

IMPORTANT NOTICE

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THINKING SKILLS

Syllabus Codes: 8436 AS Thinking Skills

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INTRODUCTION

Candidates take two papers, Paper 1 and Paper 2, which lead to the qualification of:

- **Advanced Subsidiary (AS) Thinking Skills - (Syllabus Number - 8436)**

The AS syllabus is designed to be taken as a one-year course for examination at age 17+.

THINKING SKILLS

Thinking Skills involves the study of a range of transferable thinking skills. The intention is the development of thinking skills and processes rather than the study of subject content. These skills are valuable and relevant within other subjects as well as being essential for further and higher education.

In society, there are strong commitments to the values of tolerance and democracy. Reasoning and negotiation are preferable to resorting to violence. Issues and conflicts should be resolved by reasoned discussion and informed voting and not by force. The contribution which critical thinking can make in all of these situations is clear. This is all the more true if candidates learn to take seriously arguments and perspectives quite different from their own.

This syllabus in Thinking Skills seeks to go beyond the traditional approach that has often been concerned with argument and verbal reasoning to the exclusion of other thinking skills. Hence it is thought to be important that students can demonstrate an ability to use 'thinking' in using numerical information and in understanding communications.

Students need to be able to apply arithmetic to new situations in order to demonstrate an ability at handling numerical and graphical data. Students will need to be able to extract and use relevant data in order to make informed decisions. The ability to think critically about the data provided and the problem to be solved or decision made, is seen as a vital part of a student's all-round competence as a thinker and decision-maker.

Much information is provided to us though words. In order for students to be able to develop their skills of reasoning, negotiation and argument, they require a familiarity with understanding written communications. Thus students need to be able to read passages critically in order to extract the full meaning, function and purpose of the text. These skills can be further developed to place texts in a wider context and evaluate the writer's explanations or perceptions. Such skills are excellent preparation for the later 'reasoning' sections of the syllabus.

Candidates should study the language of reasoning (therefore, because, so, if, then, reason, conclusion, evidence, opinion, inference, support, prove, refute, fallacy) and learn how to know that someone is engaged in reasoning and argument (as distinct from quarrelling, debating, explaining, or reporting). There are also semi-technical notions useful in argument (words like consistent, contradiction, converse, counter-example, valid, entail/imply, hypothetical, necessary and sufficient conditions).

Different examples of reason/argument must be explored to identify their elements and to consider how to evaluate them. Examples of arguments in 'linear' form, in dialogue form, or even in the form of a narrative should be presented for study.

Candidates should note examples of writers or speakers trying to justify a point of view (conclusion, recommendation, interpretation, decision, explanation, verdict) by providing reasons, grounds, or premises which might answer objections, counter-arguments or opposing points of view. Different kinds of reasoning should be recognised and evaluated, for example, presentation of evidence or data, expression of value judgements, statement of definitions, criteria or principles.

Candidates should consider different 'patterns' of reasoning. For example, the case for a particular government policy may take the form of 'weighing pros and cons' or it may take the form of supposition reasoning', which begins by saying, "Suppose we don't do this, then... and we don't want that to happen, so..."

Also studied will be different standards which must be applied in evaluating arguments of different kinds in different contexts. For example, depending on the argument and the context, it might be appropriate to ask whether the conclusion is 'deductively proved', 'proved beyond a reasonable doubt', or shown more likely than not on the balance of evidence.'

Candidates need to look at assumed or implicit reasons. Sometimes it is easy to detect what a speaker is assuming, but sometimes assumptions go much deeper (as in cultural and other beliefs) and it is often necessary to tackle such assumptions when engaged in critical reasoning.

Evaluating reasoning is often a very creative activity because it requires the candidate to think of alternatives or other examples. Since many beliefs are based on what other people say, in writing, on TV or by word of mouth, the critical thinker needs to know how to decide who to believe, so candidates need to think carefully about which sources and authorities are credible/reliable and on what grounds. Furthermore, the process of reasoning often encounters a need for clarification. Terms may be used, or claims may be made, the meaning of which is unclear, vague, imprecise or ambiguous. It is important to know when clarification is necessary and what kind of clarification that should be.

