

# COMBINED SCIENCE

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Paper 5129/01  
Multiple Choice

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

## Comments on individual questions (Physics)

Candidates found no question to be very easy or very difficult. **Questions 5, 7 and 13** had more candidates choosing an alternative option than did the correct one indicating uncertainty among better candidates. Some better candidates also found **Question 4** a problem.

**Questions 1 and 2** discriminated well with weaker candidates favouring option **C** in **Question 1** and option **D** in **Question 2**.

**Question 3** also discriminated well with options **A** and **D** dividing the weaker candidates.

**Question 4** had some better candidates choosing either option **A** or **D**, suggesting uncertainty over the meaning of *elastic* deformation.

**Question 5** Uncertainty and guessing among candidates resulted in each option attracting a significant response with option **C** more popular than the correct one, option **A**. Better candidates were also attracted to option **B**.

**Question 6** discriminated well with option **B** the most popular incorrect choice for candidates, including some of the better ones.

**Question 7** also showed uncertainty and guessing among candidates with options **A**, **B** and **C** sharing the responses. Option **B** gained slightly more than either option **A** (correct) or option **C**.

**Question 8** showed good discrimination with weaker candidates divided between options **C** and **D**.

**Questions 10 and 11** Well-known with both questions producing an almost 70% correct response. Option **B** was the most popular incorrect response in **Question 10**, and in **Question 11** options **A** and **C** were equally popular.

**Question 12** showed good discrimination with weaker candidates favouring option **D**.

**Question 13** The use of radioactive nuclides in medicine was not well-known, with more candidates choosing both options **B** and **C** than the correct one, option **D**, an indication of uncertainty among even the better candidates who were also attracted to option **B**.

### Comments on individual questions (Chemistry)

#### **Question 14**

A large number of the candidates did not appreciate the limited accuracy of the measuring cylinder and chose option **C**. The better candidates recognised the burette as the piece of apparatus which measures accurate volumes.

#### **Question 15**

A large number of the candidates, including the better ones, did not understand the significance of the nucleon and proton numbers and simply added the two together and chose option **D**.

#### **Question 16**

This question was well-answered by the better candidates, but there was evidence of guesswork amongst the weaker candidates.

#### **Question 17**

The weaker candidates did not appreciate the number of electrons in the outer shells from each of the atoms **Z** and **Y**. The majority of the candidates knew that the molecule is covalent.

#### **Question 18**

The majority of candidates were unable to deduce the charge on the uranium, or did not know that oxygen and chlorine have different charges. Almost half of the candidates chose option **A**, which simply replaced O in the formula with Cl.

#### **Question 19**

There was evidence of guesswork even amongst the better candidates. Candidates should understand that it is the presence of hydrogen ions in a solution that causes the solution to have a pH less than 7.

#### **Question 20**

Almost 60% of the candidates recognised option **D** as the electronic structure of argon and the fact that it is used to fill light bulbs.

### **Question 21**

Over 50% of the candidates thought that the regular structure in option **C**, an ionic substance, represents the structure of an alloy. Candidates should be aware that an alloy is a mixture of two elements arranged in an irregular pattern.

### **Question 22**

There was evidence of widespread guesswork in this question. Candidates should know that a metal oxide is more difficult to reduce as the reactivity of the metal increases.

### **Question 23**

Only a third of the candidates recognised option **C** as the acid base reaction, but a significant proportion, including the better candidates, chose option **D**, the reduction of iron(III) oxide by carbon monoxide.

### **Question 24**

There was evidence of guesswork amongst the candidates with less than a third of the candidates understanding that oxygen reacts with the copper in the apparatus and that approximately 20% the air is oxygen, so that 80 cm<sup>3</sup> of gas remains at the end of the experiment.

### **Question 25**

The better candidates knew that lubricating oil is used as a source of polishes and waxes. A significant proportion of the candidates thought that gasoline is the feedstock for the chemical industry and did not recognise that it is used as fuel for motor vehicles.

### **Question 26**

Over half of the candidates thought that substance **X** is ethane rather than ethene and chose option **A**.

### **Question 27**

The process of fermentation was not well-known by the candidates. Almost 75% of the candidates knew that carbon dioxide is produced in the process, but the majority of these candidates thought that starch is the other product.

