BOARD OF STUDIES
NEW SOUTH WALES

HIGHER SCHOOL CERTIFICATE EXAMINATION

1996

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 .

The above picture was taken with the use of an astronomical telescope and camera. The main feature is a

(A) star.

(B) galaxy.

(C) nebula.

(D) planetary solar system.

2 . More fuel would be consumed during an *extended* space flight carrying astronauts if

(A) the spacecraft were made lighter.

(B) the spacecraft took off from a much lighter planet than the Earth.

(C) fewer astronauts were aboard.

(D) water-recycling systems were not used.

3 . The Hubble space telescope is an optical telescope orbiting the Earth. It is producing clearer pictures of distant celestial objects than telescopes on Earth do. This is because it

(A) is above the atmosphere.

(B) is closer to the objects.

(C) orbits the Earth.

(D) has a larger mirror.

4 . The Sun appears to move from east to west across the sky each day. This is because

(A) the Earth revolves around the Sun.

(B) the Earth rotates on its axis towards the west.

(C) the Earth rotates on its axis towards the east.

(D) the Sun revolves around the Earth.

5 . Which of the following characteristics *best* distinguishes modern humans from apes?

(A) Opposable thumb.

(B) Complex language.

(C) Lack of a tail.

(D) Living in groups.

6 . Caves throughout Europe contain evidence of occupation by both Neanderthal people and Cro-Magnon people. Of these two peoples, evidence showing that a site was used by Cro-Magnon people would be the discovery of

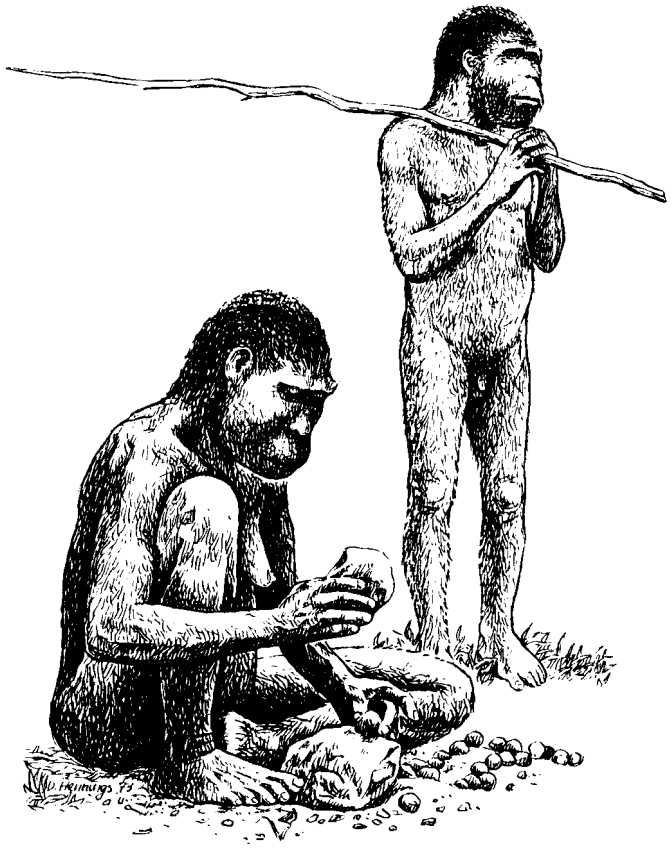
(A) a fireplace.

(B) burial of dead.

(C) stone tools.

(D) cave paintings.

7. The diagram below shows the reconstruction of an adult female *Australopithecus africanus* cracking nuts with a stone, while a male stands guard with a wooden spear.



Which of the following provides direct evidence for this reconstruction?

(A) Scientists observing these individuals in an isolated part of South Africa.

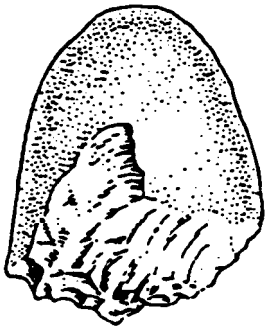
(B) Scientists finding fossils of *Australopithecus* near stones that had been used as hammers.

(C) A cave painting done by these individuals, showing this type of activity.

