SCIE1001 Sydney Science 2050: Towards the Future

THE UNIVERSITY OF SYDNEY · UNDERGRADUATE · SEMESTER 2, 2026

Full guide + ask Sia about SCIE1001

SIDE 1/2 WHAT MUST BE IN YOUR HEAD · definitions · mechanisms · comparisons · decision rules

CLOSED-BOOK MEMORY SHEET

Final 35% · compulsory sitting · weeks 7–12

0 · Exam map

COURSE DATA + LECTURE 13

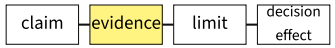
Final 35 | Test 20 | Report | WSR | Part. 18

Final Exam 35% · Course Quiz 2% · In-class Test 20% · Scientific Report 15% · Weekly Short Response 10% · Participation 18%

"Secure settings - no phones, smart watches, notes permitted" (SCIE1001 2026 Lecture 13 'Exam Details & Conditions' slide (PDF_Lecture_13_2026_pdf.txt))

PART	WHAT HAPPENS
1 · 25%	6 multiple-choice; one from each week 7–12
2 · 25%	choose week 7 or week 10 short answer
3 · 25%	choose week 8 or week 9 short answer
4 · 25%	choose week 11 or week 12 short answer

Operating facts: 1.5 hours, on campus, final covers weeks 7–12 only; short answers are roughly half a page. The final is compulsory: you must sit it to pass. No minimum exam mark is stated.



Every short answer: claim → evidence → limitation → decision consequence.

1 · Recitable core

C2–C7

Falsification exposes a claim to observations that could show it false. *Inductive risk* is possible harm from accepting or rejecting a claim under uncertainty. *Epistemic values* concern knowledge quality; *non-epistemic values* concern ethical, social or political priorities shaping questions, methods and uses.

CHECK → *A scientific answer says what observation would count against it; a policy answer also says whose harms and benefits set the decision threshold.*

1b · Four jobs, in order

C1 · C12

JOB	RECITE THIS CHECK
orient	What system, population, scale or condition is being analysed?
connect	What verb-led mechanism changes the starting condition?
discriminate	What pattern favours this explanation over a plausible alternative?
bound	What uncertainty or missing link stops the conclusion?

A complete response makes the task visible before detail: define the relevant terms, connect evidence to mechanism, use a comparison to test it, and answer the question actually asked. **Do not report a label or group difference as a mechanism.**

2 · Claim → test → revise

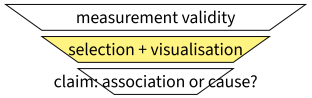
C2 · C3 · C4

TESTABLE-CLAIM FRAME

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Define variable + population + comparison → predict an observable difference → name a possible disconfirming result → revise if contrary evidence arrives.
```

Demarcation problem: distinguish scientific inquiry and claims from non-science or pseudoscience without assuming one simple rule fits every discipline. One demarcation rule cannot settle every disputed field.

AUDIT POINT	QUESTION TO ASK
Validity	Does the variable measure the intended thing?
Selection	Who or what entered the data, and what was omitted?
Visual	Are scale, denominator and comparison preserved?
Inference	Association, tested mechanism, or causal claim?

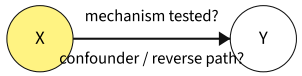


Audit the graph from variable definition through conclusion.

P-VALUE AND P-HACKING

A *p-value* is the probability, *assuming a specified null model*, of data at least as extreme as observed. It is not the probability the hypothesis is true. *p-hacking* selectively analyses or reports results to obtain significance.

TRAP → *More rows cannot repair biased measurement or an invalid comparison.*



Observed association is not a tested causal mechanism.

2b · Graph-to-claim audit

C3 WORKED METHOD

Start at the denominator. Define who or what each mark represents, the population from which observations were selected, and whether the axes or display preserve the comparison. A familiar term is not enough: state the precondition under which the measure is relevant.

FINDING	PERMITTED WORDING
pattern in selected data	"is associated with" in that sample
controlled comparison	difference under specified conditions

3 · Uncertainty language

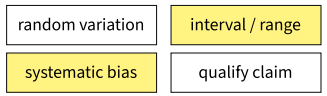
C4

TYPE	EFFECT ON CONCLUSION
Random uncertainty	Variation across observations; report interval/range and avoid false precision.
Systematic uncertainty	Bias or untested assumption; more observations alone do not remove it.
Unknown mechanism	Association may remain useful, but causal language must narrow.

CALIBRATION LADDER

