BOARD OF STUDIES
NEW SOUTH WALES

HIGHER SCHOOL CERTIFICATE EXAMINATION

1997

GENERAL SCIENCE

2 UNIT

Time allowed—Three hours
(Plus 5 minutes reading time)

DIRECTIONS TO CANDIDATES

- Board-approved calculators may be used.

Section I—Core

- Attempt ALL questions.
- **Part A** 15 multiple-choice questions, each worth 1 mark.
  Mark your answers in pencil on the Answer Sheet provided.
- **Part B** 10 questions, each worth 3 marks.
  Answer this Part in the Part B Answer Book.
- **Part C** 6 questions, each worth 5 marks.
  Answer this Part in the Part C Answer Book.
- Write your Student Number and Centre Number on each Answer Book.
- You may keep this Question Book. Anything written in the Question Book will NOT be marked.

Section II—Electives

- Attempt ONE question.
- Each question is worth 25 marks.
- Answer the question in a *separate* Elective Answer Book.
- Write your Student Number and Centre Number on the cover of each Elective Answer Book.
- Write the Course, Elective Name, and Question Number on the cover of each Elective Answer Book.
- You may ask for extra Elective Answer Books if you need them.

SECTION I—CORE

(75 Marks)

Attempt ALL questions.

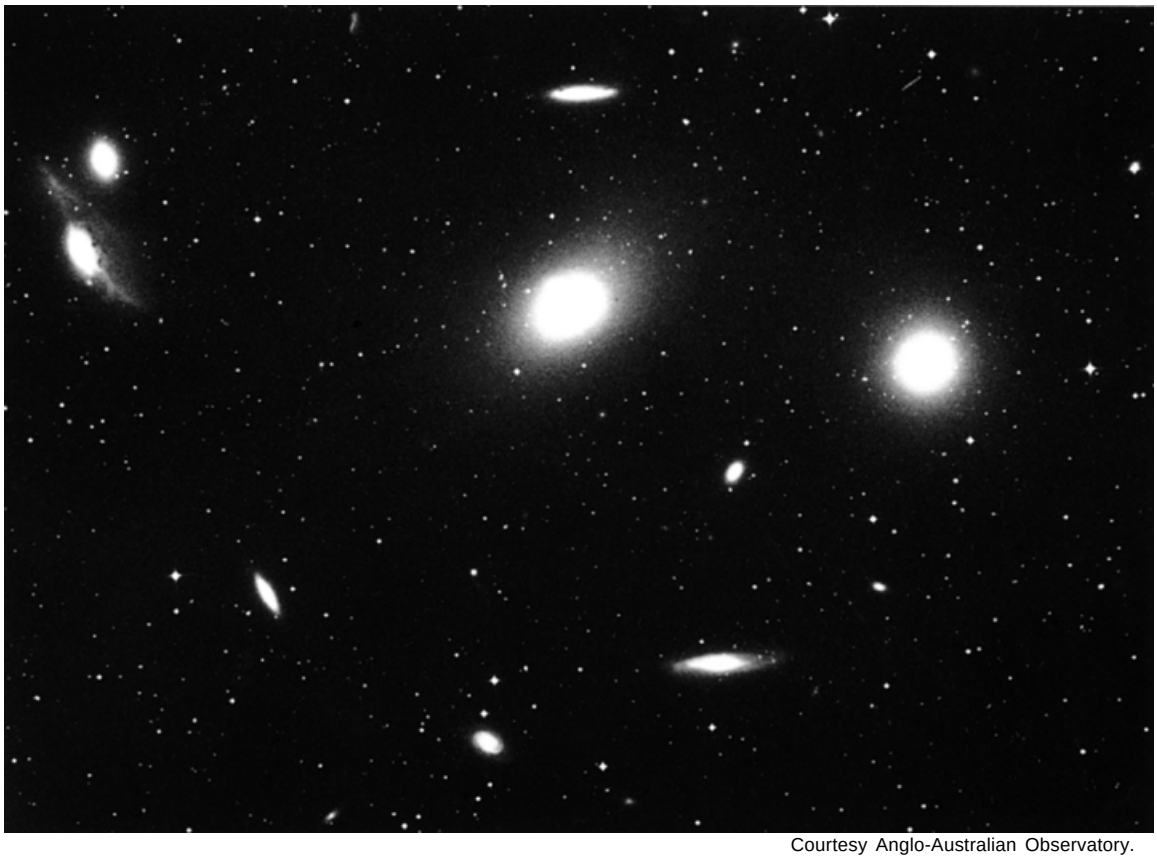
PART A

Questions 1–15 are worth 1 mark each.