## **Comments on individual questions (Biology)**

### **Question 28**

This question caused some problems – candidates needed to recognise that plants produce starch in their chloroplasts.

### **Questions 29-30**

These questions worked well.

### **Question 31**

Candidates were unclear as to which leaf cells contained chloroplasts.

### **Question 32**

This was a relatively easy question, but some candidates were evidently guessing.

### **Question 33**

Some candidates chose the option with the heart valve operations reversed.

**Question 34**

This question discriminated well between candidates. Again, the commonest error was to have the correct answers exactly transposed.

**Question 35**

This question worked well.

**Question 36**

Evidently, candidates were guessing at the answer here.

**Question 37**

Some candidates picked the peak of the graph, instead of the section with the steepest decline.

**Question 38**

This question, about a control experiment, proved to be difficult.

**Question 39**

Again, many candidates seemed to be guessing at the answer.

**Question 40**

This question discriminated well.

# COMBINED SCIENCE

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Paper 5129/02

Theory

## General comments

The responses to questions were in line with previous examination sessions. The responses to questions involving experimental work were disappointingly answered by many of the candidates. Candidates should be able to interpret the results of experiments in the light of their scientific knowledge. This was particularly evident in **Question 9**, where there was little evidence of understanding the science of the question. In the Physics part of the paper the calculations were answered better than in previous years, but, as usual, the units were frequently incorrect. The Chemistry questions on the paper were poorly done, in particular there was some misunderstanding about atomic structure, electronic structure and the Periodic Table. It is pleasing to note that many of the candidates were able to correctly draw the path of a ray of light through a solid glass block.

## Comments on specific questions

### Question 1

The candidates responses suggested that there was a considerable amount of guesswork in this question.

- (a) Many candidates knew that sulphur dioxide causes the erosion of buildings.
- (b) This answer was not known by many of the candidates.
- (c) A large proportion of the candidates were unaware of the use of hydrogen in the manufacture of margarine.
- (d) The use of chlorine in the purification of water supplies was quite well-known.
- (e) A disappointing number of candidates thought that chlorine is an alkaline gas instead of ammonia.

### Question 2

- (a) The circuit diagram was quite well done by a large number of candidates. The majority of the candidates knew how to draw a series circuit and were able to draw the symbols for a cell and an ammeter, however the bulb was carelessly and inaccurately drawn by many candidates. Only a small number of candidates were able to draw the symbol for a variable resistor, the most common error was to leave out the arrow head.
- (b)(i) Only the best candidates were able to state that the potential difference across the lamp decreases when the resistance is increased.
  - (ii) The decrease in the brightness of the lamp was better known.

### Question 3

- (a) Many candidates were able to state in which region absorption and digestion occurs, however the regions where egestion and ingestion occurs were much less well-known.
- (b)(i) The process of peristalsis was known only by the best candidates. The majority of the candidates preferred to use the names given in **part (a)** of the question, of which egestion was by far the most common.
- (ii) The function of fibre or roughage in the process of peristalsis was not well-known.
- (c) This question was poorly answered by many of the candidates. The response required from the candidates should have mentioned the fact that saliva contains enzymes which digest starch and/or that saliva moistens or softens food. The majority of the candidates referred to the ease of swallowing but did not state why the food was easier to swallow which is what was required by the question.

### Question 4

- (a) Many candidates were aware that the two gases, **A** and **B**, were oxygen and nitrogen, but far too many candidates got the answers the wrong way round and stated that oxygen is 79% and nitrogen 20% of the air.
- (b) The responses to this question were disappointing. Candidates were only required to state that the amount of water vapour in the air varies due to the variation in temperature. A number of candidates referred to the humidity which did not gain credit as that was simply repeating the question.
- (c) A large number of candidates thought that carbon dioxide is a pollutant gas. Of the candidates who correctly identified a pollutant gas, many stated a problem associated with the gas instead of the source of the pollutant.

