

MARK SCHEME for the May/June 2007 question paper

9694 THINKING SKILLS

9694/04

Paper 4 (Applied Reasoning), maximum raw mark 50

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the May/June 2007 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

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In the following mark-scheme, *italic text* will be used for necessary constituents of an answer. Normal text is used for explanatory notes/guidance.

- 1 (a) Diesel B: 2100W needed. This requires 3 generators. 60c + 60c + 20c per hour: \$33.60 per day = \$3360 for the trial. Purchase cost = (3 × \$1800) = \$5400. Total = \$8760.
This answer only will be accepted. No working needed.

- (b) *One mark for each of the three cases that need to be considered. Neither the purchase costs nor the running costs need to be shown to win the mark, but the number of generators and the correct conclusion must be shown for each case.*

[all the necessary power : 2100 W + 1000 W + 1250 W = 4350 W]

(i) 2 Diesel A's. \$5000 × 2 = \$10 000, so no money for fuel. *Not possible.*

(ii) 5 Diesel B's. \$1800 × 5 = \$9 000, so not enough money for fuel. *Not possible.*

(iii) 1 Diesel A and 2 Diesel B's. \$5000 + \$3600 = \$8 600, so not enough money for fuel. *Not possible.*

- (c) *There are two possible solutions, either of which can gain full marks . One mark given for calculations involving Solar B's only rather than Solar A's, OR if calculations for both A's and B's are shown but no clear recommendation is given as to which is better.*

SOLUTION 1: [Remaining power: 3100W for vitals + 2500W for freelance (2500W during 12 hours of day gives 1250W average over the 24 hours period) = 5600W in total]

32 solar A's = \$28 800 – *two marks.*

63 solar B's = \$31 500 – *one mark.*

SOLUTION 2: [remaining power: 3100 W + 1250W (instead of 2500W) required for freelance appliances = 4350W needed in total]

25 solar A's = \$22 500 – *two marks.*

49 solar B's = \$24 500 – *one mark.*

- (d) (i) *One mark if candidates consider a combination of all three power sources – diesel, wind and solar – irrespective of whether it fits within the budget.*

One mark if candidates consider a combination of power sources which fits within the budget – irrespective of whether it fulfils the requirements of the different appliances.

Solutions need to show the number of different power sources, and an attempt to calculate the cost.

Solutions fulfilling all the criteria:

One diesel A: \$5000 + \$2400 for fuel (\$7400) = 3000W continually

One solar A: \$900 = 175W

Two wind A's: \$1500 = 900W

Total = \$9800

One diesel A: \$5000 + \$2400 for fuel (\$7400) = 3000W continually

Two solar B's: \$1000 = 180W

One wind A & one wind B: \$1300 = 810W

Total = \$9700

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- (ii) *The marks are only available to candidates who have produced a correct solution to (d)(i). Two marks are to be awarded for calculating the new reduced cost. If candidates do not manage this, one mark is available for calculating how much extra power was produced.*

Referring to the two correct solution given above (for **(d)(i)**):

The \$9800 solution:

	24 vital	Day vital	Freelance
Diesel	2100	900	450
Solar		100	37.5
wind			900

The *137.5W* over on the freelance power units allows for the diesel generators to run a less than full speed: $137.5W \text{ less} = 4.58c \times 2400 = \text{roughly } \110 . So *the new reduced cost would be \$9690*.

The \$9700 solution:

	24 vital	Day vital	Freelance
Diesel	2100	900	450
Solar		100	40
wind			810

The *50W* over on the freelance power units allows for the diesel generators to run a less than full speed: $50W \text{ less} = 1.67c \times 2400 = \text{roughly } \40 . So *the new reduced cost would be \$9660*.

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2 (a) (i) 5 payments – award 1 mark.

Alice needs to have \$900 savings before she can borrow \$2700, so she must save at least a further \$460.

(ii) 31 months – award 1 mark.
See the loan repayment guide.

(b) (i) \$10.80 – award 3 marks.

\$120 (80% of \$150) goes towards paying the loan each month. The balance of the loan after 4 payments = $\$2400 - 4 \times \$120 = \$1920$. The interest on this balance is \$19.20, so the amount credited to his share account is $\$30 - \19.20 .

If answer is wrong, award 1 mark for appreciation that the balance is being reduced by \$120 each month and/or 1 mark for an attempt to subtract a calculated interest from \$30.

(ii) 3 months – award 2 marks.

If answer is wrong, award 1 mark for either of the following points:

To repay \$1800 at \$200 per month takes 12 months.

The total repayment period is now 17 months (5 + 12). (The original period was 20 months).

(c) Award 3 marks for convincing working leading to both figures,

e.g. First month's interest is \$3.00 (1% of \$300).

