

# **NORTHBROOKS SECONDARY SCHOOL**

**SOARING YET ROOTED**

*Sec 2 Subject  
Information:  
**Science**  
(Exp)*





# Sciences subjects for Exp stream:

- Physics and Chemistry
- Biology and Chemistry
- Science (Physics/Chemistry)
- Science (Biology/Chemistry)



# Physics / Science (Physics)

## Overview

- provides students with a coherent understanding of energy, matter, and their interrelationships
- develops in students investigative and problem-solving skills, effective communication of theoretical concepts and appreciation of the contribution physics makes to our understanding of the physical world

Section
I. Measurement
I. Newtonian Mechanics
III. Thermal Physics
IV. Waves
V. Electricity & Magnetism
VI. Radioactivity



# Physics / Science (Physics)

## Syllabuses and Topics

Section	O-Level Physics	O-Level Science(Physics)
<b>I. Measurement</b>	1) Physical Quantities, Units and Measurements	1) Physical Quantities, Units and Measurements
<b>II. Newtonian Mechanics</b>	2) Kinematics	2) Kinematics
	3) Dynamics	3) Forces and Pressure
	4) Turning Effects of Forces	4) Dynamics
	5) Pressure	5) Turning Effects of Forces
	6) Energy	6) Energy
<b>III. Thermal Physics</b>	7) Kinetic Particle Model of Matter	7) Kinetic Particle Model of Matter
	8) Thermal Processes	8) Thermal Processes
	9) Thermal Properties of Matter	
<b>IV. Waves</b>	10) General Wave Properties	9) General Wave Properties
	11) Electromagnetic Spectrum	10) Electromagnetic Spectrum
	12) Light	11) Light
<b>V. Electricity &amp; Magnetism</b>	13) Static Electricity	12) Electric Charge and Current of Electricity
	14) Current of Electricity	13) D.C. Circuits
	15) D.C. Circuits	14) Practical Electricity
	16) Practical Electricity	15) Magnetism and Electromagnetism
	17) Magnetism	
	18) Electromagnetism	
	19) Electromagnetic Induction	
<b>VI. Radioactivity</b>	20) Radioactivity	16) Radioactivity



# Biology / Science (Biology)

## Overview

- enables students to deepen their interest in biology for future learning and work
- develops a way of thinking to understand how living organisms work to sustain life and use the disciplinary ideas in biology to approach, analyse and solve problems in biological systems

Section
I. Cells and Chemistry of Life
II. The Human Body – Maintaining Life
III. Living Together – Plants, Animals and Ecosystems
IV. Continuity of Life

# Biology / Science (Biology)

## Syllabuses and Topics

Sections	Topics	O-Bio	O-Sci (Bio)
I. Cells and Chemistry of Life	1. Cell Structure and Organisation	✓	✓
	2. Movement of Substances	✓	✓
	3. Biological Molecules	✓	✓
II. The Human Body – Maintaining Life	4. Nutrition in Humans	✓	✓
	5. Transport in Humans	✓	✓
	6. Respiration in Humans	✓	✓
	7. Excretion in Humans	✓	
	8. Homeostasis, Co-ordination and Response in Humans	✓	
	9. Infectious Diseases in Humans <b>*NEW!*</b>	✓	✓
III. Living Together – Plants, Animals and Ecosystems*	10. Nutrition and Transport in Flowering Plants	✓	✓
	11. Organisms and their Environment	✓	✓
IV. Continuity of Life	12. Reproduction <sup>#</sup>	✓	✓ <sup>#</sup>
	13. Molecular Genetics	✓	✓
	14. Inheritance	✓	✓

\*III. Living Together – Plants and Animals for N-Sci (Bio)

<sup>#</sup>Reproduction in Humans for O-Sci (Bio)



# Chemistry / Science (Chemistry)

## Overview

- enables students to appreciate practical applications of chemistry in the real world,
- develops in students a way of thinking to approach, analyse and solve problems by explaining macroscopic characteristics and changes in chemical systems

Section
I. Matter – Structures and Properties
II. Chemical Reactions
III. Chemistry in a Sustainable World



# Chemistry / Science (Chemistry)

## Syllabuses and Topics

Section	Chemistry & Science(Chemistry)
I. Matter – Structure and Properties	1) Experimental Chemistry
	2) The Particulate Nature of Matter
	3) Chemical Bonding and Structure
II. Chemical Reactions	4) Chemical Calculations
	5) Acid-Base Chemistry
	6) Qualitative Chemistry
	7) Redox Chemistry
	8) Patterns in the Periodic Table
	9) Chemical Energetics
	10) Rate of Reactions
III. Chemistry in a Sustainable World	11) Organic Chemistry
	12) Maintaining Air Quality

While the topics covered are the same for Pure Chemistry and Science(Chemistry), there is a reduction in Learning Outcomes within certain topics for Science(Chemistry).



