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FOREWORD

This booklet contains reports written by Examiners on the work of candidates in certain papers. **Its contents are primarily for the information of the subject teachers concerned.**

SCIENCE

GCE Ordinary Level

Papers 5124/01, 5125/01 and 5126/01
Multiple Choice

Paper 5124/01 (Physics/Chemistry)

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

Paper 5125/01 (Physics/Biology)

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

5126/01 (Chemistry/Biology)

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

General comments

The candidates and their teachers are to be congratulated on achieving a higher standard than last year – candidates produced a mean score of 23.62 (19.68) with a standard deviation of 7.19. Figures in brackets are the mean score for 2003. No questions proved difficult to any of the candidates and there was little suggestion of guessing. Only in **Question 9** was such uncertainty evident for all candidates along with **Questions 15, 17 and 18** for some. A number of questions proved to be easy with some 80% or more of candidates choosing correctly. These were **Questions 7, 12 and 20**. All questions discriminated well between candidates with the less able favouring, in most cases, the closest incorrect distractor.

Comments on specific questions***Physics, Papers 5124/01 and 5125/01 – Questions 1 to 20*****Questions 1 and 2**

These showed excellent discrimination among candidates with, in **Question 1**, the less able equally divided between options **C** and **D**.

Question 3

This question also showed good discrimination with the less able favouring option **D** over option **C**.

Question 4

This discriminated well among all candidates with option **C** the favoured response from the less able.

Question 5

This question was answered correctly by 76% of candidates.

Question 6

A significant number of the more able chose option **C**, while the majority of the less able favoured option **A**.

Question 8

Good discrimination with some more able candidates attracted to option **B**.

Question 9

More candidates chose option **B** than did the correct response, option **D**, possibly failing to fully understand the word 'always'.

Question 10

Another good discriminating question with the less able candidates equally divided between options **A** and **C**.

Question 11

This question gave excellent discrimination between candidates who were divided between two options: the more able correctly choosing option **B** and the less able option **D**.

Question 12

A number of candidates stubbornly continue to consider copper a magnetic material!

Questions 13 and 14

These both discriminated well with, for both questions, more than 70% of candidates choosing the correct option, **D**. The less able candidates favoured options **A** and **C** in almost equal numbers.

Questions 15, 17 and 18

These all showed evidence of guessing by some of the more able candidates who opted for response **C** in **Question 15**. In **Question 17**, possibly applying the selection rule for a fuse, they chose option **D** and in **Question 18** the response was either option **A** or **D**. The less able candidates opted for response **B** in **Question 15**, **A** in **Question 17** and **C** in **Question 18**.

Question 16

Good discrimination with the less able candidates opting for response **A**.

Question 19

Half-life was well known by the better candidates but the less able were uncertain, spreading their responses over the three incorrect options with a preference for option **D**.

Question 20

Nuclide notation was well known by ~90% of candidates.

Chemistry, Papers 5124/01 and 5126/01 – Questions 21 to 40 and 1 to 20**Question 21**

This question was well answered by the better candidates, but the weaker candidates chose option **B** suggesting a misunderstanding of the term diatomic.

Question 22

The majority of the candidates chose option **B**, the pipette, which is the apparatus used to measure the volume of alkali, but the question required the candidate to choose the apparatus used to measure the volume of acid required to neutralise the alkali.

Question 23

An easy question, particularly for the better candidates.

Question 24

An easy question for the majority of the candidates.

Question 25

This question was answered well by the better candidates but a significant proportion of the weaker candidates chose option **C**, indicating that the candidates thought that one mole of magnesium reacts with a mole of oxygen gas.

Question 27

There was evidence of guesswork amongst the weaker candidates, but the better candidates realised that the reaction would be quicker and that the volume of carbon dioxide would be the same for experiment 2.

Question 28

A significant number of candidates thought that copper(II) hydroxide is soluble in water and chose option **A**. The best candidates knew that the one soluble metal hydroxide is potassium hydroxide and chose option **D**.

Question 29

This question proved to be very easy, particularly for the better candidates.

Question 30

Another easy question.

Question 31

Over 40% of the candidates chose option **A**, which is an order of reactivity suggested by considering the information about the reaction of the metal with dilute hydrochloric acid. The better candidates also realised that element Z is more reactive than X and Y because it is not reduced by carbon and correctly chose option **C**.

Question 32

There was evidence of guesswork, particularly amongst the weaker candidates. Option **B** was a popular distractor chosen by over a third of the candidates.

