Q.U.I.N.N.

Quantum Understanding and Interactive Navigation for Newbies

Junior curriculum

Year 7

Q1, 2 – Understanding Particle Families

Analyse data and information to describe patterns, trends and relationships and identify anomalies (AC9S7I05).

Q3 – Electron Properties and Everyday Life

Construct evidence-based arguments to support conclusions or evaluate claims and consider any ethical issues and cultural protocols associated with using or citing secondary data or information (AC9S7I07).

Q4 – Designing Electron Experiments

Plan and conduct reproducible investigations to answer questions and test hypotheses, including identifying variables and assumptions and, as appropriate, recognising and managing risks, considering ethical issues and recognising key considerations regarding heritage sites and artefacts on Country/Place (AC9S7I02).

Q5 – Mass Calculations

Select and construct appropriate representations, including tables, graphs, models and mathematical relationships, to organise and process data and information (AC9S7I04).

Q6, 7, 8, 10 – Research and Explain Particle Accelerator, Higgs Boson, Quarks, Fundamental Forces

Write and create texts to communicate ideas, findings and arguments for specific purposes and audiences, including selection of appropriate language and text features, using digital tools as appropriate (AC9S7I08).

Q9 – Particle-Antiparticle Hypotheses

Develop investigable questions, reasoned predictions and hypotheses to explore scientific models, identify patterns and test relationships (AC9S7I01).

Q.U.I.N.N.

Quantum Understanding and Interactive Navigation for Newbies

Junior curriculum

Year 8

Q1, 2 – Understanding Particle Families

Analyse data and information to describe patterns, trends and relationships and identify anomalies (AC9S8I05).

Q3 – Electron Properties and Everyday Life

Construct evidence-based arguments to support conclusions or evaluate claims and consider any ethical issues and cultural protocols associated with using or citing secondary data or information (AC9S8I07).

Q4 – Designing Electron Experiments

Plan and conduct reproducible investigations to answer questions and test hypotheses, including identifying variables and assumptions and, as appropriate, recognising and managing risks, considering ethical issues and recognising key considerations regarding heritage sites and artefacts on Country/Place (AC9S8I02).

Q5 – Mass Calculations

Select and construct appropriate representations, including tables, graphs, models and mathematical relationships, to organise and process data and information (AC9S8I04).

Q6, 7 – Particle Accelerators and Higgs Boson Discovery

Explain how new evidence or different perspectives can lead to changes in scientific knowledge (AC9S8H01).

Q8, 10 – Quark Analogies and Fundamental Forces Presentation

Write and create texts to communicate ideas, findings and arguments for specific purposes and audiences, including selection of appropriate language and text features, using digital tools as appropriate (AC9S8I08).

Q9 – Particle-Antiparticle Hypotheses

Develop investigable questions, reasoned predictions and hypotheses to explore scientific models, identify patterns and test relationships (AC9S8I01).

Q.U.I.N.N.

Quantum Understanding and Interactive Navigation for Newbies

Junior curriculum

Year 9

Q1, 2 – Understanding Particle Families

Analyse and connect a variety of data and information to identify and explain patterns, trends, relationships and anomalies (AC9S9I05).

Q3 – Electron Properties and Everyday Life

Construct arguments based on analysis of a variety of evidence to support conclusions or evaluate claims, and consider any ethical issues and cultural protocols associated with accessing, using or citing secondary data or information (AC9S9I07).

Q4 – Designing Electron Experiments

Plan and conduct valid, reproducible investigations to answer questions and test hypotheses, including identifying and controlling for possible sources of error and, as appropriate, developing and following risk assessments, considering ethical issues, and addressing key considerations regarding heritage sites and artefacts on Country/Place (AC9S9I02).

Q5 – Mass Calculations

Select and construct appropriate representations, including tables, graphs, descriptive statistics, models and mathematical relationships, to organise and process data and information (AC9S9I04).

Q6 – Particle Accelerators Research

Investigate how advances in technologies enable advances in science, and how science has contributed to developments in technologies and engineering (AC9S9H02).

Q7 – Higgs Boson Timeline

Explain how scientific knowledge is validated and refined, including the role of publication and peer review (AC9S9H01).

Q8, 10 – Quark Analogies and Fundamental Forces Presentation

Write and create texts to communicate ideas, findings and arguments effectively for identified purposes and audiences, including selection of appropriate content, language and text features, using digital tools as appropriate (AC9S9I08).

