Developing application tasks in VCE Science

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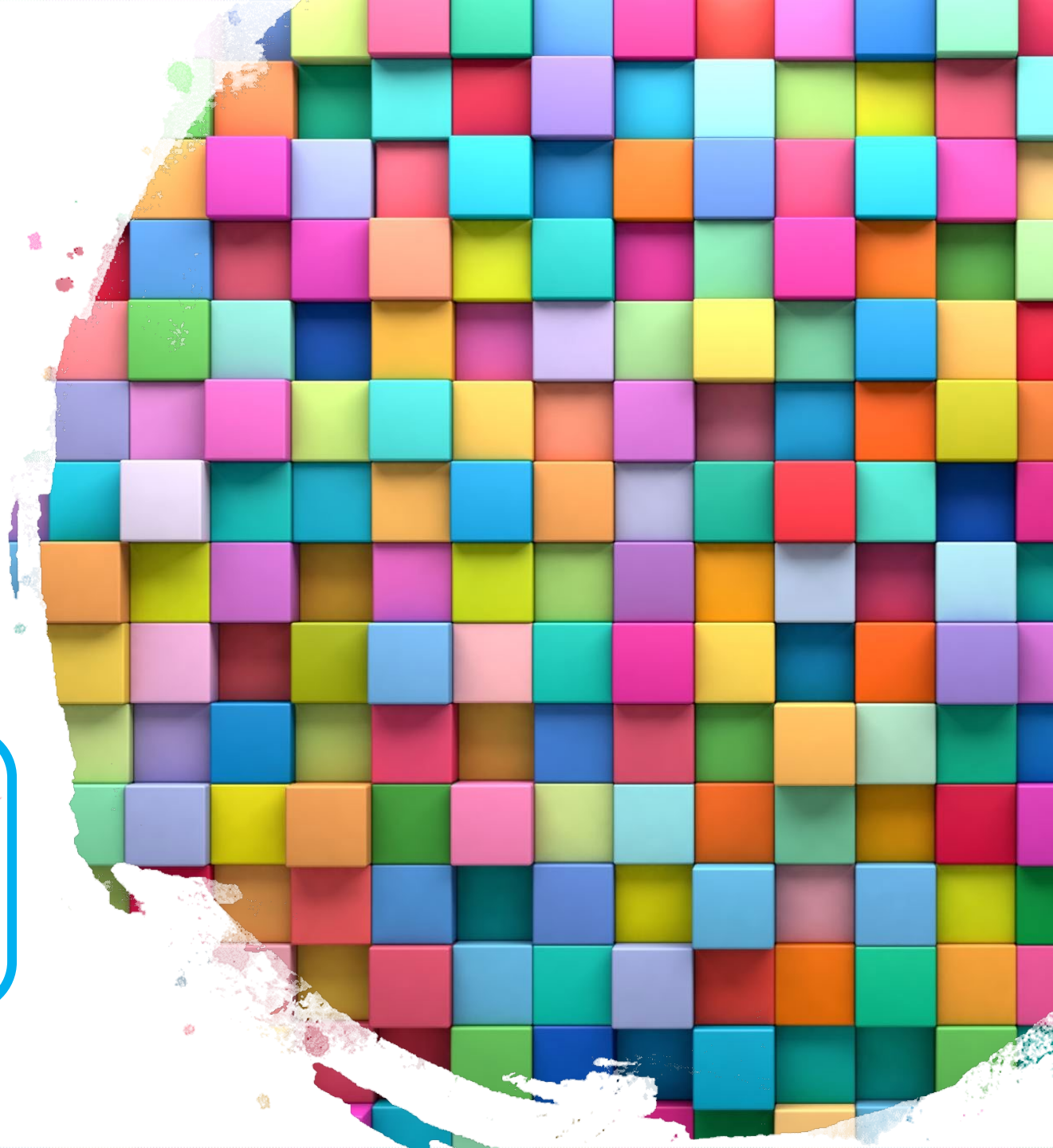

Purpose of VCE

Equitable education preparing students with skills for life.