# Pure Sciences

## Assessment Objectives

### Theory Papers (Papers 1 and 2)

- A** Knowledge with Understanding, approximately 45% of the marks.
- B** Handling Information and Solving Problems, approximately 55% of the marks.

### Practical (Paper 3)

- C** Experimental Skills and Investigations, 100% of the marks.

Paper 3 will assess appropriate aspects of objectives C1 to C6 in the following skill areas

- Planning (P)
- Manipulation, measurement and observation (MMO)
- Presentation of data and observations (PDO)
- Analysis, conclusions and evaluation (ACE)

The assessment of Planning (P) will have a weighting of 15%. The assessment of skill areas MMO, PDO and ACE will have a weighting of 85%.



# Pure Sciences

## Scheme of Assessment

Candidates are required to enter for **ALL** three Papers for each Pure Science.

Paper	Type of Paper	Duration	Marks	Weighting
1	Multiple Choice	1 h	40	30%
2	Structured and Free Response	1 h 45 min	80	50%
3	Practical	1 hr 50 min	40	20%

# Combined Sciences Assessment Objectives

## Theory Papers (Papers 1, 2, 3 and 4)

- A** Knowledge with Understanding, approximately 50% of the marks with approximately 20% allocated to recall.
- B** Handling Information and Solving Problems, approximately 50% of the marks.

## Practical Assessment (Paper 5)

Paper 5 is designed to test appropriate skills in **C**, Experimental Skills and Investigations.

In one or more of the questions in Paper 5, candidates will be expected to suggest a modification or an extension, which does not need to be executed. Depending on the context in which the modification / extension element is set, the number of marks associated with this element will be in the range of 10% to 20% of the total marks available for the practical test.



# Combined Sciences

## Scheme of Assessment

Candidates will take Paper 1, Paper 5 and two of Papers 2, 3 and 4, depending on the combination of Science offered.

Paper	Type of Paper	Duration	Marks	Weighting
1	Multiple Choice	1 h	40	20.0%
2	Structured and Free Response (Physics)	1 h 15 min	65	32.5%
3	Structured and Free Response (Chemistry)	1 h 15 min	65	32.5%
4	Structured and Free Response (Biology)	1 h 15 min	65	32.5%
5	Practical Test	1 h 30 min	30	15.0%



# Frequently Asked Questions

Q1: What are the differences between Pure and Combined Sciences?

Q2: Are Pure Sciences compulsory subjects for admission into Junior Colleges?

Q3: Will doing Combined Science affect the courses my child can take in a Polytechnic?

Q4: Will my child not be able to qualify for admission to School of Medicine in NUS or NTU if he/she does not take triple and/or Pure Sciences at O Level?

Q5: Should my child take Pure Sciences or Combined Science?

Q6: Can my child drop to Combined Science if he/she is not able to cope with the demand and rigour of Pure Sciences?

# Q<sub>1</sub>: What are the differences between Pure and Combined Sciences?

In terms of content coverage, **Pure Sciences** cover more topics and in greater depth.

For **Pure Sciences**, the scientific disciplines (Physics, Chemistry, and Biology) are assessed as three **separate** subjects.

For **Combined Science**, **two** of the scientific disciplines (e.g. Physics and Chemistry) are assessed together as one subject in **Combined Science**.

Compared to Combined Science, the theory paper for **Pure Sciences** has:

- **higher** percentage of **Handling Information and Solving Problems** type of questions
- **lower** percentage of **Knowledge with Understanding** type of questions when compared to Combined Science.



# Examples of different types of Questions (Chemistry Discipline)

**A2** The table shows information about the electrolysis of some substances.

Complete the table by filling in the missing information.

substance	electrodes used	product of reaction at positive electrode	product of reaction at negative electrode
concentrated aqueous copper(II) chloride	carbon		copper
dilute aqueous copper(II) sulfate	copper	copper(II) ions	
	platinum	chlorine	sodium

[3]

## Topic: Electrolysis

- Part of Pure Chemistry Syllabus
- Demonstrate **Knowledge with Understanding** in relation to concepts of electrolysis

Source: 2018 GCE O Level Chemistry Paper 2

# Examples of different types of Questions

## (Chemistry Discipline)

### Topic: Atmosphere & Group Properties (Pure and Combined Chem Syllabus)

- A5** Helium is a gas with many uses. It is needed for technical equipment, such as MRI scanners. MRI scanners are used in hospitals to produce detailed images of the body. Helium is also used to fill party balloons.

