Medicine and Abstract Reasoning - Example 1.
The similarities and subtle differences between biochemical structures is the bases of pharmacology - the study of medications.

Below we see penicillin and flucloxacillin, two widely used antibiotics. They both work by inhibiting bacteria cell wall synthesis, however due to the additional isoxazolyl group on the side-chain of the core penicillin structure, flucloxacillin is able to work against bacteria that have evolved to produce chemicals known as “β-lactamase” that would render penicillin useless. By understanding the chemical differences in pharmacology, doctors can prescribe the appropriate antibiotic to defeat bacteria.

Penicillin

Flucloxacillin
Introduction

- The third section of the UKCAT is Abstract Reasoning. This section is designed to test your ability to interpret and apply logic to a set of problems.

- ‘Abstract’ refers to something which is not concrete, practical or easily applied.

- ‘Reasoning’ is the formation of judgements and opinions constructed through logic.

- Therefore this section tests your ability to problem solve and analyse complex, unfamiliar information.

How does Abstract Reasoning apply to medicine/dentistry?

- Clinicians routinely have to interpret information from a variety of sources. Often this information is not in a numerical or written format.

- Abstract information may come in the form of symptoms or social information from a patient or patient’s family. Being able to see patterns and commonalities in patient information plays a crucial role in diagnosing.

- Abstract Reasoning is concerned with the process of identifying patterns and grouping similarities. By training yourself to identify patterns within abstract information, you will be improving your ability to observe patterns amongst numerical and qualitative data; a skill essential to research.

- The timing of the section is tight, which reflects the speed at which decisions have to be made on a day to day basis when working as a healthcare professional. With practice, pattern recognition and decision making will improve greatly, giving you an appreciation of the speed and efficacy of some clinical decision making.

Breakdown of section

- 55 questions, containing up to 13 sets of shapes.

- Up to 5 test shapes per given set.

- 13 minutes to answer all questions (excluding 1 minute for instructions).

- 14 seconds per question.

- Time pressure: High.

- 2012 mean candidate score: 625/900³.

³ UKCAT 2012 annual report: average candidate score for the abstract reasoning section, from 24951 candidates who took the exam in 2012
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Common concerns with Abstract Reasoning

- This is an unusual style of questioning for many candidates, therefore familiarity with the question types are essential in achieving a good score.

- The types of questions given range from very simple to very complex, this can often put candidates off, especially if they have only been practicing simple question types.

- There are often 4 or 5 questions per set of shapes, this means that if a candidate does not work out the rule for each set, they could stand to lose more than just one mark.

- Often candidates will seek to match up the question shapes to the set shapes without working out the rule for each set. This often leads to incorrect answers and a poor result.

- This section is highly time pressured, it therefore makes sense to move on quickly and not take too much time per question. Flagging questions to return to at the end of this section may also prove challenging due to the time constraints.

Types of Abstract Reasoning Questions

Type 1: Basic and Complex sets

- You are presented with two sets of shapes; each set contains a grid of 6 different shapes, there is a specific ‘rule’ for each set.

- Each set ‘rule’ refers to a set of features which every shape within the set abides by.

- Rules can be split into two categories: ‘Basic’ or ‘Complex’. The UKCAT contains a bank of abstract reasoning questions, of which a majority will belong to the ‘basic’ category.

- You are given five test shapes, and you must decide whether the shape belongs to Set ‘A’, ‘B’ or ‘Neither’ set.

![Diagram of Set A and Set B with a test shape to categorize]
Type 2: Series based sets

- This question type asks that you think about the given shapes as a linear sequence.
- You are provided with a continuing series of four shapes, one after the other.
- You are also given four different test shapes.
- You must decide which of the test shapes fits next in the sequence.

Type 3: Relationship sets

- For this question type you will be presented with three test shapes, and one empty box.
- The shapes are related to one another, and a rule is suggested between the first two shapes.
- Using the example, you must determine the suggested rule and apply it to one of four test objects.
Evaluating a Basic Set

- Each set contains shapes which comply to a specific set of patterns, this is called the set ‘rule’.
- Basic set rules include variations of number, arrangement, shape and shade. This can be put into
  the acronym: N.A.S.S.
- When given a set of questions, the first thing you should do is ignore the test shapes. Looking at
  the test shapes will likely distract you from working out the rules for each set.
- When evaluating a set, ‘N.A.S.S.’ should be the first thing to think about. If it is a basic set rule, then
  N.A.S.S. will often apply.
- Find the most simple box of shapes of the set of six and apply N.A.S.S.

Basic Set example:
- Set A:

  ![Set A](image)

- This is a typical set, it contains six shapes all of which comply to a particular rule. By quickly
  analysing it and using N.A.S.S. we can try and pick up any general rules:

  **Number:**
  - Number of sides are all different, however some shapes appear twice in each box.
  - The number of sides correlate to shading: an even sided shape is shaded white, whilst
    an odd sided shape is black.

  **Arrangement:**
  - Randomly arranged on the page, no patterns observed.

  **Shape:**
  - All different shapes, no specific preferences observed.

  **Shade:**
  - Shade and number of sides correlate, we can confirm this rule by selecting the shade and
    counting the number of sides.

  **Rule:** even sided shapes are white, odd sided shapes are black.
• Set B:

This is the corresponding set to ‘set A’, it presents a different set of rules, however, very often these rules are related which means that if you have worked out a rule or pattern for the first set, then the second set shouldn’t be as difficult to understand.

• With set A, we used N.A.S.S. to discover a correlation between even and odd sided shapes and their blocked shading.

• Now we can apply what we learned from set A to set B, and see if we have a similar correlation:

**Rule:** *Even sided shapes are shaded black, odd sided shapes are shaded white.*

• In this relatively straightforward example, we have discovered the rule by applying N.A.S.S., and without even looking at a test object. Now we can apply these rules to the following test shapes:

1. C. Neither.
   As the shape here contains both oddly sided and evenly sided shapes in different colours, this shape breaks the established rule, and therefore doesn’t belong to either set.

2. Set B.
   This shape follows the rules, and has an even sided shape shaded black, and an oddly sided shape shaded white. Remember that a circle has one side! Secondly, this shape contains a distractor object – a double headed arrow. This can be ignored and is only in place to distract you.

3. Set A.
   Again, we are applying the discovered set rules, and the object contains a white shaded even numbered object, and an odd sided black shaded object. Remember, the rule does not specify ‘arrangement’ and therefore it does not matter that one shape is within the other!