Mark your answers in pencil on the Answer Sheet provided.

Select the alternative A, B, C, or D that best answers the question.

1 . This picture was taken by telescopes at the Anglo-Australian Observatory. The nine large features represent objects fifty million light years away from Earth.



Courtesy Anglo-Australian Observatory.

These nine features represent

(A) asteroids.

(B) galaxies.

(C) moons.

(D) planets.

2 . The shape of the Moon appears to change on a regular cycle. These phases of the moon occur because

(A) the same side of the Moon always faces the Earth.

(B) the Moon is always between the Earth and the Sun.

(C) different amounts of the bright half of the Moon face the Earth.

(D) the shadow of the Earth is passing across the face of the Moon.

3 . Plato's major contribution to astronomy was his

(A) accurate measurements of the positions of stars, planets, and moons.

(B) idea that the planets' orbits are elliptical rather than circular.

(C) idea that explanations should be judged by how well they fit the observations.

(D) idea that the Sun is the centre of the solar system.

4 . Models are often used by scientists when they are developing theories. One example would be models of the universe. Which of the following statements about models is correct?

(A) A commonly accepted model can never be changed.

(B) If some measurements do not fit a model, then these measurements are wrong.

(C) Models are rarely based on observations and knowledge.

(D) A model can be used to make predictions.

5 . *Homo erectus* made cultural advances. One of these was

(A) burying their dead.

(B) cave paintings.

(C) making musical instruments.

(D) use of fire.

6 . A study of physical characteristics of primates and other animals indicates that

(A) humans and apes are not related to each other.

(B) humans are more similar to apes than to other animals.

(C) humans live on the ground, while all primates live in trees.

(D) humans are not primates, but are more similar to other animals.

7 . The body of a man preserved in ice was recently discovered in the Italian Alps. Scientists have determined that the body is about 5000 years old. A copper axe was found near the body. Tattoos could still be seen on the skin. The man was probably

(A) an Australopithecus.

(B) a *Homo erectus*.

(C) a Modern Human.

(D) a Neanderthal.

8 . Fruit flies can have straight or wrinkled wings. Straight wings (W) are dominant over wrinkled wings (w). A female with wrinkled wings is fertilised by an unknown male. Of the ten offspring, eight have straight wings and two have wrinkled wings. The most likely genetic make-up of the male is

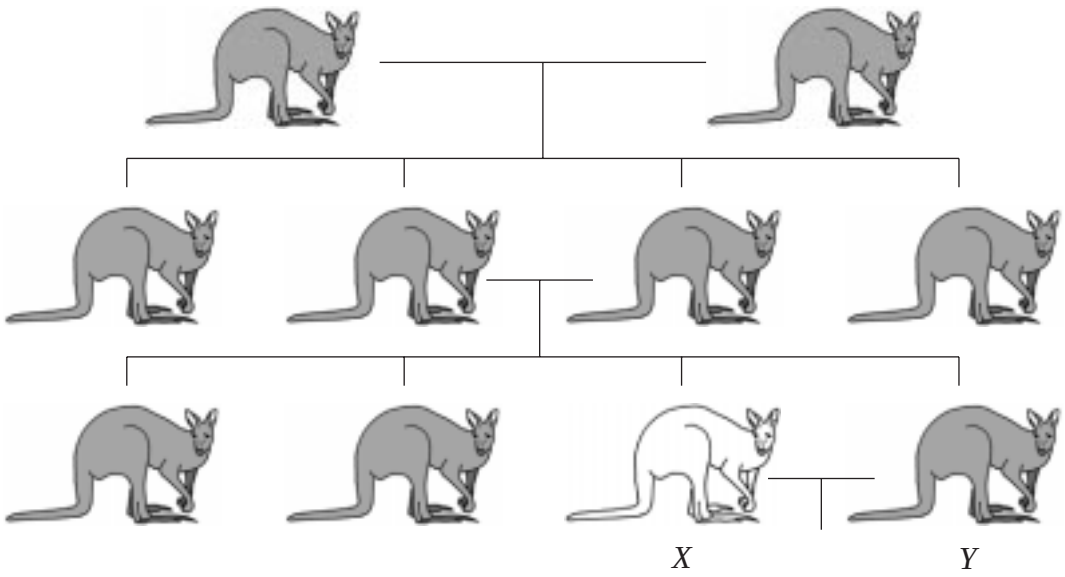
(A) WW.

