair of electrons

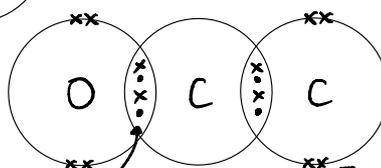
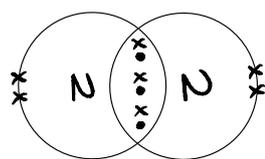
• 8 - group no.* = the no. of covalent bonds

E.g. nitrogen has 8 - 5 = 3 covalent bonds.

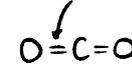
5 x's as nitrogen is in group 5



* Hydrogen always has 1 covalent bond



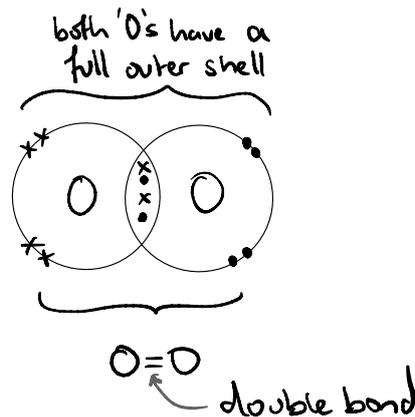
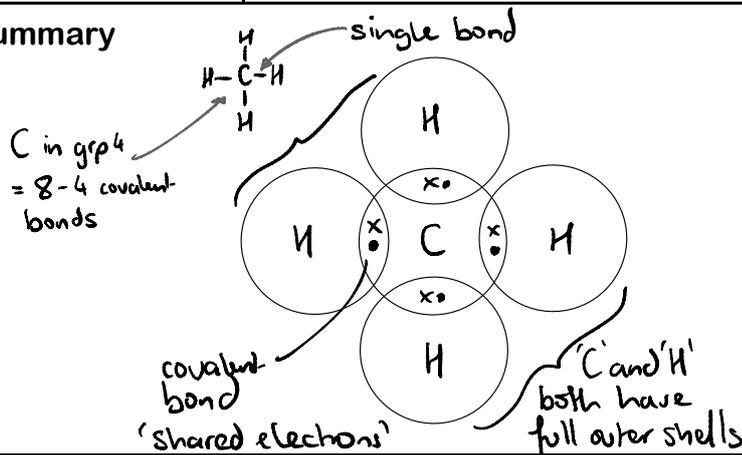
double bond

