

COMBINED SCIENCE

Paper 5129/01 Multiple Choice
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<i>Question Number</i>	<i>Key</i>	<i>Question Number</i>	<i>Key</i>
1	D	21	D
2	A	22	C
3	C	23	B
4	A	24	D
5	B	25	C
6	A	26	B
7	B	27	A
8	D	28	A
9	D	29	C
10	B	30	A
11	C	31	B
12	C	32	D
13	C	33	A
14	D	34	A
15	D	35	D
16	B	36	B
17	B	37	A
18	D	38	D
19	B	39	B
20	B	40	B

General comments

The paper produced a mean score of 16.10 and a standard deviation of 4.96. Candidates found no questions very easy or very difficult although **Questions 2, 4, 11 and 13** did pose difficulties for even the more able candidates, some of whom ended up guessing an answer.

Question 1

Weaker candidates favoured options **A** and **C** in almost equal numbers.

Question 2

Density did not appear to be well known by the candidates with 54% incorrectly choosing option **D**, twice the number of correct (option **A**) responses!

Question 3 was correctly answered by the majority of candidates.

Question 4

Calibration of a liquid-in-glass thermometer was not well known and resulted in better candidates guessing.

Question 5 showed good discrimination with weaker candidates favouring option **A**.

Question 6

Well known by the majority of candidates. Those answering incorrectly showed widespread guessing in choosing the incorrect options (**B**, **C** and **D**) in equal numbers.

Question 7

Good discrimination with option **C** favoured by the weaker candidates.

Question 8 also showed good discrimination. The electro-magnetic spectrum was not well known by the weaker candidates with each of the incorrect options (**A**, **B** and **C**) attracting a significant response.

Question 9

The definition of the volt was not well known with only 31% answering correctly (option **D**); option **B** attracted the same number of responses.

Question 10

Well known by the majority of the candidates.

Question 11 showed widespread guessing with each option attracting almost the same number of responses.

Question 12

Very good discrimination with weaker candidates divided between options **A** and **B**.

Question 13

The novel approach to half-life appeared to pose problems for all candidates who chose each option in significant numbers.

Question 14

An easy question for the better candidates but a significant number of the weaker candidates thought that the first step in the sequence was to filter the potassium nitrate and sand. There was evidence of guesswork amongst the weaker candidates.

Question 15

The arrangement and movement of molecules in ice was quite well known although there was evidence of guesswork by the weaker candidates..

Question 16

The structure of atoms is well understood by the majority of the better candidates.

Question 17

The conduction of electricity by ionic compounds is poorly understood by many candidates. A significant number of the candidates thought that sodium chloride does not conduct electricity when it is molten.

Question 18

Covalent bonding is not understood by the majority of the candidates. A large proportion of the candidates answered the question in terms of electron pairs and chose option **B** or in terms of the number of electrons in one covalent bond and chose option **A** rather than total number of shared electrons as required by the question.

Question 19

The calculation of the mass of carbon dioxide proved difficult for the majority of the candidates. The majority of the candidates simply stated the relative atomic mass of carbon and chose option **A**.

Question 20

A majority of the candidates knew that the pH of an acid is less than 7 but only the better candidates were able to distinguish between a weak and a strong acid and choose option **B** rather than option **A**.

Question 21

The trends shown by the elements in Group I of the Periodic Table are not well known by the candidates. There was evidence of widespread guesswork even amongst the better candidates. Less than 20% of the candidates knew that the metals form chlorides of similar formula.

Question 22

The majority of the candidates were able to interpret the experimental results and correctly deduce the order of reactivity of the metals, however, a large number of candidates then chose option **B** where the metals were listed with the least reactive first rather than option **C**.

Question 23

Less than a quarter of the candidates correctly chose option **B** as the property which is **not** important. The majority of the candidates answered the question in terms of properties which **are** important for the use of aluminium for cooking utensils.

Question 24

It is widely thought by the candidates that the main constituent of natural gas is hydrogen or helium rather than methane.

Question 25

The majority of the better candidates could correctly state the molecular formula of octane, however many of the candidates, particularly the weaker ones, chose option **B**, the molecular formula of an alkene rather than an alkane.

Question 26

Only a minority of the candidates recognised the hydrocarbon as an alkene and were able to correctly identify the correct test for an alkene. There was an element of guesswork amongst the weaker candidates.

Question 27

The process of cracking alkanes is not well known by the candidates. There was evidence of widespread guesswork particularly by the weaker candidates.