(B) Ww.

(C) ww.

(D) W only.

9 . The colours of offspring in a kangaroo-breeding experiment are shown below.



From the pattern of inheritance, we can conclude that

(A) the allele for dark coat is dominant.

(B) the allele for white coat is dominant.

(C) the white kangaroo must be a mutation.

(D) all the offspring of *X* and *Y* will be white.

10. The following process is used to extract both iron and lead from their ores.

$$\text{metal ore} + \text{carbon} \xrightarrow{\text{heat}} \text{metal} + \text{carbon dioxide}$$

However, lead can be extracted more easily than iron. The main reason for this is that

(A) less energy is needed to extract an active metal.
(B) more energy is needed to extract an active metal.
(C) more energy is needed to extract a metal of low activity.
(D) no energy is needed to extract a metal of high activity.

11. Which of the following groups does NOT contain any polymers?

(A) Glass, gold, and rubber.
(B) Plastic, copper, and aluminium.
(C) Rubber, zinc, and wool.
(D) Silver, glass, and iron.

12. In an experiment to test engine efficiency, two engines with the same power output were run under identical test conditions. Each engine started with one litre of fuel. At the end of the trial, engine *A* had 450 mL of fuel remaining and engine *B* had 380 mL of fuel remaining. These results suggest that

(A) engine *A* is more efficient than engine *B.*
(B) the two engines have the same efficiency.
(C) engine *B* is more efficient than engine *A.*
(D) no conclusion can be drawn on engine efficiency.

13. An hypothesis is *best* described as

(A) a proven explanation of an observation.
(B) a scientific law.
(C) a theory that has been proved false.
(D) an unproven explanation of an observation.

14. Jihan wanted to test her idea that Maths students would perform worse in an examination if they did not eat breakfast.

The *best* control group for this experiment would be one that

(A) ate breakfast and attempted the same examination as the test group.

(B) ate breakfast and attempted similar questions to those of the test group.

(C) did not eat breakfast and attempted the same examination as the test group.

(D) did not eat breakfast and attempted similar questions to those of the test group.

15. Scientists developing new drugs do not usually test them on people until many other tests have been performed. This is mostly because

(A) the results of tests can be inaccurate.

(B) untested drugs can be harmful to people.

(C) there are few scientific facts to be learnt.

(D) control groups are difficult to arrange.

PART B

Questions 16–25 are worth 3 marks each.

Answer this Part in the Part B Answer Book.

16. An unidentified animal is handed in at a zoo. It is a fur-covered animal with forward pointing eyes, a relatively large brain, and a bushy tail.

(a) What other piece of evidence is needed to identify it as a primate?

(b) Give ONE reason why forward pointing eyes are more suited to most primate lifestyles than eyes on the side of the head?

(c) (i) Is the animal an ape?

(ii) Explain your answer.

17. Remains of skeletons of Cro-Magnon people indicate they were physically similar to Modern Humans. However, Cro-Magnon artefacts indicate that they had a different culture to Modern Humans.

(a) State ONE advance in technology used by Modern Humans, but not by Cro-Magnon people. Briefly describe how this advance helped Modern Humans to survive.

(b) List TWO aspects of culture that are common to BOTH Cro-Magnon people and Modern Humans.

18. The table below shows human blood types:

Blood type	*Possible allele pairs*	*% of Australian population*
A	$I^A I^A$ OR I^A i	38
B	$I^B I^B$ OR I^B i	10
AB	$I^A I^B$ ONLY	3
O	i i ONLY	49

(a) Explain why a person with an allele pair I^A i will have type A blood.

(b) If the parents of a child have allele pairs I^A I^B and i i, what *blood types* are possible in the child?

(c) Type AB blood is less common than *either* type A *or* type B blood. Explain why.

19. Natural rubber, wool, and cotton each have properties that make them useful in our society. Choose ONE of these materials, and answer the questions below.

(a) Name ONE property of this material.

(b) Explain how this property makes it useful in modern society.

(c) Name a synthetic material that can be used as a suitable replacement.

20. Biosphere 2 was designed to be a sealed, self-sustaining, Earth-based station supplying its eight human occupants with all their physical needs for 2 years. Below is a picture of Biosphere 2.