The kinds of reasoning involved in explaining and in decision-making need special attention because they are so common and important. Explanations of causes require careful consideration of evidence and of alternative hypotheses; explanations in history, psychology and the social sciences are especially complex. In decision-making it is important to consider options, consequences (contrasting risks and likelihoods of each) and ethical or other value considerations.

AIMS

This syllabus in Thinking Skills is intended to develop a candidate's ability to:

- extract and process relevant data
- apply formulae
- undertake simple mathematical modelling
- make decisions
- understand the meaning, function and relevance of text
- evaluate scenarios and explanations
- understand the significance of different types of communication
- identify reasons
- evaluate reasoning of different kinds
- recognise and evaluate assumptions
- clarify expressions and ideas
- produce reasoning appropriate to a given task

ASSESSMENT

The Cambridge AS in Thinking Skills is awarded on successful completion of Papers 1 and 2.

The AS qualification is available in June and November each year.

Syllabus	Time	Weighting	Marks	
AS Thinking Skills (8436)	2 hours	Paper 1: 50%	Applied Arithmetic	25
			Assessing Argument	25
	2 hours	Paper 2: 50%	Evaluating Evidence	15
			Evaluating and presenting an argument	35

For AS Thinking Skills (8436) the normal AS grades of A to E are awarded.

PAPER 1 – INTRODUCTION

Paper 1 consists of 50 multiple-choice format questions. These questions test the following sections of the syllabus:

Section 1: Applied Arithmetic
Section 2: Assessing Argument

Each question is independent of the others. The questions are set in alternating groups of 5 Applied Arithmetic questions and 5 Assessing Argument questions.

A single mark is awarded for each correct answer to a question and no marks are deducted for incorrect answers.

Items are designed so calculators are not needed, but these may be used within the examination.

CONTENT AND ASSESSMENT OBJECTIVES

Section 1: Applied Arithmetic

This section assesses the candidate's ability to apply **numerical skills** to solve **unfamiliar problems**.

The skills are assessed through multiple choice questions made up of a stimulus, a question and five options - one of which is the correct answer. The stimulus may be a brief paragraph together with a diagram or table, and the question is presented separately. Any negatives in the question are highlighted, and numerical options are presented in ascending numerical order.

The following Applied Arithmetic skills are tested:

Reading and processing data

- 1 a. Extracting data
- 1 b. Processing data
- 1 c. Choices and decisions

Modelling

- 1 d. Executing instructions for computation
- 1 e. Using a word formula
- 1 f. Choosing a model

Reading and processing data

1 a. Extracting data

These questions ask the candidate to extract numerical and other data from a range of graphical, tabular and textual sources. No other processing is required. The intellectual challenge is to isolate the correct piece of data.

1 b. Processing data

These questions ask the candidate to extract and process data to provide a derived quantity not present in the original data.

1 c. Choices and decisions

These questions ask the candidate to process several data and make a decision on the basis of these data. The easier questions can be answered by reading the data only, whereas the more complex questions require some processing. In the most complex of these questions, the candidate is presented with a set of data, a set of constraints and a problem. The task is to find a solution to the problem based on the data and the constraints.

Modelling**1 d. Executing instructions for computation**

These questions ask the candidate to execute instructions to perform a computation. The numbers are given in a readily available form and are sufficiently easy to allow computation without any electronic aid. The operations will be limited to the use of addition, subtraction, multiplication and division.

1 e. Using a word formula

These questions are similar to those above but the formula is presented in a briefer format, and the same restrictions apply. There is no intention to use algebra or any form of algebraic formula.

1 f. Choosing a model

These questions ask the candidate to identify or choose a mathematical model for a relationship between two variables. The data are numerical but in a form which can be processed without a calculator. The various models may be presented in the form of word formulae or of graphs. Models in the form of word formulae will be arithmetic or geometric only. More sophisticated models will require the recognition of the correct graph.

Sample Questions for Applied Arithmetic

Example 1: Extracting and Processing Data

The table below shows the price of various ladders. I need a ladder at least 8m long to reach the gutters of my house. I want to store it in my garage which is only 4.2m long.

What is the lowest price I must pay to satisfy these conditions?

