

COMBINED SCIENCE

Paper 5129/11
Multiple Choice

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

General comments

Candidates found questions 31, 37 and 39 to be very challenging.

Comments on specific questions

Question 1

Many candidates correctly identified that red blood cells have a large surface area to volume ratio and transport oxygen. Option D was the strongest distractor.

Question 2

Many candidates found this question challenging. Options **A** and **C** were strong distracters. Candidates need to ensure that they are clear about the role of the cell wall and cell membrane.

Question 3

Candidates also found this question challenging. The majority of candidates incorrectly selected option **D**. Enzymes are not used up during a reaction and therefore option **C** was the expected answer.

Question 4

Many candidates identified that leaves would be pale and growth poor if a plant had insufficient nitrogen.

Question 7

Candidates found this question more challenging. Option **B** was a strong distractor for the weaker candidates.

Question 8

Candidates also found this question challenging. Many candidates thought the lactic acid had been broken down after 3 minutes.

Question 9

Option **C**, the liver, was a strong distractor for many candidates but many candidates were able to correctly select the kidney as the organ through which the blood passed.

Question 10

Many candidates were able to identify the ciliary muscles as the correct structure although option **D**, the iris, was a strong distractor.

Question 11

This question discriminated well between candidates. Weaker candidates selected addiction which is an effect of alcohol consumption but it is not a short-term effect.

Question 13

Candidates found this question more challenging. Option **A** was the strongest distractor for the weaker candidates; they must ensure that they are clear about the features of sexual and asexual reproduction.

Question 14

A large proportion of the candidates recognised that a burette and a pipette are used for a titration. However, many of these candidates thought that a pipette is used to accurately measure 18.50 cm^3 and chose option **C**.

Question 16

The stronger candidates understand the notation used to represent atoms of elements. A large proportion of the weaker candidates thought that the nucleon number (19) represents the number of electrons in an atom and chose option **C**.

Question 17

Candidates must be clear about the general properties of ionic compounds.

Question 18

The concept of covalent bonding is well understood by the stronger candidates.

Question 19

A large proportion of the stronger candidates recognised that formula of an indium ion is In^{3+} but a significant proportion of the candidates thought that the ion is represented by In^{4+} and chose option **B**.

Question 21

This proved to be a straightforward question for the stronger candidates. A significant proportion of the candidates thought that acidic solutions have a pH value above 7 and chose option **D**.

Question 22

There is a misconception amongst the candidates that the relative atomic mass of the element or the number of electrons in the outer shell determines the position of the elements in the Periodic Table rather than the number of protons in the nucleus.

Question 25

This was another straightforward question for the stronger candidates. A large proportion of the weaker candidates thought that oxygen is the most abundant gas in clean air.

Question 27

The vast majority of the candidates were able to calculate that there are 15 carbon atoms and 30 hydrogen atoms unaccounted for in the reaction. Candidates also needed to recognise that the question stated that three molecules of the other substance are produced in the reaction. Many chose option **C** rather than option **A**.

Question 28

This question showed excellent discrimination with the better candidates choosing the key, option **C**, and the weaker candidates option **B**, the time for half oscillations.

Question 29

This question also showed excellent discrimination with weaker candidates divided, almost equally, between options **A** and **B**.

Question 30

In this question more candidates, including a number of the stronger candidates, chose option **B** rather than the key, option **C**.

Question 31

This question was found to be very challenging, with most candidates using the final length of the spring to obtain the load to choose option **C**. The key, option **B**, was chosen by a small number of stronger candidates.

Question 32

This question was well answered. However, a significant number of the stronger candidates chose distractor **A**.

Question 33

The key to this question lay in recognizing that gases expand more than solids or liquids. **B** proved to be a popular distractor for even the stronger candidates.

Question 36

This question showed excellent discrimination with the stronger candidates choosing the key, option **C**, and the weaker candidates favouring option **D**.

Question 37

This question differentiated well. The weaker candidates calculated using the time in hours, choosing the answer given in distractor **A**.

Question 38

This question showed some uncertainty with some stronger candidates choosing option **B**.