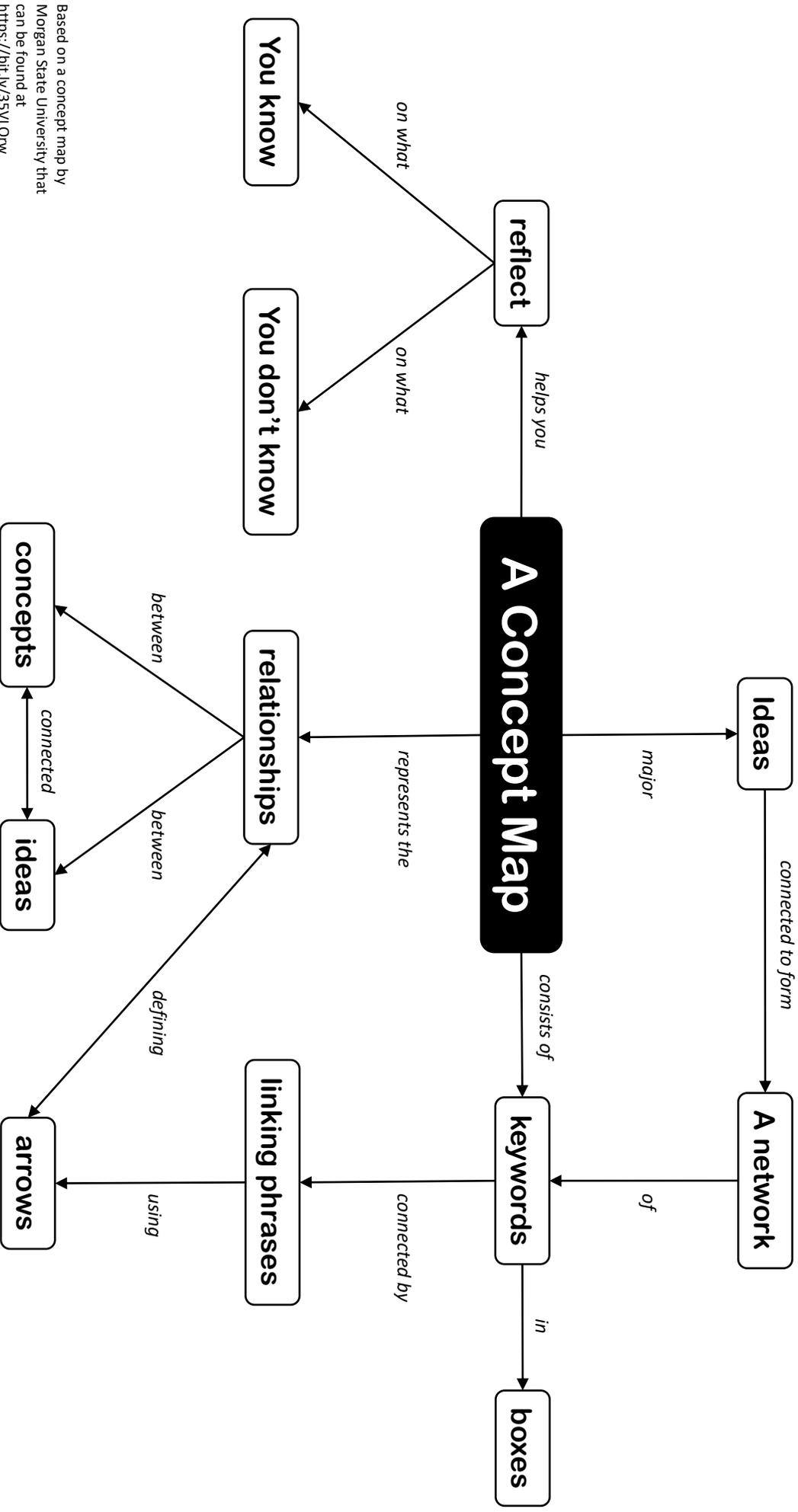


4 e's as C is in grp 4

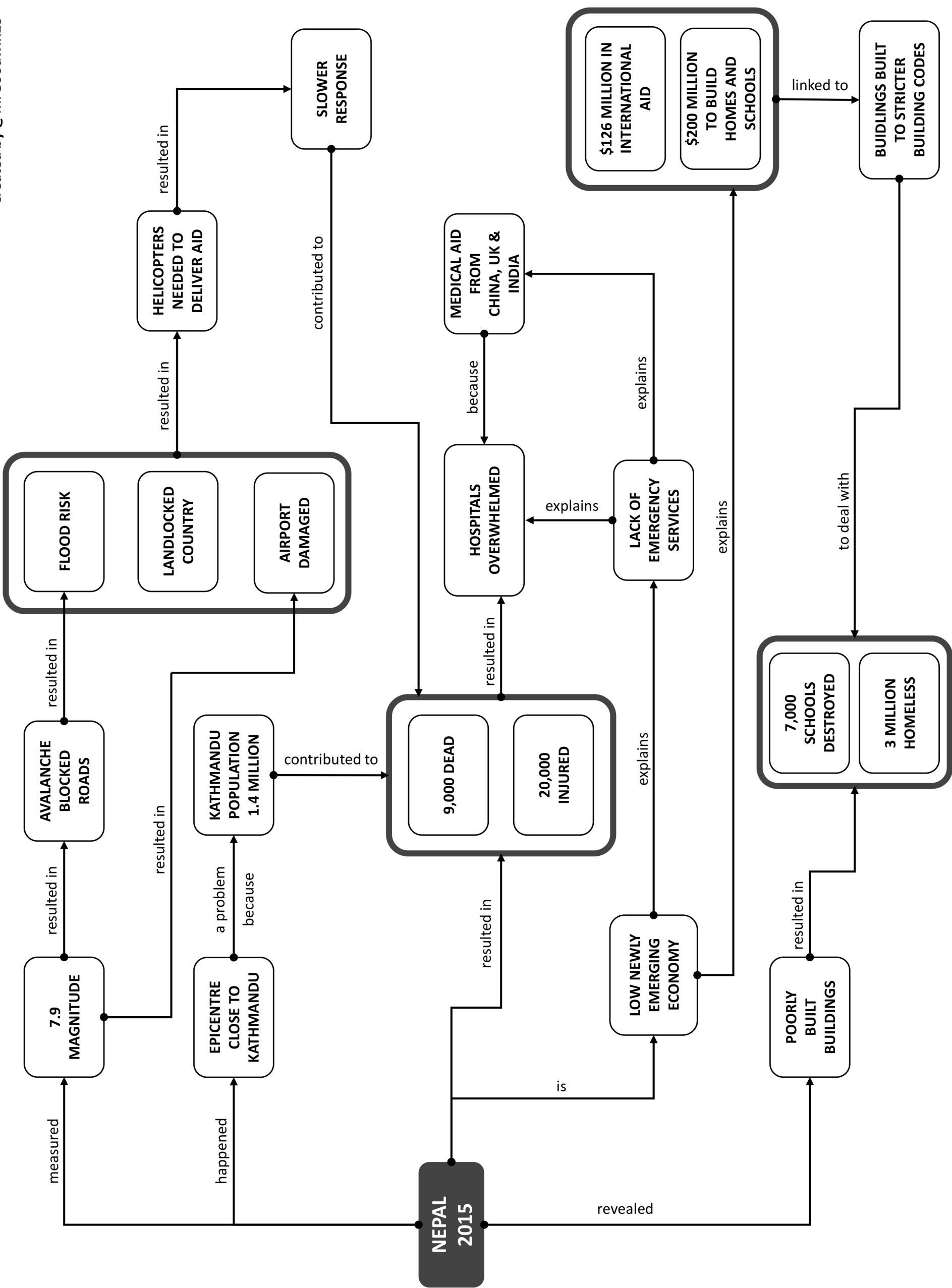
