COMBINED SCIENCE

Paper 0653/01
Multiple Choice

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

General comments

Candidates achieved a mean mark of 22 with a standard deviation of 6.6. Mark distribution and discrimination were good across the ability range.

Comments on specific questions

Question 1

The perennial problem of candidates believing that the cell wall is partially permeable was again exposed, with one third of the candidates subscribing to the belief.

Question 3

There was a strong suspicion from the answers given to this question, that at least a quarter of the candidates are of the opinion that water required for photosynthesis enters the leaf through the epidermal cells.

Question 5

Although a simple knowledge of tooth structure is required, since all options were popular, there was every indication that candidates were far from confident in this section of the syllabus.

Question 6

The evidence here would suggest that, while candidates may know the effects of deficiencies in vitamins C and D, they may be less than able to recognise the symptoms when provided with illustration. Thus, 25% felt that the child might be showing signs of vitamin C deficiency.

Question 7

For some, this was a test of simple knowledge, for others of logical thought, but either way, it proved too difficult for over 50% of the candidates.

Question 12

It was a little disturbing that almost a half of the candidates felt that a contraceptive coil might be placed in the vagina (with 7% opting for between the legs!)

Question 14

By far the most difficult question, the problems related to the belief that changes in genes rather than in environment would cause a change in the colour of a plant's flowers from one year to the next.

Question 16

Only a quarter of the less able chose the key. Indeed, overall this group of candidates seem to have guessed. Not only is copper unreactive towards dilute acids but the question also refers to its being a catalyst in this context. Both of these considerations lead to **B** being the key.

Question 17

Some 40% of the less able chose **D** and only 18% of this group chose correctly, despite the question being straightforwardly based on chromatography.

Question 18

Over 40% of the less able chose **B** rather than the key. This suggests that they did not take account of the "2" in front of the carbon dioxide.

Question 19

Response **C** was noticeably popular with the less able, attracting 38%. This is, of course, the 'wrong way round'. Were these candidates confused about which type of element forms which type of oxide or (perhaps, more likely) confused about the 'direction' of the pH scale?

Question 20

Response **A** was relatively popular with both ends of the ability range. This suggests some basic misunderstanding about the nature of alloys.

Question 21

This was, somewhat surprisingly, the most difficult of the Chemistry questions, even though it is largely a matter of recall. Almost as many chose **B** as the key, **A**. Perhaps candidates did not understand what "brittle" means.

Question 22

The less able seem merely to have guessed between **B**, **C** and **D** but the more able were not totally confident in that only 60% of them answered correctly. The others in this latter group may have guessed if they did not know.

Question 24

Although not really difficult in principle, the question was perhaps a little subtle in having to pair the state of the lamp with the link across the two free wires. The less able almost certainly guessed but only slightly more than half of the more able could put together the idea that wood is a non-conductor with the lamp being unlit.

Question 25

Candidates do not seem to be happy with the concept of thermal decomposition being the breaking down of a compound by heat. Only 30% of the less able chose **A** and this only increased to 57% amongst the more able.

Question 26

The statistics of this question also seem to indicate a basic lack of understanding about monomer v. polymer.

Question 27

This was the second hardest of the Chemistry question – due to the popularity of response **B**: substance **P** is a carbohydrate and not a fossil fuel.

Question 29

This was correctly answered by about half the candidates, but it is interesting to observe that the most common mistake was to choose the length PQ to give the distance travelled.

Question 31

Many candidates were guilty of not reading the question with sufficient care, because nearly half chose option **D**, which was the only one with the same figures in the same order as those shown in the diagram. No attempt had been made to use the other information in the question to obtain the density.

Question 32

About 25% of the candidates showed the common misconception that the extension of a spring is the current length minus the previous length (rather than the original length).

Question 34

The hot water system caught some candidates. Just under half chose the correct option **B**, but over one third of candidates chose **C** which might be regarded as the next most logical choice after **B**.