Question 39

In this question more than twice as many candidates choose option **A** than did the key, option **C**. Option **B** proved a powerful positive distractor.

COMBINED SCIENCE

Paper 5129/12
Multiple Choice

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

General comments

Candidates found no question to be very easy and only **Question 38** to be very challenging. However, **Questions 31, 35, 37** and **38** showed uncertainty and guessing among the stronger candidates.

Comments on specific questions

Question 2

Many candidates found this question challenging. Options **A** and **B** were strong distractors; candidates must ensure that they are clear about the roles of the cell wall and cell membrane.

Question 3

Most of the stronger candidates correctly recognised that enzymes increase the rate of a reaction..

Question 4

Many candidates identified that leaves would be pale if the plant had insufficient nitrogen. A significant number of weaker candidates incorrectly thought that the plant would wilt.

Question 5

Candidates found this question challenging, with option **A** proving to be a very strong distractor.

Question 7

Candidates found this question challenging with red blood cells proving to be a strong distractor for the weaker candidates.

Question 8

Candidates found this question very challenging. Option **C** was the strongest distractor suggesting that candidates think carbon dioxide is a product of anaerobic respiration.

Question 9

The majority of candidates incorrectly selected **A** as the correct graph. Candidates may not have appreciated that the first graph showed the concentrations in the blood whereas the second graph showed the concentrations in the urine.

Question 10

The majority of candidates were able to identify the ciliary muscles as the correct structure although option **D**, the iris, was a strong distractor for the weaker candidates.

Question 12

The majority of candidates found this question very challenging with **B** (respiration) being the strongest distractor.

Question 13

Candidates also found this question more challenging. Option **A** was the strongest distractor for the weaker candidates; they must ensure that they are clear about the features of sexual and asexual reproduction.

Question 14

There was evidence of guesswork even amongst the stronger candidates. Candidates should know that the apparatus used to add the acid in a titration is a burette and that a measuring cylinder and a pipette are in sufficiently accurate to measure an unknown volume.

Question 15

The stronger candidates understand the notation used to represent atoms of elements. A large proportion of the weaker candidates thought that the nucleon number (19) represents the number of electrons in an atom and chose option **C**.

Question 17

Candidates need to ensure that they know the general properties of ionic compounds; there was evidence of guesswork even amongst the stronger candidates.

Question 18

A large proportion of the stronger candidates recognised that formula of an aluminium ion is Al^{3+} but a significant proportion of the candidates thought that the ion is represented by Al^+ and chose option **B**.

Question 20

This proved to be another straightforward question for the stronger candidates. A significant proportion of the candidates thought that acidic solutions have a pH value above 7 and chose option **D**.

Question 22

There is a misconception amongst the candidates that the relative atomic mass of the element or the number of electrons in the outer shell determines the position of the elements in the Periodic Table rather than the number of protons in the nucleus.

Question 23

There was evidence of widespread guesswork even amongst the stronger candidates.

Question 24

A majority of the candidates deduced that metal K is the most reactive but the weaker candidates had more difficulty deducing the relative reactivity of metals L and N and chose option **B**.

Question 25

This was another straightforward question for the stronger candidates. A large proportion of the weaker candidates thought that oxygen is the most abundant gas in clean air and chose option **D**.

Question 26

Candidates need to ensure that they know the uses of the fractions obtained from the fractional distillation of petroleum.

Question 27

The idea that ethanol is used as a solvent in perfumes is well known by the stronger candidates although many of the candidates thought that ethanol is used as a component of some perfumes due to its smell and chose option **B**.

Question 30

This was well answered but option **B** was chosen by some of the stronger candidates.

Question 31

In selecting their answer candidates needed to account for the original length of the spring; most candidates, including a significant number of stronger ones, chose option **A**.

Question 34

This showed very good discrimination although a number of stronger candidates chose option **D** with weaker candidates choosing option **A**.

Question 35

Responses to this question showed uncertainty and guessing among candidates with options **A** and **C** each attracting a significant number of the stronger ones.

Question 36

Candidates must read the question carefully; a number of stronger candidates chose option **C**, the angle of reflection at the first mirror.