Question 33

There was evidence of widespread guesswork, even amongst the better candidates in this question. Air is made up of 20% oxygen, which reacts with the iron filings causing them to rust and this will lead to the oxygen being used up and the water level rises to the 40 mark.

Question 34

An easy question, particularly for the better candidates.

Question 35

Over 50% of the candidates knew that distillation was a method used in the laboratory for desalination but a significant number of candidates chose option **B**, crystallisation.

Question 36

The structure of an alkene functional group is well known by almost 90% of the candidates, but the carboxylic acid group is not well known. Over 40% of the candidates chose option **D**, identifying the other functional group in the molecule as an alcohol.

Question 37

The majority of candidates knew that members of a homologous series do not have the same empirical formula.

Question 38

An easy question for the better candidates.

Question 39

Another easy question.

Question 40

An easy question, particularly for the better candidates. A number of the weaker candidates chose option **D**, where the methyl group and chlorine atom were on the same carbon atom rather than on alternate carbon atoms.

Biology, Papers 5125/01 and 5126/01 – Questions 21 to 40

Only a relatively small number of candidates elected to take one of the biology options. It is therefore unwise to make any general comments based on these statistics.

Papers 5124/02 and 5125/02

Paper 2 – Physics

General comments

In general **Section A** was well done in comparison with **Section B**. This is reasonable given the more open form of **Section B** questions, but many candidates seemed to have memorised a stock answer for some topics, these answers then being written down without due regard being given to the specific requirements of the question.

The value of knowing the correct units of physical quantities has been mentioned in previous reports, but several candidates still do not appreciate the importance of this topic. As a result errors were made which could fairly easily have been avoided.

Comments on specific questions**Section A****Question 1**

- (a) Incorrect answers indicated a common lack of understanding of the term *period*.
- (b) The correct method is the measurement of the time taken for a reasonably large number of complete oscillations – 20 or more. The period is then calculated by dividing this time by the number of oscillations. This is to be distinguished from the incorrect but frequently stated method of measuring the time for 20 separate single oscillations, then calculating the average value.

Answer: (a) 2 s.

Question 2

- (a)(i) Most candidates were aware that the acceleration of the box was zero, but fewer then went on to use the consequent fact that the *resultant* force must also have been zero.
- (ii) Various ways of describing the direction of the force were accepted, such as “west” or “towards the man” – any unambiguous correct answer gained the mark.
- (b) The box was moving with a constant speed, so no kinetic energy was being added. The correct answer is that heat was created.

Answer: (a)(i) 80 N.

Question 3

- (a) Most candidates were aware that calculation of moment needs the multiplication of a force and a distance, but a frequent error was to use the position of the line of action of the force as shown on the rule instead of the distance between that point and the **P**. Units were often incorrect or omitted.
- (b) The correct use of a balanced moments equation was generally well done.

Answers: (a) 36 Ncm (or 0.36 Nm); (b) 1.2 N.

Question 4

- (a) Most candidates quoted the correct equation for kinetic energy, but a significant number failed to square the speed when attempting to use the formula.

Many candidates attempted a conversion of their answer from J to kJ, even though this was not required.

- (b) This part is most easily answered by the method suggested in the question i.e. equating the kinetic energy from (a) to work done Fd .

Those who tried the more difficult method of getting the correct answer, using $F = ma$, often failed to distinguish between initial speed and average speed when calculating the time taken for the car to stop. Others used the value 20 as an acceleration, even though its units clearly show that it is a speed.

Answers: (a) 280 000 J; (b) 5600 N.

Question 5

- (a)(b) Almost all candidates appreciated that radiation was the process involved, and that black surfaces are better than polished surfaces at absorbing infra red radiation.

Question 6

- (a)(i) Despite this being a familiar question, there was still a lack of clarity from candidates in stating which two aspects of a transverse wave are perpendicular.

(ii) The answer, energy, was not often given.

- (b) A majority of candidates knew the correct formula, $v = f\lambda$. The major difficulty was in the calculation of the frequency (2 Hz).

Answer: (b) 50 cm/s.

Question 7

- (a) The key points required in the ray drawing were, the correct direction of bending at the two faces of the block and the emergent ray being parallel to the incident ray. The angles of incidence and refraction could be indicated only if the normal had been drawn. Most candidates did this part correctly.

- (b) Only a small proportion of the entry divided angles rather than the sines of angles.

Answer: (b) 1.51.

Question 8

- (a)(b) In those parts of the question requiring candidates to complete circuit diagrams, many incorrect symbols were used to indicate resistors. Whether or not the drawings were satisfactory, most candidates carried out the calculations to get correct answers. The only common difficulty was in remembering the formula for calculating the resistance of resistors in parallel.

