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General Science
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1999 HIGHER SCHOOL CERTIFICATE GENERAL SCIENCE NOTES FROM THE EXAMINATION CENTRE

Introduction

The number of candidates presenting for the examination in General Science has remained fairly stable over the past three years as shown in the following table:

YEAR	CANDIDATE
1999	2026
1998	1988
1997	1996

General Comments

As in previous years there was a need for candidates to identify and interpret key words such as 'state', 'name', 'explain', 'describe' and 'list'. There was an overall improvement in candidates' performance in this area. There was less evidence of the use of prepared answers than in previous years, possibly due to the structured nature of the questions and answer books provided.

Better candidates were able to direct their answers to the specifics of the questions, expressing themselves clearly and with appropriate use of labelled diagrams. Candidates responses to a variety of questions demonstrated better preparation in the areas of experimental design although the concept of the Scientific Method and its application are not well understood by a significant number of candidates.

Section I – Core

PART A – Multiple Choice

General Comments

The following table gives the percentage of the candidature correctly answering each question.

Questions 1-15 Mean = 9.05

Question	Correct Answer	Percentage Correct
1	D	83.84
2	C	76.86
3	C	58.20
4	A	70.07
5	D	34.31
6	B	19.85
7	B and D	72.86
8	C	42.74

Question	Correct Answer	Percentage Correct
9	A	74.11
10	A	61.25
11	D	79.35
12	D	42.54
13	B	82.19
14	C	72.82
15	C	50.37

Specific Comments

The correct answer was chosen more frequently than any of the alternatives for all questions except Questions 5, 6, and 12.

For Questions 5, 6, 8 and 12 the correct answer was chosen by less than 50% of the candidature.

In Question 5 approximately 47% of candidates chose alternative B (energy input multiplied by efficiency).

In Question 6 approximately 71% of candidates chose alternative A indicating a failure to understand the key words 'As proposed by Darwin ...'

In Question 7 both alternatives B and D were correct with approximately 57% of candidates choosing alternatives B and 16% alternative D.

In Question 8 approximately 25% of candidates chose each of the incorrect alternatives A and D.

In Question 12 approximately 44% of candidates chose alternative B (pesticides never break down naturally and become concentrated in the food chains).

PART B – Short-response Answers

Question 16

- Most candidates answered correctly, showing the Earth at the centre with circular orbits for the planets. Better responses included epicycles in their diagram.
- Candidates were generally able to identify one difference and one similarity between the models, but in a significant number of cases did not relate the property to a specific model eg. 'one model was geocentric and the other heliocentric.'

Question 17

- (a) Most candidates were able to explain the changing position of Orion as due to the change in position of the observer as Earth orbits the Sun. A small but significant number of candidates used rotation of the Earth on its axis as the reason.
- (b) While the better responses correctly identified the position of Orion as 'below the western horizon', many candidates had difficulty expressing or describing the position.
- (c) Most candidates suggested either size or relative distance as the reasons for the stars' brightness.

Question 18

- (a) Approximately half of the candidates were able to correctly interpret the pedigree and identify the gene as recessive.
- (b) The candidates who were able to interpret the pedigree correctly in part (a) were generally able to identify the genotype as Bb. A small but significant number of candidates gave two genotypes for individual 8.
- (c) This was well answered by approximately half of the candidates. The better responses used a punnet square to derive their answer of zero.

Question 19

- (a) Most candidates correctly identified primate A as having the best developed sense of smell because of its relatively long snout.
- (b) This was correctly answered by most candidates relating the advantage of binocular vision to arboreal life or more specifically to depth perception. Some candidates confused focussing of the eye with depth perception.

Question 20

- (a) Most candidates were able to correctly identify the order of the skulls from most ancient to most recent.
- (b) Most candidates were able to describe two characteristics visible in the diagrams (size of brow ridges, slope of face, jaw size, shape of skull cranial capacity) but a significant number used characteristics not visible in the diagrams (foramen magnum, arrangement of dentition).

Question 21

This question was generally not well answered by candidates.

- (a) Only the better responses gave a medical consequence (such as re-infection) if the advice wasn't followed. Many candidates discussed what would happen to the bacterial population rather than to Kim.
- (b) Again, only the better responses identified the consequence as increased bacterial resistance to antibiotics or the consequence of less effective antibiotics on the human population. There was considerable confusion between the terms 'resistance' and 'immunity'. A significant number of candidates were unable to link infection to the action of bacteria.