6 x's as O in grp 6

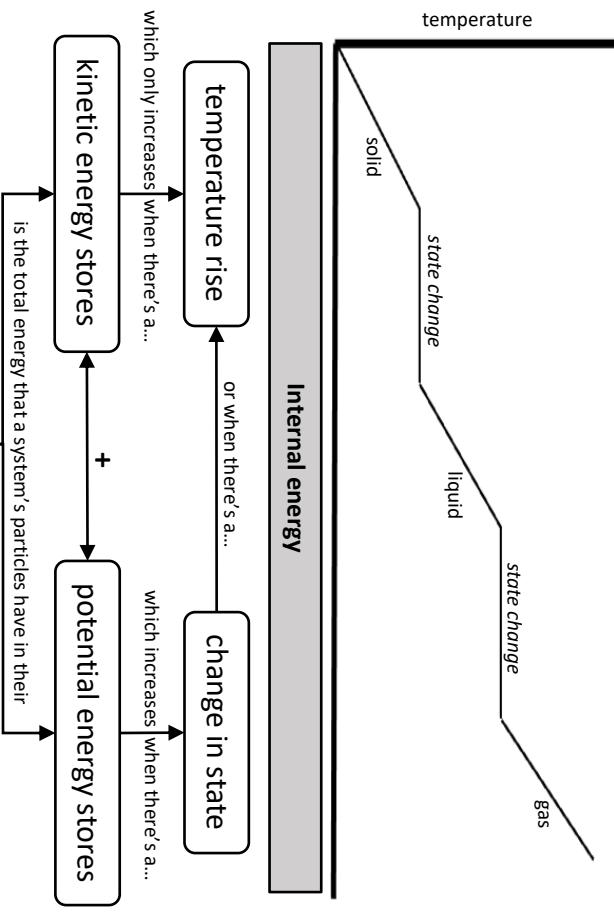
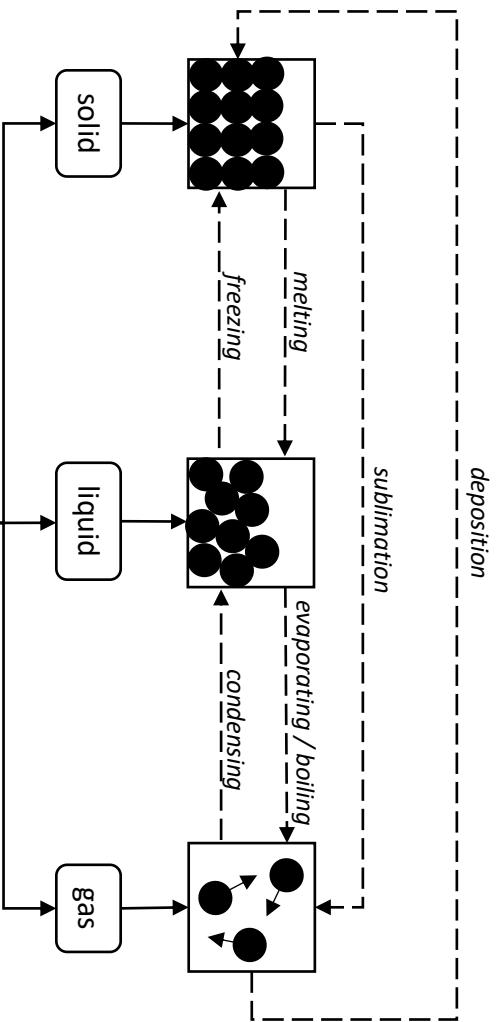
Summary





