TWENTY FIRST CENTURY SCIENCE

Paper 0608/01
Multiple Choice (Core)

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

The core paper gave a spread of marks, but there was a distinct improvement in performance from last year.

The candidates made good use of time during the examination. No questions were left blank. There were no ambiguous responses made.

Questions answered well

In broad terms, questions testing direct recall of knowledge were well answered.

Candidates answered questions well relating to...

- tectonic plates (9).
- evidence for plate movement (11).
- interpretation of graphs (13).
- forces between polymer molecules (21).
- risks of uv radiation exposure (24).
- the issues relating to local food (34).
- Sankey diagrams (40).

Questions that proved difficult

Fewer questions proved difficult for candidates than in previous years, with only the following seeing large proportions of the candidates making incorrect responses.

3

Although candidates recognised that not all children would be carriers (thus eliminating option D), the other options were chosen with equal frequency, implying guesswork rather than reasoning.

6

Most thought that carbon particulates cause acid rain.

12

Option A (asteroids) was the most common incorrect choice for objects that travel furthest from the Sun.

28

Many thought energy enters a food web through the soil.

TWENTY FIRST CENTURY SCIENCE

Paper 0608/02
Multiple Choice (Extended)

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

The extension paper gave a narrow spread of marks, with performance exceeding that displayed last year.

The candidates made good use of time during the examination. No questions were left blank. There were no ambiguous responses made.

Questions answered well

In broad terms, questions testing direct recall of knowledge were well answered.

Candidates answered questions well relating to...

- representing reactions with equations (9).
- objects in the solar system (11). This question proved very difficult for core paper candidates but candidates taking this paper answered it well.
- using graphical evidence to support Hubble's ideas (13).
- light energy and light intensity (21) and (24).
- food additives (34).
- nuclear reactors (40).

Questions that proved difficult

1

Most confused sexual and asexual reproduction, choosing the option that described sex cells joining to make an embryo (option D).

3

Although candidates recognised that not all children would be carriers (thus eliminating option D), the other options were chosen with equal frequency, implying guesswork rather than reasoning.

6

Most thought carbon particulates formed acid rain.

18

Monomer A was the most popular choice, implying that candidates had not noticed the fluorine in the formula.

28

Some thought that nervous impulses are slow, selecting option D.

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Paper 0608/03

Core Written

Key Messages

This is the final examination session for this syllabus, and so key messages must, of necessity, be of a general nature which Centres can then apply to any CIE Science syllabus. In both this session, and the previous one, it was gratifying to note that the standard achieved by candidates had improved, that fewer candidates had omitted questions totally, and that most candidates had attempted to answer the question as set, rather than their own interpretation of what they thought the question ought to be asking.

General Comments

The entry for this paper was too small to draw rigorous statistical conclusions, but, in general, candidates seemed to find the physics and chemistry questions more accessible than the biology ones. Candidates often found applying the *Ideas about Science* to the specific examples in the questions difficult, answering their own version of the questions rather than what was asked.

Comments on Specific Questions

Question 1

Most candidates could identify at least one of the different stages in the block diagram of the production of electricity in **(a)**, and could calculate the energy produced in **(b)**, although the efficiency calculation was naturally more demanding. In part **(c)**, most could suggest an alternative renewable energy source, although some chose non-renewable ones, and could write down one disadvantage that their source had over nuclear power.

Question 2

Although only one-third of the candidates could identify the mantle as the layer where movement caused tectonic plates to move, most of this question was well answered. In **(c)(ii)**, which required an explanation of why both the formation of the Himalayas and the slowing down of the Indian plate occurred at the same time, most candidates explained only one of the two events, so restricting credit earned.

Question 3

This question was the most accessible of the physics questions, with the regions of the electromagnetic spectrum well known in **(a)** and the effects of electromagnetic radiation on living cells very well tackled in **(b)**. Candidates usually gave a good justification for a child having a mobile phone; reasons against the child having a mobile phone were not as well considered.

Question 4

Identification of the gases and their molecules in **(a)** was very well done. Knowledge of the products of incomplete combustion of hydrocarbons, as requested in **(b)**, is limited and represents an area for improvement.