<i>Length closed (m)</i>	<i>Length extended (m)</i>	<i>Lightweight (DIY use)</i>	<i>Heavyweight (Trade use)</i>
Triple section ladders:			
2.6	6.0	£82	£100
3.0	7.5	£104	£120
3.5	9.0	£133	£150
4.0	10.0	--	£169
Double section ladders:			
3.0	5.3	£52	£64
3.5	6.2	£67	£82
4.0	7.2	£78	£95
4.5	8.3	£98	£115
5.0	9.0	--	£140
5.5	10.0	--	£155

- A** £78
- B** £98
- C** £133
- D** £150
- E** £169

The answer is **C**. We need to find a ladder which extends to 8 metres but has a closed length of no more than 4.2 metres. There are no double section ladders which fit the requirements. Two triple section ladders are possible, one extending to 9m and the other to 10m. With heavyweight and lightweight options taken into account there are three possibilities. We require the cheapest and this costs £133.00. A lightweight ladder with a closed length of 3.5m and an extended length of 9m.

- A** £78 - lightweight - too short when extended
- B** £98 - lightweight - too long when closed
- D** £150 - heavyweight - more expensive than **C**
- E** £169 - heavyweight - more expensive than **C**

Example 2: Choosing a Model

Mr Jones has to renew the white lines on a 1 km stretch of road. Each edge of the road is marked with a solid line and there is a "dashed" line in the centre. Drivers are warned of approaching bends by two curved arrows. Mr Jones will have to paint four curved arrows. The manufacturers have printed the following guidance on each 5 litre drum of paint.

Solid lines - 5 metres per litre.

Dashed lines - 20 metres per litre

Curved arrows - 3 litres each

How many drums of paint will Mr Jones require?

- A** 53
- B** 92
- C** 93
- D** 103
- E** 462

The answer is **C**. The solid lines require 200 litres for each side of the road ($1000 \div 5 = 200$). The dashed lines require 50 litres ($1000 \div 20 = 50$). The arrows require $3 \times 4 = 12$ litres. The total amount of paint is $200 + 200 + 50 + 12 = 462$ litres. Each drum contains 5 litres of paint; so 93 drums will be needed ($462 \div 5 = 92.4$) 92 drums will not be enough so 93 will be needed. The final drum will be only partially used.

- A** It has been assumed that there is a solid line on only one side of the road.
- B** The calculations are correct but it has been assumed incorrectly that 92 drums would be sufficient.
- D** It has been assumed that there are two dashed lines rather than one.
- E** The total amount in litres has been calculated but not the number of drums required.

Example 3: Choices and Decisions

I wish to tile an area of wall 120cm wide by 100cm high. Tiles are 20cm square. I will, therefore, need $6 \times 5 = 30$ tiles.

Which of the following uses the same method of calculation as that above?

- A** A staircase is 3m high. Each step rises 0.25m. Therefore, there are 12 steps.
- B** A room is 4.2m by 2.0m. Carpet costs £10.00 per square metre. Therefore, it will cost £84.00 to carpet the room.
- C** A box containing sugar cubes is 10cm x 10cm x 5cm. A sugar cube is 1cm on each side. Therefore, the box contains 500 cubes.
- D** Using square tables 1.5m on each side, I need to make up a conference table 6m x 3m. Therefore I will need 8 tables.
- E** I work 40 hours a week and earn £5.00 an hour. Therefore, in 4 weeks I will earn £800.00.

The answer is **D**. The procedure of multiplying 6×5 is based on 6 tiles fitting along one edge and 5 tiles along another. In option **D**, 4 of the small tables will fit along the 6 m side and 2 along the 3m side. The computation will therefore be 4×2 .

Option **A** divides 3 by 0.25.

Option **B** multiplies 4.2 by 2.0 by 10.

Option **C** multiplies 10 by 10 by 5.

Option **E** multiplies 5 by 40.

Although in **D** there is a multiplication this is the only case in which the numbers to be multiplied must first be obtained as they are in the tiling example.

Section 2: Assessing Argument

This section assesses the candidate's ability to understand and evaluate arguments. 'Argument' in this context is 'a number of **reasons** put forward as grounds for a **conclusion**.'