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Students need higher order thinking skills

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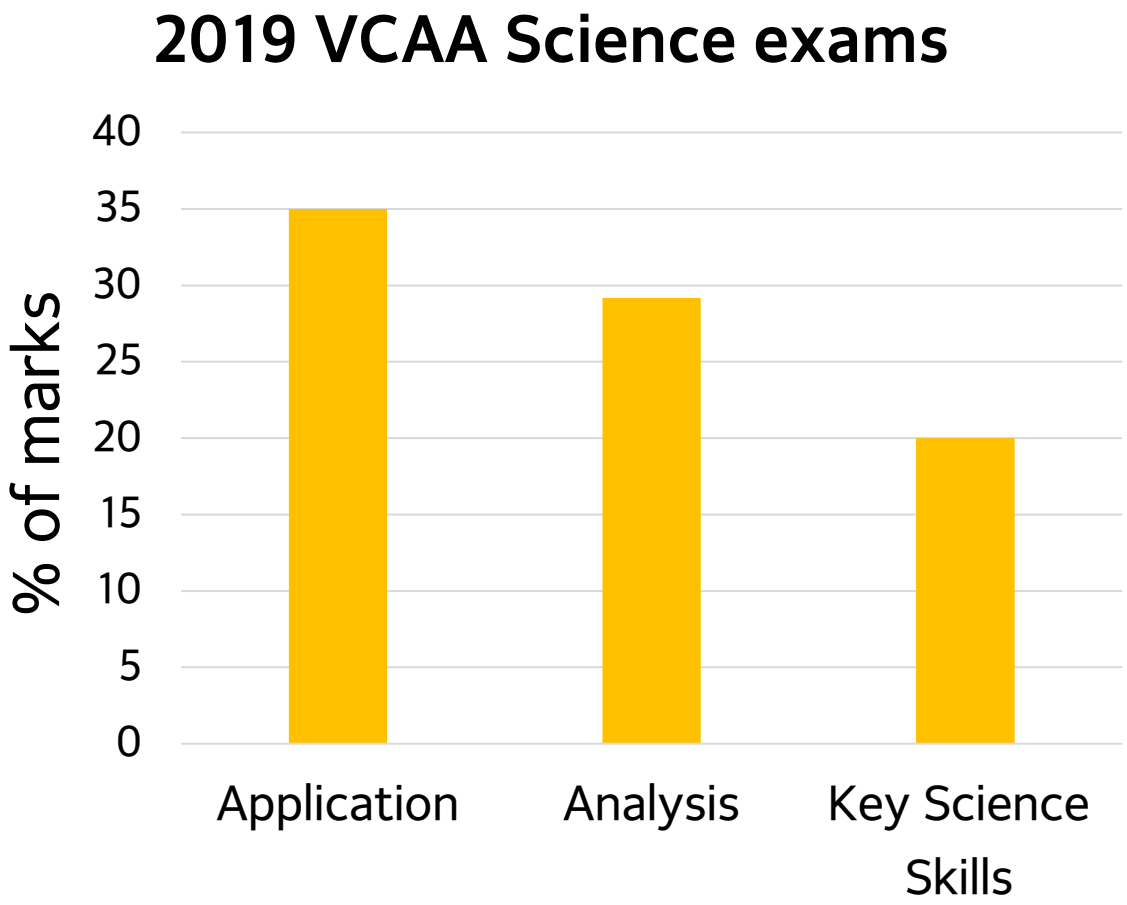
Importance of STEM