Question 28

This question caused problems. Candidates needed to recognise the role of the cell membrane in controlling water uptake.

Question 29

Most candidates understood that osmosis always involves water movement.

Question 30

Answer **C** was a popular choice here: many candidates apparently think that the optimum pH for an enzyme is always 7.

Question 31

Candidates had difficulty in interpreting this experiment, and they were apparently guessing.

Question 32

Candidates needed to understand the difference between absorption and assimilation; and to recognise the role of the liver, in secreting bile to aid digestion.

Question 33 and Question 34

These were easy questions.

Question 35

Only a minority of candidates realised that the carbon dioxide concentration is highest in blood entering the lungs.

Question 36

Many candidates were apparently guessing here.

Question 37

This question was one of simple factual recall.

Question 38

This question was very easy.

Question 39

Significant numbers of candidates think that plant respiration uses up carbon dioxide.

Question 40

Many candidates failed to realise that the outcome of plant sexual reproduction (from seeds) is unpredictable.

COMBINED SCIENCE

Paper 5129/02

Theory

General comments

There are certain areas of the syllabus that are misunderstood by many of the candidates. In particular, **Question 8a**), demonstrated the candidates' lack of knowledge and understanding about blood supply and the substances carried in the blood and **Question 4**, where candidates were expected to use their knowledge and apply it to a specific situation. Candidates are becoming more able to perform calculations in Physics but some candidates lose marks due to their inability to manipulate equations and quote the appropriate units. The responses to question involving experiments are not well done by the majority of the candidates. This is shown by the poor response to questions in Biology, e.g. **Question 11**.

Comments on specific questions

Question 1

- (a) This question was well done by the majority of the candidates. Many candidates correctly drew the emergent ray although some candidates did not gain the second mark because their emergent ray was not parallel with the incident ray.
- (b) The formula for calculating the refractive index was quite well known by the candidates, however it was clear that a significant number of candidates were unable to use the formula. Many simply divided the angle of incidence by the angle of refraction rather than using the sines of these angles.

Answer: (b) 1.58

Question 2

- (a) A large number of candidates were unable to state that an enzyme is a protein or a catalyst.
- (b) The effect of an enzyme on a chemical reaction was not well known even amongst those who had identified amylase as a catalyst. The majority of the candidates stated that the enzyme converts starch into maltose.
- (c) This question was poorly answered by the majority of the candidates. A large number of the candidates answered the question in terms of chemical digestion rather than how the process of chewing helps the process of digestion. Candidates were expected to describe the effects of mechanical digestion, where the food is broken down into smaller pieces to increase the surface area of the food and to mix the food with saliva in order to soften or moisten the food, which either dissolves soluble materials in the food or speeds up the process of digestion.

Question 3

- (a) Candidates were unaware of the reasons why helium is used to fill airships and balloons. Candidates were required to state that helium is less dense than air and is not flammable. The majority of candidates were aware that helium has a low density but did not make the necessary comparison with the air. Similarly many candidates simply stated that helium is a noble gas with no reference to its lack of reactivity.
- (b)(i) Only a small proportion of the candidates were aware of the significance of oxygen in the air and the fact that it would react with the tungsten filament in a light bulb. A large number of candidates do not realise that argon is used in light bulb because of its lack of reactivity. Many candidates thought that argon is used because it is a better electrical conductor than air.

- (ii) Only a small number of candidates answered the question in terms of electronic structure. Of those candidates who stated that argon has a full outer shell of electrons very few realised that this meant that argon does not lose or gain electrons. A large number of candidates were aware that argon has a stable electronic structure, which was insufficient to gain credit.

Question 4

- (a) (i) Many candidates knew that the water loses potential energy as it falls from the upper lake, but a significant number of candidates thought that kinetic energy was lost.
- (ii) Candidates who answered (a)(i) correctly invariably knew that the water loses kinetic energy as it slows down in the turbine. The candidates who stated kinetic in (a)(ii) almost always lost the mark in this part by stating the answer potential.
- (b) The diagram was successfully completed by the majority of the candidates, however some candidates were penalised for drawing the sine curve with insufficient care.
- (c) The calculation was well done by many of the candidates. A significant number of candidates were penalised because they did not convert the time to seconds before multiplying by the power. Candidates should also be aware that the correct unit for energy is joules (J).

