PHYSICAL SCIENCE

Paper 0652/01

Multiple choice

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

General comments

The candidates for this paper achieved a mean mark of 24, with a standard deviation of 6.27. These statistics derive from a well spread distribution of marks. Some three or four of the Chemistry questions proved disappointingly hard and particular attention is drawn to these in the comments below. Nevertheless, with such a small entry, the conclusions to be drawn from the statistics may not be altogether certain. As always questions were of the same standard as equivalent IGCSE single science papers.

Comments on specific questions

Question 2

It is a little surprising that over 40% of the less able candidates chose **A** instead of the key, **B**. It is quite possible, of course, for the experiment to be carried out using the measuring cylinder as the reaction vessel but time is not involved so the clock seems to the obvious redundant piece of apparatus.

Question 5

A third of the less able candidates chose **B**, which suggests that they failed to appreciate that ionic compounds only conduct electricity when molten or in solution.

Question 7

After the key, **C**, response **D** was the most popular, especially amongst the less able. Perhaps these candidates merely guessed between **C** and **D** or omitted to recognise the presence of a catalyst.

Question 9

It is both disappointing and puzzling that this question should have been found so hard. Overall, 32% chose **A** whereas only 31% chose **D**, the key. Even amongst the more able some 42% chose **A** and a similar percentage of the less able chose **B**. It is the iron oxide that provides the oxygen to increase the proportion of oxygen attached to carbon. It is thus the 'oxidiser' or oxidising agent. The example is taken straight from the syllabus and is only slightly more complicated than reducing an oxide with elemental hydrogen.

Question 12

Amongst the less able, about as many chose **C** as chose **A**, the key. This shows that candidates recognised the difference between an alkali metal and a noble element but it is a pity that more did not realise that Group 1 metals increase in reactivity down the group.

Question 14

Even the more able found this question to be harder than other questions. A third of the less able chose **A** and the evenness of the numbers choosing the other options suggests that the less able were perhaps guessing. Does this imply difficulty with the concept of 'reactivity series'? This query is also supported by the statistics for **Question 15**.

Question 18

This question is perhaps unusual in focusing on the residue and this seems to have increased the difficulty. Only half of the more able chose correctly and there is evidence that the remainder of this group merely guessed. Guessing also seems to have occurred within the less able of whom over half chose **D**.

Question 19

Over half the candidates (roughly equally divided between the most able and the less able) chose **B**. Brass does not contain iron and so cannot, by definition rust. It is, at least, some comfort that candidates generally recognised that a chrome plated ring does not rust.

Question 20

Another quite hard question with more choosing **A** rather than **B**, the key. The polymer is indeed saturated but the convention is to name it from its monomer.

Question 22

A quarter of candidates thought that the length PQ gave the distance travelled.

Question 24

The statistics suggest that the candidates did not read this item carefully enough, because over 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 find the density.

Question 25

It is clear that large numbers of candidates have no idea how to calculate the extension of a spring. This deficiency occurs regularly in examination scripts.

Question 28

Just over half chose the correct option **B**, but one third of the candidates chose **C** which might be regarded as the next most logical choice after **B**.

Question 29

Virtually all candidates realised that the waves had the same speed in all directions, but a third of these thought that water waves are longitudinal waves.

Question 30

This proved to be one of the easy items, but there was still nearly a quarter of the candidates who thought that both alpha– and beta– particles are included in the electromagnetic spectrum.

Question 32

There were few candidates who did not recognise the general shape of the field pattern around a bar magnet. Unfortunately, a quarter of them chose arrows in the wrong direction.

Questions 33, 34, 36 and 37

All of these showed evidence of widespread guessing, a worrying observation on what is really basic Physics.

Paper 0652/02

Paper 2 (Core)

General comments

The general standard of the scripts was quite pleasing, however, it was disappointing to see an increase in the number of scripts which were of a very low standard. The basic Science was generally well understood by the majority, although a large number have great difficulty in applying well known ideas in novel situations.

Comments on specific questions

Question 1

This question was quite well done. Many candidates correctly completed the rays to get them to focus in the correct place, and then were able to correctly identify x as the focal length of the lens. The explanation as to why the paper may catch fire, however, was not done as well; a few candidates recognised that the energy would be concentrated on a small area but then did not develop the argument to gain full marks.