Questions 35, 39 and 40

These questions indicated a lot of uncertainty about matters relating to radioactivity.

Question 37

It is a cause for concern that nearly half the candidates did not know which quantities are measured in volts.

Paper 0653/02

Paper 2 (Core)

General comments

The examination produced the full mark range and some excellent scripts were seen from many candidates who demonstrated good knowledge of the syllabus and used scientific terminology appropriately. Performance across the three Science disciplines was even, and candidates were generally able to complete the paper in the allotted time. As in previous years, there was evidence that some candidates did not seem to be very familiar with the techniques needed to gain good marks in this type of examination.

Comments on specific questions

Question 1

(a) Candidates had to specify *left* atrium/auricle for **A** and this was generally well answered. The labelling line for **B** shows a tendon. It was far less common to award this mark.

(b)(i)(ii) Usually answered correctly.

(iii) The first mark was for the idea that blood from the left and right sides of the heart could mix. This mark was very often scored. For the second mark, candidates had to convey the idea that blood being pumped to body tissues was not fully oxygenated. Some good descriptions of the function of the heart were seen but often candidates failed to state clearly why body tissues would be short of oxygen.

Question 2

(a) This question produced the full range of marks although it was rare for candidates to score less than two.

(b)(i) Most candidates in most Centres correctly answered this question.

(ii) This is a very likely question in Chemistry examinations and yet candidates still have trouble in answering it appropriately. Vague or incorrect statements such as *compounds are bonded and mixtures are not* and *it is impossible to separate compounds* or *mixtures can be easily separated* were penalised. Candidates are safer to explain the difference in terms of the components in mixtures retaining their properties compared to compounds which have different properties from the separate components. Another safe answer would be to explain that the proportions of the components in a mixture can have any value but have a fixed ratio in a compound. References to bonding must specify that it is the *particles of* the components in a compound that are bonded.

Question 3

(a) This was generally well understood by most candidates across the ability range.

(b)(i) This was answered correctly by the majority of candidates.

(ii) Many candidates understood speed/time graphs and scored one mark for saying that between **B** and **C** the athlete ran at constant speed. The term steady speed was accepted. The second mark was for specifying that the speed was 10 m/s.

(iii) This was answered correctly by the majority of candidates.

Question 4

(a)(i) Candidates need to be careful when answering questions of this nature. The safest answer is *the place where something/an organism lives*. Answers such as *an animal's home or an environment where there are animals* are not accurate enough to score the mark.

(ii) Similarly in this answer wording is critical. Candidates needed to convey the idea the community refers to <u>all</u> the organisms in a particular place. Many answers offered for this question were definitions of the term *population*.

(b)(i) The food web question was generally answered well by the majority of candidates. A minority drew their arrows pointing in the wrong direction but were penalised only once if the rest of the web was correct. A number of weaker candidates ignored the question and drew a web using organisms of their own. Even if technically correct no marks could be awarded.

(ii) The required answer is *direction of energy flow* or similar. The most common answer was *what eats what* which does not receive credit.

(iii) This was answered correctly by the majority of candidates.

Question 5

(a)(i) The words carbon dioxide were required and the majority scored the mark. Candidates writing carbon dioxide + heat were not penalised but those writing carbon oxide were.

(ii) The two ideas wanted here were the idea of increased surface area of the solid reactant and the consequence of more rapid/more efficient combustion. More practical answers such *as easier to light* were accepted but the phrase *gives more heat* was not unless qualified by saying *more heat given out in a shorter time.*

(b) All parts of this question were generally well known and most candidates scored all three marks.

Question 6

(a) Only the stronger candidates scored all the marks here, with the angle of refraction being the least accessible. Candidates had to draw in the normal at point **L** in order to show the angle of refraction. Candidates could have their ray emerge from either the surface opposite to **L** or from the top surface. In the latter case the ray must of course bend away from the normal. This caught out some candidates.