Question 5

Candidates were able to calculate the range and the best estimate of the data. Candidates should take great care in transferring this data to their graph in **(b)(i)** as mistakes were made. Candidates experienced little difficulty in describing the correlation in the data correctly in **(b)(ii)**. Part **(c)** of this question was the only one in this paper where a signification number of candidates left the question blank. The most successful candidates could describe one of the ways in which polymers could be modified but few could state how it would change the properties of the polymer.

Question 6

In **(a)**, most knew the reasons for adding flavourings and preservatives to food but few could name the type of food additive that stops oil and water from separating. In **(b)**, few suggested an advantage of replacing sugar with aspartame related to the health implications of excessive sugar intake but many suggested that there could be an allergic or similar response to aspartame for certain individuals. In **(c)**, few could suggest two reasons for the difference between countries where food is eaten near to the point of production and countries where it is transported long distances.

Question 7

Candidates were unaware of when life started on Earth in **(a)**. The linking between new scientific data and Darwin's theory in **(b)** was answered correctly by a majority of candidates. In **(c)**, nearly everyone suggested a percentage of common genes (between chimpanzees and humans) greater that those we share with mice. Candidates must ensure they address both command terms in the question stem: few continued to gain further credit by stating that we are more closely related to chimpanzees than to mice in this question.

Question 8

Most candidates could select two of the three terms describing genes in **(a)**. Candidates must ensure they thoroughly read the question and address its requirements: in **(b)**, only half realised that the question was asking for the fact the pairs of chromosomes are inherited, one from each parent.
Candidates seemed to have little difficulty in completing the Punnett square in **(c)(i)**. Interpretation of data in such squares proved more troublesome and few candidates could calculate the probability of the baby carrying cystic fibrosis in **(c)(ii)** or comprehend that, in **(c)(iii)**, there was no possibility of the baby having the condition. In **(c)(iv)**, about half of all candidates could suggest one (but not two) reasons why some people believe that foetuses should never be tested for alleles causing genetic disease.

Question 9

This proved the most difficult of the all questions on this paper. In **(a)**, very few could suggest even one way in which microorganisms cause the symptoms of disease. In **(b)**, about half could identify 'antibodies' as the molecules required, but there role was less clearly understood and few could explain, in **(c)**, why a child is unlikely to get chickenpox a second time.

TWENTY FIRST CENTURY SCIENCE

Paper 0608/04
Extended Written

Key Messages

This is the final examination session for this syllabus, and so key messages must, of necessity, be of a general nature which Centres can then apply to any CIE Science syllabus. In both this session, and the previous one, it was gratifying to note that the standard achieved by candidates had improved, that fewer candidates had omitted questions totally, and that most candidates had attempted to answer the question as set, rather than their own interpretation of what they thought the question ought to be asking.

General Comments

The entry for this paper was too small to draw rigorous statistical conclusions, but, in general, candidates seemed to find the physics and chemistry questions more accessible than the biology ones. Candidates often found applying the *Ideas about Science* to the specific examples in the questions difficult, answering their own version of the questions rather than what was asked.

Comments on Specific Questions

Question 1

Most candidates knew the different stages in the block diagram of the production of electricity in **(a)**, and could calculate the efficiency well in **(b)**. Part **(c)** was less well done, with only the most able candidates able to suggest how the readings from radiation monitors could be used by the power station management to reduce risk to their workers. In part **(d)**, most could suggest an alternative renewable energy source and write down one disadvantage, compared with nuclear power.

Question 2

This question was generally well done, but few candidates were able to explain that seafloor spreading is due to movements in the Earth's mantle.

Question 3

This question was also generally well done, but few candidates gained full credit in explaining the precautionary principle: "better safe than sorry" gains credit, but it was necessary to explain that the risks (though small) were not completely known, and the consequences could be very severe, to gain full credit here.

Question 4

This question was the least successfully attempted question on this paper. Whilst the risk-benefit analysis of using aspartame in **(b)** was generally successfully attempted, the action of antioxidants in **(a)** was not known and few could suggest two reasons for the difference between countries where food is eaten near to the point of production and countries where it is transported long distances.