Q9 – Particle-Antiparticle Hypotheses

Develop investigable questions, reasoned predictions and hypotheses to test relationships and develop explanatory models (AC9S9I01).

EQUS Australian Research Council Centre of Excellence for Engineered Quantum Systems

CSIRO

Q.U.I.N.N.

Quantum Understanding and Interactive Navigation for Newbies

Junior curriculum

Year 10

Q1, 2 – Understanding Particle Families

Analyse and connect a variety of data and information to identify and explain patterns, trends, relationships and anomalies (AC9S10I05).

Q3 – Electron Properties and Everyday Life

Construct arguments based on analysis of a variety of evidence to support conclusions or evaluate claims, and consider any ethical issues and cultural protocols associated with accessing, using or citing secondary data or information (AC9S10I07).

Q4 – Designing Electron Experiments

Plan and conduct valid, reproducible investigations to answer questions and test hypotheses, including identifying and controlling for possible sources of error and, as appropriate, developing and following risk assessments, considering ethical issues, and addressing key considerations regarding heritage sites and artefacts on Country/Place (AC9S10I02).

Q5 – Mass Calculations

Select and construct appropriate representations, including tables, graphs, descriptive statistics, models and mathematical relationships, to organise and process data and information (AC9S10I04).

Q6 – Particle Accelerators Research

Investigate how advances in technologies enable advances in science, and how science has contributed to developments in technologies and engineering (AC9S10H02).

Q7 – Higgs Boson Timeline

Explain how scientific knowledge is validated and refined, including the role of publication and peer review (AC9S10H01).

Q8, 10 – Quark Analogies and Fundamental Forces Presentation

Write and create texts to communicate ideas, findings and arguments effectively for identified purposes and audiences, including selection of appropriate content, language and text features, using digital tools as appropriate (AC9S10I08).

Q9 – Particle-Antiparticle Hypotheses

Develop investigable questions, reasoned predictions and hypotheses to test relationships and develop explanatory models (AC9S10I01).

Q.U.I.N.N.

Quantum Understanding and Interactive Navigation for Newbies

Senior curriculum

The Standard Model in the senior physics syllabus around Australia

The Standard Model of particle physics provides Australian secondary schools with both a consistent learning framework and flexibility in classroom implementation. While all States introduce fundamental concepts, they differ considerably in subject depth, assessment approaches and technology integration.

For example, most curricula emphasise particle accelerators and modern detection methods, while increasingly connecting theoretical concepts to contemporary research and real-world applications. This reflects the evolving nature of physics education that balances foundational knowledge with current scientific relevance.

Key differences in approach

Depth and Mathematical Rigour

Most Mathematical: Queensland and SA include quantitative problem-solving with conservation laws.

Least Mathematical: Tasmania focuses on qualitative understanding only.

Evidence-Based: NSW emphasises scientific inquiry and experimental evidence analysis.

Balanced: Victoria, WA, ACT, and NSW combine qualitative concepts with some calculations.

Integration with Other Topics

Victoria: Integrates through optional topics (particle accelerators, origins of matter).

Queensland: Standalone dedicated topic with clear time allocation (13 hours).

Western Australia: Embedded within broader electromagnetism and modern physics unit.

ACT: Connected to special relativity and cosmology.

SA: Part of comprehensive modern physics sequence.

Tasmania: Brief qualitative introduction within nuclear physics.

NSW: Integrated within “From the Universe to the Atom” module connecting cosmic and atomic scales.

Practical Applications Emphasis

Strongest: Victoria, SA and NSW emphasise technological applications and research.

Moderate: Queensland and ACT include some applications.

Limited: WA and Tasmania focus primarily on theoretical concepts.

Contemporary Research Integration

Victoria: Explicit focus on contemporary research and regional applications.

Queensland: Includes modern discoveries like Higgs boson.

NSW: Strong emphasis on particle accelerator evidence and current experimental techniques.

Others: Variable emphasis on current research developments.

Inquiry and Evidence Focus

NSW: Strongest emphasis on analysing evidence that led to Standard Model development.

Queensland: Focus on mathematical modeling and problem-solving.

Victoria: Contemporary research applications and technological connections.

Others: More traditional theoretical approach with limited inquiry emphasis.