(b) Generally, simple Ohm's Law questions are well answered, but to score all the marks candidates must do as the question asks and show both the formula used and their working. The use of unusual symbols in the Ohm's Law equation were penalised if those symbols usually mean something else. The majority gave the expected answer of **6** ohms.

Question 7

(a) This was answered correctly by the majority of candidates.

(b) Candidates must make it clear that sulphur dioxide reacts/dissolves in the rain. Simple mixing was not accepted. The majority scored the mark for a reference to the rain becoming acidic. A mark was also available for discussing that acidic rain could <u>react</u> with stonework. Vague terms such as *wear away the stone* or *erode the stone* were nor accepted.

(c)(i) It was important in this answer to make it clear that carbon monoxide is produced by the burning of hydrocarbon fuel or at least that cars cannot avoid producing the gas when they are working. Most candidates scored the mark.

(ii) Candidates were required to make reference to the toxicity of carbon monoxide. The vaguer idea of harmful was accepted if specifically linked to humans. Stronger candidates described the physiological affects of carbon monoxide although this was not necessary in order to gain the mark.

(d)(i) Reference to the inert nature of argon was the only answer accepted, and many candidates scored the mark.

(ii) Generally candidates are well drilled in drawing atom diagrams and candidates across the ability range tended to score both marks. One mark was available for showing eighteen electrons and the other was for the correct configuration.

Question 8

(a) This question is often asked and the standard answer is *cell membrane which controls what enters and leaves the cell.* Candidates in some Centres had been well prepared for this question. Too many candidates suggested that the structure was the *cell* wall and that its function was to *protect the cell.*

(b) This was poorly answered by many candidates. The expected answer, refers to the need for nutrients for the zygote. A common incorrect answer referred to large surface area for the sperm to find.

(c)(i) This question was not very well known and large numbers offered uterus or vagina. The term *ovary duct* was seen more than once and was not allowed.

(ii) The most common incorrect answer, predictably, was 23; although a range of other numbers were offered. The majority scored the mark.

(d) There were three possible marking points *from the mother's blood;* by *diffusion; across the placenta.* The most common way that candidates lost marks was to imply that the mother and fetus had a common blood supply and that *food is* simply transferred. Far too many stated that *what the mother eats the baby eats.*

Question 9

(a) Although most candidates scored the mark by stating that the reading would be reduced, a significant minority of candidates across the ability range misinterpreted the question and discussed absorption without ever mentioning what had happened to the reading.

(b) **A** must be alpha because it is stopped by a sheet of paper and **B** is gamma because it is partially stopped by lead. This was quite well answered although the reasons for specifying the radiation type were sometimes very vague. For example ***A*** *is alpha because it is the weakest and* ***B*** *is gamma because it is the strongest.* This would score two of the available marks.

(c) This was not as well answered as had been anticipated. A simple reference to background radiation was all that was required but it was clear that many candidates were not familiar with the concept. If candidates did not use the term *background radiation* they could still score the mark if they described it well enough.

Paper 0653/03

Paper 3 (Extended)

General comments

Many candidates were thoroughly prepared for this paper, and there were a significant number who did well throughout all questions. However, these were in the minority; many candidates were totally at sea, with little understanding of any of the topics being tested.

There was no evidence that time was a problem. No one question proved particularly difficult or easy, and most candidates scored marks fairly evenly across all questions. Common errors include the omission of formulae when these are asked for in calculations, and omission of units in numerical answers.

Comments on specific questions

Question 1

Part **(a)** was quite well done, with many candidates able to say that the graph showed that voltage was proportional to current. However, many others left this blank. Even some of the latter, though, did manage to arrive at an answer of 1.8 A in **(b)**, but often this failed to score a mark because no units were given. The second mark here was given for some indication of how the prediction was made, using the idea of proportionality, and this was often well done.