Science exam analysis

Focus: Scientific literacy and experimental design



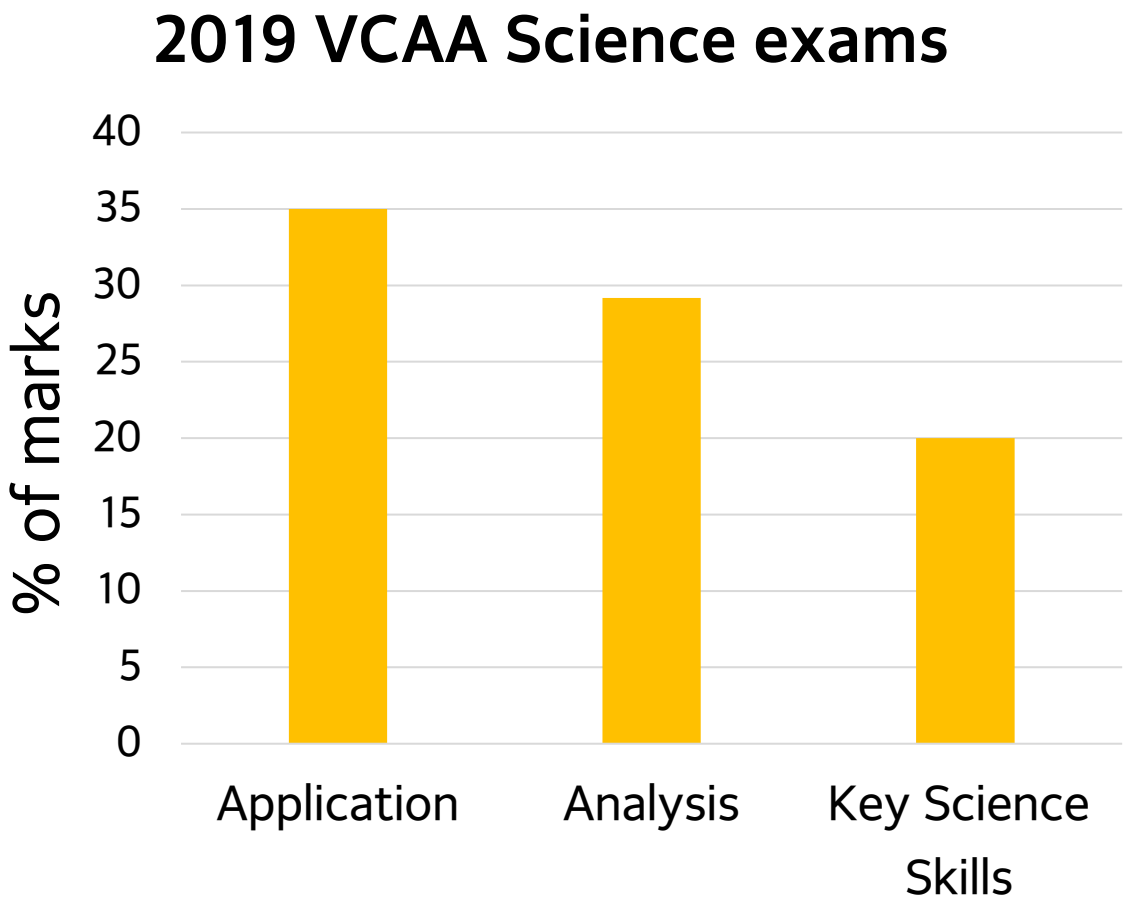
Resources

- VCAA 2019 Biology, Chemistry, Environmental Science, Physics and Psychology exams