'Science for living', A Skinner, Heinemann 1994, p 321. Space Biospheres Ventures. Courtesy Reed Education.

One aim of the program was to provide solutions to the problems involved in long-distance space travel.

(a) Describe ONE problem that Biosphere 2 might help to solve.

(b) Describe ONE way in which Biosphere 2 is like a space station.

(c) Describe ONE problem of space travel that the Biosphere 2 project could *not* solve.

21. You have conducted a practical investigation to illustrate the apparent movement of the moon over a period of at least two weeks.

(a) Describe the procedure that you used in the investigation.

(b) State the results that you obtained. You may use diagrams to illustrate your answer.

22. The Theory of Evolution by Natural Selection was first proposed independently by two British scientists.

(a) Name the TWO scientists who proposed this theory of evolution.

(b) Briefly describe ONE argument that was used in the nineteenth century to oppose this theory.

23. You have carried out an investigation to illustrate the efficiency of a simple machine such as a lever or a pulley.

(a) Describe what you did. You may include a diagram.

(b) Show how you calculated the efficiency of the machine.

24. You have been asked to plan an experiment to test the Theory of Evolution by Natural Selection.

(a) Briefly describe the experiment you planned.

(b) Briefly describe the results that would support the Theory of Evolution by Natural Selection.

(c) Give ONE reason why it would be difficult to *conduct* this experiment.

25. You have made a small sample of glass in the laboratory.

(a) What materials did you use to make your sample of glass?

(b) Briefly describe how you made the glass. You may include a diagram.

(c) Describe ONE safety precaution you should take during this process.

PART C

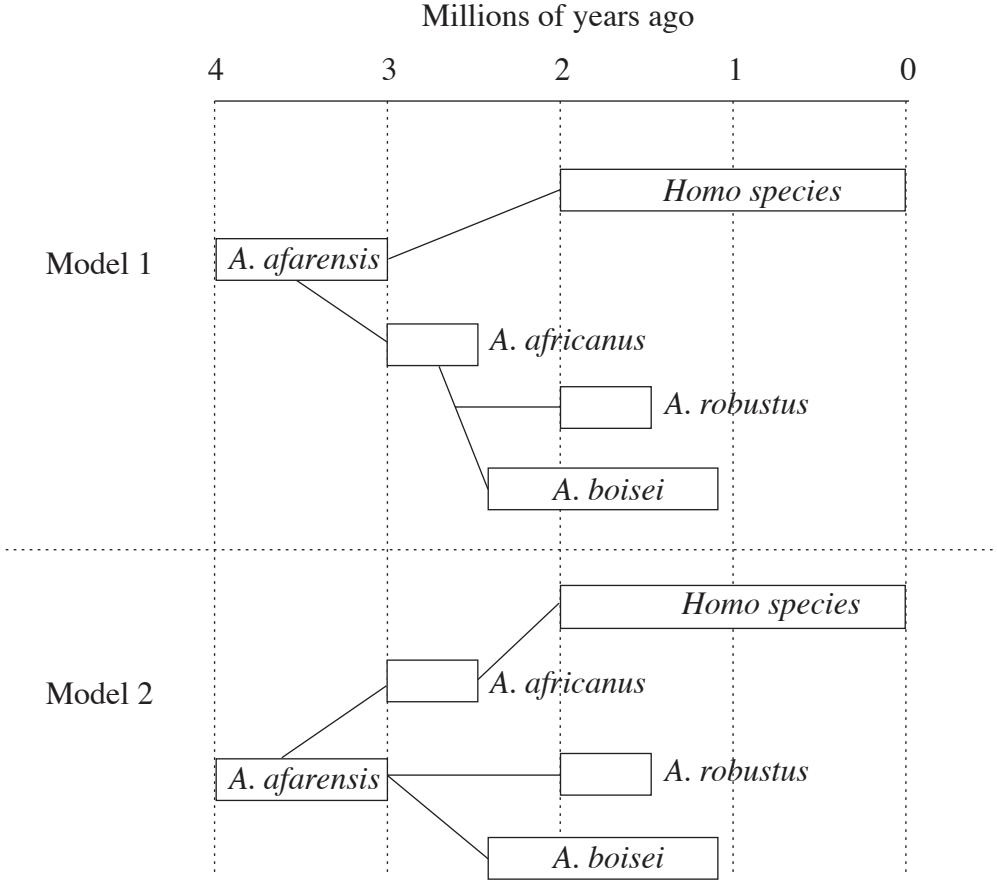
Questions 26–31 are worth 5 marks each.