The circuit diagrams were very variable. Symbols for a voltmeter and an ammeter were often correct, with the ammeter correctly placed in series; the positioning of the voltmeter was more likely to be incorrect. Some circuits lacked any power supply.

Question 2

Part **(a)** was well answered, most candidates correctly stating that haemoglobin is found in red blood cells. They also did well in **(b)(i)**, but the genetic diagrams in **(ii)** were usually incomplete, missing at least one of the components specifically requested.

In **(c)**, the majority of answers did no more than repeat the information given earlier in the question. Marks were awarded for the idea that less oxygen would be supplied to the muscles, which would affect the rate of respiration and therefore mean less energy could be made available.

Part **(d)** produced some very surprising answers, many of which were not minerals at all.

Question 3

Part **(a)** was often correct, although in many answers at least one of the three processes was in the wrong sequence. In **(b)**, although many candidates answered correctly, ***A*** was commonly given as an answer to **(i)** and ***B*** to **(ii)**.

Part **(c)** was only very rarely answered correctly, with the majority of answers being wild guesses. Marks were awarded for naming the solid as polythene, stating that the molecules join together, and that they form long chains.

The calculation of the relative molecular mass in **(d)** was often correct, although occasionally the addition of an incorrect unit spoilt the final answer.

Question 4

Despite the wording of the question, many answers failed to mention 'molecules'. In most cases, only the effects on water were described, not on the flask itself. Marks were available for the idea that the water molecules gain more kinetic energy, which results in their spreading further apart from each other; this makes the water expand and so rise up the tube. Similarly, the glass would expand, as its molecules vibrate more. Many candidates inappropriately described boiling, despite the question stating clearly that the temperature rose only to 50°C.

Question 5

In **(a)**, many candidates were able to state that speed = distance/time, and also to calculate the speed. However, weaker candidates often failed to give units with their answer.

The answer to part **(b)(i)** was known by some candidates, but others had no idea and made a wild guess. This obviously affected their answer to **(ii)**, but credit was given here as long as the incorrect value was used correctly here. Some did manage to make this calculation and give suitable units with their answer.

Part **(c)** was not done as well as expected. It was much more common to see answers suggesting that her mass would be less, rather than that it would stay the same; many candidates are confused between mass and weight.

Question 6

Although quite a few candidates could work out the correct formula for iron oxide in **(a)**, not many of these could explain their answer in terms of balancing charges. Some wrote formulae including aluminium as well. Some wrote word or symbol equations.

Part **(b)(i)** was quite often answered correctly, as was **(ii)**. However, many had no idea how to answer either of these questions. Part **(c)(i)** proved even more demanding. In **(ii)**, a mark was awarded for the idea that aluminium is more reactive than carbon and so would not be displaced from its oxide, and the better candidates usually answered this well.

Question 7

Apart from a small number of the better candidates, this question was very badly answered throughout. Part **(a)(i)** was the most accessible, but even here some very strange ideas were put forward. In **(ii)**, evaporation was looked for, together with the idea that this takes heat away from the skin. This was not often seen, with most candidates incorrectly stating that sweat is cool and so cools you down.

Part **(b)(i)** was also badly answered, with the majority of candidates suggesting that the blood vessels move closer to the skin. Of the few who correctly described vasodilation, only a small number were then able to explain, in **(ii)**, that this allows more blood to flow close to the skin surface, so allowing more heat to be lost by radiation. There was a great deal of totally incorrect description of blood vessels 'pumping', and much irrelevance concerned with oxygen transport.

Part **(c)** was often answered in very general terms, such as 'because you get ill if you get too hot'. Credit was given here for a mention of temperature affecting the rate of (metabolic) reactions, and that enzymes can be denatured if temperature rises too high.

Question 8

Many answers to **(a)** correctly explained that, as the centre of mass is over land, the car will not fall over the cliff. It was rare, however, to give the second mark for a clear explanation of this, for example in terms of turning forces (moments). Quite a few of the weaker answers concentrated on trying to predict what the driver would do.