Science exam analysis

Focus: Scientific literacy and experimental design

Connections: AOS, key knowledge descriptors, key science skills



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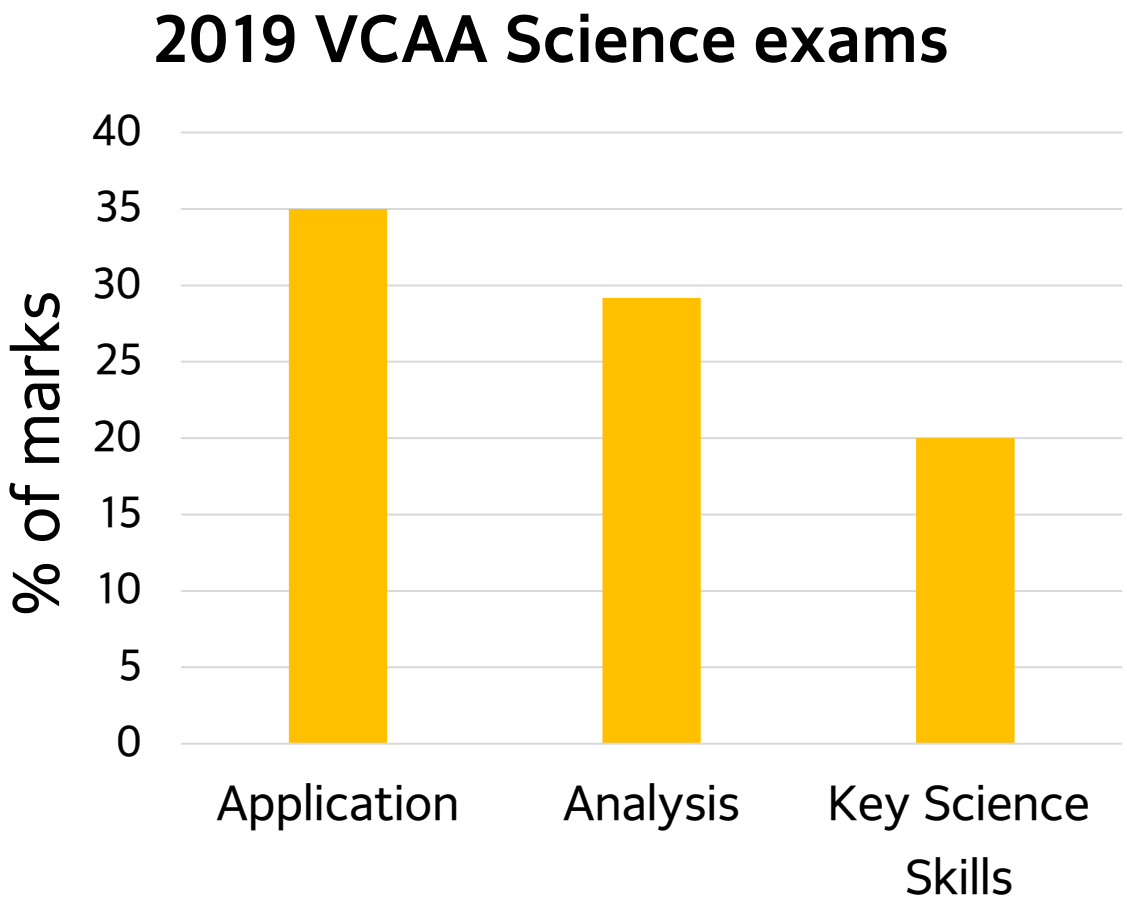
Science exam analysis

Focus: Scientific literacy and experimental design

Connections: AOS, key knowledge descriptors, key science skills

High order thinking skills: Application & Analysis



Resources

- VCAA 2019 Biology, Chemistry, Environmental Science, Physics and Psychology exams

What exam skills are important?

Key science skills

Resources

- VCAA 2019 Biology, Chemistry, Environmental Science, Physics and Psychology examiner reports

What exam skills are important?

High order thinking skills

Key science skills

Basic skills

Resources

- VCAA 2019 Biology, Chemistry, Environmental Science, Physics and Psychology examiner reports

2019 Science examiner report tips

Application Questions

✓ Provide answers relevant to the scenario or context.

✗ Do not use generic answers from textbooks, previous exams, or commercially produced reference sheets.

Answering questions

✓ Use logical approach to answering questions.

e.g. What is _____? Justify your answer.

1. Give answer.
2. Justify response.

✗ Do not restate the stem in the question

✓ Identify the intent of the question from the command terms.

✓ Spell key terms correctly.

Calculations; practise

- unit conversions e.g. g to kg.
- significant figures.
- apply and use of formulas.
- the use of correct units.

Interpreting graphs

1. Read labels, titles, and legend.
2. Identify the variables, units and scale from axes.
3. Identify, low and high points, turning points, shape of graph.
4. Identify trends.

Key Science Skills: know

- how to write conclusions.
- difference between systematic and random errors.
- how to use terms: accuracy, precision, validity, reliability, reproducibility, and uncertainty.