First month's payment reduces the loan balance by \$40 (80% of \$50) to \$260 so second month's interest is \$2.60. Continuing in this way the total interest is 8 sums decreasing successively by \$0.40.

$$\$3.00 + \$2.60 + \$2.20 + \$1.80 + \$1.40 + \$1.00 + \$0.60 + \$0.20 = \$12.80.$$

$$\text{The amount saved must be } \$400 - \$300 - \$12.80 = \$87.20$$

If 3 marks cannot be awarded:

- Award 2 marks for demonstrating that the interest decreases by \$0.40 per month [e.g. by showing $\$3 + \$2.60 + \$2.20 + \$1.80 + \dots$]
- Award 1 mark for recognition that the interest will decrease by the same amount every month.
- Award 1 mark for recognition that once the total interest has been calculated the savings will be $\$400 - \$300 - \text{interest}$ or that savings will increase by the same amount every month except the last month when there will be an extra \$20 because only \$20 is required to pay off the balance of the loan.

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3 (a) Marks are to be awarded according to the following table:

Marks	Minimum requirements
4–6	<p>Identification of the main reasons and conclusions. Top end if the key intermediate conclusion is expressed.</p> <p>Candidates who do not identify the main conclusion cannot score more than 4 marks.</p>
2–3	Identification of three well-expressed analytical points
1	General gist of the argument.

Analytical points:

The main conclusion comes in the closing lines: Sustainable developments which (comprise of/depend on/introduce) small scale and local development initiatives promote a precautionary and anti-experimental approach to human intervention in the Amazon and can only result in poverty for its inhabitants. Equivalent paraphrase should be acceptable.

The basic structure can be outlined as follows:

The introductory context/target is a counter-argument (preliminary argument):- Environmentalists argue that sustainable development initiatives such as agroforestry and extractivism are better than large-scale development projects in the Amazon on the basis that they offer more opportunities, employment and autonomy for the locals.

Reasoning:

- 1 It is wrong and deceptive of environmentalists (or environmentalists are mistaken/wrong) to (base their arguments solely on...) confuse social problems with environmental preservation, as this, in fact only helps keep the peoples of the Amazon poor.
- 2 Even if mega-projects are environmentally destructive and inefficient (counter-argument) their construction is significant, since they express a progressive attitude, and that is all about the development of the human race. By contrast the Amazon as a natural phenomenon has no such needs.
- 3 (I.C) The Amazon therefore exists to serve the human being's needs today or we (should/must/ought to) explore how best the Amazon can serve human needs.

This is the main thrust of the argument, to which all the premises relate and from which the other premises follow:

- 4 We have the capability/technological advantage today of discovering and exploiting the vast potential resources the Amazon holds.
 - 5 IC -Large developmental projects can (are an attempt to) exploit and expand these discoveries.
 - 6 But sustainable development threatens such expansion. This is reinforced by the introduction of a counter argument – their theory of 'natural capital' and implementation of alternative methods (for economic sustenance).
- C Therefore their methods (such as agroforestry and extractivism) promote a precautionary, anti-experimental approach to human intervention in the Amazon (resulting in/leading to) poverty for the majority.

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(b) Marks are to be awarded according to the following table:

Marks	Minimum requirements
6–8	Comment on 3+ strengths/weaknesses. Top end responses will comment on the lack of conceptual clarity. Thinking Skills language used.
4–5	Limited evaluation of two strengths/weaknesses.
1–3	Identification of one or two strengths/weaknesses.

In general, a candidate will be awarded two marks for each well-expressed strength/weakness (up to a maximum of 8), and one mark for a poorly-expressed strength/weakness (up to a maximum of 4).

Evaluative points:

The main strength of the argument lies in the claim that advocates of sustainable development are keeping the peoples of the Amazon from potential betterment, or in poverty, by implementing small scale, low-tech developments as better/more satisfactory alternatives to large-scale development. The charges levelled at them imply that in actual fact they are not genuinely concerned about the locals' welfare but are preoccupied with ideological standpoints that ultimately will be to the national detriment. The most significant counter-claim is that environmentalists are anti-experimental, which raises alarm bells, if we accept that research/experiment and discovery are prime factors in man's development.

Candidates would have to assess the validity of the reasoning, which cover a series of related issues and determine whether the conclusion is overdrawn:-

- Within the body of her reasoning Miss B would have to provide evidence to support a number of implicit and explicit assumptions that make the argument work: that exploitation of nature is truly desirable, or that the methods used by sustainable development are ineffectual, or do not lead to economic well-being or are the sole factors for resulting poverty.
- There is at the heart of the argument core definitional concepts which are problematic: e.g. human development – what is and what is not a 'real human development', or whether they convey different things to different peoples and cultures. Another ambiguous definitional concept 'poverty' – differing in degrees or kinds? Sustainable poverty or unsustainable poverty? It could be shown that the unambiguous use of terms such as development, progress and poverty compromise the validity of even good reasoning at various points of the argument.
- The process of the argument entails a clash of ideological principles and positions which are implicitly or explicitly alluded to in the text, which either strengthen or weaken the conclusion. If Miss B is restricting her definition to a purely Western mechanistic concept of economic progress and technological development then the conclusion can be stated to be 'overdrawn'.

