SCIENCE FOR ALL

Paper 5031/01
Multiple Choice

Question Number	*Key*	*Question Number*	*Key*
1	**B**	21	**D**
2	**A**	22	**A**
3	**C**	23	**A**
4	**D**	24	**C**
5	**C**	25	**C**
6	**D**	26	**A**
7	**C**	27	**C**
8	**D**	28	**B**
9	**D**	29	**B**
10	**A**	30	**C**
11	**C**	31	**A**
12	**B**	32	**C**
13	**D**	33	**D**
14	**B**	34	**A**
15	**B**	35	**D**
16	**C**	36	**B**
17	**B**	37	**B**
18	**C**	38	**B**
19	**A**	39	**C**
20	**A**	40	**C**

General comments

There was a small entry for this paper. The answers given by the candidates showed a spread of ability.

Questions answered well

In broad terms, both questions which tested recall of knowledge and those which required simple data processing were well answered.

Candidates answered questions well relating to:
- White blood cells (15)
- Causes of heart attacks (19)
- The effect of cross links on melting point of polymers (22)
- Food additives (23 and 36)
- Sustainable resources (31)

Questions that proved difficult

Candidates in general were well prepared for the examination. For the questions identified below there is evidence that candidates found these questions particularly difficult or may hold misconceptions in these areas. The common incorrect choices, which identify the misconceptions are identified below.

Comments on specific questions

Question 8

A common misconception was that a catalytic converter, **A**, reduced carbon emissions.

Question 9

The common incorrect choice was **B**, that generating electricity does not produce air pollution.

Question 14

Most candidates chose **A**, asteroids or **D**, planets in preference to comets.

Question 20

Few knew the meaning of density. Most incorrectly chose the description of hardness or compression strength.

Question 26

Most chose 25 which was half the horizontal axis, rather than the correct answer **A**.

Question 27

Most people read the graph and hence chose the incorrect response **A** rather than considering the data about a person's dose to process the data to give the correct response **C**.

Question 29

Most candidates believed that evidence from fossils is proof of natural selection rather than understanding that it accounts for current observations.

Question 32

Most candidates incorrectly thought that vinegar contains hydrochloric acid.

Question 38

The correct answer **B** was not commonly seen, implying confusion over interpretation of a Sankey diagram.

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Paper 5031/02
Paper 2

Key messages

Most of the candidates were well prepared for this examination. There are a few areas of the syllabus which were less well understood than others, as detailed in the comments on the responses to specific questions.

Candidates generally understood what the questions were demanding. Sometimes answers were given which had been prepared for slightly different questions on those topics. Candidates should be encouraged to read the question instructions carefully, possibly underlining the command words to fix their attention on these.

Candidates need to look carefully at the diagrams in the questions, as these frequently contain key information required to answering the question.

General comments

Biology questions were slightly better answered than Chemistry, with candidates finding Physics questions the most challenging. Candidates found **Question 8** to be the most challenging.

Comments on specific questions

Question 1

This was the most successful answered Biology question.

(a) Most candidates knew at least one symptom of Sickle Cell disease.

(b) Many candidates could suggest a possible reason for declining gene therapy.

(c)(i) The analysis of the Punnett square was usually well done.

(ii) A few candidates understood the meaning of the term *carriers*; many assumed this was synonymous with 'having an affected gene.'

(iii) Candidates were confident in using the genetic diagram to determine the percentage.

Question 2

(a) Most candidates recognised that the number of affected people in the graph rose with time; the increase in rate was not identified.

(b) An explanation for the increase in terms of more infected people having contact with others was not seen.

(c) Some candidates were able to explain the difference in treatment for bacterial diseases and Ebola.

Question 3

(a) Nearly all candidates were able to explain which bird ate which food in terms of their beak shapes and sizes.

(b) Fewer could suggest and explain reasons to support Huxley (pro-evolution) or Wilberforce (anti-evolution).

Question 4

(a)(i) Completing the balanced diagram equations proved challenging for most. Many did not realise that the number of atoms of each sort should be the same before and after the reaction.

(ii) Most candidates were able to explain oxidation.