Question 22

- (a) Most candidates recognised that occurrence of the pure metal was related to activity but many failed to make a direct comparison between gold and the more active aluminium and iron.
- (b) This part was well answered. Most candidates were able to relate activity to method or ease of extraction. A small but significant number of candidates confused extraction from the ore with mining methods.

Question 23

This question was well answered by most candidates.

- (a) Candidates could readily identify a natural fibre used in manufacturing cloth.
- (b) Most candidates could name a synthetic alternative to the natural fibre. Some candidates confused the alternative fibre with an alternative weaving method or style (for example, using satin as an alternative fibre to cotton).
- (c) This part was well answered with most candidates correctly identifying a property of the alternative synthetic fibre. A significant number of candidates gave a property of the woven cloth or a garment rather than a property of the fibre.

Question 24

This question was not well answered with many candidates giving a response indicating poor understanding of the principles of the Scientific Method.

- (a) Hypothesis. While the better responses contained a hypothesis as a testable statement, many candidates responded with an aim or a question.
- (b) Method. The better responses related experimental design to the stated hypothesis, clearly identifying the task undertaken and indicating how observed differences would be measured. They included at least two of the following aspects:
 - the concept of one experimental variable
 - the using of large sample sizes
 - the repetition of the experimental trials
 - the concept of keeping all other variables constant.

The responses of a large number of candidates did not relate to the stated hypothesis or failed to specify tasks to be undertaken or measurements to be made.

Question 25

- (a) (i) Most candidates were able to describe a method of making their opinion poll random but many were not specific in that description.
- (ii) The concept of scientific bias was not well understood by most candidates. Those that answered well gave responses relating to the nature of the questions or how the interviewer may deliver the questions. Candidates commonly suggested excluding scientists or scientific questions from the poll without realising this was a source of bias in itself. Many candidates attempted to use randomising the sample as a method of reducing bias.
- (b) Candidates tended to identify inventions or technological developments (for example - the telephone or television) rather than specific scientific discoveries. The explanations of positive influences on Australian culture were very general and often trivial. The concept of 'culture' seemed poorly understood.

Annotated Sample Responses

Candidate 1 3 Marks

- (a) (i) asked every third person who walked past in a shopping mall 1
- (ii) used questions that were easy to understand with no scientific words that could not be understood 1
- (b) Scientific Discovery : Antibiotics 1
Influence : has helped to fight a lot of diseases that before antibiotics may have killed people

Candidate 2 2 Marks

- (a) (i) picked the names out of a hat 0¹
- (ii) the person asking the questions did not prompt any answers nor give any personal opinions 1
- (b) Scientific Discovery : Telephone 1
Influence: has allowed long distance communication

Candidate 3 1 Mark

- (a) (i) Chose people of all ages and both sexes 1
- (ii) asked people from all cultural backgrounds 0²
- (b) Scientific Discovery : Technology 0³
Influence: made life easier.

Candidate 4 0 Marks

- (a) (i) Choose different streets 0⁴
- (ii) Ask Yes/No questions 0⁵
- (b) Scientific Discovery: Life has been discovered on the Moon 0⁶
Influence: This has helped us to know that there are others out there.

Notes

1. This response does not guarantee randomness.
How were the names originally picked to go into the hat?
2. This response is just a repeat of the idea of randomness and doesn't guarantee the poll is free of scientific bias.
3. Technology is too broad an answer - it is an application of science.
Specific examples needed to be mentioned.
4. This response does not relate to an opinion poll or to people involved in answering a poll. No mention was made of what to do after the streets had been selected.
5. Yes/No questions do not guarantee freedom from bias. The phrasing of the question can direct to a required answer and bias the poll.
6. This response is incorrect as no life has been discovered on the Moon.

PART C

Question 26

- (a) Most candidates answered this question correctly. The majority of candidates did not recognise the Greek symbol gamma and transcribed it as γ . A small number of candidates did not refer to the diagram and gave the correct response of 'the Sun'.
- (b) Most candidates answered this correctly within a tolerance of 5 light years. This required the accurate construction of a perpendicular from the star to the scale and an estimate of a value from a scale calibrated to 100s of light years.
- (c) Most candidates could calculate the difference in distance that light travels from each star but often gave this as their answer, failing to recognise that light years is not a time unit.
- (d) Again, as in part (c), candidates were able to calculate the distance between the stars but gave the time taken in light years.
- (e) Most candidates recognised that light years were more appropriate to the scale of distances involved but were often unable to express this clearly.