In **(b)(i)**, many who remembered that weight = mass x gravitational field strength did not then remember that they needed to consider the height through which the car was lifted in their calculation. As in all calculation questions, formulae were often missing, as were units in the answer. Similar problems occurred in **(ii)**.

When they do give a formula, it is important that candidates make their meaning clear, and use either words or recognised symbols. It is not correct to use the symbols of units. For example, $W = fd$ is acceptable, while $J = fd$ is not. The correct symbols are shown towards the back of the syllabus.

Question 9

A number of candidates were able to answer **(a)(i)** correctly. However, a number attempted to write balanced equations, while others introduced substances not listed, such as potassium carbonate. Part **(ii)** was either known or not. Answers to **(iii)** were very disappointing, with relatively few candidates showing any knowledge at all of this process. A mark was given simply for the idea that acid would be added to alkali in the flask, but even this was awarded only rarely. Further marks were given for the idea that this would be done in a controlled way, and that an indicator would be used to determine the end point, or when neutrality had been reached. Part **(iv)** proved much easier, and many candidates correctly stated that the flask would be heated, or that evaporation would be allowed to take place.

Part **(b)** was only answered correctly by a very few candidates.

Question 10

Some candidates had clearly carried out this piece of required practical work, but many appeared to have no understanding of it at all. In **(a)**, many stated that this was because she wanted to know if light was necessary for photosynthesis, suggesting that they had either not read the introduction or had misunderstood it. Marks were given for the idea that this would stop photosynthesis happening, in order to destarch the plant.

There were some correct answers to **(i)** and **(ii)**, but once again these were relatively rare. Many candidates did not even attempt to answer **(c)**, and where they did, they frequently did not give the correct answer. Part **(d)** was a little better answered, with at least some candidates correctly stating that the chlorophyll absorbs sunlight. Of these, some were also able to explain that the energy from sunlight is used to make the reactions take place.

Paper 0653/04

Coursework

General comments

Nature of tasks set by Centres

Of the six Centres submitting coursework for the examination in June 2002, three had provided coursework before and three were new Centres.

While tasks in most Centres were entirely suitable, some of the new Centres displayed a little uncertainty in a few cases. It is hoped that they will find the "feedback" helpful. Overall the standard of work this year was of a similar standard to previous years, with marks ranging from outstanding to disappointing.

Teacher's application of assessment criteria

In all Centres the assessment criteria were understood and applied well for all of their activities. Advice given last year was taken and no Centres had any confusion about the skills being assessed. New Centres are reminded that skills C1 and C4 should not be assessed in the same investigation.

Recording of marks and Teacher's annotation

As always the Moderator is greatly helped by the annotation of candidates' scripts carried out by some Centres. While "tick lists" remain popular, particularly for skill C1, some recording systems are very comprehensive.

Good practice

The use of a summary sheet to make comments on an individual candidate's performance is another useful and helpful method employed by some Centres.

Paper 0653/05

Practical Test

General comments

The mark scheme produced a good spread of marks although as in previous years there were no very good candidates. Some elementary mistakes were made suggesting that many candidates had not had sufficient practice. A failure to recognise correct use of limewater when it is shown in the notes provided and a failure follow simple instructions are examples that support this criticism. Supervisors' co-operation was appreciated and few failed to provide a specimen set of results.

Comments on specific questions

Question 1

Although potassium hydrogencarbonate is not very soluble in water and it was expected that most would report solubility in warm water only, many reported it was soluble in cold. This was allowed. The question asked for a description of what was done and both marks were not awarded unless this description was given.

The pH of the solution is 8 or 9 and it was the value rather than the colour that scored the mark. On boiling, the solution converts to the carbonate. The pH value increases and the colour of the indicator moves in the direction of blue.