Question 37

This question discriminated well but the volt as J/C was not well known. There was guessing among candidates as more chose option **C** than did option **B**, the key, and some stronger candidates chose option **A**.

Question 38

This showed very good differentiation but weaker candidates used the time given in hours and chose option **A**.

COMBINED SCIENCE

Paper 5129/21
Theory

Key Message

Candidates should be aware that equations in physics should be represented by the usual symbols if the variables are not defined in the question or answer.

General comments

It is encouraging to note that more candidates are showing their working in calculations in the Physics questions on the paper.

Ideas about the refraction of a ray of light through a lens and reflection by a mirror are not well understood by many of the candidates. The Chemistry questions were less well answered than in previous sessions, particularly the organic Chemistry question. The questions on the Biology section of the syllabus, particularly those which involved recall were answered well by the candidates. The question about reproduction was generally answered very well.

Comments on specific questions

Question 1

This question was well answered by many of the candidates. The weaker candidates were aware of the need for a supply of oxygen and water for germination to occur but the names of the parts of a seed were less well known by some of the candidates.

Question 2

(a)(i) Many of the candidates were able to calculate the relative molecular mass of aluminium oxide.

Answer: 102

(ii) The stronger candidates were able to use the stoichiometry of the equation correctly, however many candidates recognised the proportionality between the reactants and products in a chemical reaction.

Answer: 204 384
5.1

(b) The use of copper for electrical wiring was well known by many of the candidates but the uses of aluminium were less well known.

Question 3

(a) The symbol for an ammeter and where it is placed in the circuit was well known by many of the candidates, however the fact that the voltmeter is placed in parallel with the variable resistor was known only by the stronger candidates.

(b)(i) This proved to be a straightforward question for many of the candidates.

Answer: 1.85 A

- (ii) The equation, $V = IR$, was well known by many of the candidates but some of the candidates had difficulty rearranging the equation to make the resistance the subject of the equation. The units of potential difference are not well known.

Answer: 16 V

Question 4

- (a) The word equation for photosynthesis was well known by many of the candidates.
- (b) (i) The nucleus was identified by a large proportion of the candidates but the cuticle and vacuole were less well known.
- (ii) The function of chlorophyll was well known by the candidates.
- (iii) The idea that layer **E**, the palisade mesophyll cells, contains more chloroplasts than layer **D**, the spongy mesophyll cells because they are closer to the surface of the leaf and therefore able to absorb more sunlight so that more photosynthesis occurs is not well understood by the candidates. A significant proportion of the candidates knew that chloroplasts / chlorophyll were responsible for photosynthesis. They needed to be able to express their responses to show the differences between the two layers. This was found to be challenging.

Question 5

- (a) The apparatus used for a titration are not well known by the majority of the candidates. The strongest candidates recognised that the end point of a titration is shown when the Universal Indicator turns green, showing that the pH of the solution is neutral.
- (b) The stronger candidates recognised that a reaction between an acid and an alkali is described as a neutralisation reaction.
- (c) The concept of an ionic equation needs to be understood by candidates. This did not appear to be well understood.

Question 6

- (a) (i) This question was answered extremely well by the vast majority of the candidates.
- (ii) Many of the candidates were able to read the scale on the ruler and calculate the length of the crocodile clip.

Answer: 5.2 cm

- (iii) A large proportion of the candidates gave their answer in centimetres rather than millimetres. A clear understanding of the concept of ratios was required by candidates.

Answer: 7.8 mm

- (b) (i) This question was well done by many of the candidates.

Answer: 0.375 cm^3

- (ii) Many of the candidates recognised that the volume of one crocodile clip is too small to give an accurate reading.
- (iii) The equation for calculating the density is well known by a large majority of the candidates.

Answer: 7.2 g/cm^3

Question 7

- (a) The substances produced in the liver are well known by many of the candidates.
- (b) The substances broken down by the liver are well known by the stronger candidates but there is a misconception amongst some of the candidates that fats are broken down by the liver.