Question 27

- (a) Most candidates were able to name two materials that would have been used to make the artefacts. Examples included rock, flint, bone and clay.
- (b) The concept of mapping artefacts onto a time line was an effective question clearly distinguishing the better candidates. Most candidates were able to establish partial order (most recent, oldest, partial sequences).
- (c) Most candidates failed to recognise the connection between the age of the artefacts (up to 2.5 million years) and the evolution of human ancestors in Africa. A significant number of candidates gave responses based on tenuous connections between the artefacts and the continent, eg a continent next to the sea because there was a fish hook.

Annotated Sample Responses

Candidate 1	5 Marks
(a) Material 1 – Stone	1
Material 2 – Clay	
(b) Present C	2
DE	
A	
B	
2.5 million years ago	
(c) Continent Africa	1
Explanation: These artefacts were used by human ancestors in Africa at times up to 2.5 million years ago.	1
Candidate 2	4 Marks
(a) Material 1 – Bone	1
Material 2 – Rock	
(b) Present C	1¹
DE	
B	
(c) Continent Africa	1
Explanation: Africa is the only continent occupied continuously by humans for the past 2.5 million years.	1
Candidate 3	2 Marks
(a) Material 1 – Wood	0²
Material 2 – Stone	
(b) Present D	1³
AE	
C	
B	
(c) Continent India	0⁴
Explanation: This is the only continent which would have human artefacts 2.5 million years old.	1⁵

Notes

1. Candidate 2 gains one mark in part (b) as C is identified as the most recent artefact. A is incorrectly shown as older than B.
2. Candidate 3 loses one mark for part (a) as wooden artefacts are unlikely to be preserved. Both materials must be correct to gain the mark.
3. Candidate 3 has the artefacts in an incorrect sequence but gains one mark for showing that B is older than A.
4. The continent is incorrect (India is not a continent in any case).
5. The explanation would be correct for Africa (correct response) and so Candidate 3 receives one mark.

Question 28

- (a) Most candidates expressed a purpose linked to the space venture chosen that was non-specific and probably more in line with the general aims of space exploration. Most candidates were unaware of the specific aims of these programs.
- (b) Again many candidates responded generally citing problems that have occurred with most space ventures (computer program failure, booster problems, weightlessness). One word answers were not uncommon, with many candidates responding with non-descriptive answers. Some candidates demonstrated an in-depth knowledge of individual space ventures.
- (c) This was answered fairly well by most candidates with most solutions quoted being relevant to the described problems. There was a significant number of candidates who gave solutions to problems unrelated to those described in part (b). There was noteworthy variety in the problems and solutions proposed in parts (b) and (c).

Question 29

- (a) Most candidates could produce a correct formula for efficiency.

$$\text{(efficiency = } \frac{\text{load}}{\text{effort}} \times \frac{\text{load distance}}{\text{effort distance}} \times \frac{100\%}{1} \text{)}$$

OR

$$\text{(efficiency = } \frac{\text{energy output}}{\text{energy input}} \times \frac{100\%}{1} \text{)}$$

Many candidates, however confused the concepts of force and energy, not including distances moved by load and effort in the calculations.

- (b) Most candidates could identify two sources of energy loss. The most common responses involved energy loss as heat or sound.
- (c) This question was well answered by most candidates with friction reduction methods the most common response - (lubricate or improve pulley bearings, smoother rope). Some candidates recognised that reducing the weight of the ropes or moveable pulley would improve efficiency. A significant number of candidates confused mechanical advantage with efficiency and gave responses which would improve mechanical advantage.
- (d) Most candidates were able to interpret the diagram to derive a correct equation.

Question 30

- (a) The majority of candidates recognised that resistance to myxomatosis was the characteristic which had changed in the rabbit population.
- (b) (i)(ii) Most candidates could distinguish between the explanations of Darwin and Lamarck. Some candidates confused the Darwinian and Lamarckian explanations or gave responses which did not clearly differentiate between the two. Poor use of language often implied Lamarckian concepts in the Darwin answer. This question required higher level language skills than the other core questions. The better candidates were able to relate the concepts to the specific scenario rather than just stating the theories.

Question 31

- (a) Most candidates were able to define the term 'polymer' but experienced difficulty in expressing it in diagrammatic form. Many diagrams failed to indicate the extended nature of the chain of monomers forming a polymer, simply showing a terminated multi-carbon chain.
- (b) (i) Many candidates could give a vague description of an experiment they had carried out but could not outline specific procedures or ingredients. Those candidates who answered well usually described a glass making process.
- (ii) Most candidates were able to describe one safety precaution appropriate to their procedure. A small but significant number of candidates described precautions relating to not damaging the equipment ('don't drop the thermometer or it will break').

