Revision Skills! - *three areas to work on…and simple methods to succeed*:

1) Understanding

Making sense of a concept, being able to explain it and visualise it.
Watch out for the 'Dunning-Kruger Effect' (https://www.youtube.com/watch?v=GJz66wm95-M) which shows us that we humans usually fool ourselves that we understand more than we do. **Until proven otherwise by <u>test results</u>, assume there's a lot more to understand about a topic than you are aware of; test yourself to find those areas of weakness.**

2) Exam technique/problem solving skills

How to approach different types of questions, how to approach a whole test or exam paper, and how to model real life situations using scientific ideas so that you can figure them out.
Practice makes perfect so practice answering exam questions! See also Page 4 on exam skills.

3) Recall

You must retain your understanding, knowledge and skills that you can reproduce them in final exams. If you don't come back to a topic a few times between now and 'cram time', you *will* forget most of the details of what you've learned before then, as shown on the forgetting curve:

The Forgetting Curve

It's *not how long* you spend on a topic that determines your memory…it's *<u>how often</u>* you encounter it that makes the difference! Last minute cramming is mostly just 're-learning' what has already been completely forgotten. Who wants to do all the work twice, and still forget it all after the exam? Nobody! So start today and do a little bit at a time, so you don't completely forget and have to re-learn all over again. Memorising key points of topics also helps you understand future topics better, making it easier to remember them too!

Also, we often fool ourselves by confusing our *recognition* of a topic with *recall*, so we feel false confidence. <u>Recognition</u> is the feeling of remembering a topic when you *see or hear* it later ("oh yes, I have done this before"), but <u>recall</u> is being able to explain that topic from memory *without having to see or hear it*, and is much more useful. **Practice active recall, don't be confident in only *recognising* a topic!**
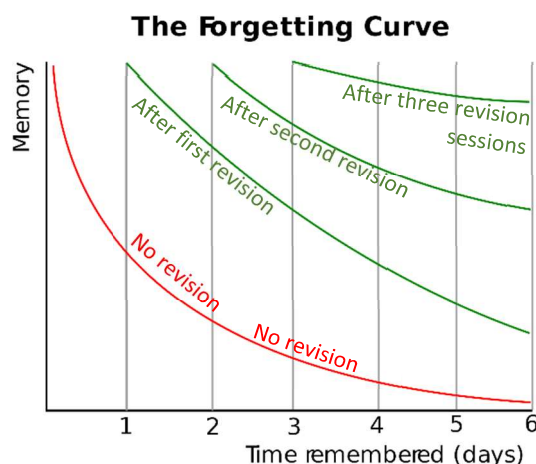
Easy and powerful ideas for independent work:

This page lists some '*active*' learning and revision methods. Most of them are also very short, making it much easier to start and to be *consistent*. Try creating a *mini-habit** in which **each day you simply pick one of the suggested activities to do** – if you are short on time or willpower, just pick one of the easier ones instead of doing nothing. As your motivation increases you can combine them to create a 'balanced diet' of learning in one session.   *https://www.youtube.com/watch?v=aHDvEfiSipo

1. **Recall Booster (approx 5 times a week) – Test yourself on your revision cards.** *If you have too many cards to test in one sitting (eg more than 15) use the easy instructions on the next page for a simple system which will tell you which cards to study for maximum benefit in minimal time.*

2. **Improve Understanding and Knowledge – A short time (eg 10 mins) with a learning resource like a textbook, teaching video, revision website, definition list, or part of a school lesson. Each time you find a key idea, create a revision card for that idea (if you don't already have one), test yourself once and add it to the first set.** *You may be surprised how powerful this is! Usually it is easiest to write the 'answer side' first, then write the question side to match.*

3. **Improve problem solving skills - answer one practice question. Pick either:**
   1) an exam question from a topic you are working on (eg from a textbook or website)
   2) an exam question from a random topic (eg from a past paper)
   Each time you write an answer, immediately check the mark scheme and tick within your answer where each mark was earned. Write corrections for any marks dropped. If the question was multiple choice, make sure you write the corrected working not just the correct answer!
   Maximise Understanding: If you have to correct an answer but don't understand the reason for the correction, stop and look up that topic in a learning resource and look for the key ideas you were missing.
   Maximise Recall: Whenever you need to write a correction, first speak it aloud a few times and then cover up the mark-scheme before you correct your answer. Then think whether there is a key idea that you have learned or had forgotten: If you don't have one already, create a revision card for that.

4. **Check your 'big-picture' recall and understanding by creating a mind map of the content in the whole subject or within one topic.** Start with the major 'blocks' of content and then work down to smaller sub-blocks within those. Try to complete each 'layer' of topics before adding sub-topics to each of them. It can work well to set a timer (eg 15 mins) and see how far you can get in the time.
   Maximise understanding: Teaching to a friend really makes this even more powerful for your own learning, as you will suddenly notice where you found it hard to explain and could benefit from spending time on that area.

5. **Do a RAG (red amber green) highlight of the content in one section of the specification**.
   Red = Don't understand this point.
   Amber = This point is mostly understand but not memorised.
   Green = This point is understood and memorised.
   Pick one red topic (if none, pick an amber) to go and find out more about.