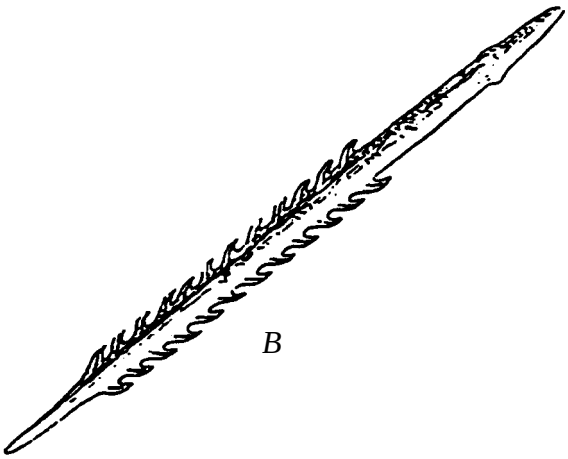
(D) The discovery of fireplaces that could be used for straightening wooden spears.

8 . The diagrams below show evidence of the culture of early humans.

Living Prehistory, SG and TW McKern, Cummings Publishing Co, 1974 pp 138/206/208/216/125.
Illustrations: D&V Hennings.

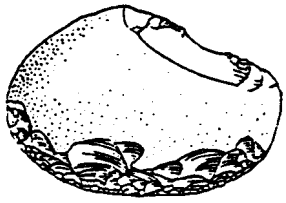


A



B

C



D

The order of evidence from most primitive to most advanced culture is

(A) $A \rightarrow D \rightarrow C \rightarrow B$

(B) $B \rightarrow C \rightarrow A \rightarrow D$

(C) $C \rightarrow A \rightarrow B \rightarrow D$

(D) $D \rightarrow C \rightarrow A \rightarrow B$

9 . Metals such as copper and aluminium have had a great effect on our culture. One reason is because they

(A) are poor conductors of heat.

(B) can be drawn or beaten into different shapes.

(C) are poor conductors of electricity.

(D) can be found as pure metals in nature.

10. The Australian scientist Howard Florey discovered the use of penicillin. The discovery resulted from Alexander Fleming's observation that

(A) a fungus stopped growing around a virus.

(B) a virus stopped growing around a fungus.

(C) bacteria stopped growing around a fungus.

(D) a fungus stopped growing around bacteria.

11. Copper weapons were used before iron weapons because

(A) copper is more chemically active than iron.

(B) copper does not rust.

(C) iron is found mostly in a pure state in nature.

(D) iron is more chemically active than copper.

12. Small insects living in sandy deserts are usually brown. Scientists would have used Darwin's theory of evolution to explain this observation by saying that

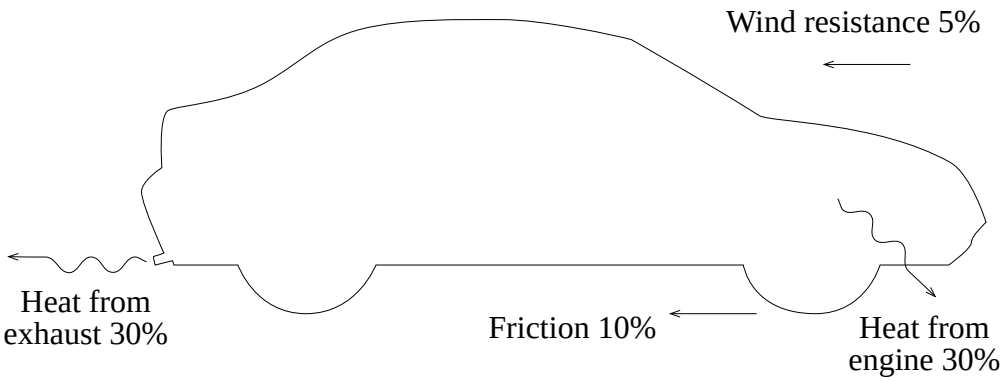
(A) the insect changed its colour to hide from birds.

(B) the colour is caused by the insect's diet.

(C) brown insects can hide from birds more successfully.

(D) chemicals from the sand soak into the insects to make them brown.

13. The burning of fuel supplies energy to move a car. The diagram below shows the percentage of energy lost as heat, and through frictional forces, by a moving car.



The efficiency of the car is

(A) 25%

(B) 40%

(C) 60%

(D) 75%

14. Many scientists perform several different experiments, and obtain results which do *not* agree with a certain theory. We could conclude that

(A) the theory has been disproved.

(B) the experiments are poorly designed.

(C) the theory should not have been proposed.

(D) no change in the theory is needed.