Section II – Electives

General Comments

As in the previous two years, a common set of marking guidelines was developed for all the elective questions and each candidate's script was independently marked by two markers.

The following comments apply to all of the electives, but where appropriate, specific references to elements of particular electives have been included.

Most candidates were well prepared and responded to the question with detailed answers. The structure given by the questions was adhered to by the candidates and practical experiences appropriate to the elective were cited.

Candidates were familiar with the terminology of the elective studied and were able to demonstrate their understanding of terms and concepts.

Use of appropriate labelled diagrams and tables by a majority of candidates enhanced their responses often clarifying poorly expressed written text.

It should be stressed to students that it is imperative for them to read the entire question prior to commencing their answers, and to plan their answers in order to give the best response. This was evident from the significant proportion of candidates who failed to complete the question or who gave only cursory responses to the latter parts despite full responses early in the question.

No candidate attempted to answer more than one elective as has occurred in previous years, although a small number appeared to answer one they had not studied in depth.

The following table gives the proportion of the candidature attempting each elective.

Question	Percentage of Candidature
32	8.7
33	10.7
34	11.0
35	4.2
36	9.3

Question	Percentage of Candidature
37	7.1
38	6.9
39	9.6
40	9.6
41	22.9

Part (a) 10 mark

The better responses included clear answers to each section of the question. Many included well labelled diagrams to describe their equipment.

Poorer responses provided a list of the equipment used and gave a limited description. Many could not describe the experimental control or its purpose.

There was a weakness in stating an appropriate conclusion. Many candidates gave conclusions that did not relate to what they were trying to find out or were a restatement of the results.

Colour	Many candidates described demonstrations or investigations of colour mixing or dispersion.
Metals in the Service of People	Most candidates gave appropriate responses and referred to extraction by smelting or electrolysis.
Optics	Most candidates reported on activities involving lenses or mirrors. The poorer candidates confused mirrors and lenses.
Petroleum and its Compounds	Many candidates referred to cracking or distillation.
Physiology of the Senses	Many candidates described an investigation of 'taste bud distribution' and could describe a control.
Reproduction in Animals and Plants	Most candidates described the dissection of a flower and had difficulty describing the control or explaining why it was not necessary.
The Insects	Many candidates reported on the effect of temperature on the life cycle of flies.
The Science of Food Technology	This part of the question was well addressed by candidates.

The Scientific Basis of Photography	Many candidates reported on an investigation of the effect of shutter speed on image quality.
Water	There was a great variety of relevant investigations and the question was well answered. Some candidates reported on simplistic demonstrations eg. boiling water, and failed to identify a control or explain why it was not necessary.

Part (b) 4 marks

Most candidates were able to give clear and succinct answers. Candidates were able to list two additional terms and explain them.

Poorer responses listed terms that were not appropriate to study at this level.

Colour	Candidates had difficulty explaining trichromatism. The use of the spectrometer was well explained but explanations of the term were weak.
Metals in the Service of People	The terms ore and malleable were well explained.
Optics	Refraction was well explained. Convex lenses were confused with concave lenses by the poorer candidates.
Petroleum and its Compounds	Both fractional distillation and crude oil were well explained. Some candidates confused fractional distillation with catalytic cracking.
Physiology of the Senses	Neither neurone nor retina were well explained.
Reproduction in Animals and Plants	Neither embryo nor meiosis were well explained.
The Insects	Some candidates had difficulty explaining incomplete metamorphosis. Exoskeleton was well explained.
The Science of Food Technology	Both freeze drying and denatured were poorly explained.
The Scientific Basis of Photography	Both lens and filter were well explained.
Water	Many candidates had difficulty explaining physical property but gave appropriate examples. Water cycle was well explained.

Part (c) 9 marks

Most candidates were able to give clear answers and included diagrams, graphs, tables and flow charts, although the poorer responses were unable to provide three.

Some candidates had difficulty writing a response that addressed the area of study outlined in the stem of the question.

A small but significant number of candidates ignored the instructions and wrote out their talk. Poorer candidates provided a list of items but failed to explain the concepts.

A small number of candidates failed to use the marks allocated to this part of the question as an indicator of the depth of their response.

Part (d) 2 marks

Many candidates gave clear answers and used examples to illustrate their answer. Poorer responses often gave examples of how their study had increased their understanding but did not link it to how it had increased their understanding of the *relationship* between science and society.