Skill Progression in Application Questions

No answer

Skill Progression in Application Questions

Lists broad range of facts

No answer

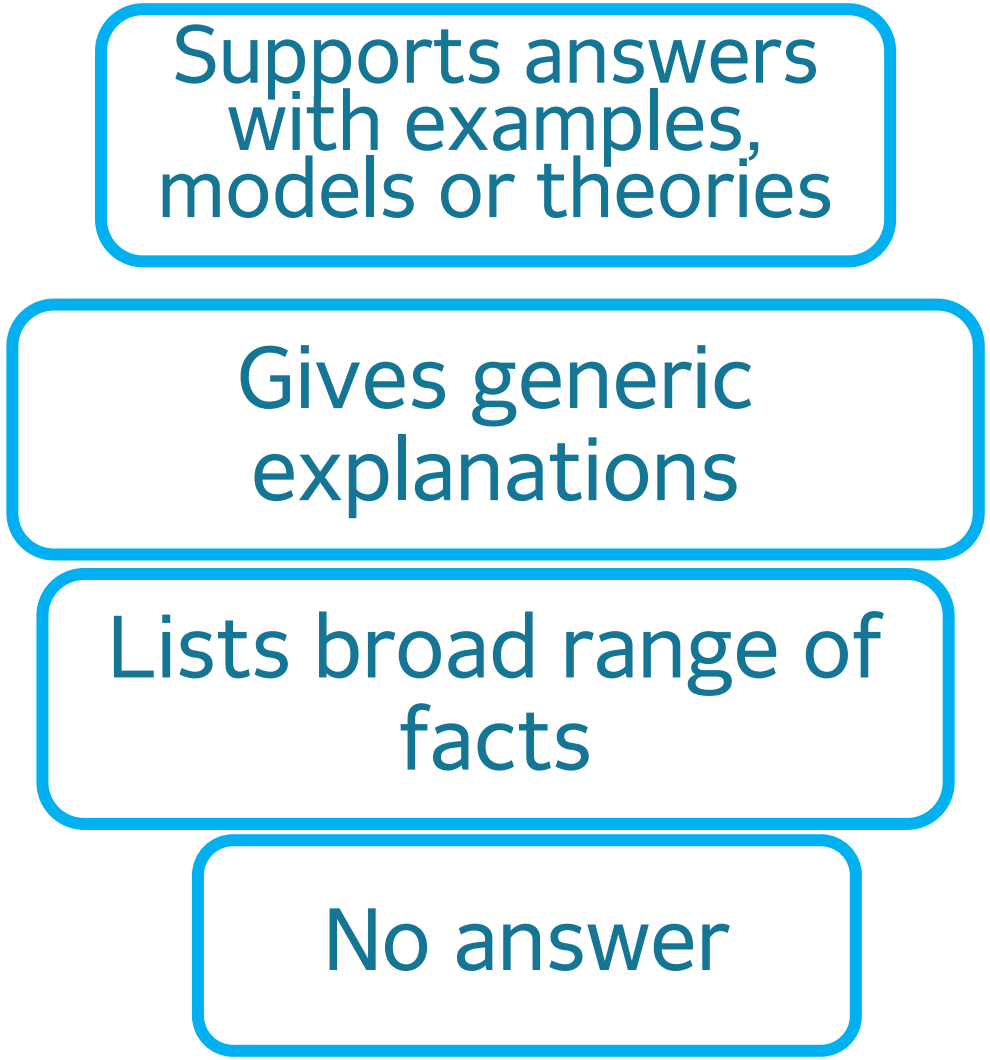
Skill Progression in Application Questions

Gives generic explanations

Lists broad range of facts

No answer

Skill Progression in Application Questions



Skill Progression in Application Questions

- Makes connections across Units 3&4
- Supports answers with examples, models or theories
- Gives generic explanations
- Lists broad range of facts
- No answer

elaborates ideas *makes connections to concepts, theories and models across the scope of Units 1-4*
uses evidence to support ideas *ideas are supported with selections of examples, theories or models*
applies ideas *applies relevant ideas from a known context to a novel context*
explains ideas *use relevant facts to clarify a concept or a process*
lists facts *records ideas, one after the other*
forms ideas

Makes connections across Units 1-4

Supports answers with examples, models or theories

Gives generic explanations

Lists wide range of facts

No answer

Teach Note taking

Unit 1 AOS3 Research assignment

- Focus on note taking
- Students represent understanding as an infographic.

Teach Note taking

Task Outline

- You will use the Cornell note taking method to summarise the key ideas from your textbook. This method of note taking was devised by Professor Walter Pauk of Cornell University in the 1950s. Many university students find this method of note taking an efficient way to consolidate their ideas.