Question 8

- (a) The fact that cracking is used to manufacture alkenes from alkanes was not well known by the majority of the candidates.
- (b)(i) The general formula of alkenes was not well known by a large proportion of the candidates.
 - (ii) A large proportion of the candidates appreciate that the structure of alkenes contains a double bond. The vast majority of the candidates did not state that the double bond is between carbon atoms.
 - (iii) The use of bromine to distinguish between alkenes and alkanes is not well known by many of the candidates.
- (c) The fact that water/steam undergoes an addition reaction with ethane to make ethanol is known by the stronger candidates.
- (d) Most candidates knew that carbon dioxide is produced during the combustion of ethanol. Candidates should have noted the statement in the question "in excess oxygen" and given water as the second product rather than carbon monoxide.

Question 9

- (a) A large proportion of the candidates were able to label the neutral wire correctly.
- (b) Candidates should know that current passes through the live wire to the appliance at high voltage and the current passes through the neutral wire away from the appliance at a low voltage.
- (c) Most candidates were able to calculate the current in the fuse.

Answer: 13 A

Question 10

- (a) The structures in the heart were well known particularly by the stronger candidates.
- (b) In order to answer the question candidates need to be able to identify the aorta on the diagram.

Question 11

- (a) Candidates need to be clear about what the letters A and Z represent. Many candidates were able to work out the number of protons and neutrons in the atom but then a number of these candidates allocated the numbers the wrong way round.
- (b) Many candidates recognise that the group number of a particular element indicates the number of electrons in the outer shell of an atom of the element.
- (c) The idea that non-metallic elements form acidic oxides needs to be understood. This did not appear to be the case for the majority of candidates.
- (d) Those candidates who recognised that the type of bonding is covalent invariably were able to explain that this type of bonding is formed when two non-metals combine together.

Question 12

- (a) Many of the candidates were able to show the refraction of the ray through the lens; many of the candidates did not realise that the refracted ray passes through the focal point of the lens. A small proportion of the candidates were able to show the ray being reflected by the mirror so that the angle of incidence equals the angle of reflection.
- (b)(i) Many candidates were able to state that the range of wavelengths in the region marked X. To receive credit for their response candidates needed to include the 10^{-9} . This was not the case for the vast majority of candidates.

Answer: $350 \cdot 10^{-9}$ to $400 \cdot 10^{-9}$ m

- (ii) The speed of light in vacuum was not well known by many of the candidates.

Answer: $3 \cdot 10^8$

- (iii) The equation $v = f\lambda$ was well known by many of the candidates however the majority of the candidates chose the incorrect value for the wavelength or rearranged the equation incorrectly.

Answer: $5 \cdot 10^{14}$ Hz

Question 13

- (a) The reproductive organs of a woman are very well known by many of the candidates.
- (b) The functions of the oviduct and of the uterus are well understood by a majority of the candidates.
- (c) The advantages of breast feeding a baby are well known by many of the candidates.

Question 14

- (a) The majority of candidates recognised that carbon dioxide is produced during respiration but there was some confusion between respiration and photosynthesis amongst the weaker candidates.
- (b) The fact that nitrogen dioxide turns Universal Indicator red was not well known by many of the candidates.
- (c) The use of chlorine to sterilize water is well known by the vast majority of the candidates.
- (d) The use of helium in balloons is well known by many of the candidates.
- (e) The rest for oxygen is well known by a large majority of the candidates.

Question 15

- (a) Many candidates were able to read the graph correctly.
- (b) Stronger candidates recognised that the floating marker reached a maximum volume of 100 cm^3 in a shorter time.
- (c) The equation $W = fd$ is well known by many of the candidates.

Answer: 0.015 J

Question 16

- (a) (i) This question proved straightforward for the vast majority of the candidates.
- (ii) This question proved straightforward for the vast majority of the candidates.
- (b) Many candidates recognised that candidate **L** has a lower number of white blood cells. Candidates needed to explain why this would lead to candidate **L** suffering from more frequent infections.

Question 17

Stronger candidates were able to match the element to the property.

COMBINED SCIENCE

Paper 5129/22
Theory

Key Message

Candidates should be aware that equations in physics should be represented by the usual symbols if the variables are not defined in the question or answer.

General comments

It is encouraging to note that more candidates are showing their working in calculations in the Physics questions on the paper.