Question 5

Identification of the gases and their molecules in **(a)** was very well done. The products of incomplete combustion of hydrocarbons, and their effects, were not well known by most

Question 6

Calculation of the best estimate was well done but transferral of information onto the graph was a skill that needs further practice: only about half the candidates could plot the mean and range on the graph in **(b)(i)**, and virtually no-one managed to test the data for linearity by drawing a best-fit straight line and commenting on its fit to the range bars in **(b)(ii)**. The modification asked for in **(c)** was generally well done although a number described the effect of plasticisers, despite the question stipulating "...other than by adding plasticiser"; candidates must ensure that they both fully read the question, and refrain from simply restating it when providing an answer.

Question 7

Most candidates could describe one function of genes in **(a)**. The Punnett square in **(b)(i)** was generally well done and the probability of the baby carrying cystic fibrosis correctly calculated in **(b)(ii)**. Many realised that there was no possibility of the baby having the condition in **(b)(iii)** although they did not attempt to suggest *why*, as the question requested: all command terms in a question must be addressed. Thorough reading of the question was required for **(b)(iv)**: few candidates discussed the function of the X and Y chromosomes, in terms of their *genes* in causing development of the sex organs. The implication of having a foetus tested in **(c)**, in terms of the consequences of a negative result, were not usually dealt with fully, and most candidates achieved partial credit here.

Question 8

Although many did not know when life started on Earth in **(a)**, the linking between new scientific data and Darwin's theory in **(b)** was well done. The way in which DNA data can give information about the evolutionary relationships between different organisms was only partially answered by most in **(c)**.

Question 9

This was found to be the most challenging of the biology questions by most candidates. Although most gained partial credit in **(a)**, describing how the immune system destroys a virus, very few could describe the consequence on the population of a low uptake in vaccination and the consequent lack of herd immunity in **(b)**.

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Paper 0608/05

Analysis and Interpretation

General comments

More able candidates were able to show knowledge and understanding in a number of areas of the specification, though rarely in all areas or in depth. Less able candidates evidenced patchy knowledge and often a superficial understanding of key concepts. Extraction of information from the articles was generally performed well, but answers that depended on a greater depth of understanding challenged many candidates. Some clearly had difficulty in understanding what was required by the questions. Interpretation of simple data was generally good, but more complex data proved incomprehensible to many candidates. Even simple calculations often presented an insurmountable problem. Many of the 'ideas about science' concepts were poorly understood. There was no evidence that candidates had insufficient time to complete the paper, and few left blank spaces.

Comments on specific questions

Question 1

Most candidates used information from the article to answer at least some of the questions well.

(a) Most of the more able candidates chose a correct pollutant gas but fewer could give a sensible reason for why it is damaging. The most common incorrect gas was sulfur dioxide.

(b) Many candidates realised that ultraviolet radiation causes cancer but only the most able knew that it is ionising radiation.

(c) Most candidates correctly suggested chlorofluorocarbons and gave a correct use based on information given in the article. Only the least able gave incorrect suggestions.

(d) More able candidates realised that the ozone concentration was lower over the South Pole and supported this with data from the diagram. Some less able candidates simply described the shading in the diagram and a few thought that the ozone concentration was higher over the South Pole.

(e) Most candidates made at least one sensible suggestion, the most common being the desire to get a tan.

(f) Many of the more able candidates realised that the ban could have an economic effect on these countries. Fewer made other sensible suggestions.

(g) (i) The majority of candidates knew that a propellant is used to force contents out of an aerosol spray can. A wide variety of incorrect suggestions were seen from less able candidates.

(ii) Most candidates realised that CFCs damage the ozone layer and propane is flammable, gaining both marks.

Question 2

Simple extraction of information from the article was generally carried out well.

(a) (i) Most candidates described this correlation correctly.

(b) Good descriptions of the inhalation of particulates and their passage into the blood stream gained both marks for many candidates.

(c) (i) Most candidates knew these blood vessels are arteries, though only a few suggested coronary arteries.

(ii) Few candidates presented creditable answers. Most gave vague descriptions of the pumping of blood that gained no marks.

(iii) Only the more able candidates realised that particulates cause a narrowing of arteries and fewer went on to explain that this restricts the supply of blood or oxygen to the heart.