(b) Many candidates went on to choose some of the right words to complete the sentences about nitrogen dioxide.

Question 5

(a) and **(b)**
Most candidates gave reasonable answers when comparing the properties of pure metals and alloys.

(c) Candidates found this part challenging and many could not identify the two statements. It was common to see statements chosen which were true but irrelevant for the life-cycle analysis.

Question 6

(a)(i)(ii) Very few candidates could clearly explain the issues relevant to sand mining.

(b) Most candidates were able to identify the process not involved in production of drinking water.

(c) A minority of candidates could compare the two statements in terms of technical feasibility.

Question 7

(a) Most candidates recognised the fact that earthquakes occur at tectonic plate boundaries.

(b) Fewer knew the movements occurring during the build-up and release of stress were responsible for earthquakes.

(c) Most candidates made sensible suggestion about government actions to reduce the impact of future earthquakes.

Question 8

This was least well-answered question in the paper.

(a) Few recognised that the Sun is necessary for providing light for photosynthesis and heat for keeping the Earth warm.

(b) Most candidates did not realise that the Sun and the Earth emit different radiations because the Sun is at a much higher temperature.

(c) Few candidates were able to explain how greenhouse gases make the Earth warmer.

(d)(i)(ii)
Few candidates could suggest a reason for Don's (incorrect) belief that the Earth is not getting warmer. Most could suggest one piece of scientific evidence for global warming, usually due to melting polar icecaps.

Question 9

(a) Most candidates knew the names of the two regions of the spectrum.

(b) Most candidates tackled the question well, combining the data given with their prior knowledge of the electromagnetic spectrum.

(c) Candidates were able to use the data and their own knowledge to explain why most scientists do not think radiation given out be transmitter masts is a health risk.

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Paper 5031/03
Paper 3

Key messages

- Most marks were awarded to candidates in the first three questions, which relied on interpretation of the short articles.
- In general, candidates were less sure in their answers for the practical questions in the second half of the paper.
- Some candidates left questions unanswered towards the end of the paper.

General comments

Candidates used the information given at the start of **Questions 1 – 3** well. They extracted relevant information and gave answers showing that they had read and understood the ideas in the articles. Candidates should, however, use the mark allocations to judge how many separate points to make in response to each question. Many candidates only make a single point, even when the mark allocation is for [2] or [3] marks. In general, candidates need to take care not to merely copy parts from the question when giving an answer; credit is usually only awarded by adding to or extending the information given. This is also important for **Questions 4 – 6**, where quoting information that has been provided without showing any interpretation does not usually lead to credit being awarded.

Comments on specific questions

Question 1

(a) Most candidates gave the correct answer, 180 million years. Some did not find the correct data to do a subtraction, but quoted 245 million years, which is the time since the dinosaurs became extinct.

(b) Most candidates could explain the term *extinction* as the total death of a species. Common responses that were not enough to gain credit stated ‘dinosaurs disappeared’ or that ‘dinosaurs died’.

(c) (i) Most candidates knew that asteroids are smaller than planets; a second clear point was not usually seen. Some candidates gave incorrect answers such as ‘they are rocky’ (implying planets are not) or stating that asteroids do not orbit the Sun.

(ii) Responses often mistakenly described and accounted for deaths caused immediately by the asteroid, for example as a direct result of the impact, rather than explaining how deaths all over the world occurred.

(d) This was well answered, with most candidates identifying a similarity and difference between the two organisms.

Question 2

(a) This was a well answered question. Candidates know the difference between how diseases are spread by direct and indirect contact and quoted appropriate examples from the article to support their answers.

(b) Most candidates stated that symptoms are similar to other diseases and/or that all symptoms do not always appear; some candidates confused the idea of a doctor making a diagnosis with a doctor offering treatment. Some said that treatment started too late, rather than discussing why it is difficult to identify meningitis in patients.

(c) Most candidates described the idea of future immunity. However, many answers were hampered by a confusion between the key terms used to explain vaccination. Many candidates used terms such as *antibodies*, *antibiotics* and *antigens* incorrectly, for example stating that the body produces antigens or that the vaccinations contain antibodies.