15. A toy manufacturer needed a new material to produce gear wheels for a toy car. Four materials were suggested.

Material	*Property*
A	• Strong, will stretch • High electrical resistance • Water vapour can pass through
B	• Tough, resists wear • Low friction • Water vapour can pass through
C	• Cracks if heated or dropped • Water vapour cannot pass through • Does not react with acids and alkalis
D	• Air and water cannot pass through • Shrinks when heated • Flexible

Based on the properties above, which material would be most useful?

(A) *A*

(B) *B*

(C) *C*

(D) *D*

PART B

Questions 16–25 are worth 3 marks each.
Answer this Part in the Part B Answer Book.

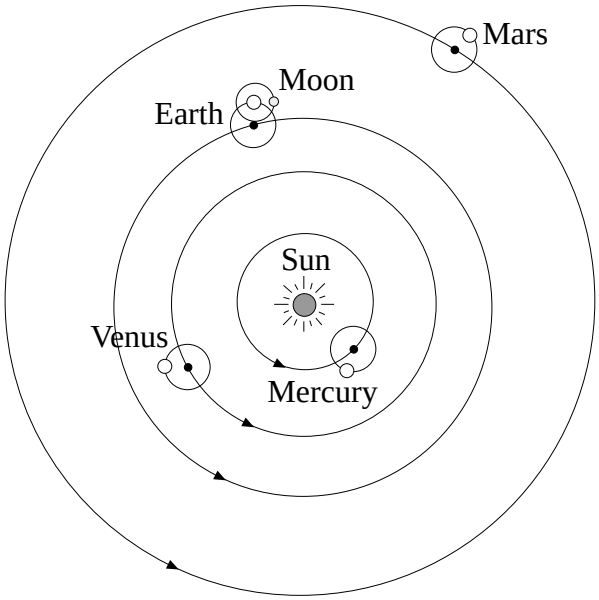
16. You have been asked to make a two-week study of the Moon's movement in the sky.

(a) How did you describe the position of the Moon in the sky on each observation?

(b) What other information MUST be recorded at each observation?

(c) Describe ONE thing you learnt about the movement of the moon over a two-week period.

17. A sixteenth-century model of the solar system is shown below.



(a) Describe the orbits of the planets around the Sun in:

(i) the sixteenth-century model above;

(ii) the twentieth-century model.

(b) Describe the contribution of ONE scientist to the development of the current model from this sixteenth-century model of the solar system.

18. (a) Describe ONE feature all polymers have in common.

(b) Wool is a natural polymer. State TWO properties of wool that make it useful in clothing.

(c) Name ONE synthetic polymer that is replacing wool for some clothing.

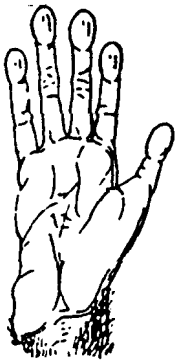
19. Genetic engineering is a recent scientific development.

(a) Give TWO examples to show how genetic engineering has been beneficial to humans.

(b) Give ONE possible risk of research in genetic engineering.

20. Diagrams of the foot and hand of a lemur and of a human are shown below. The diagrams are not to scale.

Living Prehistory, SG and TW McKern, Cummings Publishing Co, 1974 pp 138/206/208/216/125.
Illustrations: D&V Hennings.

	Lemur	Human
Hand		
Foot		

(a) (i) Describe ONE difference in the hands of these two primates.

(ii) How does this characteristic help the *human* survive in its environment.

(b) (i) Describe ONE difference in the feet of these two primates.

(ii) How does this characteristic help the *lemur* survive in its environment.

21. The introduction of each of the following marked a change in human culture.

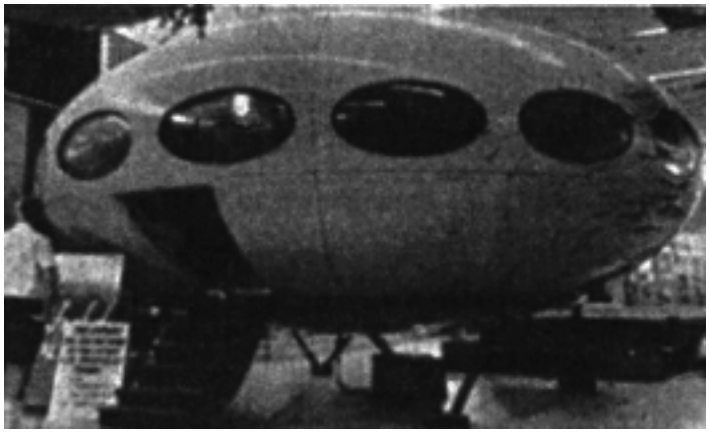
- flint piece
- printing-press
- fireplace
- bronze arrowhead
- bone needle.