Based on a concept map by
Morgan State University that
can be found at
<https://bit.ly/35VLOw>





Density (ρ)

$$\text{density (kg/m}^3\text{)} = \frac{\text{mass (kg)}}{\text{Volume (m}^3\text{)}}$$

$$\rho V = m$$

$$V = \frac{m}{\rho}$$

States of matter

exists as one of three...

Matter

has...

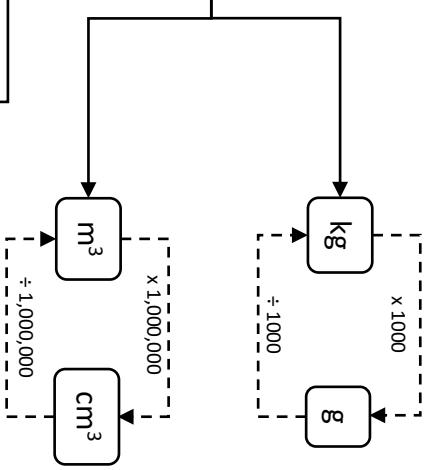
Internal energy

Practical

To determine the density of a...

Units can also be g/cm³

To convert...



Irregular solid

e.g. a crown, a rock

you need to...

measure its mass

using an...

electronic mass balance

measure its volume

by measuring the...

volume of water displaced

when the solid is placed in a...

Eureka can

remembering that...

1 ml = 1 cm³

Regular solid

e.g. a cube, a block

you need to...

measure its mass

using a...

electronic mass balance

measure its volume

using a...

ruler

and multiplying...

W x l x h

Using...

vernier callipers

increases...

accuracy

Liquid

e.g. water, oil

you need to...

measure its mass

by measuring the...

mass of the beaker and liquid

and then subtracting the...

mass of the empty beaker

measure its volume

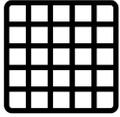
using a...

measuring cylinder

and remembering that...

1 ml = 1 cm³

Thinking and Linking Grids



These force you to think deeply about an area of a subject you've studied. Below is an example grid for Macbeth, along with the instructions. You and your friends can make grids of your own for any subject. Create a 6 x 6 grid and look through your class notes and study guides to identify key people, ideas, themes, countries etc., to populate the grid. Ask your teacher to double-check them and share them with your classmates.

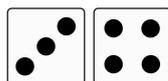
'Macbeth' Thinking and Linking Grid (created by @SPryke2)

	1	2	3	4	5	6
1	Macduff	Guilt	Infanticide	Power	Murder	Tyranny
2	The Supernatural	Light	Prophecy	Visions and Hallucinations	Hamartia	Animal Imagery
3	Lennox	Equivocation	Witches	Macbeth	Morality	Lady Macbeth
4	Hubris	Masculinity	Kingship	Appearance vs Reality	Violence	Children
5	Sleep	Banquo	Loyalty	Hands	King Duncan	Time
6	Blood	Regicide	Lady Macduff	Ambition	The porter	Darkness

Instructions

You need a pair of dice.

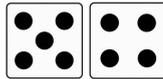
1. Roll your dice to get the coordinates of your first box and find the word/phrase in it. Start with the numbers along the side first. For example:



would equal 'Macbeth'.