Answer this Part in the Part C Answer Book.

26. Fossil evidence suggests that early humans first appeared about 2 million years ago. One of these types of early humans has been named *Homo erectus* by scientists.

Remains of four distinct groups of ape-like primates have been discovered in the same area. Scientists have named these ape-like primates *Australopithecus*. The species of *Australopithecus* are named *A. afarensis*, *A. africanus*, *A. robustus* and *A. boisei*.

Two of the models that have been proposed to show the evolutionary relationship between *Australopithecus* and *Homo* are shown below.



'Apes and Ancestors', Martin Hanson, Longman Paul Ltd, 1991 p66.

(a) On which continent were the earliest human remains discovered?

(b) (i) Which two species of *Australopithecus* are shown in both models as NOT being ancestors of humans?

(ii) Which species is shown in both models as an ancestor of humans?

(c) Briefly describe ONE piece of evidence suggesting that early humans such as *Homo erectus* made and used tools.

(d) State ONE reason why two models could be proposed, based on the same evidence.

27. The telescope was first made by Zacharias Jansen at the end of the sixteenth century. Telescopes were used for astronomy by Galileo Galilei in the early seventeenth century.

(a) Describe TWO discoveries about our solar system made possible by the invention of the telescope.

(b) Describe the effect of ONE of these discoveries on our understanding of the solar system.

(c) (i) Describe another technique used by scientists in gaining knowledge of the solar system.

(ii) What advantage does this technique have, compared to a simple telescope?

28. J. Robert Oppenheimer's work contributed to an understanding of nuclear energy. He knew that his discoveries might be used for both peaceful and destructive purposes. During the Second World War, he worked on the United States atomic bomb project. Now nuclear energy is used to provide electricity.

(a) Give ONE reason why some people might think Oppenheimer

(i) should be held accountable for the harmful effects of nuclear energy;

(ii) should NOT be held accountable for the harmful effects of nuclear energy.

(b) (i) Apart from nuclear energy and the atomic bomb, name a scientific discovery that has been both helpful *and* harmful.

(ii) Describe how this discovery has been helpful.

(iii) Describe how this discovery has been harmful.

29. Read the following article before answering the questions below.

‘Super bugs on the rise!’

Penicillin, the first antibiotic, was discovered by Sir Alexander Fleming in London in 1928. The substance is derived from the penicillium mould that occurs naturally in soil. Twelve years later, Sir Howard Florey of Australia showed that penicillin could be purified and safely used in the human body.

Today, antibiotics are mass produced and widely used to treat bacterial infections and disease. Many antibiotics have been isolated. Each has a specific group of organisms that it targets. Penicillin is still the most widely used antibiotic. Scientists discovered that the addition of antibiotics and vitamin B_{12} to the feed of chickens and livestock, particularly pigs, makes them grow faster. Antibiotics are also used as crop sprays to prevent the disease *blight*.

One side effect of this use of antibiotics is the emergence of resistant strains of bacteria, or so-called ‘super bugs’.

(a) What is an antibiotic?

(b) What type of living thing causes *blight*?

(c) Use the information in the article to describe how ‘super bugs’ can develop.

(d) What is ONE advantage to our society of controlling disease in crops?

30. The pipes in the photograph below are used to transport waste. They are made from a plastic known as PVC.

'Concepts of Science', 3rd edn, Cull & Drake, Jacaranda 1981, p154.

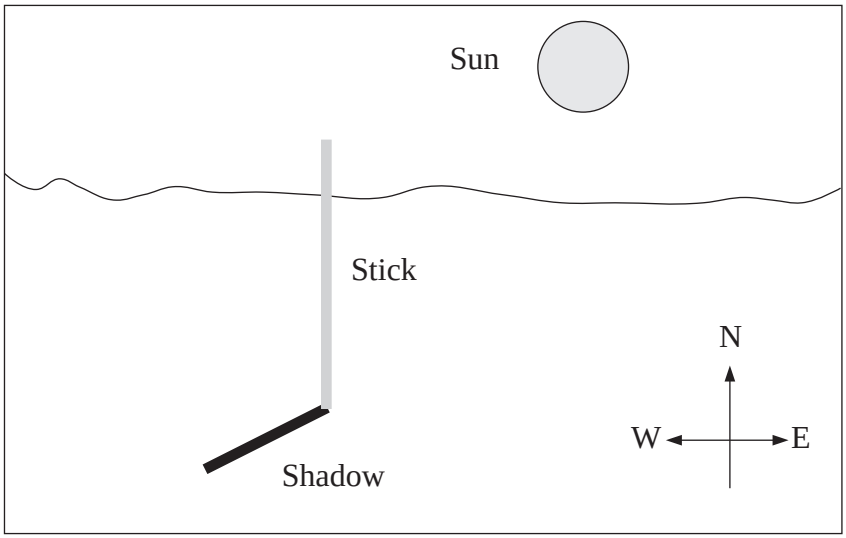
(a) List TWO advantages of using plastic for this purpose instead of metal.