(a) Place these objects in order from earliest to most recent introduction.

(b) Choose any TWO of the objects. Briefly describe how each improved a group's ability to survive.

22. This house, designed for use at a snow or beach resort, is made from a plastic.

'Concepts of Science 4', Cull & drake, Jacaranda 1970, p154.



(a) List TWO advantages of using plastic to make a house.

(b) List ONE disadvantage of using plastic to make a house.

(c) Name a synthetic polymer that could be used in the windows instead of glass.

23. Scientific discoveries can help or harm our society.

(a) When considering the introduction of a new pesticide, state ONE issue scientists should consider.

(b) State an effect of the use of antibiotics that is:

(i) helpful;

(ii) harmful.

24. Lee wanted to see which was the most efficient way to move a block of wood across a table. Lee tried three methods of moving the block, and recorded the results in the table below.

Method	*Energy in* (J)	*Work out* (J)
A	200	100
B	150	100
C	50	100

(a) (i) In which method *must* Lee have recorded the results incorrectly?

(ii) How do you know that this must be incorrect?

(b) (i) Which method is *least* efficient in moving the block?

(ii) Calculate the efficiency of this method. Show working.

25. In 1922, Thomas Midgley found that adding a small amount of a lead compound to petrol allowed development of a more powerful engine.

More recently, lead compounds have been shown to have a harmful effect on brain development in children.

(a) Give ONE reason why some people might think that Thomas Midgley

(i) should be held accountable for the harmful effects on children;

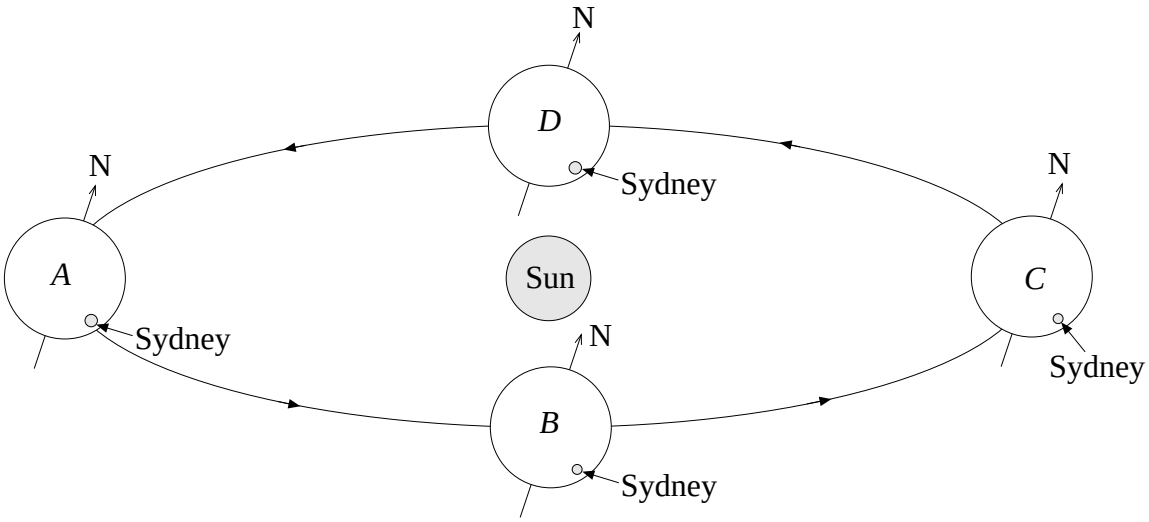
(ii) should NOT be held accountable for the harmful effects on children.

(b) Opinion polls are used to survey community attitudes to issues such as the one in part (a). Give TWO features of a well-designed opinion poll.

PART C

Questions 26–31 are worth 5 marks each.
Answer this Part in the Part C Answer Book.

26. Below is a model of the Earth as it orbits the Sun. The diagram is not to scale.



(a) In which of the four positions (*A*, *B*, *C*, *D*) above would it be:

(i) day in Sydney?