2. Write how your word/phrase links to the play. For example, for 'Macbeth', you could talk about how he is a loyal soldier at the beginning of the play who is corrupted by ambition and falls into a cyclical nature of violence to preserve the power that he has pursued.

3. Roll the dice again to find a new word. For example:



would equal 'hands'

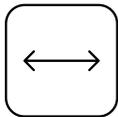
4. Write both words in the blank table below the grid. Think about how the two words/phrases link together before writing your answer in the table.

LINKS MADE

Box 1	Box 2	The connection between the two

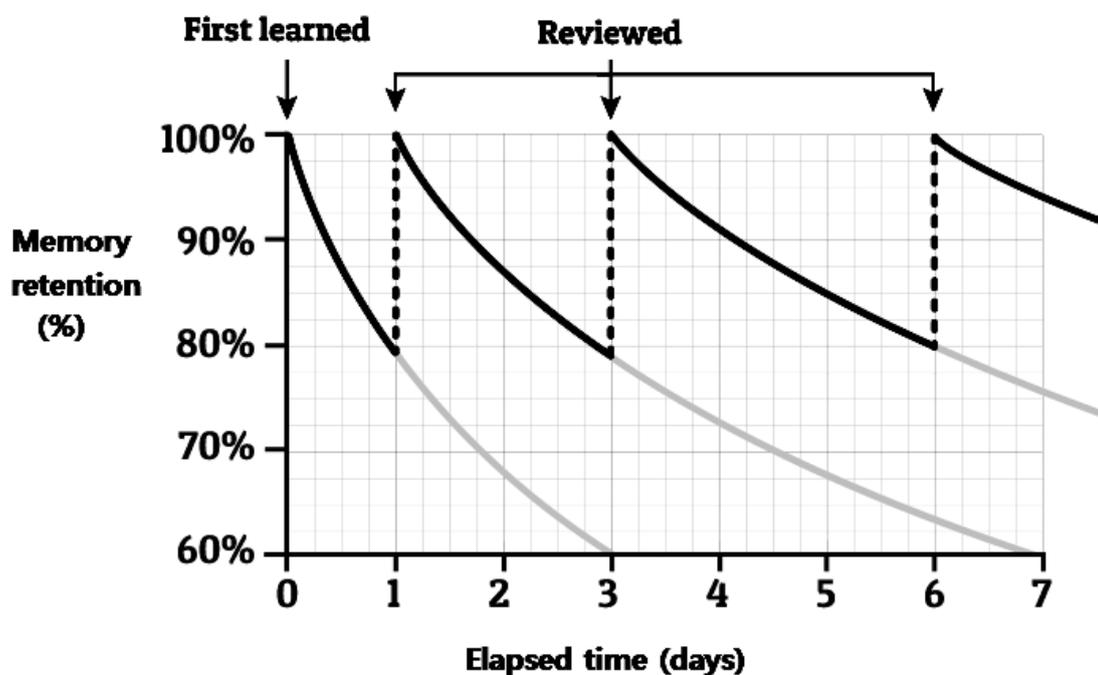
Final Learning Tips

Space out your learning on a subject



Spacing out your learning over time is far more effective than last-minute cramming.

This is based on research into how we forget and how we remember. The speed at which we forget something will depend on many factors, such as the difficulty of the material, how meaningful it was to us, how we learned it and how frequently we relearn or remember it. The last factor tells us that when we learn something for the first time, we need to review it quickly afterwards. The more times we force ourselves to remember something, the longer the gap between reviews, which the diagram below illustrates nicely. The Leitner system and Cornell Notes mentioned earlier provide an excellent way of achieving this, but the principle applies to all learning strategies mentioned in this booklet.



Don't study one topic at a time – mix it up!



It's better to jumble up your learning within a subject instead of focussing solely on one topic at a time and block studying that. So, rather than studying AAA BBB CCC (each letter represents a topic within a subject), there is a significant benefit in approaching it as, say, ABC BCA CAB because you're more likely to see connections between topics, which will result in a better grade.

This interleaving of content can also be helpful when it comes to practising questions. Problems are interleaved if arranged so that consecutive questions cannot be solved by the same strategy. This forces you to choose a strategy based on the problem, just as you must in exams.