In 2016, a large underground deposit of helium was discovered in Tanzania. Scientists were delighted with the discovery because helium is a finite resource. Scientist cannot get helium back after it is released into the atmosphere.

The table shows some information about helium and some gases in dry air.

gas	density of pure gas at room temperature and pressure in g/dm <sup>3</sup>	percentage volume composition of dry air
helium	0.17	0
nitrogen	1.17	
oxygen	1.33	
argon		<1

- (a) Complete the last column of the table. [1]

- Demonstrate **Knowledge with Understanding** in relation to state the volume composition of gases in dry air

- (b) (i) Suggest why helium cannot be recovered if it is released into the atmosphere. [1]

- Use **information** provided to draw **inference**

- (ii) Calculate the density of pure argon at room temperature and pressure in g/dm<sup>3</sup>. [1]

- **Recall & locate information** from a variety of sources

- **Apply information** into formula to **solve problem**

- (iii) Some people think that the use of helium to fill party balloons should be discouraged.

Explain why they think this. [2]

- Use **information** to present **reasoned explanations** for phenomena

Source: 2018 GCE O Level Chemistry Paper 2



## Q2: Are Pure Sciences compulsory subjects for admission into Junior Colleges?

- To be eligible for admission to a JC course, students must satisfy the following criteria:
  - > L1R5 (excludes bonus points)  $\leq 15$  and meet subject requirements\* or
  - > L1R5 (excludes bonus point) 16 – 20 and meet subject requirements\*\*

L1R5 : For Junior College Course		
L1	First Language	- English/Higher Mother Tongue
R5	Relevant Subject 1	- Humanities/Higher Art/Higher Music/Malay (Special Programme)/Chinese (Special Programme)/Bahasa Indonesia
	Relevant Subject 2	- Mathematics/Science
	Relevant Subject 3	- Humanities/Higher Art/Higher Music/Mathematics/ Science/ Malay (Special Programme)/Chinese (Special Programme)/ Bahasa Indonesia
	Relevant Subject 4	- Any GCE 'O' Level subjects (except Religious Knowledge)
	Relevant Subject 5	- Any GCE 'O' Level subjects (except Religious Knowledge)

\*Students are eligible for conditional admission if they do not meet subject requirements.

\*\*Students are eligible for conditional admission only if they have grades of 'A1' or 'A2' in all the R5 subjects.

Source: 2021 JAE Information Booklet (Click [here](#) to access)

## Q2: Are Pure Sciences compulsory for admission into Junior Colleges' Science stream?

While students' admission to JC is based on L1R5 results, **different JCs require different subject pre-requisites** for the subjects to be offered. It is good to find out the relevant information from the targeted JC directly.

- Under the A level curriculum, candidates select subjects from three levels of study, Higher 1 (H1), Higher 2 (H2) and Higher 3 (H3). H2 level is broadly equivalent to A level, subjects at H1 level are of reduced breadth of content and subjects at H3 level are taken as extension of H2 level to allow more in-depth study and advanced content.
- To do a Science subject at H1 or H2 level, your child must have studied the subject either as **Combined Science** or **Pure Science** at GCE 'O' level.

# Q3: Will doing Combined Science enable my child to take his/her desired courses in a Polytechnic?

- To be eligible for consideration for admission to the various courses in polytechnics, students must obtain **26 points or better for the net ELR2B2 aggregate score** (i.e. English Language, 2 relevant subjects and best 2 other subjects, including CCA Bonus Points) and **meet the minimum entry requirements**.
- **Either Combined Science or Pure Sciences subjects** can be used for admission to Polytechnic courses in the Applied Sciences, Engineering, Health Sciences, Information & Digital Technologies, Built Environment, Maritime Studies, Media & Design and most Business & Management courses.
- **With Combined Science**, your child can still choose from a wide range of courses, as long as he or she **meets the eligibility criteria** for the individual courses.