Considering the tests for oxygen and carbon dioxide are given in the practical notes, this part was not well answered. Whilst some candidates had little idea how to approach part **(d)**, many did and scored all three marks. It was necessary to include some measurements or at least draw attention to the fact that the test-tube became cool. It must be emphasised that it was necessary for the candidates to actually perform the experiment and reporting how it ought to be done is not acceptable.

Question 2

The majority of candidates failed to record their experimental values with the units as asked. The question clearly required length measurements in millimetres and current values in milliamps. Failure to do so was a major reason for poor marks. Not only did such candidates make the question more difficult for themselves, it amounted to changing the question, an action that is not permitted. Many recorded length values from 80 down to 20 in the first column of the table clearly labelled 'mm'. Were these values actually centimetres? The Examiner marked what was written, not what the candidate might have intended. The same criticism is applied to the current values. Even if the meter used was calibrated in amperes, there is no excuse for a failure to convert to milliamperes. Each individual current reading was not vital. It was the trend in the recorded values that was important. Whatever values were recorded, the graph was marked on the correct use of candidates values. However, as few recorded the length in millimetres, it was rare to see anyone with a scale to accommodate 1000mm. Hence the mark in **(e)** was rarely scored. Part **(f)** involved a simple substitution of the candidate's values and a correct calculation.

Question 3

The most common acceptable answer to part **(a)** was temperature although light was another acceptable response. There were some very poor tables and despite the words germination and growth being in bold, many tables failed to include reference to both. Marks were given for the correct trend in the responses with respect to both germination and growth with one mark for a presentable table. Most were able to score one mark in part **(b)(ii)** by stating that acid rain had an adverse effect on the seeds, but few noted any distinction between the diluted and more concentrated acid rain. The quality of drawings varied greatly although most candidates were able to pick up at least two marks. The drawing size needed to be at least 5cm and it required a full set of labels for three marks.

Paper 0653/06

Alternative to Practical

General comments

As usual, the Examiners tried to design an examination that encouraged the candidates, wherever possible, to demonstrate their experience in practical science. They were expected to know how to carry out many standard experiments and tests, to be able to record the results in an appropriate way, to draw conclusions from the results and to design extensions to the investigations. Many candidates were successful in all of these areas, showing that they had received a good grounding in experimental work and techniques appropriate to the syllabuses. Candidates who normally use a language other than English face particular difficulties, so the importance of both understanding and using scientifically accurate terms must be stressed. Some examples of problems in terminology will follow in the comments on specific questions.

A number of candidates, often whole Centres, were not adequately prepared for the examination itself since they had no rulers graduated in millimetres. The instructions for the examination are clear and there is no excuse for candidates not being correctly equipped.

Comments on specific questions

Question 1

Candidates who did not thoroughly absorb the long introduction to this question were at a disadvantage. Those who did not realise that the potato *produced* the enzyme later wrote about the reaction of the enzyme with the potato. The instruction "measure" in **(a)** was misunderstood by some candidates who calculated the heights of foam by proportion from the first set of data. Some other candidates had no ruler so they could not answer this question. The plotting of the graph was simple since the axes were labelled. A straight line graph was what was required here, passing through the origin if extended. A surprising number of candidates failed to answer **(b)(ii)** in correct terms, merely saying that "the larger the surface area, the higher was the foam." "The activity of the catalase was proportional to the surface area" gained both marks. The mark for **(iii)** was awarded for the statement that the surface area increased when the potato was cut up, but a more correct answer referred to the release of more catalase from the damaged cells.

Question 2

This question was intended to explore the understanding of the principle of moments.

Part **(a)** was the simple introduction for the lower ability candidates, but many failed to grasp the command "calculate" (as opposed to "measure" in **Question 1**) and so they actually measured the length of the lever arm in the diagram to find the distance.

