SCIENCE FOR LIFE

In 1996, 4531 students presented for the examination in Science for Life compared with 4503 in 1995.

The standard of the 1996 candidates' answers was generally similar or slightly better than that of 1995. As in previous years, those candidates who chose Biotechnology achieved a higher average mark on the Core than did the rest of the candidature.

Many students did not finish the paper, which implies that the required reading as well as analysis of tables and graphs was time consuming.

SECTION I : General

Part A

In the Multiple Choice questions Nos. 1, 2, 3, 4, 5, and 7 were well answered.

For Question 6 in the Multiple Choice, only 28% of candidates scored the correct answer (C). The most popular incorrect alternative was (A), suggesting that many students misread the units on the X-axis, and also, apparently, did not realise that the units were in thousands of years.

For Question 9, the most popular incorrect answer was (D), suggesting that students either did not know how to use a vacuum cleaner normally, or did not understand the unit of measurement, viz. mm.

The modules attempted by the largest number of candidates continue to be Science of Toys, Disasters and then Communication. Biotechnology continues to be the module attempted by the smallest number of candidates.

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Part B : Questions 11 and 12

Question 11

(a)
- Many candidates either did not draw a line between the data points or they used a histogram to answer the question.
- In many scripts, scaling was transposed directly from the table and not evenly spaced.
- Most candidates identified the correct units and were able to distinguish between the independent and the dependent variable.
- The plotting of co-ordinates indicated that most candidates had a good understanding of this skill.
- The majority of candidates did not provide a heading and those who did so frequently provided an inappropriate description.

(b)
- The majority of candidates did not include the correct units.
- Even where units were entered, more than half were incorrect, e.g. *age is 4-6 or 2-6 years*.
- The acceptable range was 2 to 6 months but, although many gave a response within this range, several added incorrect information or omitted the units.

(c)
- Where a histogram was used, the only acceptable response was 11.1 kg., i.e. as calculated from the table.
- A few candidates gave a range and only those within 0.1 kg were accepted, e.g. 11.0 to 11.1 kg.
- Compressed graphs, i.e. small scales on either or both axes and/or thick pencil lines, gave information that was not accurate.

Question 12

(a)
- Most candidates answered this question correctly.
- A small number could not convert 300 minutes into 5 hours; such candidates usually stated 3 hours.
- In some cases incorrect answers were given, even though working was correct, i.e. 15 x .....

(b)
- This very broad question elicited a multitude of responses.
- Many candidates were unable to decide how much information was required.
- A number of candidates mistakenly assumed that *SPF* is cream/sunblock/lotion.
- Some responses were calculations similar to those in Question 12(a).
- Many answers were related to heat or temperature.

(c)
- Many responses did not compare *clothing* with *cream*.
- Several responses repeated the information.
- In cases in which a comparison was provided, it was often not qualified, saying, for example, *It is thicker* rather than *Clothing is thicker than cream therefore it blocks the sun more.*

Question 13

- Many candidates did not attempt this question, but those who did so generally scored well.

- In order to do so, candidates needed to include more of the relevant information and avoid personal views.

- Some did not relate the poster specifically to Rubella but to immunisation in general.

- The majority interpreted the term *design* as meaning *draw*.

Question 14

- Candidates found it difficult to restrict their answers to the spaces provided in parts (a) and (c).

- Many showed a lack of understanding of the term *hypothesis* in part (a) or could not calculate 50% of 113 million, and failed to include units in their answer for part (b).

- A number failed to give a reason, as required in part (c), and simply stated the possible result of the failing sperm count in males.

Question 15

- In this question many candidates could not distinguish between a graph and a table; of those who could do so, many were unable to construct a table comparing the amount of niacin, thiamine and iron in each of the breakfast cereals named.

- Most candidates were able both to transfer data and to use a rule accurately.

- Part (b) was generally answered well.

SECTION II : Modules

Question 16 : Fashion and Science

(a)   (i)   The majority of students scored some marks. Many listed design changes that could **not** be seen, e.g. power steering.