Answers: (a)(ii) 12 Ω ; (b)(ii) 3 Ω , (iii) 0.3 A.

Question 9

- (a) Many candidates did not make clear that the earth wire is connected to the ground. Instead they gave a description of the function of an earth wire.

- (b)(i) It was not generally made clear that the rating of the fuse has to be of a slightly higher value than that of the expected current in the appliance.

(ii) There were several confused ideas shown in the answers to this part of the question. There seems to be a frequently held notion that current advances through the live wire before encountering the appliance, or that there is more current in the live wire than in other parts of the circuit.

Question 10

- (a)(b) Some candidates confused proton number with nucleon number even though the alternative names, atomic number and mass number, were given in the question.

Answers: (a) 81, 206; (b) 84, 210.

Section B**Question 11**

- (a) This part was well answered by a majority of candidates.
- (b) Few candidates were able to give satisfactory descriptions of a thermocouple thermometer. The fact that the small physical size of this type of thermometer makes it possible to react quickly to temperature changes is not well known.

Question 12

- (a) The good answers to this part, and part (a) of the previous question, show that a majority of candidates have learned how to describe important basic experiments.
- (b) Candidates should be sure to read the questions with care. The highest audible frequency was asked for, but most candidates gave a range of frequencies, not just the maximum. Although no candidates were penalised here, in answers to other questions it may be of importance to avoid the automatic reproduction of a memorised response to a topic.

Question 13

- (a)(i) This proved to be a topic that was not well understood. A surprising number of candidates confused induced e.m.f. and induced magnetism, therefore not gaining any marks. The basic demonstrations of electromagnetic induction can be shown using a galvanometer, a solenoid and a sensitive galvanometer, and should be known to all candidates.
- (ii) Either the speed of movement of the magnet or the number of turns on the solenoid would have been accepted by the Examiners.
- (b) This was well answered except by those who referred to charges rather than to magnetism and magnetic poles. Most recognised that the rods became magnets with like poles next to each other, and after switching the current off only the steel was then magnetised.

Papers 5124/03 and 5126/03 Paper 3 – Chemistry
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Comments on specific questions**Section A****Question 1**

Identifying substances by their descriptions

Names were asked for: candidates giving formulae were penalised but only once while answering this question.

In (b), 'Diesel' was the fuel accepted as the one that powers heavy road vehicles. In (c), 'chlorine' was the element required for its use in disinfecting contaminated water. In (e), 'aluminium' was the element expected for use in making aircraft.

Question 2*Chromatography*

Several solvents were acceptable though the most commonly correct responses were 'water' and 'ethanol', though 'alcohol' was also accepted. This was very well answered.

Question 3*Molecular mass when related to hydrocarbons in a homologous series*

The concept of molecular mass is a difficult one for candidates at this level and this was reflected in the quality of responses. One-twelfth a carbon atom, a hydrogen atom and one-sixteenth an oxygen atom were all accepted as standards. Assigning the name of methane to a hydrocarbon with a relative molecular mass of 16 was well done. Many candidates failed to identify the 'odd' hydrocarbon as being 'J'.

Question 4*Elements, mixtures and compounds*

Another difficult concept that was answered well.

Question 5*Oxidation and reduction*

In **(a)**, the state symbols were well identified. In **(b)**, few candidates associated oxidation and reduction with electron transfer. In **(c)**, most candidates could suggest means of increasing the rate of a reaction but not all could then explain why the rate should increase under these new circumstances.

Question 6*Nuclear structure and isotopes*

Most candidates realised that a metal ion contains fewer, in this case two, electrons than the associated metal atom. 'Losing electrons' was the factor that indicated that the calcium atom described in this question was acting as a metal.

Besides the conventional difference between isotopes of the same element of 'different numbers of neutrons in a nucleus', though just 'different number of neutrons' was enough to earn the mark, 'different rates of diffusion' was also accepted, as were 'mass', 'mass number' and 'isotopic mass number'.

Question 7*Calculation and equation writing*

Calculating the relative molecular mass of sodium hydroxide correctly earned the first mark of two in part **(a)**. The equation for the reaction of sodium hydroxide to give sodium hydrogensulphate was accepted as well as the more commonly and correctly given formation of sodium sulphate. A balanced chemical equation was needed: simple ionic equation were equally acceptable. Even so, candidates had difficulty in writing a balanced chemical equation.