Ideas about the refraction of a ray of light through a lens and reflection by a mirror are not well understood by many of the candidates. The Chemistry questions were less well answered than in previous sessions, particularly the organic Chemistry question. The questions on the Biology section of the syllabus, particularly those which involved recall were answered well by the candidates. The question about reproduction was generally answered very well, but those questions which involved explanations were less well answered.

Comments on specific questions

Question 1

- (a) (i) A significant proportion of the candidates were able to calculate the relative molecular mass of sodium carbonate.

Answer: 106

- (ii) Candidates needed to take the stoichiometry of the equation into account for the mass produced from 84 g of sodium hydrogencarbonate. Most candidates recognised the proportionality between the reactants and product in a chemical reaction.

Answer: 53 9
2.65

- (b) The test for carbon dioxide is well known by many of the candidates.

Question 2

- (a) A large number of candidates recognised that lactic acid is produced during anaerobic respiration but not aerobic respiration and that aerobic respiration releases relatively more energy than anaerobic respiration. The products of each type of respiration were less well known by the candidates.
- (b) A large proportion of the candidates answered this question as a description of aerobic respiration rather than describing how oxygen reaches the muscles. Candidates were expected to state that the oxygen in the air is taken into the lungs, absorbed by the red blood cells by combining with the haemoglobin and transported by the blood to the muscles where it diffuses into the muscle.

Question 3

- (a) Many of the candidates identified the meters used to measure the potential difference and the current.
- (b)(i) The equation for calculating the resistance, $V = IR$, is well known by a majority of the candidates.

Answer: $42.5\ \Omega$

- (ii) This proved to be a straightforward question for many of the candidates.

Answer: 4.2V

Question 4

- (a) A large proportion of the candidates were able to identify **A** and **C** as water and carbon dioxide, however only the stronger candidates were able to name **B** as zinc nitrate.
- (b) The apparatus used for a titration needs to be known by candidates. Many of the candidates recognised that when the universal indicator goes green, the solution is neutral. The fact that a reaction that releases energy is an exothermic reaction is known only by the strongest candidates.
- (c) Candidates need to understand how to construct the formula of a compound from its constituent ions.

Question 5

- (a)(i) This question was extremely well answered by the candidates.
- (ii) A large proportion of the candidates were able to read the scale on the ruler. However, many of these candidates did not convert their answer into millimetres.

Answer: 49 mm

- (iii) An understanding of the concept of ratios is needed by candidates.

Answer: 11 mm

- (b)(i) The stronger candidates were able to describe how a measuring cylinder and water are used to determine the volume of a used AAA cell. A significant number of the weaker candidates recognised that the cell is added to the water in the measuring cylinder but then did not indicate that the volume of the cell is the difference between the initial and final readings on the measuring cylinder.
- (ii) The calculation of the density was well done by a large number of the candidates. Many of the candidates quoted a correct equation and were awarded some credit even when the calculation was incorrect.

Answer: 13.9g

Question 6

- (a) Many of the candidates know that the role of chlorophyll is to absorb light however the role of light is less well understood. Candidates should know that light is a source of energy which is converted to chemical energy during photosynthesis.
- (b)(i) Many of the candidates interpreted the bar chart correctly but were unable to explain why an increase in temperature increases the rate of photosynthesis.
- (ii) A large proportion of the candidates thought that the rate of photosynthesis increases at 45°C or gave their answer in terms of transpiration and wilting. Candidates were expected to state that the rate of photosynthesis decreases due to the fact that the enzymes become denatured.

- (c) Many of the candidates knew that animals depend on plants provide food and oxygen.

Question 7

- (a) Only the stronger candidates were able to name the fractions.
- (b) Candidates should be aware that a hydrocarbon is a compound or molecule containing carbon and hydrogen only.
- (c) (i) This question proved to be very challenging for the majority of the candidates. Candidates should be aware that in a balanced chemical equation there are the same numbers of atoms on each side of the equation.
- (ii) Candidates should pay attention to the information given in the question that both **X** and **Y** change the colour of aqueous bromine from brown to colourless. Therefore both **X** and **Y** are alkenes. The responses also indicated that many of the candidates are unsure about the concept of a homologous series.