Answers such as *aerodynamic shape, larger windscreens, extra blinkers* and *side mirrors* scored well. Poor answers included vague descriptions such as *sleekness, size, wheels* and *style.*

(ii)   Many students did not explain adequately *how* Science and Technology have made the change possible Those who mentioned aerodynamics in part (i) should have mentioned the type of technology used in the design, e.g. wind tunnels, computer-aided design.

(iii)   This question was generally handled fairly well, although it was misinterpreted by some who failed to name another detrimental effect on the environment apart from exhaust gases, or who gave a response that had little environmental impact, e.g. tyre burnouts..

(iv)   In answering this question, students failed to show an understanding of the term *cultural heritage* and its influence on fashion. Although the question was linked directly to a focus idea, it was not well done. Almost half of the candidates did not provide diagrams or labelled their diagrams inadequately.

(b)   (i)   This question was answered very well. A high proportion of students gave two good reasons to show why some people prefer to buy T-shirts with designer labels on the outside and scored two marks.

(ii)   Many students did not appear to understand the question.   They failed to *describe* how they would carry out their investigation. Most answers only discussed *conduct a survey*. They should have shown an understanding of *how* a survey is constructed.

(c)   Those who scored well in this section named a fashion in which there has been a distinct change in the materials used, e.g. cotton to lycra, and gave appropriate advantages and disadvantages of such change. Most students commonly failed to name their fashion and/or to describe the change in materials adequately.

(d)   (i)   The majority of students successfully stated two methods of preventing decay of food in the 1980s.

(ii)   Questions 1 and 2 were answered very well.
Questions 3 and 4 were answered poorly.
Those students who chose smoke/fire as being harmful to the environment often failed to give specific reasons to show *why* smoke or fire is more harmful.

A common misconception was that a microwave (a modern cooking method) is more harmful to the environment because it gives off dangerous radiation, OR that frying is worse than burning because the oil left over pollutes the aquatic environment.

Question 17 : Horticulture

(a)   (i)   (1)   From the information given, most students had little difficulty in identifying an animal-based system.

(2)   Although many said that the selected system was not a part of horticulture, a number could not relate horticulture specifically to the study of plants.

(ii)   On the whole this part of the paper was fairly well answered. A number of students, however, stated that one problem of plant production could be the zone in which it was occurring.

(iii)   This part was well answered by the majority of candidates.

(iv)   (1)   Many students failed to understand that a mathematical calculation was required in order to answer part (1) successfully. This could have been reduced if the formula (people per hectare) had been expressed in a mathematical format.

(2)   The type of processing required to answer this question was beyond the scope of many students.

(b)   Most students answered this question well, showing a clear understanding of how to design an experimental concept - variables, controls, etc. They did not, however, correlate the leaf size and the plant's need for water.

(c)   •   Students showed a clear understanding of the uses and benefits of all stages in the life cycle of a plant.

•   In answering part (iii) a large number of students wrongly selected a different stage from that selected in part (ii).

•   An adequate knowledge of the problems associated with growing plants, and the means of reducing a specific problem, were shown.

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General Comments:

- Part (a) required fairly high literacy skills and it seemed that many candidates were intimidated by this fact.

- The formatting of questions within questions confused a number of candidates, and this was clearly reflected in the way the papers were answered.

- In general this was one of the harder modules to complete effectively.

Question 18 : The Human Body

(a) (i) Students confused *prevention* with *treatment*.

Many gave answers which did not clearly identify the stage of development in the life cycle, saying, for example, *kill the worms in the water*.

Most students could not spell *vaccination*; giving the word as *vacation* was one of the most common incorrect forms.

(iii) This was very poorly answered since students did not appear to have sufficient information to guide them here. Frequent answers included:

- *we have the best quarantine system/station*
- *we don't have many lakes and rivers*
- *we swim in pools and beaches*

Throughout this section (a) some students confused the water of the rivers and lakes with our drinking water supply.