The following Assessing Argument skills are tested:

- 2a. Identifying the main conclusion
- 2b. Drawing conclusions
- 2c. Identifying assumptions
- 2d. Assessing the impact of additional evidence or information
- 2e. Identifying flaws in arguments
- 2f. Applying principles

The skills are assessed by means of multiple choice questions based on passages of reasoning of between 25 and 125 words. For each passage, a question and 5 options are set - one of which is the correct answer. The passages typically come from newspaper reports, articles, editorials, or letters to the editor. They are likely to have been modified in order to ensure conciseness, clarity and simplicity of language.

2a. Identifying the main conclusion

These questions ask the candidate to decide which of the given answers best expresses the main conclusion of the argument.

Every argument must have one main conclusion, for which one or more reasons are offered.

2b. Drawing Conclusions

These questions ask the candidate to draw a conclusion from a passage.

This tests the candidate's ability to make inferences from evidence, so it does not require an argument in the stimulus passage (although a passage of argument could be used, if it had further implications). In general, the passage will be a series of statements which support the correct answer in the way in which reasons in an argument support its conclusion.

2c. Identifying Assumptions

These questions ask the candidate to recognise the underlying assumption of an argument.

In some arguments, a crucial aspect or step of the argument is not explicitly stated, but needs to be taken for granted in order to draw the conclusion ~ that is to say, the argument relies on an unstated assumption.

2d. Assessing the impact of additional evidence or information

These questions ask 'Which of the following, if true, most weakens the argument?' or 'Which of the following, if true, most strengthens the argument?'

Candidates must consider the way in which information which has not been given in the stimulus passage would affect the argument - would it give additional support to the conclusion, or would it, serve to undermine the conclusion?

2e. Identifying flaws in arguments

These questions test the candidate's ability to recognise why the conclusion of an argument does not follow from the reasons given.

An argument will fail to establish its conclusion:

- if one or more of its reasons are false, and/or
- the conclusion does not follow from the reasons offered

What is meant by 'identifying flaws' in the context of reasoning tests is identifying the statement which explains why the conclusion does not follow - it has nothing to do with the truth of the reasons. Being able to point out what is wrong with drawing a particular conclusion from the reasons which someone else offers is a valuable skill.

Responses to this type of question may be either technical descriptions of flaws (e.g. 'assumes what it attempts to prove' or 'draws a general conclusion from only one case') or the candidate may state the flaw by reference to the subject matter of the specific argument (e.g. 'assumes that studying hard is a sufficient condition for academic success').

2f. Applying Principles

These questions ask candidates to recognise principles in a given argument and apply these principles to another argument.

This aims to test the candidate's ability to see the implications which some arguments - specifically those which rely on a general principle - have for other arguments with different subject matters. This can be valuable in reasoning, because it demands consistency in a way that can help one to see whether the principles upon which one's reasoning is based are justifiable. For example, 'Killing is wrong' is a general principle which may be used by someone who is arguing against the use of capital punishment. It has wide applicability, and implies that all instances of killing ~ including killing in self-defence and in wartime - are wrong. Recognising the further implications of such a principle may lead one to modify or reject the principle.

Not all arguments use a general principle. When they do, the principle may figure as a reason, a conclusion or an unstated assumption.

When the principle is a reason, it will be stated in the stimulus as a general principle and used in order to draw a conclusion about a particular case.

When the principle is a conclusion, it will be one drawn perhaps from a number of instances. This type may be rare because it will be difficult to produce a plausible argument which claims that a general principle can be established by a small number of instances.

When the principle is an unstated assumption, the candidate will have to do two things - identify an unstated assumption AND see how a principle applies to another case.

The correct response in each of these types will be another case to which the principle applies. The distractors may be instances of principles other than the one used in the passage.

PAPER 2 – INTRODUCTION

Paper 2, the AS Critical Thinking paper tests two further skills in 2 separate sections:

Section 1: Evaluating evidence

Section 2: Evaluating and presenting an argument

Evaluating evidence is assessed in Paper 2 by one question. This will be presented as a piece of text and may be accompanied by graphics. An incident will be described or case presented from different points of view. The candidate will evaluate the evidence, making clear their assumptions about the likely credibility of the witnesses.

Evaluating and presenting an argument is assessed in Paper 2 by two questions. Each will be presented in written format. The first question will be based on a passage of prose of about 400 words, followed by structured questions testing the candidate's understanding of the argument and of the writer's attitude.