```
establishes → supports → is consistent with → suggests → cannot distinguish
```

Uncertainty is not ignorance and does not make every claim equally credible. State whether the problem is random variation, systematic bias or an untested assumption because each changes the conclusion differently.



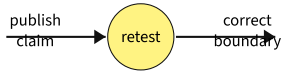
Name the uncertainty, then change the strength of the conclusion.

4 · Repeat the right thing

C5

TERM	WHAT REPEATS?
Reproducibility	same data + same analysis → same result
Replicability	new data test the finding
Robustness	reasonable analytical changes preserve it

One failed replication is evidence to investigate, not an automatic verdict of fraud. Check power, method and boundary conditions; publication incentives and questionable practices can affect what becomes visible.



Correction asks whether the failure lies in data, analysis or scope.

4b · Fair comparison + report

C6

Controls and comparison change the intended factor while holding plausible alternatives stable. A *confounder* offers another route to the outcome. *Report architecture* keeps observation separate from interpretation.

DESIGN CHECK	REPORT CHECK
comparison addresses the question	state what was observed first
plausible confounders controlled	interpret through evidence, not rhetoric
a result could count against claim	report uncertainty and variation

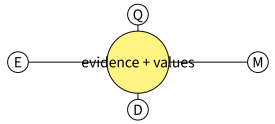
5 · Values inside science

C7 · WEEK 7

Values can enter **question selection, method and policy response**. Make each entry point explicit: what is prioritised, whose interests or harms matter, and how the choice changes the evidence sought or the action threshold.

STAGE	EVIDENCE JOB	VALUE JOB
Question	define answerable comparison	choose which problem matters
Method	measure consequences reliably	set ethical constraints
Decision	estimate outcomes + uncertainty	weigh harms, benefits, distribution

Value influence does not mean evidence can be replaced by preference. A decision threshold may depend on consequences of error; the empirical claim still needs evidential support.



Question, method, decision and ethics interact; preference never substitutes for evidence.

6 · FLICC denial audit

GLOSSARY

Fake experts	credentials or consensus misrepresented
Logical fallacies	conclusion does not follow
Impossible expectations	certainty demanded before action
Cherry-picking	selective evidence hides the whole pattern
Conspiracy theories	counter-evidence becomes proof of a cover-up

MCQ → *Name the technique from the operation, not from whether you agree with the speaker.*

6b · Decision-threshold logic

C7

Under uncertainty, accepting and rejecting a claim can each produce harm. The threshold is therefore not merely "is the evidence perfect?" but "what level of support is appropriate given the consequences of each possible error?"

EXAM SENTENCE

```
Because a false [accept/reject] would harm [group/consequence], the decision threshold should [rise/fall]; however, the empirical claim remains limited by [evidence/uncertainty].
```

BAD MOVE	REPAIR
hide the value judgement	name the prioritised harm/benefit

7 · Ecosystem evidence → action

C8 · WEEK 8/9 CHOICE

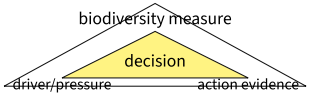
Begin with the *biodiversity measure* at the relevant spatial and temporal scale. Connect a *driver* to the pressure it exerts, identify the expected ecological indicator, then ask whether intervention evidence supports the management decision.

MECHANISM CHAIN