(b) (i) The instruction *draw a table* appeared to be misunderstood by the majority of students.

(c) Students did not select a large enough sample group; the majority chose two people only. Having a control group was generally well handled, but little indication was given of objective testing.

(d) (i) Students were able to identify a lifestyle but rarely related this to a specific effect on physical health.

(ii) Again students were able to identify a specific lifestyle but were unable to show its effect on mental health.

(e) (i) This part was not well answered since many students tried to describe *where* the biosphere is rather than to show its significance to life on earth.

(ii) Here students were able to identify their behaviour but could not describe ONE specific way in which it affects the biosphere. Many confused the greenhouse effect with the hole in the ozone layer.

(iii)   Many of those who answered part (ii) correctly found this part easier to answer. Those who answered part (ii) incorrectly found part (iii) significantly more difficult.

Question 19 : Science Fiction

(a)   (i)   Most students drew an accurate diagram of the beast described in the excerpt.

(ii)   Students focussed on the first part of the question and talked about the problems that the beast would have in surviving on Earth rather than talking about two characteristics of the beast that would disadvantage it on Earth.

(iii)   Here the reasons given were related to disadvantages in general rather than to the disadvantages of each characteristic.

(b)   (i)   Most students answered this part of the question with little difficulty.

(ii)   Many suggested a utilitarian function for the small backpack which was unrelated to space. Tools for working in space, radio communications, life support/air/
oxygen, etc, should have been mentioned.

(c)   (i)   Many students found this question difficult because they focussed on the difficulties extraterrestrials would have in invading earth, e.g. atmosphere, food, transport, rather than the difficulties, other than communication, that extraterrestrials would have in interacting with humans.

(ii)   Students stated an item which they believed would benefit the extra terrestrials as a result of their contact with humans, but did not explain why this item would be a benefit.

Some wrote about the benefits to humans rather than to extraterrestrials.

(e)   Students did not generally respond to the word *design* - they wrote questions that they would ask in surveys but did not design a survey or other investigation.

Question 20 : Science of Toys

(a)   (i)   Most students were able to name an appropriate toy.

        (ii)   Candidates gave some fundamental ways in which science has improved the ways in which toys work, but were unable to show how they have been improved scientifically. Many failed to answer all parts of this question. Some included safety reasons for improvements which were not necessarily the same as the fundamental improvements and hence answers were repeated in part (iii). Many improvements in design were not necessarily scientific improvements.

        (iii)   Here very general answers were given and candidates failed to explain *how* and *why* such improvements made the toy safer.

(b)   (i)   Although a few candidates did not list a toy here, most were able to do so.

        (ii)   This question was answered very well since most candidates had a good understanding of how a suitable label warning should be written for the toy named.

        (iii)   This section was answered well as candidates seemed able to provide two reasons for putting the warning on the toy. Some again gave very broad reasons without linking them to the specific warning.

(c)   (i)   Most students answered this well.

        (ii)   Some students chose a toy and technology that has not been developed in the last 30 years, e.g. porcelain doll ÿ plastic dolls such as Barbie doll.

(d)   Many students wrote a list of questions instead of designing an investigation. Students must learn how to conduct a fair investigation and must list all the steps they would take.

(e)   Many candidates made observations that did not relate to child development. A number of answers were too vague, overlooking specifics such as hand-eye co-ordination. The change of scale in the diagram of child development misled some students.

(f)   Most students could not draw a scale diagram of a toy other than blocks. This part of the question was poorly answered. Often an example of a toy was chosen on which the features either were not or could not be labelled. Although students could generally identify features of the toy which aided development, their diagrams were often modelled on that used in section (e) which was not relevant for this question.

Question 21 : Sport Science

(a)   (i)

            Most students recognised one way in which the physical fitness of Sophie and Kurt

    and

            could be improved but failed to give a reason.

    (ii)

(b)   (i)   The majority recognised at least one reason for the extra time needed to stretch before a 300 km ride on Saturdays.