(b) State ONE advantage of using metal pipes instead of plastic pipes for this purpose.

(c) (i) State ONE use of metals for which plastic would NOT be suitable.

(ii) What property of metals makes them suitable for this use?

3 1 . A straight stick stuck vertically in the ground is a simple piece of astronomical equipment.



The diagram shows the shadow of the stick at a particular time on a Spring day.

The shadow can be used to determine the Earth's position in its orbit around the Sun.

(a) (i) Describe the length of the shadow at the same time of day in the middle of Summer.

(ii) Explain why this would be so.

(iii) In which direction will the shadow move during the day?

(b) Many astronomers have contributed to our current understanding of the solar system. Astronomers Kepler and Copernicus both developed models of the solar system.

(i) Describe ONE difference between their models.

(ii) Describe ONE way in which their models were similar.

SECTION II—ELECTIVES

(25 Marks)

Attempt ONE question.

Answer the question in a *separate* Elective Answer Book.

Write your Student Number and Centre Number on the cover of each Elective Answer Book.

Write the Course, Elective Name and Question Number on the cover of each Elective Answer Book.

The questions for each Elective start on the page given after the Elective Name.

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QUESTION 32. Colour **Marks**

(a) In your study of colour you carried out laboratory work. **7**

Choose ONE topic, and write it as a heading.

Either

- The physics of colour.

Or

- Colour and living things.

Describe ONE experiment you did during your investigation of this topic. Write a report of your investigation that would allow the experiment to be repeated by a General Science student next year.

(b) You have used a number of scientific terms in your study of this elective that help describe what you have learnt. **5**

(i) Explain the meaning of the TWO terms below:

1. spectra;

2. trichromatism.

(ii) List TWO other terms used in your study, and explain what *each* term means.

(c) Laboratory work relies on scientific equipment or procedures to improve our understanding. **7**

Choose ONE OTHER investigation you did in this elective that used scientific equipment or procedures. Describe:

(i) what you were trying to find out;

(ii) the equipment you used;

(iii) what you did to help make your results reliable;

(iv) any problems you had, or allowed for, in the investigation;

(v) the results you obtained from the experiment.

(d) List items of information you learnt from your study of behavioural reactions to colour. You may include diagrams and tables in your answer. **6**

QUESTION 33. Metals in the Service of People **Marks**

(a) In your study of metals in the service of people, you carried out laboratory work. **7**

Choose ONE topic and write it as a heading.

Either

- Modern methods of extraction.

Or

- Uses of metals related to their particular properties.

Describe ONE experiment you did during your investigation of this topic. Write a report of your investigation that would allow the experiment to be repeated by a General Science student next year.

(b) You have used a number of scientific terms in your study of this elective that help describe what you have learnt. **5**

(i) Explain the meaning of the TWO terms below:

1. conductivity;

2. alloy.

(ii) List TWO other terms used in your study, and explain what *each* term means.

(c) Laboratory work relies on scientific equipment or procedures to improve our understanding. **7**

Choose ONE OTHER investigation you did in this elective that used scientific equipment or procedures. Describe:

(i) what you were trying to find out;

(ii) the equipment you used;

(iii) what you did to help make your results reliable;

(iv) any problems you had, or allowed for, in the investigation;

(v) the results you obtained from the experiment.

(d) List items of information you learnt from your study of the discovery and use of metals. You may include diagrams and tables in your answer. **6**

QUESTION 34. Optics **Marks**

(a) In your study of optics, you carried out laboratory work. **7**

Choose ONE topic and write it as a heading.

Either

- Image formation by mirrors and lenses.

Or

- Multicomponent optical systems.