There are a number of flaws and assumptions in the passage which also point to the argument as weighing overall on the weak side, and offers the candidate much opportunity to demonstrate the skills of identifying reasoning errors:-

- The first paragraph of the counter-argument is, in effect, a weak straw man ploy to knock down the environmentalist's argument. In focusing the argument the anthropocentric dimension (for benefit of human beings) is by-passed with an implicit assumption that the argument is purely ecocentric and must be treated as such.
- Miss B moves along an ad hominem trail of discrediting and dismissing the environmentalist argument, by attacking 'attitudes' without dealing with the substance.

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- The inconsistency of her position is reflected when Miss B uses the anthropocentric principle herself to bolster her own argument i.e. putting man at the centre (3rd para). She also contradicts her earlier premise of rejecting that correlation exists between environment and social well-being (2nd para), by using this correlation to argue for large-scale development (para 4 & 5).
- The counter-assertion that mega projects do destroy the forest (3rd para) and affirmation of an overriding principle of progress creates the decision-making dilemma; yet the choice of the human being's need over preserving nature are made without weighing the pros and the cons or considering other options. This makes the intermediate conclusion rest on an absolute/arbitrary principle rather than on sound rationale (more able candidates may point out that there is no sufficient Difference Principle to back the choice; alternatively candidates may consider whether the principle has been stretched too far).
- There is an assumption of sufficient dissimilarity in the analogy in the 3rd para, which contrasts the human being with nature, that would show it to be blotched. In effect the Amazon is treated as an inanimate object, whereas it could be argued both human and the Amazon are biological contingent living things, with biological needs (candidates may use ascriptions of pathetic fallacy which attribute a sensitive spirit to nature – e.g. as the poet Wordsworth does).
- Other analysis of flaws may point to bias, jumping to conclusions, slippery slope, to count against the conclusion. A serious failure is the absence of reasoning/evidence for labelling advocates of sustainable development “wrong deceptive and disingenuous”. “Precautionary and anti-experimental” are value judgments that do not merit the sweeping accusation of wrongdoing, unless backed by examples of supporting evidence. Further, in the context of the reasoning, they fall down since para 5 acquiesces to a genuine but mistaken belief on the part of environmentalists.

Candidates may work some of the flaws identified above as assumptions. Other assumptions are:

- Assumes that only the empirical sciences such as science and technology contribute to progressiveness in human development, whereas history of mankind shows civilisation is undergirded by countless philosophical and ethical theories, developed over time by various research disciplines, which all guide progress and social development and contribute to personal well-being as well as to infra-structure.
- Assumes the inhabitants of the Amazon are gullible or being duped, whereas the environmentalists would have negotiated involvement with them.
- Assumes that the inhabitants would want the concept of economic progress expressed in the argument, whereas they may want to preserve a different eco-friendly lifestyle.
- Assumes that, in the past, human beings would not have been able to exploit environment ; whereas they may have been ‘unwilling’ i.e., may have held belief-based understanding of nature and its functions which made them willing to be at harmony with nature.
- Assumes environmentalists are the only people who raise objections to large-scale developments whereas there may be others (and for different reasons), such as politicians, religious parties, humanitarians and animal rights groups.
- Assumes that aggregates within nature are insufficient to meet humans’ needs unless there is forced interference.

The above examples are not exhaustive.

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(c) Marks are to be awarded according to the following table:

Marks	Minimum requirements
12–16	Clear conclusion expressed. A range of reasons/evidence evaluated from different documents (3+). For the top end, contrary reasoning should be dismissed, and the argument coherently assembled.
6–11	Conclusion is clear. One or two evaluative points made about the documents. Other documents are used uncritically. Some irrelevant reasoning.
1–5	Candidate does not consider the precise conclusion but a broadly related theme. Only one or two references to the documents, and these are uncritical.

Candidates will be marked on the following three components of their response:

selection and synthesis:

- choosing relevant and useful material – evidence, opinion, argument etc. – from the documents.

critical reasoning:

- assessing the strength of available evidence;
- evaluating the claims and arguments in the selected materials;
- challenging or supporting claims made in the documents with ideas and arguments of their own;
- drawing or justifying their own inferences;

synthesis:

- integrating the material in the documents with their own ideas and arguments to produce a coherent case.

Credit will be given for judicious use of the resources in the documents. Candidates' understanding/definition of what constitutes 'real' human development is crucial to their argument. Doc. 2 should help them to take a position. Factual data/statistics within documents could also be interpreted to support their take or to form counter-arguments.