    (ii)   13% of the candidature did not attempt this question, while 5% drew graphs. Some students actually summarised the information into a table. The fact that most did not put units for time and distance in the headings of the table caused some concern.

    (iii)   A large number of students gave **one** reason, e.g. endurance, and developed it instead of giving two distinct reasons.

(c)   (i)   1.   Many students gave an acceptable reason for explaining the need for Megan's mother to exercise, but some repeated the question as their answer, saying, for example, *because she is overweight.*

            2.   A number of students did design a repetitive and itemised program of exercise which showed variation or increase in intensity. Some, however, named only one activity, giving no indication of frequency.

    (ii)   1.   A large number of students were able to link an appropriate somatotype with an activity or sport, or provided adequate physical descriptors, although some appeared confused about what a *body type* might be.

            2.   This section was generally well answered.

(d)   Generally this section was very poorly answered since students lacked a clear understanding of the focus area associated with the question. The better responses, however, linked body movement to streamlining, low centre of gravity, or centre of balance.

Question 22 : Disasters

Students should not be drilled in particular definitions which they may then use in response to questions without being able to show either understanding or appropriate application.

(a)   (i)   Many candidates could not distinguish between the skill needed and the occupation that involves the skill.

(ii)   A number of candidates repeated their answer from part (i) and did not succeed in explaining why the skills were necessary; nevertheless, there were some very fine answers.

(iii)   On the whole candidates neglected to justify their choice of what should be sent in first.

(b)   (i)   Those candidates who found this question difficult could not give an acceptable definition of a disaster.

(ii)   A sizeable proportion of the candidates had trouble in presenting an acceptable solution to the problem of how disasters caused by satellite crashes can be avoided.

(c)   (i)   Candidates were generally able to name one natural disaster, but many would have benefited from reading the whole question before answering.

(ii)   Most of those who chose a specific disaster successfully related the evidence found to that disaster. Some had difficulty in dealing with the time scale of *thousands of years ago*.

(d)   (i)   A number of candidates failed to understand the facts on which the question was based and hence had difficulty in deciding whether it was a disaster or not - they mentioned the *death* of people.

Candidates seemed to know a definition of a disaster but became confused in applying that definition to this scenario.

(ii)   Candidates were generally able to name a disaster.

(iii)   Those who found this question difficult failed to give examples of specific technologies, being rather confused about the products of the technology. Some included technology used after a disaster has happened as well as preventive technology.

(e)   (i)   Candidates were able to identify an appropriate event from the graph but many either omitted the explanation that was requested, or failed to use the graph in support of their selection.

       (ii)   1.   Candidates had difficulty in suggesting a reasonable yet probable cause of the increase of the death-rate from diphtheria.

                 2.   Candidates had trouble in identifying whether this was a disaster.

       (iii)   A large proportion of the candidates had difficulty in explaining the concept of *death-rate* as applied to the label.

Question 23 : Managing Natural Resources

(a)   (i)   Most students were able to use the key to identify the pollutants infiltrating the ground water. Where one major source of this was apparent, the students answered the question well. Many failed to read the question carefully and did not identify the **sole most likely** source of each pollutant. Another common problem was that students identified rainwater as being a pollutant simply through reading the list of substances in the key. Some thought that the pumping wells were for oil.

       (ii)   The majority of students could answer this question but many had difficulty in giving details or making distinctions between their two solutions. The most common misconception was that simple water filtration systems would remove pesticides from the drinking water. Many also failed to give sufficient detail in their answers.

(b)   (i)   A number of students did well in this question, identifying all four renewable resources. Some, however, did not realise that wood is a renewable resource, or failed to list more than one or two such resources.

       (ii)   Responses to this question varied. Students need to ensure that they answer the question by giving a *reason* for the difference, instead of simply just restating the stimulus material.

(c)   (i)   This question was poorly answered. Many students obviously knew what had to be done but could not design a detailed and scientific experiment. A number of candidates identified the fact that the fish needed to be placed in an isolated area and monitored. Few, however, understood that a large sample, a control group and a lengthy observation period were also needed.