Describe ONE experiment you did during your investigation of this topic. Write a report of your investigation that would allow the experiment to be repeated by a General Science student next year.

(b) You have used a number of scientific terms in your study of this elective that help describe what you have learnt. **5**

(i) Explain the meaning of the TWO terms below:

1. diffraction;

2. hologram.

(ii) List TWO other terms used in your study, and explain what *each* term means.

(c) Laboratory work relies on scientific equipment or procedures to improve our understanding. **7**

Choose ONE OTHER investigation you did in this elective that used scientific equipment or procedures. Describe:

(i) what you were trying to find out;

(ii) the equipment you used;

(iii) what you did to help make your results reliable;

(iv) any problems you had, or allowed for, in the investigation;

(v) the results you obtained from the experiment.

(d) List items of information you learnt from your study of the wave properties of light. You may include diagrams and tables in your answer. **6**

QUESTION 35. Petroleum and its Compounds **Marks**

(a) In your study of petroleum and its compounds, you carried out laboratory work. **7**

Choose ONE topic and write it as a heading.

Either

- The extraction of fuels from petroleum.

Or

- The properties and uses of the distillation products of petroleum.

Describe ONE experiment you did during your investigation of this topic. Write a report of your investigation that would allow the experiment to be repeated by a General Science student next year.

(b) You have used a number of scientific terms in your study of this elective that help describe what you have learnt. **5**

(i) Explain the meaning of the TWO terms below:

1. cracking;

2. synthetic.

(ii) List TWO other terms used in your study, and explain what *each* term means.

(c) Laboratory work relies on scientific equipment or procedures to improve our understanding. **7**

Choose ONE OTHER investigation you did in this elective that used scientific equipment or procedures. Describe:

(i) what you were trying to find out;

(ii) the equipment you used;

(iii) what you did to help make your results reliable;

(iv) any problems you had, or allowed for, in the investigation;

(v) the results you obtained from the experiment.

(d) List items of information you learnt from your study of the formation of petroleum in the Earth's crust. You may include diagrams and tables in your answer. **6**

QUESTION 36. Physiology of the Senses **Marks**

(a) In your study of physiology of the senses, you carried out laboratory work. **7**

Choose ONE topic and write it as a heading.

Either

- Structure and function of the main sense organs.

Or

- Internal receptors.

Describe ONE experiment you did during your investigation of this topic. Write a report of your investigation that would allow the experiment to be repeated by a General Science student next year.

(b) You have used a number of scientific terms in your study of this elective that help describe what you have learnt. **5**

(i) Explain the meaning of the TWO terms below:

1. impulse;

2. cochlea.

(ii) List TWO other terms used in your study, and explain what *each* term means.

(c) Laboratory work relies on scientific equipment or procedures to improve our understanding. **7**

Choose ONE OTHER investigation you did in this elective that used scientific equipment or procedures. Describe:

(i) what you were trying to find out;

(ii) the equipment you used;

(iii) what you did to help make your results reliable;

(iv) any problems you had, or allowed for, in the investigation;

(v) the results you obtained from the experiment.

(d) List items of information you learnt from your study of malfunctions of the sense organs. You may include diagrams and tables in your answer. **6**

QUESTION 37. Reproduction in Animals and Plants **Marks**

(a) In your study of reproduction in animals and plants, you carried out laboratory work. **7**

Choose ONE topic and write it as a heading.

Either

- Sexual and asexual reproduction.

Or

- A detailed study of reproduction in at least ONE animal and ONE plant.

Describe ONE experiment you did during your investigation of this topic. Write a report of your investigation that would allow the experiment to be repeated by a General Science student next year.

(b) You have used a number of scientific terms in your study of this elective that help describe what you have learnt. **5**

(i) Explain the meaning of the TWO terms below:

1. gamete;

2. ovary.

(ii) List TWO other terms used in your study, and explain what *each* term means.

(c) Laboratory work relies on scientific equipment or procedures to improve our understanding. **7**

Choose ONE OTHER investigation you did in this elective that used scientific equipment or procedures. Describe:

(i) what you were trying to find out;

(ii) the equipment you used;

(iii) what you did to help make your results reliable;

(iv) any problems you had, or allowed for, in the investigation;

(v) the results you obtained from the experiment.

(d) List items of information you learnt from your study of evolutionary trends in methods of reproduction. You may include diagrams and tables in your answer. **6**

QUESTION 38. The Insects **Marks**

(a) In your study of insects, you carried out laboratory work. **7**

Choose ONE topic and write it as a heading.