Answers: **(a)** 2 mol/dm³; **(b)** 320; **(c)(ii)** 100 cm³.

Question 8*Solubility*

The presumably unfamiliar to candidates definition of the solubility of a substance in water was given in the question. Good graphs were drawn though candidates were penalised for drawing a curve that went through the point-of-origin. Candidates commonly identified the correct temperature of identical solubilities and the temperature at which substance 'W' had a particular solubility. The range 83-87 was accepted as being correct for **(i)** and 42-48 for **(ii)**.

Section B**Question 9***Manufacture of ammonia and a calculation*

This was well answered. Many candidates went beyond 'the essential condition' but were not penalised for doing so. Again, candidates struggled to write a correct chemical equation. Being given the formula for ammonia helped the weaker candidates and most were able to determine the relative molecular mass of ammonia and then determine the percentage of nitrogen by mass in a pure sample of ammonia.

Answers: (b) 17, 82.4%.

Question 10*Acids/alkalis and their properties*

Candidates found it difficult to write the symbol for a hydrogen ion and the symbol for a hydroxide ion. The remainder of this question concentrated upon the identification of simple anions and cations by the use of simple practical tests. Copper hydroxide and copper(II) oxide were accepted as an appropriate base and, as compound B, which was the compound that candidates found the most difficult to identify.

Question 11*Composition of clean air*

This was well answered, though 'hydrogen' was very often described as a constituent of clean air. Good knowledge was shown of the kinetic theory. Candidates had to explain how cooling a gas to a very low temperature will cause its particles to slow down, to come closer together until they stop moving from place to place, apart from vibrating about a fixed point, and to become regimented. Many good answers were given.

Papers 5125/04 and 5126/04

Paper 4 – Biology

General comments

The majority of candidates showed a rather poor knowledge of the syllabus, in both breadth and depth, and a weak understanding of the scientific principles involved. Only a few candidates scored well in any individual question or scored consistently across all of the questions. Answers from weaker candidates frequently bore little relation to, and often repeated phrases from the question. In **Section A** candidates left parts of questions unanswered. In **Section B** some candidates answered only one of the questions. Answers to **Section A** were generally better than those for **Section B**, where the freedom to organise their answers led many candidates into confusion. A number of candidates clearly had difficulty both in understanding the demands of the question and in framing an answer in understandable English.

Comments on specific questions**Section A****Question 1**

- (a)(i) Most candidates scored at least one mark, usually for 'petal'. Very few scored all three marks. Incorrect answers included a wide variety of flower parts, including leaf and stem.
- (ii) More able candidates realised that pollen is produced or released from this part. Others gave a variety of incorrect responses, such as 'to absorb oxygen', 'to absorb water', 'to attract the seed from another flower'.

- (b)(i) A number of candidates did not realise that this answer required more than the choice of a letter from the diagram. Only a very small number of the more able candidates gained the mark, usually from the idea of large petals or petals enclosing the stamen or stigma.
- (c) Only the most able candidates wrote about the growth of a pollen tube through which gametes travel to the ovary. Others gave vague answers referring to absorption of pollen, movement of pollen down the stigma/style or production of seeds.

Question 2

- (a)(i) Nearly all candidates realised that algae are the producers. A few of the weakest wrote water fleas.
- (ii) Nearly all candidates gained this mark, either for large fish or small fish. A few of the weakest wrote water fleas.
- (b)(i) Most candidates incorrectly thought that the radioactivity was absorbed directly by the fish from the water. Very few used the idea of a food chain in their answer.
- (ii) More able candidate suggested that large fish eat small fish, but most neglected to mention that they eat many small fish. The ideas of concentration of radioactive material through the food chain was not seen. Weaker candidates had no idea of the reason. Many wrote meaningless answers such as reference to people preferring to buy large fish.
- (iii) Very few candidates scored even one mark in this question. Some wrote about all of the fish dying, swimming away or being caught.

Question 3

- (a) More able candidates realised that the oil was there to prevent water loss by evaporation. Some thought that it was there to prevent passage of oxygen, either into or out of the water, or simply pointed out that oil floats on water.
- (b) Some candidates scored one mark for mention of xylem, but few included ideas about stomata or knew the term transpiration. Many simply wrote about movement through the stem and leaves into the air. A few incorrectly referred to root hairs, despite the presence of cut shoots in the diagram.
- (c)(i) Many candidates realised that shoot X has more leaves than shoot Y, gaining one mark. Very few mentioned surface area, number of stomata or increased transpiration for the second mark.
- (ii) Most candidates gave vague answers about sunlight and heat, gaining no marks. A few of the more able mentioned photosynthesis or evaporation, but of these even fewer mentioned an increase to gain a mark. Mention of stomata was rarely accompanied by the idea of wider opening on a sunny/hot day.