The second question will be based on a shorter passage of about 200 words. The candidate will be asked to write a critical evaluation of the argument presented, introducing any further arguments which they judge to be relevant. The evaluation should show that the candidate is clear about the structure of the argument (for example which claims are reasons, conclusions and assumptions). No credit will be given for merely paraphrasing the argument.

The overall results for AS Thinking Skills will be reported in the range A to U where grades A to E are pass grades (see grade descriptions).

CONTENT AND ASSESSMENT OBJECTIVES

In order to evaluate evidence and evaluate and present an argument candidates should:

Elements of Reasoning

- 1 a. study the language of reasoning
- 1 b. learn to use linguistic clues
- 1 c. learn how to use some semi-technical notions
- 1 d. learn that arguments may be presented in differing forms

Evaluation of Reasoning

- 2a. learn how to recognise and evaluate different kinds of claims
- 2b. use different criteria to decide which sources and authorities are reliable and consider:
 - the source's reputation for reliability
 - whether the source has a vested interest
 - whether there is corroboration of the claim from independent sources
 - whether the source has the relevant expertise/training
 - the nature of the claim itself
 - whether the source can provide credible reasons for the claim made
- 2c. learn how to identify differing reasoning patterns in order to evaluate arguments successfully
- 2d. recognise the different standards which have to be applied in evaluating arguments and inferences
- 2e. think of other relevant considerations
- 2f. recognise and evaluate simple explanatory arguments and arguments justifying decisions about a course of action

Assumptions

- 3a. recognise and evaluate assumptions
- 3b. detect implicit meaning

Clarification

- 4a. know when and what kind of clarification is required
- 4b. identify variations from normally accepted usage

Selection and Procedures

- 5a. identify which information is relevant and important
- 5b. employ an appropriate methodology to arrive at a conclusion

Presentation of Argument

- 6a. present arguments in a clear, logical and coherent way
- 6b. apply learnt standards of rigour in reasoning
- 6c. use accepted conventions of written English

GRADE DESCRIPTIONS FOR AS THINKING SKILLS

The **Grade A** candidate has demonstrated mastery in:

- understanding sophisticated and complex arguments and ideas
- evolving a methodology for solving problems
- selecting material and evaluating it in relation to the demands of the question, explaining where necessary
- discriminating between what is important and what is irrelevant to an argument
- analysing meaning and the intentions of the writer or speaker
- structuring work so that the process of thought is made clear
- demonstrating understanding of the conventions of language

The **Grade B** candidate has exhibited proficiency in:

- understanding complex arguments and ideas
- handling data and concepts of number
- selecting material and developing it in relation to the question, sufficient to show some independence of thought
- being able to recognise redundant material
- recognising and explaining assumptions
- structuring writing so that the reader can follow the argument
- demonstrating knowledge of the convention of language

The **Grade C** candidate has demonstrated a measure of competence in:

- understanding and communicating arguments and ideas
- using number and numerical procedures
- selecting material and providing straightforward explanations
- identifying the more obviously important ideas
- recognising the more obvious implicit meaning and attitudes
- ensuring that ideas generally follow on from one another
- obeying everyday conventions of language

APPENDIX A: RESOURCES AND SUPPORT MATERIALS

Book List

The following titles may be useful.

Alec Fisher; The Logic of Real Arguments; Cambridge University Press; 1998
Alec Fisher; Critical thinking, An Introduction; Cambridge University Press; 2001; ISBN 0 521 00984 7
Roy Van Den Brink-Budgen; Critical thinking for Students; How To Books; 2000; ISBN 1 857 03634 4
Anne Thomson; Critical Reasoning; Routledge; 1996; ISBN 0 415 13205 3
Nigel Warburton; Thinking from A to Z; Routledge; 1996; ISBN 0 415 09686 3

Cambridge University Press will be publishing a text to accompany the CIE Thinking Skills syllabus during the latter half of 2002. The authors, John Butterworth and Simon Carver, are senior examiners for the syllabus.

Support Materials

CIE publishes four Tutor Resource Guides for Thinking Skills. These are A4 loose-leaf photocopyable folders which may be ordered through our Publications Department.

Applied Arithmetic
Communications
Assessing Argument
Paper 2