(ii) summer in Sydney?

(b) How long would it take the Earth to move from position *A* to position *B*?

(c) In this model, the Earth's axis is tilted. Give TWO effects on Sydney if the axis were not tilted.

27. Read the article below before answering the questions.

IS SOMEONE OUT THERE?

Geoffrey Marcey and Paul Butler from the American Astronomical Society have announced the discovery of two new planets orbiting stars similar to our Sun.

It is not the first discovery of planets outside our solar system. But what has made this discovery so exciting is that at least one planet might have the right conditions for water to exist and therefore could support life on it.

The stars these planets orbit are many billions of kilometres from our solar system. The planets cannot be detected directly. The only evidence is observations of tiny wobbles of the stars they orbit.

Adapted from *Time Australia*, January 1996

(a) How did the astronomers detect the planets?

(b) These planets cannot be seen with a telescope. Give TWO reasons why they cannot be seen from Earth.

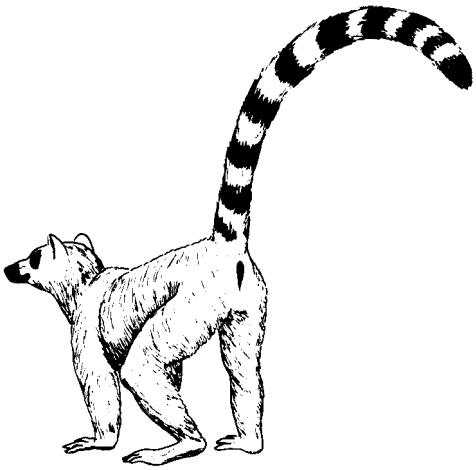
(c) At present it is not possible to visit these planets. Describe TWO problems that would need to be overcome before the voyage could be considered.

28. Use the following table of some primate families to answer part (a).

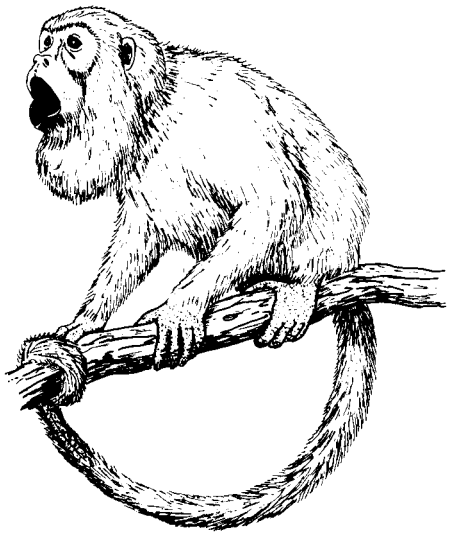
Family	*Special features*	*Head and face*	*Diet*	*Feeding habits*
Tree shrew	Clawed feet	Large eyes, long snout (nose)	Insects, grubs	Night feeder
Lemur	Cat-like body, bushy tail	Small eyes, long snout	Roots, leaves	Day feeder
Aye Aye	Very thin middle finger	Large eyes, short snout	Grubs, fruit, eggs	Night feeder
Loris	Clawed feet	Large eyes, short snout	Grubs, eggs, lizards	Day feeder
New World Monkey	Some have prehensile tails	Small eyes, flat face	Fruit, insects	Day feeder
Old World Monkey	Tails not prehensile	Small eyes, flat face	Fruit, grubs, some eat meat	Day feeder

(a) Identify the Family of *each* primate shown below.

'Apes and Ancestors', Martin Hanson, Longman Paul Ltd, 1991.
Reprinted courtesy Addison Wesley Longman NZ.



I. Active in the day. Will eat leaves, but not grubs.



II. Will eat fruit and insects, but not meat.

(b) Describe TWO features which show that animal II is a primate.

(c) Describe ONE way in which apes are different from the primate families listed in the table above.

29. A class was studying the inheritance of a human characteristic. Each student chose a characteristic known to be inherited, and collected data from their family.

Below are the results of one *female* student.

Family member	*Was the characteristic present?*
Dad's mother	No
Dad's father	No
Dad	No
Mum's mother	No
Mum's father	Yes
Mum	No
Me (a girl)	No
My sister	Yes

(a) Draw a family tree (pedigree) illustrating the inheritance of this characteristic, using the key below.

KEY

□ Unaffected male ○ Unaffected female

▨ Affected male ◍ Affected female

(b) State whether the inheritance of this characteristic is dominant or recessive. Give a reason.