```
driver → pressure → ecological change → measured indicator → intervention → monitored response
```

LINK	FAILURE QUESTION
measure → state	Does the indicator capture the claimed biodiversity feature?
driver → pressure	Could another driver create the same pattern?
pressure → change	Is the mechanism shown or only associated?
intervention → response	Is comparison evidence local and scale-appropriate?

A global trend cannot be transferred to a local site without scale-appropriate evidence. A global decline motivates inquiry; it does not estimate a site's loss or identify its cause.



All three corners must match the site's scale before action.

FAST COMPARISON

Indicator describes a pattern. **Driver/pressure** proposes why it changes. **Intervention evidence** tests whether acting on that mechanism changes the indicator. Do not collapse them into one claim.

7b · Scale + intervention ledger

C8

WRITE DOWN	WHY IT EARNS SPACE
indicator + unit	prevents an undefined "biodiversity" claim
site + time window	fixes the scale of inference
driver + pressure verb	makes the causal route inspectable
alternative driver	shows what the same pattern cannot distinguish
intervention comparator	turns action into a test
response + uncertainty	states what would maintain, narrow or reverse action

Cause–effect wording: "The indicator shows [pattern] at [scale]. Driver X could produce it through pressure Y, but alternative Z remains plausible. Compare [intervention] with [alternative/control] and monitor [response] before claiming local effectiveness."

8 · Pollution causal chain

C9 · WEEK 8/9 CHOICE

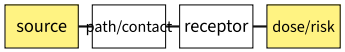
Build the causal chain before recommending monitoring or control. A named pollutant is only a *hazard*; realised risk requires a viable pathway to a receptor plus relevant exposure or dose.

SOURCE–PATHWAY–RECEPTOR