Answer: (c) 3600 J

Question 5

- (a) (i) It is disappointing to note that many candidates were unaware that it is the hydrogen ion which causes acidity.
- (ii) The vast majority of the candidates were aware that the pH of an acid is less than 7, but they did not gain credit because they did not recognise that hydrochloric acid is a strong acid and therefore the pH value is between zero and three.
- (b) (i) The use of limewater to detect carbon dioxide and the result of the test was not well known by the weaker candidates. Many candidates simply stated that the limewater bubbles.
- (ii) Many candidates stated that carbon dioxide is the gas produced in the reaction even when the correct result had not been given in (b)(i). A significant number of candidates thought that the gas produced was hydrogen.
- (iii) The better candidates were able to suggest that the name of the salt produced by hydrochloric acid and calcium carbonate is calcium chloride.

Question 6

- (a) (i) Candidates did not appreciate that it is the cardiac/heart muscle that is supplied with blood by the coronary arteries.
- (ii) The question required the candidates to identify specific substances that were supplied to the heart muscle.
- (b) (i) The majority of candidates are aware of the health issues associated with an excess of fat in the diet.
- (ii) The detrimental effect on the coronary arteries of fat in the diet is well known by the majority of the candidates. A large number of candidates were able to describe the effect in detail.
- (iii) Another well answered question. The majority of the candidates were able to state another cause of coronary heart disease, with smoking being the most common answer.

Question 7

- (a) Many candidates were able to calculate the weight of the car but were penalised because they could not state the correct units.
- (b) The formula $F = ma$ was quite well known but a number of candidates were unable to manipulate the equation to calculate the acceleration of the car or state the correct units for acceleration. There was some confusion between mass and weight when the numbers were substituted in the equation and the answer 0.25 was seen quite frequently.

Answer: (a) 8400 N (b) 2.5 m/s^2

Question 8

- (a) (i) Many candidates knew the relative mass of a proton but the relative charges of the electron and neutron were less well known.
- (ii) Only a small number of candidates could define nucleon number. A significant number of candidates defined the nucleon number as the sum of the number of protons and electrons. There was also some confusion between nucleon number and relative atomic mass.
- (b) The value of the proton number, **Z**, was deduced correctly by a large number of candidates. The value of **A** proved difficult for many of the candidates. Many candidates quoted the value 80, the relative atomic mass of bromine from the Periodic Table.

Question 9

- (a) The majority of the candidates knew the symbol for a voltmeter, however the voltmeter was invariably placed in series rather than in parallel with lamp **Q**.
- (b)(i) The calculation of the resistance of the lamp was quite well done by many of the candidates. Some candidates correctly stated the formula ($V = IR$) for calculating the resistance but then manipulated the formula or substituted the values in the formula incorrectly and therefore lost marks for the calculation. The units of resistance are quite well known.
- (ii) Many candidates were unable to determine the current at **X**, **Y** and **Z**. The most commonly correct answer was the current at **Z**.
- (c) Many candidates were able to suggest that the lamps are brighter or that the lamps are controlled separately in a parallel circuit. The weaker candidates answered the question in terms of current rather than voltage.

Answer: (b)(i) 4Ω (b)(ii) **X** = 6, **Y** = 6, **Z** = 3

Question 10

- (a) Many candidates had difficulty in identifying the compounds. It would appear that candidates are unable to link functional groups in a structural formula to the name of a particular type of compound.
- (b) Once again candidates are not able to link a structural formula to the name of a type of compound. A significant number of candidates did not understand what the question was asking as they stated the letters of both alkanes.
- (c) It was disappointing to see so few candidates being able to identify the combustion products of organic compounds. Candidates should be aware that when a compound burns the elements in the compound combine with oxygen forming the oxides, in this case carbon dioxide and water.

Question 11

- (a) (i) The loss of water was well known by many candidates.
- (ii) Many candidates knew that the water is lost through the stomata. Some candidates did not gain credit because they gave the general answer, leaf, rather than the specific structure on the leaf.
- (iii) The process by which the leaves lose water was quite well known but a significant number of candidates thought that the process was photosynthesis rather than transpiration.
- (b) (i) Only a small number of candidates correctly stated that the plant would begin to wilt after being left on the balance for a week. A large number of candidates stated that the plant would die which does not answer the question which asked for a description of how the appearance of the plant would change.
- (ii) It is clear from the responses received that there was a great deal of confusion amongst many candidates, who believed that the plastic bag is in place to stop light and carbon dioxide getting to the plant, in spite of the diagram showing that the leaves of the plant are not covered. Candidates were expected to explain that over the course of a week the plant loses more water than it could take up from the soil and therefore it loses its turgidity. Many candidates thought that the plant is unable to photosynthesize because of the plastic bag. The plastic bag is only covers the pot and only prevents the plant from receiving more water via the roots.