No calculation was needed to find the mass of load **l**, but the poorer candidates did not see the logic. In **(b)(ii)**, many correctly stated the principle of moments but did the subtractions wrongly so did not arrive at the correct answer, 120g, for load **m**. Most candidates measured the length and correctly calculated the volume. However, a surprisingly large group thought that water exerts a downward force on metals so that they are heavier when submerged. Another problem arose when some tried to explain that the cube weighed less in water; they said that it had a smaller *mass*. The distinction between mass and weight should be an important part of the study of this area of physics. The 40g mass had to be moved nearer to the fulcrum since water exerts an upthrust on load **m**.

Question 3

Like **Question 1**, this question is based on one of the questions in the corresponding practical paper in which the tests are actually carried out. In this paper, the Examiners assume that the candidates have learned the standard analytical tests listed in the "Practical Notes". Parts **(a)** to **(e)** require them to interpret the experimental results and draw conclusions. Part **(f)** clearly asks for the design of a new experiment to decide on the identity of a white powder. Many tried wrongly to use information from the tests. Often, it was apparent that candidates had no experience of experimental design. All that is needed is the addition of the powder to a sensible amount of hydrochloric acid, using a thermometer to find the initial and final temperature; a temperature rise will show the exothermic reaction given by potassium carbonate.

Question 4

This question corresponds to the biology question in the practical paper.

The introductory part **(a)** referred to "conditions", a term that is rigorously applied to the environment of living plants: temperature, light intensity or amount of water. Some candidates did not understand this. The instruction to construct a "table" for the description of the three dishes and the seedlings was sometimes answered by drawings of the specimens or of graphs. A number of candidates tried to construct a table describing the seeds and seedlings on each of the four days of growth. The word "germination" was also a cause of error, since a few candidates thought that the acid rain introduced "germs" into the dishes.

In writing their conclusions, many candidates wrote that the acid rain had killed the seeds and so prevented growth. This gained no marks, since there is no evidence that any seeds or seedlings had been killed, only that the rate of germination had been lowered and growth hampered. This kind of response gained one mark, the second mark being awarded for a reference to the increasingly unfavourable effect of higher concentrations of acid.

The answer to part **(c)** must include the use of a number of dishes containing a known number of seeds, watered with "acid rain" having a suitable pH range and kept in the same conditions. After a few days the number of germinated seeds are counted and the percentage calculated. Some good answers to this section were noted.

Question 5

The Examiners looked for a way of testing this part of the chemistry syllabus upon which some interesting practical work may be based.

Most candidates knew why flowers are coloured; to attract insects that may then assist in pollination, a process variously described as pollution, polynation and even polymerisation. That ethanol is a good solvent was also a known fact. Part **(c)** was rarely answered well. Candidates who had carried out a chromatography experiment were able to draw a diagram showing the lower end of the chromatography paper dipping into a solvent contained in a covered beaker, with the start line above the liquid level. The result **(c)(ii)** showed two spots in a vertical line.

Most candidates did not realise that an indicator is a dye such as that found in the petals of a flower. They thought that an indicator such as Universal or litmus must be added. On the whole, the question was not well answered.

Question 6

The corresponding physics question in the practical paper used the same circuit diagram and graph grid, and also included part **(e)** of this question. The ammeter dials mystified some candidates but a commendable number read them correctly and then plotted the points on the graph using sensible scales on the axes, allowing the extrapolation to 1000 mm needed for part **(c)**. Many candidates then tried to draw the best straight line through the points (though they did not do so in the **Question 1** graph). A value of **I** obtained from the straight line was accepted. An incorrect value of **I** was carried forward and accepted if used in calculating the resistance. Most candidates obtained a value of about 37mA for the current, giving a resistance of around 40 ohms. The vast majority of candidates correctly used the formula without trying to convert milliamps to amps.

It was rare to find a candidate who could construct a circuit for the verification of Ohm's Law. The circuit should show a suitable resistor in parallel with a voltmeter, and in series with an ammeter and variable resistor, and a power source supplying a steady e.m.f. The variable resistor is set at decreasing values and the current and voltage noted each time, then plotted on a graph or treated mathematically to show the relationship between current and voltage.