6. **Make a note about a topic you are stuck on in order to ask a teacher** (if you can send a message, do so *now*)**.**

7. **If you are in the last few months before an exam, try a timed whole past paper to get used to how long you have. Answer all the questions (in any order, as for a real exam!) but make a note of any questions you did after the allowed time. Total your marks and grade inside and outside the allowed time and look up the official grade boundaries to know your grades (eg 38 = D in allowed time; 45 = C with unlimited time).**
   Maximise Understanding: When marking, take it slow and learn as much as possible as you go. If you have to correct an answer but don't understand the reason for the correction, stop and look up that topic in a learning resource and look for the key ideas you were missing.
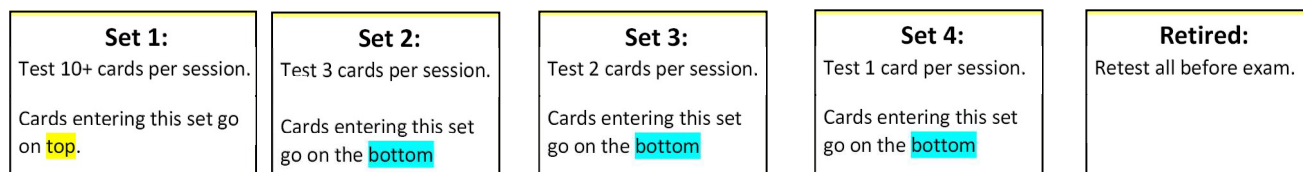   Maximise Recall: Whenever you need to write a correction, first speak it aloud a few times and then cover up the mark-scheme before you correct your answer. Then think whether there is a key idea that you have learned or had forgotten: If you don't have one already, create a revision card for that.

The Revision Card System

Once you have some revision cards and have created your first 10 or so cards, set up this easy system (it's a modified *Leitner Card System*) to move what you have learned into long term memory:

CREATING THE SYSTEM:
    A. **Container**: A small tub or rubber bands to keep your revision cards together <u>and in order</u>.
    B. **Dividers**: If your revision cards came with ready-made dividers, choose five of those. If not, use five blank revision cards and run a highlighter along the top *edge* of each to make them stand out from the rest of the cards when they are together as a pack.
    C. **Write these labels** on the five dividers:

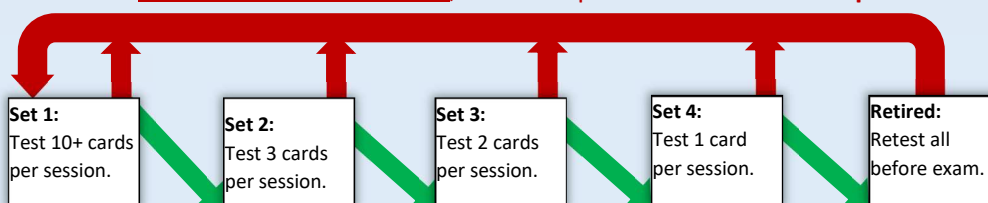| Set 1:	Set 2:	Set 3:	Set 4:	Retired:
Test 10+ cards per session. Cards entering this set go on top.	Test 3 cards per session. Cards entering this set go on the bottom	Test 2 cards per session. Cards entering this set go on the bottom	Test 1 card per session. Cards entering this set go on the bottom	Retest all before exam.

TO USE THE SYSTEM:

All new revision cards start in the first set. To do a revision card session, lay out your card sets in a line and

Go along the sets, pulling the correct number of cards from the top of each set and answering each card <u>out loud</u> as well as you can (even if it's just saying some related words) but not more than a couple of seconds to think. Then check the answer side of the card:

If you test a card and it needs more practice, just <u>read the answer side out loud</u>, cover and <u>recall the answer out loud</u>, and then put the card back on **top** of set 1.

| Set 1:
Test 10+ cards per session. | Set 2:
Test 3 cards per session. | Set 3:
Test 2 cards per session. | Set 4:
Test 1 card per session. | Retired:
Retest all before exam. |

If you test a card and it was already memorised, move it to the **bottom** of next set

follow the instructions from the diagram:

KEY TIPS:
- **Don't test a particular card more than once in a day.**
- Make sure you try to give your best possible answer to a card before you turn it over, as that struggle to recall is when the memory develops most, but also remember…
- A revision card session is supposed to be FAST! If you can't answer a card within 5-10 seconds of thinking then treat it as needing more practice and follow those steps – you <u>will</u> remember it after a few days of this!
- It's not how long you spend on each card, but <u>how many days per week</u> you do this that makes the difference! So keep it <u>speedy and light</u> and don't worry!

MODIFICATIONS – **what works and what doesn't:**
- If you find you need to speed up your memorising (eg the exam is soon or you have a lot of content to cover), I recommend multiplying **the number of cards tested** in each set, rather than doing multiple sessions in a day.
- If you have a particular subject or topic to revise for, <u>don't</u> take the other cards out and mess up their order, just <u>ignore</u> cards that aren't from the chosen topic/subject when you draw cards to test, skipping other cards and leaving them where they are.