Question 4

- (a)(i) Many candidates misinterpreted this question, framing their answer to a reason why the woman could not get pregnant on the 28th day, rather than on any day of the 28. Most of those who understood the question had no real idea of an answer. Most attempts were vague references to the fertile period or menstruation.
- (ii) Few candidates understood this question, and fewer could attempt a sensible answer. Many referred to the length of the fertile period or to the length of a sperm or an ovum.
- (b)(i) Only the more able candidates related this question to the information in the graph. Others gave vague answers referring to release or fertilisation of eggs, or left it blank. Some misread the question and wrote about the ideas of having intercourse during the fertile phase in order to become pregnant.
- (ii) Many candidates suggested another form of contraception, the most common being the condom. Some weaker candidates simply suggested 'use contraception' and did not gain the mark.

- (c)(i) Few candidates realised that this would make the fertile phase even less certain. Many referred to the woman's chance of becoming pregnant.
- (ii) Many candidates correctly suggested that stress or illness could cause irregular menstruation. Some weaker candidates incorrectly suggested what might result from her irregular menstruation, with answers ranging from failure to become pregnant to getting cancer.

Question 5

- (a)(i) Many candidates realised that teenagers are more active, gaining one mark. Some also mentioned that they are growing.
- (ii) Some candidates misinterpreted this question, and wrote about differences caused by age rather than by gender. More able candidates realised that males require more energy, and many suggested that they do more heavy work to score two marks. Very few mentioned the larger musculature of males.
- (b) More able candidates generally gained one mark, either for mention that the farmer does heavier work or that the office worker is seated for most of the day. Weaker candidates wrote about the farmer working outside or in hot/sunny conditions whilst the office worker is in an air-conditioned office, which did not gain a mark. References to the farmer working harder or doing more work than the office worker received no credit.

Question 6

- (a) Very few candidates knew the definition of a drug given in the syllabus. Most gave vague answers referring to medicine, alcohol or addiction.
- (b) Most of the more able candidates knew that penicillin is used to cure infections, and a few knew that it is an antibiotic. Many weaker candidates incorrectly thought it to be a pain-killer.
- (c) A few candidates gained one or two marks for correct effects of excessive consumption of alcohol on the human body. Most gave vague references to effects not attributable to alcohol, e.g. lung cancer, or to effects that are not directly a result of excessive consumption of alcohol on the human body e.g. car accidents.

Section B

Question 7

This was the least popular of the three questions. Candidates in general showed a poor knowledge of this area of the syllabus, and few scored more than a few marks. Many scored zero.

- (a) Most of the candidates who attempted this question ignored or did not understand the reference to the man and woman being heterozygous. They therefore used the wrong genotype for the man and/or woman. Few candidates correctly worked out the possible genotypes of the children, and even fewer made clear which were the genotypes of the son and daughter.
- (b) More candidates were successful in working out the genotypes of the son and the woman he married, but few could then work out the possible genotypes of their children. Again most candidates did not make clear which child has which genotype.

Question 8

This was the most popular of the three questions. Some candidates showed poor knowledge and understanding of both nerve and hormone action, gaining few or even no marks for the question.

- (a) Few candidates could correctly identify **A**, **B** and **C** on the diagram as sensory, motor and relay neurones respectively. More able candidates could describe part of the pathway taken by the message, but many failed to mention the spinal cord or CNS. Many candidates became confused as to the order in which the neurones receive the message. Some weaker candidates identified **A**, **B** and **C** as organs or body parts rather than neurones.
- (b) More able candidates could name a hormone, but few could give a correct definition. Even fewer could make a sensible comparison between nerve and hormone action.

Question 9

Few candidates could frame their answer to the first part of this question in a way that scored more than one or two marks. The majority of candidates either misread or misinterpreted the second part of this question. A number of candidates scored zero for both parts.

- (a) Very few candidates referred to **P** and **Q** on the graph when describing how the activity of the two enzymes varies with change in pH. Many incorrectly referred to them as an acidic enzyme and an alkaline enzyme. Only the most able could relate the optimum pH of each to the part of the alimentary canal where it is active.
- (b) Almost all candidates who attempted this question described the effect of change in temperature on the activity of an enzyme rather than how they would carry out an experiment to investigate this effect. Consequently very few candidates scored any marks.