(c) Describe a single human characteristic that can be studied in this way.

30. This question refers to the diagrams below.

'Everyday Science', Cull & drake, Jacaranda 1972

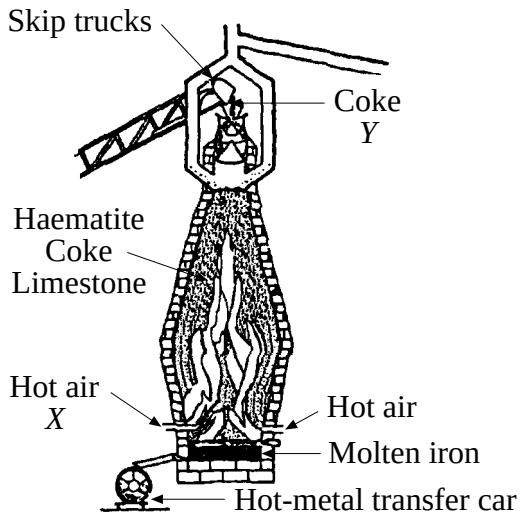


DIAGRAM A

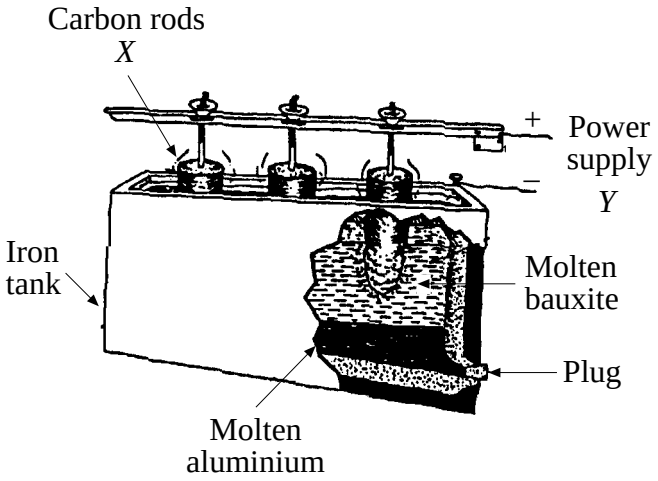


DIAGRAM B

Select ONE of the diagrams. Refer all answers to this diagram.

State the diagram you are referring to.

(a) What is the aim of the chemical process?

(b) Name the ore being used.

(c) What are the functions of the parts or materials represented by *X* and *Y* in the diagram?

(d) State ONE important property of the material produced.

31. Fossil evidence suggests that modern horses are much larger than prehistoric horses.

(a) Use Charles Darwin's theory of evolution to explain this change in size.

(b) Nineteenth-century English society strongly disagreed with Darwin's theory of evolution. State ONE objection raised at the time.

(c) In your studies, you have planned an experiment to test Darwin's theory of evolution. Briefly describe the experiment you planned.

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.

QUESTION 32. Colour

(a) List items of information that you learnt in your investigation of colour and living things. In your answer, you may include diagrams and tables.

(b) Write a report describing what you learnt in your investigation of behavioural reactions to colour.

(c) Laboratory work is an important tool in learning about our world. Choose ONE experiment you did during your investigation of:

Either

- the physics of colour;

Or

- perception of colour.

Describe the experiment you performed. Your description should include:

(i) the aim of the experiment;

(ii) what you did;

(iii) what you concluded;

(iv) an explanation of how the experiment increased your understanding of this topic.

(d) Your study of this Elective is based on laboratory work. Choose ONE OTHER experiment you did during your investigation of Colour. Describe:

(i) the aim of the experiment;

(ii) the equipment you used;

(iii) what you did to be sure your results were reliable;

(iv) any problems you had, or that you allowed for, in your experiment;

(v) the results you obtained from the experiment.

QUESTION 33. Metals in the Service of People

(a) List items of information that you learnt in your investigation of the uses of metals related to their particular properties and the methods of overcoming any difficulties associated with their use. In your answer, you may include diagrams and tables.

(b) Write a report describing what you learnt in your investigation of the discovery and use of metals by early civilisations.

(c) Laboratory work is an important tool in learning about our world. Choose ONE experiment you did during your investigation of:

Either

- modern methods of extraction and reasons for the use of the different processes;

Or

- properties of metals compared with the properties of alternative materials.