```
source → transport/contact pathway → receptor → exposure/dose → possible effect → risk communication
```

IF THE CHAIN BREAKS AT…	DO THIS
source	verify presence, form and release
pathway	test transport/contact route
receptor	define who or what can be exposed
dose	measure magnitude, duration and relevant variation
effect	separate association from mechanism

Hazard presence and realised risk are different claims. Communicate what is known, what remains uncertain and which measurement could change the recommendation.



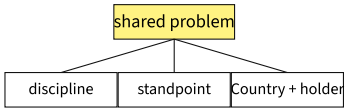
Control can target the source, interrupt the pathway or protect the receptor.

9 · Knowledge systems

C10–C11

CONCEPT	DISTINCT JOB
disciplinary diversity	brings different methods and questions
standpoint + expertise	social position can reveal hidden relations
collaborative evidence	combines contributions without extraction
Country + relational knowledge	changes system boundary and relevant relations
observation across generations	extends place-based pattern recognition
ethical engagement	preserves holder, context and permission

Do not homogenise distinct peoples, countries or knowledge traditions.



Credit what each practice reveals; collaboration does not erase context.

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SELF-TEST DRILLS · ANSWER PATHS · TRAPS · EXAM-MORNING RETRIEVAL

Full guide + ask Sia about SCIE1001

SIDE 2/2 RETRIEVE → APPLY → COUNTER-CASE → VERIFY · worked mini-examples · judgement cards

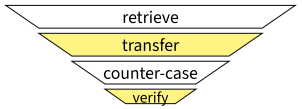
CLOSED-BOOK MEMORY SHEET

Say the path aloud before revealing the answer

10 · Drill protocol PRACTICE

1. **Retrieve:** define the three named concepts without looking.
2. **Transfer:** apply them to a changed scenario, not the memorised wording.
3. **Counter-case:** name an observation that weakens or reverses the claim.
4. **Verify:** check the conclusion against the chapter boundary.

Record the first point where reasoning fails; repair that move before another case. Recognition is not retrieval.



Closed-book loop: each pass narrows the place you need to repair.

11 · Drill A · public graph C3 WORKED EXAMPLE

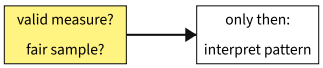
Prompt: A graph has a very large dataset and shows X rising with Y. The variable poorly represents the intended construct; selection into the dataset is uneven. Which claim survives?

ANSWER PATH

`1 define intended variable → 2 test measurement validity → 3 audit selection + visual scale/denominator → 4 label association → 5 seek alternative or mechanism test.`

Answer: the graph may show an association in the selected observations, but it cannot repair biased measurement or an invalid comparison; it does not by itself establish causation.

WHICH IS TRUE?	VERDICT
Large n removes systematic bias.	**False**
Correlation may motivate a mechanism test.	**True**
A p-value is P(hypothesis true).	**False**



Data volume comes after validity and comparison.

11b · Drill A extension C2–C4

Change the case: measurement is valid, but a comparison is missing and the interval is wide. Say what remains supported and what would test the alternative.

TEMPTING ANSWER	WHY IT FAILS
"significant, therefore causal"	conditional probability supplies no mechanism
"uncertain, therefore unknowable"	uncertainty calibrates; it does not erase

12 · Drill B · values C7 WORKED EXAMPLE

Prompt: A policy team chooses a response because "value choice" appears in the case. Test the choice with research ethics and a decision threshold.

ANSWER PATH

`required outcome/actor → when the value is relevant → ethical constraint → harm/benefit/distribution threshold → evidence of consequences → narrow or withdraw.`

Answer: State what harm, benefit or distribution matters and to whom. Use ethics to reject options that violate constraints, then apply the threshold to supported consequences. Preference cannot replace the evidential step.

IF YOU SEE...	DO THIS
"values make science subjective"	separate value entry from empirical support
high cost of false negative	explain how inductive risk affects threshold
policy recommendation	name consequence + affected group



Inductive risk asks about consequences of error; evidence still constrains the claim.

13 · MCQ contrasts C4–C7

WHICH IS TRUE?	REASON
Uncertainty makes all claims equal.	No: type and extent change confidence.
One failed replication proves fraud.	No: investigate method, power, scope.
Reproducibility uses new data.	No: same data + same analysis.
Robustness varies analysis.	Yes: reasonable alternatives test stability.
Impossible expectations can deny science.	Yes: demanding certainty blocks action.

FAST RULE → *If an option converts a qualified claim into an absolute one, look for the missing uncertainty or boundary condition.*

13b · Mini-worked uncertainty C4 WORKED EXAMPLE

Prompt: A result varies and may share one calibration bias. Give random and systematic uncertainty different jobs.

Path: use range/interval for random variation; check calibration or another standard for systematic bias; qualify the supported claim. Repetition characterises variation but does not remove a shared bias.

14 · Drill C · ecosystem C8 WORKED EXAMPLE

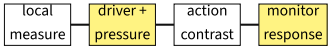
Prompt: A global biodiversity decline is cited to justify one local intervention. Audit the move.

ANSWER PATH

`local indicator + scale → candidate driver → pressure mechanism → plausible alternative → intervention evidence → monitored response.`

Answer: The global trend motivates inquiry but does not estimate the local loss or identify its cause. Choose a site-appropriate indicator; obtain local driver/pressure evidence; compare the intervention with a defensible alternative; monitor whether the indicator changes as predicted.

CLAIM	NEEDED EVIDENCE
site is losing biodiversity	defined local measure over relevant time
driver X caused loss	mechanism + contrast against alternatives
action Y will help	intervention comparison + response measure

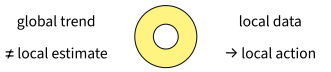


Local inference needs local measure, mechanism, comparison and follow-up.