(d) This was very well answered, with many candidates stating that people do not catch diseases after vaccination and that antibiotics are ineffective against viruses.

Question 3

(a) (i) Most candidates correctly stated that people are in the workplace for 8 hours and correctly linked this idea to the hazards of exposure to carbon monoxide.

(ii) This question was also well answered, with common answers including the much longer time spent at home. Many candidates also made relevant points about the vulnerability of at-risk groups such as babies and the elderly.

(b) This question asked candidates to ‘use data from the table’. This instruction was usually only partly followed; candidates quoted problems, such as sickness and danger of death, from the table but did not usually link these to quoted exposure times.

(c) (i) Candidates found this ratio question very challenging. Few recognised the correct ratio as 1:1.5.

(ii) The formation of carbon monoxide by incomplete combustion in limited oxygen was well known and understood.

(d) Almost all candidates correctly extracted the information and stated that the electronic alarm both gives a concentration and that it has an alarm.

Question 4

(a) Candidates did not all recognise the apparatus as a tripod. Beaker was a common incorrect answer.

(b) (i) Many responses correctly identified that ultraviolet can damage skin or eyes; a common error was to state that the box ‘keeps ultraviolet in’ without clearly linking this to a safety concern.

(ii) Again ‘keep ultraviolet in’ was a common incorrect answer, rather than stating that the box stops other light from entering and affecting the ultraviolet sensor.

(c) Some realised that the same volume of cream needs to be spread evenly, but most either omitted this answer or gave vague responses such as to take care.

(d) Many candidates misunderstood this question. Rather than explaining why an empty petri dish acts as a control, many answers described other control factors, such as making sure the time or temperature were the same.

(e) (i) In this case, the lower the reading on the sensor, the more ultraviolet absorbed by the sun cream. This idea was not well understood. This led to many candidates choosing and justifying that **B** was the better sun cream.

(ii) Most candidates could suggest at least one other consideration, such as whether it produces an allergic reaction.

Question 5

(a) Most responses gave some acceptable statement relating to the ease of use of the square. Few recognised the importance of the fact that the sample area would be the same size every time.

(b) (i) Candidates found this graph difficult to interpret. The information that the same number of counts was made at each distance was not understood. Many stated incorrectly that 2 or 2.5 counts were made.

(ii) The significance of the circle around the cross was not understood. Candidates did not appear to have understood the key. This meant that most values for the mean number of plantains were incorrect.

(iii) Candidates were unsure about the interpretation of the graph. Many were able to state that in general, there are fewer plantains further from the path.

(c) (i) Some responses stated that the samples may have been taken near the pond or play area. This question was sometimes left unanswered.

(ii) Most candidates correctly discussed repeats; fewer suggested taking samples from other locations.

(d) Ideas of competition between plants for space, water or light were well understood.

Question 6

(a) Many candidates identified which sets do not show a real difference; not all explained their answer. ‘The mean values are close’ was a common incorrect response.

(b) (i) The idea that a wide range being most likely to contain an outlier was not well understood. Many chose either set **1** or **5** because their mean was higher or lower than the other values.

(ii) Commonly, answers were too vague, for example ‘human error’ or ‘he was not careful enough’. Better answers focused on the experiment, identifying specific areas for error such as in the measurement of mass, volume or time.

(c) Many candidates recognised that 24.5 was the relevant data to be used, but fewer realised that this needed to be divided by 10 to give a rate in cm^3/s.

(d) The last question on the paper was well answered. Candidates typically stated that old and new baking soda needed to be heated. Some only went on to suggest ‘comparing the results’. Better answers stated that the time taken to collect 10 cm^3 would be less for new baking soda than for old.

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Paper 5031/04
Case Study

Introduction

There was one centre which had entered for this component. The work for the component was of variable levels. However, it was clear that encouraging and appropriate pieces of work were produced, though certain areas need to be given additional consideration.