Describe the experiment you performed. Your description should include:

(i) the aim of the experiment;

(ii) what you did;

(iii) what you concluded;

(iv) an explanation of how the experiment increased your understanding of this topic.

(d) Your study of this Elective is based on laboratory work. Choose ONE OTHER experiment you did during your investigation of Metals in the Service of People. Describe:

(i) the aim of the experiment;

(ii) the equipment you used;

(iii) what you did to be sure your results were reliable;

(iv) any problems you had, or that you allowed for, in your experiment;

(v) the results you obtained from the experiment.

QUESTION 34. Optics

(a) List items of information that you learnt in your investigation of image formation by mirrors and lenses. In your answer, you may include diagrams and tables.

(b) Write a report describing what you learnt in your investigation of modern developments in optics.

(c) Laboratory work is an important tool in learning about our world. Choose ONE experiment you did during your investigation of:

Either

- the wave properties of light—reflection, refraction, diffraction, interference, and polarisation;

Or

- multicomponent optical systems, including microscopes, telescopes, and binoculars.

Describe the experiment you performed. Your description should include:

(i) the aim of the experiment;

(ii) what you did;

(iii) what you concluded;

(iv) an explanation of how the experiment increased your understanding of this topic.

(d) Your study of this Elective is based on laboratory work. Choose ONE OTHER experiment you did during your investigation of Optics. Describe:

(i) the aim of the experiment;

(ii) the equipment you used;

(iii) what you did to be sure your results were reliable;

(iv) any problems you had, or that you allowed for, in your experiment;

(v) the results you obtained from the experiment.

QUESTION 35. Petroleum and its Compounds

(a) List items of information that you learnt in your investigation of the formation of petroleum in the Earth's crust, its location, and extraction. In your answer, you may include diagrams and tables.

(b) Write a report describing what you learnt in your investigation of the production of other chemicals from petroleum and their use in making new substances.

(c) Laboratory work is an important tool in learning about our world. Choose ONE experiment you did during your investigation of:

Either

- the extraction of fuels from petroleum;

Or

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

Describe the experiment you performed. Your description should include:

(i) the aim of the experiment;

(ii) what you did;

(iii) what you concluded;

(iv) an explanation of how the experiment increased your understanding of this topic.

(d) Your study of this Elective is based on laboratory work. Choose ONE OTHER experiment you did during your investigation of Petroleum and its Compounds. Describe:

(i) the aim of the experiment;

(ii) the equipment you used;

(iii) what you did to be sure your results were reliable;

(iv) any problems you had, or that you allowed for, in your experiment;

(v) the results you obtained from the experiment.

QUESTION 36. Physiology of the Senses

(a) List items of information that you learnt in your investigation of transmission of impulses, and their reception in particular regions of the brain. In your answer, you may include diagrams and tables.

(b) Write a report describing what you learnt in your investigation of malfunctions of the sense organs.

(c) Laboratory work is an important tool in learning about our world. Choose ONE experiment you did during your investigation of:

Either

- internal receptors, including those of blood pressure, CO_2 concentration, and muscle tension;

Or

- structure and function of the main sense organs.

Describe the experiment you performed. Your description should include:

(i) the aim of the experiment;

(ii) what you did;

(iii) what you concluded;

(iv) an explanation of how the experiment increased your understanding of this topic.

(d) Your study of this Elective is based on laboratory work. Choose ONE OTHER experiment you did during your investigation of Physiology of the Senses. Describe:

(i) the aim of the experiment;

(ii) the equipment you used;

(iii) what you did to be sure your results were reliable;

(iv) any problems you had, or that you allowed for, in your experiment;

(v) the results you obtained from the experiment.

QUESTION 37. Reproduction in Animals and Plants

(a) List items of information that you learnt in your investigation of reproduction in at least one animal and one plant. In your answer, you may include diagrams and tables.

(b) Write a report describing what you learnt in your investigation of evolutionary trends in methods of reproduction.

(c) Laboratory work is an important tool in learning about our world. Choose ONE experiment you did during your investigation of:

Either

- reproduction in the main animal and plant groups;

Or

- sexual and asexual reproduction.

Describe the experiment you performed. Your description should include:

(i) the aim of the experiment;

(ii) what you did;

(iii) what you concluded;

(iv) an explanation of how the experiment increased your understanding of this topic.