15 · Trap cards · scale C8

IF YOU SEE X...	→ DO Y
global evidence, local decision	ask what transfers across scale and what needs local data
indicator used as cause	insert driver → pressure mechanism
intervention with no baseline	define comparator and response measure
one mean or diagram	report variation and uncertainty

Short-answer close: "Therefore the evidence supports [bounded action] at [specified scale], while [limitation] means [extra measurement] could change the decision."



Do not slide between spatial or temporal scales without evidence.

15b · Four-mark ecosystem spine C8

1. **Measure:** define indicator and site boundary.
2. **Mechanism:** write the driver-to-pressure link as a verb.
3. **Discriminator:** separate the driver from an alternative.

16 · Drill D · pollution C9 WORKED EXAMPLE

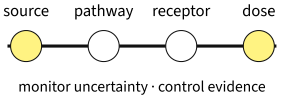
Prompt: A hazard is found at a source. The draft jumps straight to public risk. Restore the missing links.

ANSWER PATH

`source confirmed → viable pathway → receptor identified → exposure/dose measured → effect evidence → magnitude + uncertainty communicated.`

Answer: Presence at the source establishes a hazard, not realised risk. Test transport/contact to the receptor and the relevant exposure or dose. Only then communicate the supported magnitude of harm and recommend monitoring or control at the link the evidence identifies.

WHICH IS TRUE?	VERDICT
Hazard present means harm realised.	**False**
No viable pathway can interrupt risk.	**True**, for that chain
Risk message may omit uncertainty.	**False**
Control must always target source.	**False**; target any evidenced link



A risk claim fails where any causal link is absent or unsupported.

17 · Risk wording C9

AVOID	USE
"safe" / "dangerous" with no conditions	risk under stated exposure and uncertainty
source concentration = personal dose	separate release, pathway, contact and dose
association = mechanism	state what was observed and what was tested
recommendation with no reversal test	name evidence that would change action

HALF-PAGE SPINE → *Define chain; apply each link to the case; identify missing measurement; end with bounded monitoring/control.*

17b · Break-point cards C9

Source known, pathway unknown: monitor transport or contact; do not infer receptor dose. **Pathway viable, receptor undefined:** identify the affected population or ecological receptor before communicating magnitude. **Exposure measured, effect uncertain:** separate dose evidence from effect evidence and state the alternative explanation.

PROMPT WORD	REQUIRED MOVE
hazard	identify capacity to cause harm

18 · Drill E · knowledge C10–C11 WORKED EXAMPLES

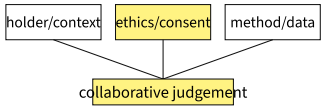
Prompt: A response treats disciplinary diversity, standpoint and expertise as interchangeable, then cites "Indigenous knowledge" without a people, Country, holder, context or permission.

ANSWER PATH

`exact comparison → separate discipline from standpoint/expertise → identify what each reveals → test collaboration → preserve holder/context/permission → qualify scope.`

Answer: Disciplinary diversity changes methods and questions; standpoint concerns what social position can make visible; expertise concerns warranted capability. Collaborative evidence may improve inquiry only if contributions remain attributed and contextualised. Name the specific people, Country and holder where the source permits; do not homogenise traditions.

IF YOU SEE X...	→ DO Y
"diversity adds opinions"	state the epistemic benefit: hidden relations, bias checking
knowledge detached from holder	restore attribution, context and ethical engagement
one group speaks for all	narrow scope; reject homogenisation

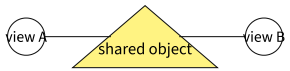


Inclusion fails when knowledge is stripped from holders or context.

19 · Feminist empiricism / standpoint GLOSSARY

VIEW	EXAM DISTINCTION
feminist empiricism	bias can be corrected through stronger methods and critical communities
standpoint theory	social position can reveal relations otherwise hidden
epistemic diversity	different perspectives can improve collective inquiry

Boundary: respectful inclusion is not achieved by extraction. Evidence can be collaborative without treating every contribution as interchangeable.



Different positions can expose different relations in the same problem.

19b · Knowledge spine C10–C11

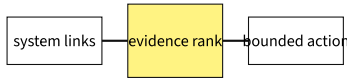
20 · Integrated scenario C12 WORKED EXAMPLE

Prompt: A future scenario links ecosystem change, pollution exposure and a community decision. It tells a plausible story but gives no evidence for the decisive connection.

FULL ANSWER FRAME

```
Claim: [bounded answer].
Evidence: [system interaction + strongest source].
Mechanism: [verb-led links; no skipped stage].
Alternative: [plausible counter-case].
Limitation: [uncertainty / scale / missing link].
Decision: [action + consequence + reversal test].
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Answer: Identify interacting systems and the relevant boundary; rank evidence by what it can establish; state the missing decisive link; recommend proportionate action while naming the uncertainty that could reverse it. A plausible story is not enough.

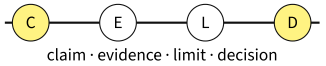


Strong synthesis connects systems through evidence, not narrative alone.

21 · Exam-morning plan FINAL RETRIEVAL

PASS	CLOSED-BOOK ACTION
1 · terms	recite ten definitions; correct only after completing all
2 · chains	draw ecosystem and pollution chains from memory
3 · contrasts	reproducible/replicable/robust; hazard/risk; evidence/value
4 · frames	write one half-page answer from the six-line frame
5 · traps	say each boundary aloud, then stop studying

During Part 1: identify which term has the exact job in the option; reject absolute wording that exceeds evidence. **Before each short answer:** choose the option with the clearest claim–evidence–limit chain. **At the end:** make the decision consequence explicit.



Last-line check: have you answered the question and bounded the claim?