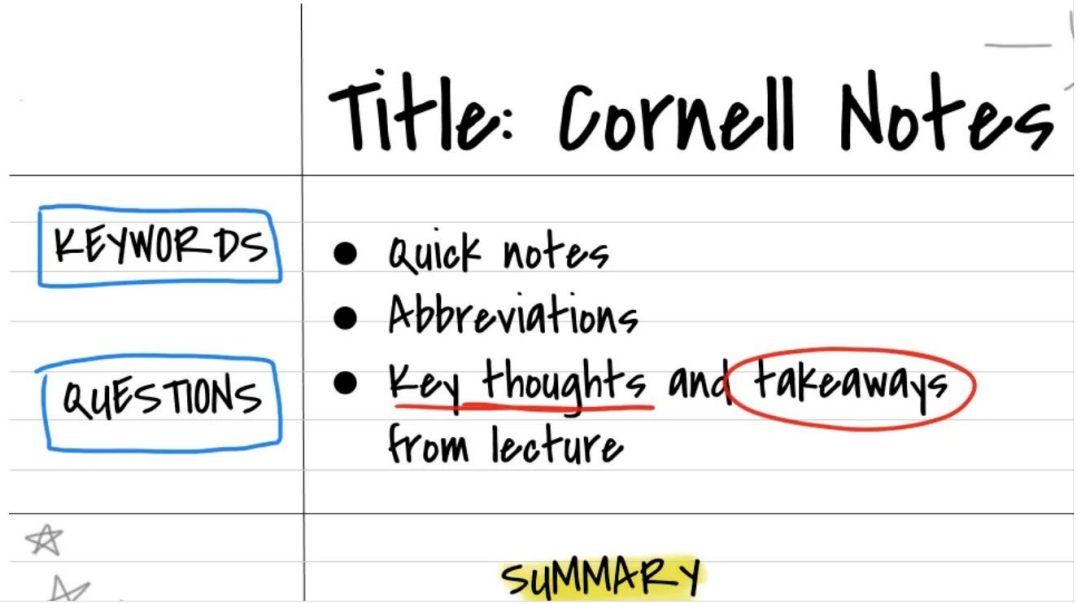


Image credit: Skinner, S (2019) Do Cornell students still use the Cornell note taking system?, www.cornellsun.com [14th Feb 2021]

Instructions

1. Write the title and date.
2. Read through the relevant textbook pages for your topic. Write questions in the margins of the textbook. You should have at least 10 questions.
3. Read the information under the **first heading**.
   a. Highlight the important phrases in the textbook. Do not highlight whole sentences. You want to focus on the most important ideas.
   b. Transfer the questions into the left hand column of the A3 template. (Keywords and questions)
   c. Insert information that answers the questions into the right hand column.
   d. Write the key terms (bolded words) into the left hand column of the A3 template. Write short definitions for the key terms. Ensure you use your own words.
4. Repeat this process for the next heading of your chapter section.
5. Find science journal articles that are relevant to your topic and insert information under the relevant heading.
6. Summarise the main ideas of your topic in 5 - 7 lines.

The Schrödinger model of the atom

Key words and Questions	Summarised main ideas and key thoughts
What is an emission spectrum? **Emission Spectrum:** An emission spectrum is a image which represents the difference wavelengths of electromagnetic energy emitted by an atom in a high-energy state. This spectrum can be represented as an image with a black background and bars of different coloured light which represents a certain wavelength.	Emissions spectrums are readings of electromagnetic radiation emitted by an atom when it is releasing energy as it comes back down from an energized state and begins to stabilize. When the electromagnetic radiation from an atom is visualized on a emission spectrum, it represents a unique signature emitted by the atom. (NASA, 2013) https://imagine.gsfc.nasa.gov/science/toolbox/spectra1.html
What is quantised energy? **Quantised:** Having a specific amount of energy depending on which state they are in. It essentially means the energy in electrons consist of fixed portions.	Quantized energy is described as energy which can only exist in fixed amounts. The quantized energy of electrons relates to how much energy an electron has in it. In the Bohr model of the atom, each electron has a different amount of energy depending on which shell it is in. (Lumen Learning, No Date) https://courses.lumenlearning.com/physics/chapter/29-1-quantization-of-energy/

