Writing Quality Assessment Items
Assessing Aspects of Science

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Assessment

- Collecting data to make decisions about student learning
- Knowledge and Understanding
  - Recall: ‘knowing that….’
  - Understanding what they have recalled: ‘knowing how to….’
- Process Skills
  - Content independent
- Investigating Skills: Performance Assessment
  - Design - Carry out – Conclude - Evaluate
  - Micro-skills / competencies
Framework of an Assessment Task

- **Specifications**
  - Focus: knowledge - skills – performance - mix
  - Total mark and desired mark range
  - Types of questions and number of each

- **Content**
  - School Teaching programs … based on
  - State Curriculum … based on
  - National Curriculum

- Professional knowledge and judgment
Performance Assessment*

- **Focus**
  - Stations tasks- ‘micro-skills’ or ‘competencies’
  - Investigation tasks
    - Follow instructions
    - Open ended in-class task
      - Hands on Investigation-teacher observation
      - Surrogates:
        - Notebook
        - Computer simulation
        - Pencil-and-paper
    - Take-home task

Findings*

- Rater reliability is good
- Task-sampling variability is an issue
- Instructional history plays a significant role
- Do not duplicate pencil and paper tests
- Surrogates not readily interchangeable

A Two-Dimensional Continuum

- Informal
  - Start of lesson review
  - Revision Quiz
- Open
  - Unit Test
- Formal
  - Half-Yearly/Yearly
- Closed
  - Exit credential-HSC/IB
  - PhD
Features of a Quality Item

- **Construct Validity:**
  - Measures ONE trait only

- **Validity:**
  - It measures what you claim it measures

- **Reliability:**
  - Similar results from different groups with the same preparation

- **Discrimination**
  - On the basis of knowledge/understanding and skills
What’s to an item?

Each type of tooth has a different purpose: incisors cut, canines rip, and molars grind.

A bandicoot is a small animal that eats insects.

The photograph shows the upper jaw and teeth of a bandicoot.

How many grinding teeth does a bandicoot have in its upper jaw?

- (A) 4
- (B) 8
- (C) 10
- (D) 26
In July 1969 the Apollo 11 Command Module with Michael Collins on board orbited the Moon waiting for the Ascent Module to return from the Moon’s surface. The mass of the Command Module was $9.98 \times 10^3$ kg, its period was 119 minutes, and the radius of its orbit from the Moon’s centre was $1.85 \times 10^6$ metres.

(a) Assuming the Command Module was in a circular orbit, calculate

(i) the mass of the Moon

(ii) the magnitude of the orbital velocity of the Command Module.

(b) The docking of the Ascent Module with the Command Module resulted in an increase in mass of the orbiting spacecraft. The spacecraft remained at the same altitude.

This docking procedure made no difference to the orbital speed. Justify this statement.

A car with a mass of 800 kg travels at a constant speed of 7.5 m s\(^{-1}\) on a roundabout so that it follows a circular path with a radius of 16 m.

A person observing this situation makes the following statement.

‘There is no net force acting on the car because the speed is constant and the friction between the tyres and the road balances the centripetal force acting on the car.’

Assess this statement.

Support your answer with an analysis of the horizontal forces acting on the car, using the numerical data provided above.

Writing questions

- The chicken and the egg.....
  - What response do you want from the students?
  - How do you get that response?
  - What will the response be worth?

- Format
  - Trade-off: simplicity of marking v simplicity of writing
  - True/False
  - Multiple Choice
  - One word/number/symbol/...
  - Constrained response
  - Free response

- Symmetry with teaching
Basic steps

- Use quality stimulus:
  - diagrams, graphs, tables
  - use keywords to search the internet, then click on ‘Images’
  - Wikimedia commons
Basic Steps

- Design each item to measure an important learning outcome (*is the question worth asking?*)

  - What is the chemical symbol for xenon?
    - (A) X
    - (B) Xe
    - (C) Xo
    - (D) Xn
    - (E) Xx
Basic Steps:

- Make sure that there is only one correct or clearly best answer (MC)
  - “Which is the odd one out?”

A → B → C → D
Basic steps

- Express each item in simple clear language
  - Avoid
    - passive voice: A beaker of water was heated…..
    - ambiguity
    - vocabulary or jargon overload

- Which of these is an arboreal nocturnal marsupial mammal native to the east coast of Terra Australis?
  - (A) *Macropus rufus*
  - (B) *Phascolarctos cinereus*
  - (C) *Pseudocheirus peregrinus*
  - (D) *Dromaius novaehollandiae*
Basic steps

- Present a single, clearly formulated problem in the stem of the item
- *Which of these animals*:
  - lives in a tree
  - carries its young in a pouch and
  - comes out only at night?
  - (A) kangaroo
  - (B) koala
  - (C) owl
  - (D) emu
Basic Steps

- State the stem in positive terms wherever possible
Basic Steps

- Avoid repetition of a word or term in the options, by including it in the stem or opening line of the answers (MC)

Michelle’s mother asked her to tip out the cold tea from the tea pot into some pot plants, saying that the tea leaves would be good for the plants.

Michelle was surprised and decided to conduct an experiment to test whether tea leaves were good for plant growth.

How should she carry out her experiment?

(A) She should grow identical plants with and without tea leaves.
(B) She should grow three different types of plants with tea leaves.
(C) She should grow identical plants with different brands of tea leaves.
(D) She should grow identical plants with one, two and three teaspoonfuls of tea leaves.
Basic steps

- Make the distractors plausible and attractive (MC)
  - No ‘silly’ options
  - Make all options similar in appearance

- Make the optional responses grammatically consistent with the stem (MC)
  - gender
  - number
  - a/an
Sodium chloride is an example of an
(A) covalent compound
(B) ionic crystal
(C) solid element
(D) coloured chemical
Basic steps

- Present the options in some logical or systematic order
  - alphabetical/numerical
  - same order as in stimulus
  - increasing/decreasing length

- Avoid
  - specific determiners such as 'always', 'never', 'all', 'none' or 'only'
  - use of the option 'All of the above' or 'None of the above'
Temperature may be measured in degrees Celsius (°C) or in degrees Fahrenheit (°F).

The photograph below shows a thermometer with both scales.

According to the scales, what would be the temperature in degrees Fahrenheit (°F) when the temperature is 0 °C?

(A) -18 (B) 26 (C) 32 (D) 70
Basic steps

- Make the options the same length, wherever possible
- Avoid similarity in both the stem and the correct answer
- Make sure that the options are not overlapping, inclusive or synonymous with one another
Basic steps (OE/PA)

- Decide on the maximum mark for the task as you develop it
- In the case of PA, the students must be totally familiar with the science
- Prepare marking guidelines as you develop the item
  - A higher mark should only be awarded for a more sophisticated or more complete answer
- Draw up a list of expected responses
- Consider all unexpected responses on their merit