EQUS Australian Research Council Centre of Excellence for Engineered Quantum Systems

CSIRO

Q.U.I.N.N.

Quantum Understanding and Interactive Navigation for Newbies

Senior curriculum

Content comparison table

	Content Area	VIC	QLD	WA	ACT	SA	TAS	NSW
Fundamental Particles	Elementary particles concept	✓	✓	✓	✓	✓	✓	✓
	Six types of quarks	✓	✓	✓	✓	✓	✓	✓
	Six types of leptons	✓	✓	✓	✓	✓	✗	✓
	Quark fractional charges	✓	✓	✓	✓	✓	✓	✓
	Antiparticles concept	✓	✓	✓	✓	✓	✗	✓
Composite Particles	Baryons (three quarks)	✓	✓	✓	✓	✓	✗	✓
	Mesons (quark-antiquark)	✓	✓	✓	✓	✓	✗	✓
	Proton/neutron composition	✓	✓	✓	✓	✓	✓	✓
Fundamental Forces	Four fundamental forces	✓	✓	✓	✓	✓	✓	✓
	Gauge bosons concept	✓	✓	✓	✓	✓	✓	✓
	Photon (EM force)	✓	✓	✓	✓	✓	✓	✓
	W/Z bosons (weak force)	✓	✓	✓	✓	✓	✓	✓
	Gluons (strong force)	✓	✓	✓	✓	✓	✓	✓
	Graviton (gravitational)	✗	✗	✗	✗	✓	✗	✗
Conservation Laws	Charge conservation	✓	✓	✓	✓	✓	✗	✓
	Baryon number conservation	✓	✓	✓	✓	✓	✗	✓
	Lepton number conservation	✓	✓	✓	✓	✓	✗	✓
	Mathematical problem solving	✗	✓	✗	✗	✓	✗	✗
Particle Interactions	Feynman diagrams	✗	✓	✗	✓	✓	✗	✗
	Beta decay interactions	✓	✓	✓	✓	✓	✗	✓
	Electron-positron annihilation	✓	✓	✓	✓	✓	✗	✓
	Symmetry principles	✗	✓	✗	✓	✗	✗	✗
Experimental Evidence	Particle accelerators	✓	✓	✓	✓	✓	✗	✓
	Large Hadron Collider	✓	✓	✓	✓	✓	✗	✓
	Australian Synchrotron	✓	✓	✓	✗	✓	✗	✓
	Higgs boson discovery	✓	✓	✗	✗	✓	✗	✓
Cosmological Connections	Big Bang theory link	✓	✓	✓	✓	✗	✗	✓
	Early universe evolution	✓	✗	✓	✗	✗	✗	✓
	Cosmic background radiation	✓	✗	✓	✗	✗	✗	✓

EQUS Australian Research Council Centre of Excellence for Engineered Quantum Systems

CSIRO

Q.U.I.N.N.

Quantum Understanding and Interactive Navigation for Newbies

Senior curriculum

Queensland (QCAA)

Dedicated 13-hour topic covering fundamental particles, forces and conservation laws with mathematical problem-solving. Provides structured, comprehensive coverage with explicit time allocation and quantitative assessment requirements.

New South Wales (NSW)

Comprehensive coverage through “Deep Inside the Atom” module investigating Standard Model evidence and particle accelerator applications. Focuses on evidence-based understanding and scientific inquiry processes with strong experimental emphasis.

Western Australia (SCSA)

Embedded within broader modern physics unit, emphasising relativistic effects and particle accelerator applications.

Connects Standard Model concepts to electromagnetic theory and special relativity principles.

South Australia (SACE)

Detailed subtopic covering fundamental particles, forces and conservation laws with practical applications. Emphasises technological applications and real-world problem-solving scenarios.

Australian Capital Territory (BSSS)

Comprehensive coverage linking Standard Model to Big Bang Theory and special relativity.

Integrates cosmological applications with fundamental particle physics in unified approach.

Victoria (VCE)

Integrates Standard Model through multiple options focusing on particle accelerators.

Offers flexible pathways through different unit combinations allowing schools to tailor coverage depth.

Tasmania (TSAC)

Qualitative introduction focusing on quarks and guage bosons, assessed only internally.

Provides foundational understanding without mathematical complexity or external examination pressure.

EQUS
Australian Research Council Centre of Excellence for Engineered Quantum Systems

CSIRO