Summary
Emissions spectra tell us about atoms regarding their atomic makeup. Quantized energy is energy that exists in fixed portions. Schrödinger's model explores the way electron's reside in the electron cloud in more detail. The 1s orbital is the closest orbital to the nucleus. The electron configurations corresponds to the amount of quantized energy each electron has. Orbitals are the name for the 3D models of the spaces that have the highest probability of containing electrons. The 2s and 2p orbitals are the next two orbitals to be filled after the 1s orbital. The Geometric pattern shows in the order in which the electrons subshells and orbitals are filled. The 4s orbital contains less quantized energy than the 3d orbital, so it fills up before the 3d. A subshell is the classification for the different types of orbitals in the electron cloud of the Schrödinger model of the atom.

Assessment Rubric

Instructions for graphics

Design graphics such as flow charts, cartoons, or simple diagrams to:

- summarise the key ideas
- answer your questions
- show links between ideas
- show information in a novel way

elaborates ideas *makes connections to theories and models that are beyond the set topic*	**tailors use of terminology** *selects appropriate key term to achieve required outcome*		**makes links to concepts beyond topic**
uses evidence to support ideas *ideas are supported with selections of examples, theories or models*	**integrates chemical terminology** *key terms are seamlessly explained within the text in own words*	**represents information in a novel way**	**shows relationships between ideas**
applies ideas *applies relevant ideas from a known context to a novel context*	**defines chemical terminology** *key terms are explained using dictionary type definitions*	**uses graphics that show links between ideas**	**identifies multiple ideas**
explains ideas *use relevant facts to clarify a concept or a process*	**uses chemical terminology** *uses relevant keys terms*	**answers questions with graphics**	**lists ideas**
lists facts *records ideas, one after the other*	**uses general words**	**uses graphics to convey ideas**	**uses words**
forms ideas	**uses terms**	**uses graphics**	**infographic**

Assessment Rubric

Instructions for infographic

Connect your ideas using words and graphics. In your infographic you need to:

- identify all your ideas
- show the connections between your ideas
- make links to concepts beyond the set topic

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U4AOS2 Application Task

Complete an essay plan for an evidence-based argument about whether you agree or disagree with the claim,

” Veganism and vegetarianism are better for a person’s health and the environment than a regular diet that includes meat.”

In your essay plan, include a statement of whether you agree or disagree with the above claim.

You need to provide evidence to support your argument by:

- identifying the proportion and type of amino acids and fats in each diet. (3)
- designing a flow chart showing the metabolism of proteins and fats in the human digestion system and the chemical reactions involved, including the role and importance of enzymes. (9)
- comparing the energy content of a plant-based meal compared to a meal that includes meat. (3)

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Process of designing application tasks

- Search Science daily for relevant journal articles.
  - Keep a bank of articles.
  - Share with friends.
- Identify the skills and concepts that you want to target.
- Design stimuli to prompt connection of ideas.

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Required skills

Recall: Proteins- essential, non-essential, plants only include some essential amino acid. (1)

Fats – animal fats mostly saturated, plant fats are mostly unsaturated. (1)

Compare Plant-based diets will be lower in essential amino acids but will also be lower in saturated fats. (1)

Students need to use flow charts and provide examples. This will encourage them to make connections across the unit.

Need to show

- **metabolism of food in digestion system - 3 marks**
- **role of enzymes – 2 marks**
- **chemical reactions - 3 marks**

U4AOS2 Application Task

Researchers test the accuracy, reproducibility, and repeatability of an analytical technique used to analyse amino acids in food. The food is first hydrolysed and then analysed using reverse phase HPLC.

The experimental design involves sending 18 food samples to 14 laboratories. Each laboratory will use the same reverse phase HPLC column and will be required to run the experiment at least 5 trials of the experiment under the same conditions.

Evaluate whether the design of the experiment will enable researchers to determine the

a. accuracy

b. reproducibility

c. and repeatability of the technique. Justify each of your responses. (6)

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Skills required

An understanding of the concepts of accuracy, reproducibility and repeatability.

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