Administrative aspect

The following key points are reminded with regards to the administration of coursework:

1. It is appropriate to have a meeting with all the teachers of the Science department with a view to discuss the marking criteria and bring the internal marking to an agreed standard before the internal marking exercise. There were cases of slight over marking in the work submitted.
2. It is a good practice to annotate the work of candidates showing where and why the marks were awarded. As an example this can be written in the form B **(a)** 4.
3. Internal moderation is carried out when more than one teacher has been involved in the assessment of the coursework. Details of the internal standardisation procedures should be described, where applicable. For example:' a sample of ten coursework was selected from a total of twenty four candidates. The sample included high, mid and low performers. After moderation, appropriate adjustments were made in the Coursework Assessment Summary Form'. 'The Coursework Assessment Summary Form should be completed and signed by the supervising teacher and the internal Moderator. The Coursework Assessment Summary Form shows the individual strand and the total marks awarded for each candidate.
4. To ease administration procedures in external moderation, it is recommended that supervising teachers guide their candidates to insert the name, centre number etc. on the first page/cover only and refrain from inserting names using headers and footers.

Case Studies

General comment

The case study is designed to help candidates develop strategies for evaluating information on everyday scientific issues and to increase awareness of appropriate ways of making decisions about such issues. Candidates should use their scientific knowledge and understanding of the Ideas about Science (IaS) to compare and evaluate the evidence that they have collected so that they can form their own conclusions and make relevant recommendations for future actions. Where candidates use the language and concepts related to IaS, such as 'peer review', 'replication of evidence', 'correlation and cause' 'reasons why scientists disagree', 'precautionary principle', 'ALARA', 'risks and benefits', 'technical feasibility and values' it is easier to match the performance descriptions of the criteria and gain higher marks. The coursework submitted showed an appropriate use of IaS. However some pieces of work submitted showed a superficial understanding of IaS.

Case Studies are always best formulated in terms of a question to provide a focus in an area of controversy. For example: 'Should animal testing be banned in scientific experimentation?' rather than just 'Animal testing' The Case Study is not a report on a topic but a critical analysis of a controversial issue. The key point is that the Case Study question must invite debate and discussion of both sides of the case and be firmly embedded in a scientific context so that candidates can use their scientific knowledge and understanding and their understanding of IaS to produce a balanced and informed account.

All candidates had submitted the coursework in the traditional booklet form.

Candidate must be instructed to acknowledge the information used in the discussion of the study. Candidates must be discouraged from directly printing information from source/s and using the print out as a final product for the presentation of the case study or to copy and paste large extracts from documents downloaded from the internet.

The following Marking Criteria for the Case Study, as per CAIE recommendations, was used during External Moderation.

Assessment

Strand A: Quality of selection and use of information.

The issue of reliability of the source of information must be carefully considered. There were cases where information was given with no comments on the reliability of the sources.

Strand B: Quality of understanding the case.

Strand B assesses the candidates' ability to describe and explain the underlying relevant science and to recognise and evaluate the scientific evidence on which any claims are based. There were many cases where candidates reproduced information which was not linked to claims and opinions to scientific evidence. There was no evidence to evaluate the quality of evidence and data on the part of the candidate. Please note that some basic science explanations which underline a topic must be given.

Strand C: Quality of conclusions.

Candidates must be encouraged to analyse, compare and evaluate the claims and opinions, describing their own point of view or position in relation to the original question and justifying this by reference to sources. Alternative conclusions should be considered and recommendations for future action should be included. Able candidates gave two sided conclusions and alternative recommendations. Many candidates made little attempt to compare aspects of 'for' and 'against' arguments. Discussions were often one-sided. Where information was given, the reliability of the information was not evaluated before reaching conclusions.

Strand D: Quality of presentation.

Candidates must be guided to look at:

- The structure and organisation of the report. There is a need to improve on the presentation of the report, example by proper listing of contents, page numbering.
- Use of visual means of communication. Many candidates did include pictures, charts and tables in their work, but were inadequate to the content. Also, the visual materials must not be decorative rather they should be informative.
- Spelling, punctuation and grammar. The report needs to be concise, with full and effective use of relevant scientific terminology. Spelling, punctuation and grammar need to be checked.