### Question 5

- (a) A large number of candidates were able to identify the form of energy as electrical.
- (b)(i) Many candidates knew the formula for calculating the amount of energy, but too many of the candidates did not convert the time into seconds.
- (ii) Only a small number of candidates realised the answer was obtained by simply subtracting 28 500 from the answer to **part (a)**. The majority of the candidates divided 28 500 by 5 and obtained the answer 5700.

### Question 6

- (a)(i) The majority of the candidates were unaware that insulin is a hormone.
- (ii) A number of candidates were penalised for stating that the insulin was carried to the liver by the blood cells rather than simply the blood.
- (iii) Many candidates avoided the correct answer to this question, the liver, presumably because it was given in the question and therefore other parts of the body, such as stomach and kidney were frequently given as the answer.
- (b)(i) Many candidates were able to state that the pupil or iris changes when bright light suddenly shines on the eye.
- (ii) The answer to this question was less well-known. Some candidates referred to suspensory ligaments not realising that, although they are connect to the ciliary muscles/body to the lens, which do change, they themselves do not change.

### Question 7

- (a) A large number of candidates simply stated the condition used for cracking of alkanes as temperature, and did not receive credit. The expected answer had to refer to a high temperature or simply state that a catalyst is used in the process.
- (b) Many candidates were aware of the structural difference between an alkane and an alkene.
- (c) The colour of bromine water was well-known but many candidates did not know that the bromine is decolourised, and therefore changes to a colourless solution when it is added to an alkene.
- (d) The term polymerisation was not well understood by the majority of the candidates.

### Question 8

- (a) A large number of candidates were able to state that the length of the spring with the load is measured, but did not state that the length of the spring without the load also needs to be measured. Some candidates simply listed the apparatus required rather than what is measured.
- (b) A large proportion of the candidates added the load and length together in order to obtain the extension. Similarly the load was calculated by subtracting 7.2 from 15.2. It was clear from the responses that many candidates did not realise the significance of the length of the spring with no load. Of the candidates who correctly calculated the extension, very few understood the linear relationship between load and extension and were therefore unable to calculate the load.

### Question 9

- (a) (i) The presence of amylase in the cotyledon was not well-known.  
(ii) The product of digestion was only rarely identified as maltose.
- (b) The answers to this question indicated that the candidates were not familiar with this type of experiment. Many candidates thought that the cotyledon releases starch rather than contains an enzyme, which digests the starch. Consequently the candidates did not understand that the clear area around the unboiled cotyledon is due to the fact that the enzyme released by the cotyledon digests the starch in the jelly and is therefore not detected by the iodine solution.
- (c) The majority of the candidates did not understand that when the cotyledon is boiled the enzymes are denatured and therefore the starch is not digested. The iodine detects the starch and the area around the cotyledon remains blue/black. Some candidates gained credit for recognising that starch is present around the cotyledon.

### Question 10

- (a) Acid **A** was correctly identified as sulphuric acid by many of the candidates, however, the colourless gas **B**, carbon dioxide, was only rarely identified. The brown solid **C**, copper, was identified as a copper compound rather than the element.
- (b) This proved to be a difficult question for many of the candidates, for whom the concept of relative reactivity is not well understood. A number of candidates thought that the lack of reactivity of silver is due to it being a non-metal. Those candidates who answered the question in terms of the reactivity series did not gain full marks because they referred only to the relative reactivity of iron and silver without mentioning the position of copper in the series.

### Question 11

The concept of induction was poorly understood by the majority of the candidates. It was disappointing to note that candidates inserted words into the sentences that were grammatically incorrect, indicating that there was a degree of guesswork about their answers.

### Question 12

- (a) (i) This question was well answered in part by many of candidates. A number of the candidates confused the diagram with a food web diagram and answered in terms of trophic levels.
- (ii) Many candidates were able to state the process represented by the arrow labelled 5.
- (b) This question was poorly answered by the majority of the candidates. Many candidates did not recognise that a substance was required to answer the question and gave the answer 'plant'. In addition, a large number of candidates thought that carbon dioxide is produced by photosynthesis rather than glucose.