(d) More able candidate performed this calculation correctly. Weaker candidates gave a jumble of figures with little relevance to the question.

(e) Some of the more able candidates suggested that there were other factors that could cause heart attacks and strokes and many gave examples. Very few reasoned that a correlation is not the same as a cause and therefore a causal link is needed.

(f) Most candidates suggested that the first study involved more people and the second a longer time period, but fewer continued to say why these were advantages.

Question 3

Many candidates could interpret results but few could describe how they were obtained.

(a) Only the most able candidate put together a sensible and coherent description of how this investigation was carried out. Most gave vague references to use of universal indicator and colours without gaining any credit.

(b) Nearly all candidates correctly read the height of seedlings, but there were fewer correct answers for the seedling in 6% fertiliser solution where common answers included 5.15 and 5.25.

(c) Most candidates gave a correct description of the correlation between percentage fertiliser and plant height. Only the most able also observed that the effect reached a limit at higher concentrations.

(d) (i) Many correct suggestions were seen. A common error from less able candidates was the amount of fertiliser.

(ii) Only the most able gave answers correctly based on the idea that only the factor under investigation should be varied in order to see its effect. Fair testing was a common answer that gained no credit.

(e) Very few candidates understood the concept of a control.

Question 4

For many candidates, calculations were a weakness.

(a) More able candidates saw the need for a timing device. A wide variety of incorrect answers were seen from less able candidates.

(b) Most candidates realised that alpha radiation passes through the thin window.

(c) More able candidates performed this calculation correctly. Less able candidates gave a jumble of figures with little relevance to the question.

(d) Only the most able candidates realised that inclusion of background radiation made the results too large. Fewer suggested that correct results could be obtained by subtraction of background radiation from the results. Vague answers referring to accuracy were common and gained no credit.

(e) Only the most able correctly gave the half life as 60 seconds. Fewer then used data from the table to show how they obtained this figure. A wide variety of incorrect answers were seen.

(f) Very few candidates had any idea of why using a graph was better than using data from a table. Ideas of evening out fluctuation in results or identification and ignoring of outliers were very rarely seen.

Question 5

Most candidates could plot points but few understood the concept of a best-fit line.

(a) Most candidates suggested using a ruler or measuring tape to gain this mark. A variety of incorrect suggestions were seen from less able candidates.

(b) Most candidates made a sensible suggestion, with the most common being the exclusion of outliers and calculation of a best estimate. Many weaker candidates thought this would increase accuracy, which gained no credit.

(c) The idea that Jo identified and omitted an outlier gained this mark for the majority of candidates.

(d) Almost all candidates plotted the points correctly.

(e) Only a few of the more able candidates drew a best-fit line correctly. Common errors were to ignore the origin, to joint first and last points and to draw undulating lines.

(f) Most candidates gave a good description of this conclusion to gain the mark.

(g) Some of the more able candidates gained one mark for suggesting Jo repeat the experiment, but very few of these could explain why this would give an improvement. A wide variety of less sensible suggestions were seen.

TWENTY FIRST CENTURY SCIENCE

Paper 0608/06

Case Study

This was the last opportunity for Schools to enter candidates for this syllabus.

There has been noticeable progress in the quality of work submitted for the Case Study over the years of this syllabus which has reflected the interest of both candidates and their teachers.

The majority of Schools provided a suitable stimulus for their candidates so that a range of Case Studies were presented, many of which were adapted to reflect the local environment and so encourage ownership and interest on the part of candidates.

The purpose of the Case Study is for candidates to gather together claims, opinions and evidence about a controversial issue in science. 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 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 to produce a balanced and informed account. The use of scientific knowledge and the associated supporting evidence for the claims and opinions expressed has improved considerably (Strand B) as has the communication skills of candidates (Strand D).

However, the reliability of the sources of information that candidates use in their Case Study reports was an area which was often not addressed sufficiently to merit the award of the top marks in Strand A. Strand C was still the weakest area of the assessment. Candidates often gather and report suitable information from a variety of sources but do not generally analyse, compare and evaluate the claims, opinions and scientific evidence. More individual input was required if the highest marks were to be awarded for Strand C.