Question 12

- (a) Only the better candidates knew that a beta-particle consists of an electron.
- (b) The majority of the candidates were unaware that the beta-particle is emitted from the nucleus of an atom.
- (c) Many candidates were unable to read the graph accurately enough to gain credit. The line clearly reaches 200 counts per second at 28 years but the most common answer given was 30 years.

Question 13

- (a) (i) Many candidates failed to read the question carefully enough and drew the structure of a magnesium atom rather than a magnesium ion.
- (ii) Candidates who correctly drew the diagram in (a) frequently stated the formula of the ion correctly, although some candidates stated the formula as Mg^{2-} . Candidates who drew the diagram of a magnesium atom simply stated the formula of a magnesium atom.
- (b) (i) State symbols are not well understood by many candidates. Of those candidates who knew the state symbols many thought that carbon was a gas.
- (ii) A significant number of candidates were able to calculate the relative molecular mass of carbon dioxide. The answer 28 was given by some candidates who did not recognise that carbon dioxide contains one carbon atom and two oxygen atoms.
- (iii) Candidates are becoming increasingly aware of how to perform reacting mass calculations. Some candidates lost one mark because they did not realise that there are two magnesium atoms in the given equation.

Answer: (b)(ii) 44 (b)(iii) 2.4 g

Question 14

- (a) (i) A large number of candidates were able to state the two types of cell that form a zygote during sexual reproduction but there was some confusion between ovum, ovary and ovule particularly amongst the weaker candidates.
- (ii) The process of fertilisation was well known by a large number of candidates. A number of candidates simply repeated the question and named the process reproduction or sexual reproduction.
- (b) (i) A number of candidates had difficulty naming the parts of the female reproductive system. The only part known by many of the candidates was the vagina.
- (ii) It is disappointing to report that only a small number of candidates is aware of the basic principles of the female reproductive system and how it operates. Quite a large number of the candidates were able to identify the parts **D** and **E** but the function of these parts was poorly answered. The majority of the candidates thought that fertilisation occurred in the fallopian tube or that it allowed the passage of sperm to the ovary.
- (c) Only a small proportion of the candidates were able to correctly indicate where the zygote developed. The majority of the candidates placed the cross on the fallopian tube, part **E**.

Question 15

- (a) (i) Many candidates stated that the concrete slabs expanded during hot weather.
- (ii) A number of candidates were confused by this question. Candidates were expected to state that the gaps between the slabs are smaller during hot weather but far too many candidates thought that the gaps are closer together under these conditions.
- (b) This question was well answered by many of the candidates.

Question 16

- (a) This question was well done by the vast majority of the candidates.
- (b) (i) Only the best candidates could make an attempt at this question. It was clear that the majority of the candidates did not understand what is meant by a dot and cross diagram to represent the bonding in a covalent molecule.
- (ii) The better candidates were able to name the salt produced when magnesium reacts with hydrochloric acid.
- (iii) The predominance of covalent bonding as the answer to this question suggests that a large number of the candidates were guessing the answer. Candidates should be aware that the type of bonding present in any salt is ionic.

Question 17

- (a) The order which the words appear in the food chain was well known by the majority of the candidates.
- (b) (i) The original source of the energy for the food chain was not well known. A significant number of the candidates thought that the source of the energy was some sort of foodstuff like carbohydrates.
- (ii) Despite the fact that the source of energy for the food chain was not well known by many candidates, the process by which the energy is made available was known.
- (iii) Answers to this question suggested that many of the candidates were guessing.

- (c) (i)** This question required the candidates to suggest a carbon compound in which carbon passes from one organism to another but a large number of candidates suggested non carbon containing compounds or used the words given in part **(a)** of the question. The most common carbon containing compound was carbon dioxide.
- (ii)** This was also answered poorly by large numbers of candidates although the better candidates were able to name carbon dioxide as the compound in which the carbon leaves the food chain. Again in the question a significant proportion of the candidates named non carbon containing compounds or used the words given in part **(a)** of the question.

Question 18

- (a)** The majority of the candidates was able to correctly label the poles on the unmarked magnet.
- (b)** This question was poorly answered by the majority of the candidates. It is clear from the candidates responses that electromagnetism is poorly understood by the majority of the candidates. Large numbers of candidates answered the question in terms of either electrical or thermal conductivity of the brass and steel rather than their magnetic properties.