Courses	Course Code	Aggregate Type	Net ELR2B2 Range for Previous (2020) JAE	Minimum Entry Requirements															
APPLIED SCIENCES																			
Applied Chemistry (Previously known as Medicinal Chemistry)	C45	ELR2B2-C	6 to 10	<table><thead><tr><th></th><th>Subject</th><th>Grade</th></tr></thead><tbody><tr><td>a)</td><td>English Language</td><td>1-7</td></tr><tr><td>b)</td><td>Mathematics (Elementary/Additional)</td><td>1-6</td></tr><tr><td>c)</td><td>Any one of the following subjects:</td><td>1-6</td></tr><tr><td></td><td><ul style="list-style-type: none"><li>Biology</li><li>Biotechnology</li><li>Chemistry</li><li>Combined Science</li><li>Food &amp; Nutrition</li><li>Physics</li><li>Engineering Science</li><li>Science (Physics, Biology)</li><li>Science (Chemistry, Biology)</li><li>Science (Physics, Chemistry) / Physical Science</li></ul></td><td></td></tr></tbody></table>		Subject	Grade	a)	English Language	1-7	b)	Mathematics (Elementary/Additional)	1-6	c)	Any one of the following subjects:	1-6		<ul style="list-style-type: none"><li>Biology</li><li>Biotechnology</li><li>Chemistry</li><li>Combined Science</li><li>Food &amp; Nutrition</li><li>Physics</li><li>Engineering Science</li><li>Science (Physics, Biology)</li><li>Science (Chemistry, Biology)</li><li>Science (Physics, Chemistry) / Physical Science</li></ul>	
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Biologics & Process Technology <b>Specialisations:</b> <ul style="list-style-type: none"><li>Biopharmaceutical Technology</li><li>Process Technology</li></ul>	C49	ELR2B2-C	9 to 12																
Chemical & Pharmaceutical Technology <b>Specialisations:</b> <ul style="list-style-type: none"><li>Petrochemical Technology</li><li>Pharmaceutical Technology</li></ul>	C73	ELR2B2-C	6 to 15																
Food Science & Nutrition	C69	ELR2B2-C	6 to 13																
Pharmaceutical Science <b>Specialisations:</b> <ul style="list-style-type: none"><li>Pharmacy Practice</li><li>Clinical Trials</li></ul>	C65	ELR2B2-C	5 to 10																

Either Pure Science or Combined Science can be used for admission

Either Pure Science or Combined Science can be used for admission

# Nanyang Polytechnic

These aggregate scores are meant as a reference for applicants applying to these courses, and do not constitute the admission scores for subsequent admission exercises.

The “Net ELR2B2 Range for Previous (2020) JAE” in the table below shows the net ELR2B2 aggregate of the highest to lowest ranked students who were admitted to these courses through the 2020 Joint Admissions Exercise (JAE).

Source: 2021 JAE Information Booklet (Click [here](#) to access)





## Q4: Must my child do Pure/Triple Science at O level to qualify for admission to School of Medicine in NUS or NTU?

- To qualify for admission to School of Medicine in NUS or NTU, students generally require a **good H2 pass in JC Chemistry and H2 pass in either JC Biology or JC Physics** (and meet other respective pre-requisites). Polytechnic students with **relevant accredited diplomas** and meet other admission criteria may qualify too.
- To do a Science subject at H2 level in JC, your child must have studied the subject **either as Combined Science or Pure Science** at GCE 'O' level. Since **different JCs require different subject pre-requisites** for the subjects to be offered, it is good to find out the relevant information from the targeted JC directly.
- It is good to check the University website as the subject pre-requisites are subject to changes every year.



# Q5: Should my child take Pure Sciences or Combined Science?

- Your child should consider his/her
  - > **interest** towards the Sciences disciplines
  - > **preferences** of post-secondary courses or future pathways
  - > **strengths and current ability** to cope with the rigour of the Sciences
- Due to the rigour of the Pure Sciences, it is important for students to manage their time and overall subject load effectively throughout the upper secondary years.



## Q6: Can my child drop to Combined Science if he/she is not able to cope with the demand and rigour of Pure Sciences?

- We acknowledge that some students may need time to adjust to the rigour of the Pure Sciences. Your child is thus **strongly encouraged** to complete the two years curriculum of Pure Sciences, if he/she **chooses and meets the criteria** to be offered the subjects.
- Furthermore, the syllabus covered at Secondary 3 may **differ** for Combined Science and Pure Sciences. Hence, your child will need to put in additional time and effort to make up for the syllabus missed, if he/she drops to Combined Science.

# Examination Syllabus of O Level Sciences

## O Level Combined Science

Science: Physics, Chemistry  
(Syllabus 5076)

Science: Chemistry, Biology  
(Syllabus 5078)



## O Level Pure Sciences

Chemistry (Syllabus 6092)



Physics (Syllabus 6091)



Biology (Syllabus 6093)





# Thank you.

You may email or contact us at **6752 4311**, if you have other queries.

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