       (ii)   This question was answered well by most students. Some, however, did little more than restate the stimulus material, while others did not give *different* consequences for each impact.

Question 24 : Marine and River Studies

(a)   (ii)   This part was not answered well. Students should have explained how water is important for the body or the body processes of the named organism.

Some acceptable answers included:

> *Water contains oxygen which fish breathe.*
> *Water carries nutrients needed by plants to grow.*
> *Frogs need water in which to reproduce.*
> *Humans are 80% water and water has to be replaced in the body.*

Many students gave more general answers, e.g.

> *Fish breathe the water.*
> *Humans drink the water and use it to cook*, etc.

(iii)   Again candidates needed to be a little more specific in describing effects. The better answers included:

> *causes or encourages diseases*;
> *reduces oxygen levels;*
> *organisms can take in poisons which cause illness then they get sick and die.*

(b)   (i)   Good answers included:

> *the increased number of trees;*
> *affect the water temperature and light levels;*
> *increase the number of predators;*
> *substances from the leaves or trees enter the water.*

Students needed to give good reasons to show how such increases would reduce the tadpole numbers.

Unacceptable general answers included *leaves falling, adding pollution*.

(ii)   This was answered fairly poorly since most students did not seem to understand the concept of a controlled experiment. The majority tested a variable which was mainly light/no light and mentioned the tadpole population but failed to mention the fact that something has been kept constant, e.g. the same amount of water.

(c)   (i)   The fishing industry, fast food outlets and agriculture were the most popular food-production industries named.

(ii)   Students needed to indicate clearly how the water was used by the specific food-production industry, e.g. *Water is used as a medium for fish production, for cooling machinery, as a raw material in drink production*, etc. The question was generally answered well.

(iii)   This question was not answered very well. The majority of students did not explain how the water supply was more reliable (quantity or quality).   Most answers simply stated *Have a dam or connect to a tap.*

(d)   (i)   This question was answered very well. The majority of students gave more than one correct factor. Some, however, simply described the graphs given. They should have interpreted the information, e.g. naming a specific type of fish, or proposing an acceptable method of fishing, e.g. more environmentally friendly.

(ii)   Most students answered *longlining* but a small number chose the negative which was also accepted. The question also included greater control over the size or type of fish, **not** numbers.   Some did not show *how* the specific method controlled these factors.

(iii)   This was answered well by most students. Answers should have related to the longline.

(e)   (i)   *Used syringes* and *oil* were the most popular answers given.

(ii)   Students needed to specify *how* the specific pollutants could have entered the water of the harbour. Many students answered *throw the syringes away when used.* They should have specified, e.g. *oil from leaks or spills from boats.* Simply saying *boats* was not sufficient.

(iii)   One mark was given for general comments, e.g. *cause, illness/injury*, another mark was given for a more detailed answer, e.g. *food containers can cause injury by people getting cut while swimming.* Most students gained only one mark for a general comment.

Question 25 : Biotechnology

(a)   This part was generally answered satisfactorily.

(b)   (i)   The best answers here stated; *if people know they have the gene*:

•   *they will change their lifestyle to offset the effect(s) of the gene;*
•   *they can get genetic counselling;*
•   *they are more able to deal with it.*

(ii)   1.   The following ethical issues were accepted as justification here of abortion in an effort to develop a super race:

- selective breeding - abortion (super-race)
- discrimination
- euthanasia
- survival of the fittest

2.   The following ways of dealing with this technology were accepted:

- ethics committee
- strict privacy laws
- anti-discrimination
- heavy fines for disclosure
- education
- screening of high risk
- the *God* factor was well explained - students said it was **NOT** against God's laws or the law of nature.

(c)
- Comparison, e.g.   short and tall   smelly
  short and tall   not smelly
  two types of genetically engineered plants.