Question 8

- (a) A majority of the candidates were able to label the live wire.
- (b) The function of the earth wire was known by the stronger candidates. Candidates should know that the earth wire carries current to earth which prevents the appliance becoming live and therefore prevents the risk if an electric shock.
- (c) This calculation was well done by many of the candidates.

Question 9

This proved to be a straightforward question for the majority of the candidates.

Question 10

- (a) The link between the proton number and the number of electrons in an atom of an element is well understood by the vast majority of the candidates.
- (b) The link between the nucleon number and the number of protons and electrons in an atom of an element is well understood by the vast majority of the candidates.
- (c) The idea that covalent compounds are formed between non-metals which appear on the right hand side of the Periodic Table is less well understood by the candidates.
- (d) A majority of the candidates recognised that a metallic element forms an ionic compound with fluorine.
- (e) The stronger candidates appreciated that element **C** gains two electrons when it forms an ion because it needs two electrons to complete the outer shell.

Question 11

- (a) Many of the candidates were able to show the refraction of the ray through the lens. Many of the candidates did not realise that the refracted ray passes through the focal point of the lens. A small proportion of the candidates showed the ray being reflected by the mirror so that the angle of incidence equalled the angle of reflection.
- (b) (i) Many candidates were able to state that the range of wavelengths of orange light. In order to receive credit candidates needed to include the 10^{-9} in their response and to quote a range of wavelengths.

Answer: $600 \cdot 10^{-9}$ to $650 \cdot 10^{-9}$ m

- (ii) The speed of light in vacuum was not well known by many of the candidates.

Answer: $3 \cdot 10^8$

- (iii) The equation $v = f\lambda$ was well known by many of the candidates. The majority of the candidates chose the incorrect value for the wavelength or rearranged the equation incorrectly.

Answer: $5 \cdot 10^{14}$ Hz

Question 12

This question was well answered by many of the candidates. Ideas about blood are well known by many of the candidates. The function of the white blood cells and that the fact that hormones are carried by the blood to target organs needed to be better understood amongst candidates.

Question 13

- (a) The trend in melting point shown by the elements in Group I of the Periodic Table is known by the stronger candidates.
- (b) The fact that the Group I elements are called the alkali metals because they react with water to produce alkaline solutions is not understood by the candidates.
- (c) (i) Candidates need to be clear about what is meant by a chemical formula and a chemical equation. Many of the candidates simply wrote the formula of potassium chloride. Those candidates who attempted an equation used the symbol Cl instead of Cl_2 .
- (ii) The stronger candidates recognised that the reactivity of the alkali metals increases down the group and stated that potassium is more reactive than lithium or the converse.
- (iii) The candidates need to be clear about the meaning of the word *property*. Many of the candidates knew that potassium chloride is an ionic compound but instead of stating a property of potassium chloride these candidates stated that it is a compound formed by the combination of a metallic element and a non-metallic element.

Question 14

- (a) The stronger candidates recognised that the volume of the metals strips changes when bimetallic strip is heated and that this causes the movement of the pointer on the scale.
- (b) A large proportion of the candidates were unable to correctly label the axes on the graph. Many of the candidates, however, were able to sketch the graph with a positive gradient from zero on the x-axis.
- (c) The calculation was well done by a large proportion of the candidates.

Question 15

- (a) (i) This proved to be a straightforward question for the vast majority of the candidates.
- (ii) This proved to be a straightforward question for the vast majority of the candidates.
- (b) The concept of a trend is not appreciated by some of the weaker candidates who simply stated the number of alcohol related deaths in a particular year. Most candidates recognised that there are more male deaths than female deaths. Some of the candidates who stated general trends without mentioning the gender or the correct years in their responses did not receive credit if it was an overall incorrect trend.
- (c) A majority of the candidates knew that the organ that breaks down alcohol in the body is the liver.

(d) The effects of long term excessive use of alcohol are well known by many of the candidates.

Question 16

A large proportion of the candidates knew that a covalent compound is formed when two non-metal atoms combine, however, the words *elements*, *molecule* and *alloy* were less well known.