MAKING CARDS:
Try to split up information so that it is on separate cards. One card, one concept. This will enable you to quickly separate out the easy learning points from the hard ones so you can focus your efforts more efficiently.

Exam Skills/Problem Solving Skills:

Calculation Questions – *follow the **WISEN** method:*

Want? – Write down what they want.
Information? – Label information given.
Standard Units? – Convert to standard units
Equation(s) – Arrange Equation(s)
Numbers – Plug the numbers in.

(The only time it's worth substituting in a number before arranging the equation is when doing so will save a truly gigantic amount of working. E.G. if substituting the value will cancel lots of terms, or if no algebraic equation is ever given for that topic and you already know what to do anyway. Otherwise, stick with symbols for as long as possible to keep the meaning clear and help you to avoid "silly mistakes".)

Example Question:
Calculate the acceleration of a rocket just after it has lifted off. It has a weight force of 60kN, a thrust force of 80kN, and a mass of 6000kg. You may ignore air resistance.

$$W \quad a = ?$$

$$I \quad F_T = 80kN = 80000N$$
$$m = 6000kg$$
$$F_w = 60kN = 60000N$$

$$S \quad \boxed{F_{resultant} = m \times a}$$

$$E \quad a = \frac{F_{resultant}}{m}$$

$$a = \frac{F_T - F_w}{m}$$

$$N \quad a = \frac{80000 - 60000}{6000}$$

$$a = 3.3 \, m/s^2 \, (2sf)$$

Approaching Written Answer Questions – *the **DISSECT** planning tool*:

Do I need to include…

D.	…**Definitions**?	*(A quick definition/formula/diagram could support your worded answer)*
I.	…the **Initial** situation?	*("Before the mass was released, the forces on the aircraft were balanced…")*
S.	…a sequence of **Steps**?	*("A is already the case and then B happens, leading to C. Next, C decays to D….")*
S.	…thoughtful **Suggestions?**	*(Use principles you know to make reasonable predictions about new situations.)*
E.	…**Explaining?**	*(Giving reasons/causes for some points as you write)*
C.	…**Comparing**?	*(similarities&differences, advantages&disadvantages, increases&decreases)*
T.	…any sort of '**Therefore…**' at the end?	*(eg Perhaps a final decision, or summing up the overall result of a process)*

You can use this acronym as a checklist to quickly plan your answer. Eg:
Q1: Evaluate the use of solar vs biomass electricity generation for a large rural farm, giving reasons to support your choice. (6 marks)

So in this question it looks like I should be comparing the two forms of power generation, giving advantages and disadvantages with reasons for each from a farmer's perspective. At the end I will come to a decision and recommend one of the options.

(I know I don't need to be an expert on farming, just know about solar and biomass electricty generation make sensible suggestions about what characteristics might suit a farmer)

Approaching Multiple Choice Questions:
Don't be fooled into thinking these are easy just because ticking a box is easy - expect a twist! The question is usually designed so that an 'educated guess' leads to a wrong answer if you don't check the details.
So DO NOT just 'eyeball it' – do some working out, making brief notes of relevant equations or ideas. And when marking and making corrections, find out and write the corrected *working*, not just the correct answer.

Rearranging Equations

1. What variable do I need to get by itself?
2. What is stopping it being by itself?
3. How do I undo that? *(write that on an arrow going to the next line)*
4. Apply (3) to both sides and resolve, then repeat steps.
   (Undo multiple things in steps, following reverse BIDMAS order)

$$E = \frac{1}{2}mv^2$$

- I need to get v by itself
- v isn't by itself because of $\times \frac{1}{2}m$ and being squared.
- …. so first I undo the $\times \frac{1}{2}$ by doing $\times 2$ to both sides.

$$2E = mv^2 \quad \xrightarrow{\times 2}$$

…then undo the $\times m$ by doing $\div m$ to both sides

$$\frac{2E}{m} = v^2 \quad \xrightarrow{\div m}$$

…then undo the power of 2 by doing square root.

$$\sqrt{\frac{2E}{m}} = v \quad \xrightarrow{\sqrt{}}$$

Command Words and what to do about them:

"Calculate…" – see the WISEN method, above. Working out should be needed.

"Show that…" – pretend they haven't told you the answer and are asking you to "calculate".

"Determine…" – with a simple observation and *maybe* a simple bit of arithmetic, deduce the answer. No significant calculation should be needed.

"Use the data to…" - mention evidence from the graph/table (patterns, significant datapoints or examples) as part of your answer.

"Give/state/label…" – You are supposed to already know this answer. In an exam if you don't know, **don't** take ages figuring it out, you'll lose too much time! Guess or skip it and move on! If you miss one of these questions in a mock paper, 'plug that gap' with some simple memorising, eg make a revision card and use the revision card system.

"Suggest…" – Don't panic, you are **not** supposed to already know this topic! You **are** supposed to know some related scientific concepts and facts which will allow you to make **sensible suggestions**.