- Controlling variables, e.g.
  Snails   -   same species
     -   large number

$ Replication/large number
  Soil
  Rain
  Temperature
  Light
  Any THREE from FOUR of the above were accepted.

(d)   Application   -   This must be described.

Advantage

Disadvantage
   -   The *God* factor was NOT applicable.

Question 26 : Communications

(a) (i)
     and   These questions were both well answered.
     (ii)

     (iii) This question proved difficult. Few students seemed to consider noise as a source of interference in communication. Many viewed noise only as loud or distracting sounds.

(b) (i)   Students easily selected an appropriate sign.

     (ii)   Students found it easy to suggest a meaning for the signs. A number of students could explain how the features of the selected sign could convey meaning. Many simply described the appearance of the sign.

     (iii) Students could explain the advantages of using the pictures rather than words. Some found it difficult to relate their response to the sign they had selected.

(c) (i)   Students found it difficult to identify the type of evidence the newspaper should have for publishing the statement quoted.

     (ii)   Most candidates found it difficult to describe how they would design an investigation to test the effects of modern technology on people's talking less to each other.

(d) (i)
     and   These questions were well answered.
     (ii)

(e) (i)   The majority of students answered this part well; some, however, selected examples from the stimulus material.

     (ii)   Students found it difficult to describe how their specific process works. Many either described a process but failed to mention the way in which the information was obtained by large numbers of people, or did not describe it sequentially. Some described the process of producing a single copy, e.g. a fax machine.

     (iii) This question was answered well.

Question 27 : Consumer Science

(a) (i) A large number of students failed to appreciate the fact that saving by buying in bulk applies equally to small or large toilet rolls - the same volume is involved, regardless. Savings are made by using:

ONE	-	less packaging
TWO	-	fewer cardboard rolls
THREE	-	less labour costs involved in changing the rolls.

(ii) A number of candidates wrongly believed that toilet paper can be recycled.

(iii) This question was generally answered well.

(b) (i) Students had difficulty in identifying a specific example of a technology that has caused problems for the environment.

(ii) Generally candidates found it difficult to state one way in which the technology could affect the environment. This was very evident from the specific examples given of the causes of ozone layer depletion and global warming.

(iii) Students found it difficult to make suggestions that were clear alternatives.

(c) In order to test one claim made about ACU-MAG2000 students found it difficult to apply criteria of experimental design, e.g. randomisation, control, etc.

(d) (i)
and These parts were reasonably well answered.
(ii)

(iii) In answering this question students failed to appreciate:

1. what constitutes an expert in a particular field; and

2. how to assess a person's expertise by asking him/her a question about the specific topic.

(e) The majority of students possessed little knowledge about what technology was available in the 1890s and of the reasons underlying any change.

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Question 28 : Space Science

The majority of students answered all the questions well; a small number, however, did have difficulty in interpreting some questions.

(a) This question covered the focus area of space travel and the problems associated with it.

    (i) Most students generally had no difficulty in identifying four problems. Some, however, found it difficult to separate technical from non-technical problems, e.g. weightlessness, boredom and loneliness.

    (ii) This part was poorly answered. Students were not specific enough in describing their solutions to each problem and many used the same solution repeatedly, e.g. training in a simulator.

(b) This question covered the focus area; not all materials sent into space come back to Earth.

    (i) Answers to this part were good.

    (ii) This was poorly answered and many students used non-specific terms, e.g. *floating*.

    (iii) This was fairly well answered, although a number of students repeated identical answers in parts (ii) and (iii), e.g. *orbiting*.

(c) This question covered the focus area dealing with the development of new materials as the result of space travel.

    (i) Answers to this part were good.

    (ii) This was also well answered.

    (iii) Answers here were poor since many students confused what the question asked with the information given, e.g. *removing the waste products from a space laser*.

    (iv) This part was generally well answered; some students, however, could not apply a scientific method to ascertain whether it is better to place the chemical produced by NASA filters or paint it on the wall.

(d) Answers here were satisfactory.