(d) Your study of this Elective is based on laboratory work. Choose ONE OTHER experiment you did during your investigation of Reproduction in Animals and Plants. Describe:

(i) the aim of the experiment;

(ii) the equipment you used;

(iii) what you did to be sure your results were reliable;

(iv) any problems you had, or that you allowed for, in your experiment;

(v) the results you obtained from the experiment.

QUESTION 38. The Insects

(a) List items of information that you learnt in your investigation of the behaviour and communication of insects that live in communities. In your answer, you may include diagrams and tables.

(b) Write a report describing what you learnt in your investigation of the biological success of insects, and its implications for people.

(c) Laboratory work is an important tool in learning about our world. Choose ONE experiment you did during your investigation of:

Either

- two insects, one which has complete metamorphosis and one which has incomplete metamorphosis;

Or

- the distinguishing characteristics and classification of insects.

Describe the experiment you performed. Your description should include:

(i) the aim of the experiment;

(ii) what you did;

(iii) what you concluded;

(iv) an explanation of how the experiment increased your understanding of this topic.

(d) Your study of this Elective is based on laboratory work. Choose ONE OTHER experiment you did during your investigation of The Insects. Describe:

(i) the aim of the experiment;

(ii) the equipment you used;

(iii) what you did to be sure your results were reliable;

(iv) any problems you had, or that you allowed for, in your experiment;

(v) the results you obtained from the experiment.

QUESTION 39. The Science of Food Technology

(a) List items of information that you learnt in your investigation of methods of food preservation and their scientific bases. In your answer, you may include diagrams and tables.

(b) Write a report describing what you learnt in your investigation of scientific principles applied to food packaging.

(c) Laboratory work is an important tool in learning about our world. Choose ONE experiment you did during your investigation of:

Either

- physical and chemical effects of cooking on food;

Or

- factors causing deterioration, decay, and food spoilage.

Describe the experiment you performed. Your description should include:

(i) the aim of the experiment;

(ii) what you did;

(iii) what you concluded;

(iv) an explanation of how the experiment increased your understanding of this topic.

(d) Your study of this Elective is based on laboratory work. Choose ONE OTHER experiment you did during your investigation of The Science of Food Technology. Describe:

(i) the aim of the experiment;

(ii) the equipment you used;

(iii) what you did to be sure your results were reliable;

(iv) any problems you had, or that you allowed for, in your experiment;

(v) the results you obtained from the experiment.

QUESTION 40. The Scientific Basis of Photography

(a) List items of information that you learnt in your investigation of techniques of developing and printing. In your answer, you may include diagrams and tables.

(b) Write a report describing what you learnt in your investigation of the chemical basis of the photographic process.

(c) Laboratory work is an important tool in learning about our world. Choose ONE experiment you did during your investigation of:

Either

- the function and method of operation of various parts of a camera, such as the lens, shutter speed, and diaphragm aperture;

Or

- the structure and working of a simple camera.

Describe the experiment you performed. Your description should include:

(i) the aim of the experiment;

(ii) what you did;

(iii) what you concluded;

(iv) an explanation of how the experiment increased your understanding of this topic.

(d) Your study of this Elective is based on laboratory work. Choose ONE OTHER experiment you did during your investigation of The Scientific Basis of Photography. Describe:

(i) the aim of the experiment;

(ii) the equipment you used;

(iii) what you did to be sure your results were reliable;

(iv) any problems you had, or that you allowed for, in your experiment;

(v) the results you obtained from the experiment.

QUESTION 41. Water

(a) List items of information that you learnt in your investigation of the effects of water on the Earth's crust. In your answer, you may include diagrams and tables.

(b) Write a report describing what you learnt in your investigation of problems associated with the shortage of water.

(c) Laboratory work is an important tool in learning about our world. Choose ONE experiment you did during your investigation of:

Either

- the physical and chemical properties of water;

Or

- the importance of water in living systems.

Describe the experiment you performed. Your description should include:

(i) the aim of the experiment;

(ii) what you did;

(iii) what you concluded;

(iv) an explanation of how the experiment increased your understanding of this topic.

(d) Your study of this Elective is based on laboratory work. Choose ONE OTHER experiment you did during your investigation of Water. Describe:

(i) the aim of the experiment;

(ii) the equipment you used;

(iii) what you did to be sure your results were reliable;

(iv) any problems you had, or that you allowed for, in your experiment;

(v) the results you obtained from the experiment.