Either

- A detailed study of TWO insects.

Or

- Behaviour and communication of insects.

Describe ONE experiment you did during your investigation of this topic. Write a report of your investigation that would allow the experiment to be repeated by a General Science student next year.

(b) You have used a number of scientific terms in your study of this elective that help describe what you have learnt. **5**

(i) Explain the meaning of the TWO terms below:

1. metamorphosis;

2. segmented.

(ii) List TWO other terms used in your study, and explain what *each* term means.

(c) Laboratory work relies on scientific equipment or procedures to improve our understanding. **7**

Choose ONE OTHER investigation you did in this elective that used scientific equipment or procedures. Describe:

(i) what you were trying to find out;

(ii) the equipment you used;

(iii) what you did to help make your results reliable;

(iv) any problems you had, or allowed for, in the investigation;

(v) the results you obtained from the experiment.

(d) List items of information you learnt from your study of the biological success of insects. You may include diagrams and tables in your answer. **6**

QUESTION 39. The Science of Food Technology **Marks**

(a) In your study of the science of food technology, you carried out laboratory work. **7**

Choose ONE topic and write it as a heading.

Either

- Factors causing deterioration.

Or

- The physical and chemical effects of cooking on food.

Describe ONE experiment you did during your investigation of this topic. Write a report of your investigation that would allow the experiment to be repeated by a General Science student next year.

(b) You have used a number of scientific terms in your study of this elective that help describe what you have learnt. **5**

(i) Explain the meaning of the TWO terms below:

1. freeze drying;

2. fermentation.

(ii) List TWO other terms used in your study, and explain what *each* term means.

(c) Laboratory work relies on scientific equipment or procedures to improve our understanding. **7**

Choose ONE OTHER investigation you did in this elective that used scientific equipment or procedures. Describe:

(i) what you were trying to find out;

(ii) the equipment you used;

(iii) what you did to help make your results reliable;

(iv) any problems you had, or allowed for, in the investigation;

(v) the results you obtained from the experiment.

(d) List items of information you learnt from your study of scientific principles applied to food packaging. You may include diagrams and tables in your answer. **6**

QUESTION 40. The Scientific Basis of Photography **Marks**

(a) In your study of the scientific basis of photography, you carried out laboratory work. **7**

Choose ONE topic and write it as a heading.

Either

- The working of a simple camera.

Or

- The techniques of developing and printing.

Describe ONE experiment you did during your investigation of this topic. Write a report of your investigation that would allow the experiment to be repeated by a General Science student next year.

(b) You have used a number of scientific terms in your study of this elective that help describe what you have learnt. **5**

(i) Explain the meaning of the TWO terms below:

1. aperture;

2. exposure.

(ii) List TWO other terms used in your study, and explain what *each* term means.

(c) Laboratory work relies on scientific equipment or procedures to improve our understanding. **7**

Choose ONE OTHER investigation you did in this elective that used scientific equipment or procedures. Describe:

(i) what you were trying to find out;

(ii) the equipment you used;

(iii) what you did to help make your results reliable;

(iv) any problems you had, or allowed for, in the investigation;

(v) the results you obtained from the experiment.

(d) List items of information you learnt from your study of the chemical basis of the photographic process. You may include diagrams and tables in your answer. **6**

QUESTION 41. Water **Marks**

(a) In your study of water, you carried out laboratory work. **7**

Choose ONE topic and write it as a heading.

Either

- The physical and chemical properties of water.

Or

- The importance of water in living systems.

Describe ONE experiment you did during your investigation of this topic. Write a report of your investigation that would allow the experiment to be repeated by a General Science student next year.

(b) You have used a number of scientific terms in your study of this elective that help describe what you have learnt. **5**

(i) Explain the meaning of the TWO terms below:

1. osmosis;

2. weathering.

(ii) List TWO other terms used in your study, and explain what *each* term means.

(c) Laboratory work relies on scientific equipment or procedures to improve our understanding. **7**

Choose ONE OTHER investigation you did in this elective that used scientific equipment or procedures. Describe:

(i) what you were trying to find out;

(ii) the equipment you used;

(iii) what you did to help make your results reliable;

(iv) any problems you had, or allowed for, in the investigation;

(v) the results you obtained from the experiment.

(d) List items of information you learnt from your study of problems associated with the shortage of water. You may include diagrams and tables in your answer. **6**

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