### Question 13

- (a) Candidates should be encouraged to write the formula of the equation they are going to use in the calculation. Of those candidates who wrote a formula, many rearranged the formula incorrectly. A number of the candidates who correctly calculated the acceleration were unable to quote the correct units.
- (b) This calculation proved to be easy for many of the candidates.
- (c) This calculation was poorly done. Many of the candidates simply multiplied the distance in centimetres by the force, rather than using the distance in metres. The unit for work done was not known by the majority of candidates. Many candidates tried to work out the unit from the equation and obtained N/cm rather than N cm or N m. Candidates should know that the unit of energy is Joules.

### Question 14

- (a) (i) Many candidates knew that the speed of light is greater than the speed of sound.
- (ii) The calculation was well done by the better candidates, but far too many obtained the answer 3.33, by dividing 330 by 99, rather than dividing 99 by 330. Once again, many candidates had difficulty rearranging a correct formula.
- (b) The majority of candidates were unable to define the frequency of a wave. There is apparent confusion amongst many of the candidates between wavelength and frequency.
- (c) This question was well answered by a significant proportion of the candidates.

### Question 15

- (a) (i) The structures that contain the cells with nuclei which fuse during sexual production were quite well-known.
- (ii) Only a small proportion of the candidates were able to name the structure formed by the fusion of the nuclei. Many candidates simply stated various parts of the flower.
- (b) Many candidates knew that **D** and **E** referred to fruit and seeds, but unfortunately some candidates got the answers the wrong way round.

### Question 16

- (a) A large number of the candidates referred to the number of nucleons rather than protons. Candidates should know that the nucleons are the particles present in the nucleus, the protons and the neutrons. A number of candidates simply stated that the mass numbers are different without explaining that this is because the number of neutrons in the nucleus is different.
- (b) The relationship between the number of electrons in the outermost shell and the properties of an element is not well understood. A significant proportion of the candidates thought that the properties of an atom are related to the number of protons.

- (c) A disappointingly small number of candidates were able to state the electronic structure of oxygen. It was clear that many candidates thought that the 16 on the symbol for the isotope refers to the number of electrons in an atom, as the most common answer for the electronic structure involved 16 electrons and was written as 2 8 6.
- (d) The relationship between the number of electrons and the group number in the Periodic Table is not well-known. Many candidates stated that oxygen is found in group VI of the Periodic Table without making any reference to the number of electrons in the outer shell.

#### Question 17

- (a) Many candidates knew that water is absorbed by the root hair cell but were unable to correctly state a second substance. The fact that oxygen and carbon dioxide were common incorrect answers indicates that there is some confusion about the function of the root hair cell.
- (b) The features of the root hair cell were not well-known by the candidates. Candidates should know that the root hair cell is suitable for absorption because it has thin cell walls with a large surface area. Many candidates confused the size of the vacuole with the ability to absorb substances into the cell.

#### Question 18

- (a) (i) Many candidates were able to correctly construct the normal to the mirror.
- (ii) A large number of candidates were able to locate the image of the pin correctly. A significant proportion thought that the image is located on the same side of the mirror as the pin.
- (iii) This question was well answered by many candidates but too many subtracted  $58^\circ$  from  $180^\circ$  rather than  $90^\circ$ .
- (b) The majority of the candidates were able to correctly draw the ray of light through the glass block. Only a small number of these candidates did not draw the emergent ray parallel to the incident ray.

#### Question 19

- (a) The vast majority of the candidates were unable to define the relative atomic mass as the mass of one atom of an element compared with the mass of one atom of carbon 12. Most candidates incorrectly thought that the relative atomic mass is related to the nucleon (mass) number of the atom and therefore defined it in terms of the number of protons and neutrons in the nucleus of the atom.
- (b) (i) This calculation was poorly done. Many of the candidates included the 2 from the equation and calculated the answer as 80 rather than 40.
- (ii) This calculation was well done by many of the candidates. Some candidates, however, misread the question and used the relative atomic mass of sodium hydroxide calculated in (b)(i) rather than the relative atomic mass of water. Candidates who calculated the relative molecular mass of water incorrectly were awarded some credit if they used it correctly in the calculation.
- (c) The answers to this question were very disappointing. Large numbers of candidates did not know that the alkalinity of sodium hydroxide is shown by the use of Universal Indicator or red litmus. A significant number of candidates answered the question in terms of a test for a gas such as hydrogen or oxygen.