Credit will be given for assessment and interpretation of evidence. E.g. Doc 4 highlights how problematic, in practice, a program of sustainable development can be. The miniscule statistical data may be interpreted by knowledgeable candidates to assess how it is being received. Doc 2 raises the fundamental debate: is it a realistic concept? On a different level, Doc 3 shows nature giving man a helping hand! – what are the implications for the theory of nature in Doc 1 para 3. And even more significantly for a theory of human development/evolution as rational beings? Or from the perspectives afforded by Doc 2, do Doc 3 and 4 enable one to draw the inference that promoting better satisfaction of living conditions in poor countries necessarily requires a reduction in the satisfaction level of richer countries?

Credit will be given for the critical analysis and evaluation that candidates apply to the sources. E.g. how objective is document (5)? Are the projections for the next 25 years reasonable or coloured by their own vested interests? It can be argued that the underlying motives of doers of "do ecology" in Doc. 3 are no different from those in "well-off" countries (i.e. self-interest) ; or that "don't ecology" doers do not have corresponding punitive lessons from mother nature to convince them they should regulate their carbon emissions. On the other hand they are triggered by massive economic opportunities which are reasons why they shouldn't cut back on 'destructive' activities.

Credit will be given for the inferences candidates draw from other sources and from other examples of observations they bring to the debate. What is rated as a good argument, whether for or against the compatibility of sustainable development, will be one which shows that the candidate has fully appreciated the dilemma/s focused in the question, selected relevant material from all the sources, showed consistency in interpretations, have anticipated challenges and argued convincingly with supporting reasons. Ideological or belief- based standpoints can be credited only if they are adequately/validly supported.

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Doc 2 prompts the candidate to give critical depth to the concept of sustainable development i.e. theoretical rationale/underlying motives for human behaviour. To obtain higher mark bands, a candidate should consider counter-arguments and objections to their own positions. They could draw/synthesise relevantly from cross curricular knowledge gained from other subjects they may be studying, e.g. history, philosophy, economics, religious studies, sociology or scientific disciplines.

Content of Further Argument:-

Most arguments may utilise current debates on climate change, ecological concerns, facts relating to poverty, global trends etc or to argue for or against sustainable development. The topic of environment, nature and man's relationship to it, may predominate/figure significantly in the responses, forming sub-arguments/intermediate conclusions in the process. More able students could construct arguments with theoretical basis. Debates/discussion on science and religion, ethical principles, understanding of needs theory, talk of 'nature' and the 'natural' may figure relevantly in these higher-critical arguments for or against sustainable development. For example, some who are in favour, may argue that nature is a force/principle that orders the way things are or the opposite; or that all things within nature (including animal lives) are of intrinsic value in themselves and worthy of moral respect. They may argue that when nature is reduced to mechanistic 'brute' impersonal realm of what is there, only people matter, but perhaps it is also why more often than not human conduct in the present day end up on the wrong side of the line, and therefore the need now for redress. They may treat the subject of nature as a standard for ethics and morality, which guides welfare economics, adjudicate needs fairly and thus facilitate a 'just' world; or argue that the concept of nature as an impersonal force that matters is irrational, or talk of 'natural' is irrelevant to moral decisions, and draw the implications thereof for their argument.

Candidates may use Eastern philosophy which emphasise harmony between man and nature as embracing total reality of existence, to counter Western trends of thought that devise barriers between impersonal nature and personal human being. On the other hand they may argue that nature is 'naturally' and rationally the field of human endeavour and the most radical interference with nature can be justified if it serves man's interest; that only technological advancement would continue to solve the new problems that arise for the human race because of the depletion of resources (e.g. suggest space exploration and discovery of habitable resource-rich places), and therefore demonstrates that sustainable development, in the nature of it, does not sit easily with the concept of human progress etc. Perceptive students of ancient history may point out that ancient stoic and platonic philosophy treated 'natural' as the 'rational' and such people as postmodernists, environmentalists etc. are beginning to return to this understanding of rationalism (discarded by the Enlightenment) and argue against or for the wisdom/merits of doing so.

All such sub-arguments/reasoning where employed, should relevantly relate and support the main argument for or against the compatibility of sustainable development with real human development. Very able candidates, with prior grasp of the topic, may offer more complex arguments; they may want to be more specific about what they consider to be 'sustainable' sustainable development, and indicate that the emphasis should be on sustainable sufficiency, as against sustainable efficiency, in order for it to be compatible with true well-being or true human development.

Responses that draw on personal experience and local/national factors should show a measure of objectivity and be made in the context demanded by the question, which calls up wider dimensions.

No marks are reserved for the quality of the written English. It is the quality of the critical thinking and reasoning alone which is under assessment, and provided the candidate has made his/her thought processes sufficiently clear to be understood, full credit will be given.