Question 2

Only the strongest candidates were able to score well on this question. Rarely did candidates correctly identify the correct number of bonds for both diamond and graphite. Descriptions of the structure of the macro molecules was very varied, too often descriptions of the properties of the materials were given instead of the structure of the molecule.

Question 3

Examiners were simply looking for the answer that the magnet comes to rest in a North-South direction due to the magnetic field of the Earth, however relatively few candidates clearly expressed their ideas even though they had some concept of North-South, many simply repeated that the magnet did lie in the North-South direction. There was confusion as to the name of the end pointing to the North. Where candidates were taught the full name (North Seeking Pole) there seemed to be less chance of them being confused. It was encouraging that many candidates recognised that a simple compass relied on this property of the metals in part **(b)**. Many candidates recognised that *Q* and *R* must both be a magnetic material, and that *R* must be magnetically hard and that *Q* must be magnetically soft. Any sensible nonferrous metal was acceptable for *P*, however highly reactive metals such as sodium were not accepted. As might be expected most candidates recognised that if the other end of metal *R* was brought up to the magnet it would attract.

Question 4

The answers to this were very variable, Examiners were, basically, looking for universal indicator, paper or solution to turn green. If litmus paper was used then it had to be stated that both blue and red litmus paper remained the same colour. Part **(b)** is a fairly standard procedure which has been asked in previous years, but once again candidates gave incomplete answers.

Question 5

This took a situation which was unusual, to try to demonstrate the ideas of convection. Sadly this caused a great deal of confusion for many candidates. However, many did score good marks in part **(b)(ii)**. Part **(c)** was probably found by many to be the hardest question on the paper and very few candidates scored both marks: many got the idea that hot air rises (it was not acceptable to say that heat rises), however it was a rarity to find an answer that developed the idea that this fed more oxygen to the fire.

Question 6

The majority of candidates were able to identify that the two isotopes had the same number of protons but different number of neutrons, this was described in a variety of forms. Part **(d)** however caused more problems and only the best answers gave an accurate description of the colour changes and then went on to explain why this change occurred.

Question 7

It was intended to help the candidates by giving the mass of the gold in both kilograms and grams, however it seemed to cause some confusion amongst the weaker candidates. The calculation of the turning effect or moment of the gold about the pivot was done reasonably well by the majority of candidates. Likewise finding the density of gold, however, there was a significant number of candidates who were unable to manipulate the formula correctly. It is worth noting on this point that candidates who did not show their working clearly could not score compensation marks when they made errors in the calculation. Part **(c)** was done quite well, although some discretion was used when candidates failed to fully answer the question that was originally asked, so comments such as gold is not reactive were allowed, although the question did actually ask for its position in the Activity Series. Candidates should be encouraged to read the question carefully and answer accordingly.

Question 8

Few candidates were aware of why the hydrocarbon was heated indirectly, many thinking that it was to give a more even heat. Most candidates recognised that this was a cooling curve, and the majority of those were able to correctly insert the correct words in the passage. The stronger candidates were able to recognise the melting point of the hydrocarbon as 37°C, however there was some difficulty explaining how the shape of the graph showed that the hydrocarbon was pure. It was surprising how few candidates were able to explain the significance of the final temperature.

Question 9

It was pleasing how many candidates were able to state that energy is the ability or capacity to do work. Of those who had the right idea, however a few spoiled their answer by talking about “the power to do work”. Power has a specific, linked meaning, consequently this answer was not acceptable. As might be expected the majority were able to state the correct unit of energy. In part **(b)**, the stronger candidates recognised that the kinetic energy was changed into heat energy, but there was a significant number of candidates whose ideas were muddled and who talked about “friction energy”, which is disappointing, particularly as part **(ii)** gave an indication that friction was a force, the force that work was being done against!

Question 10

Although many candidates described hydrogen as being lighter than air, relatively few gave the better answer that hydrogen is less dense than air, and thereby would stay in the tube due to the upthrust of the air. The chemical test for hydrogen should be well known by all candidates, so it was disappointing that so many candidates are introducing a glowing splint rather than a lighted one, into the test-tube. This would not work and such answers could not score. Some of the better candidates made a good effort at constructing the balanced chemical equation for the reaction of hydrogen and oxygen to form water. The dot-cross diagrams were done well by many candidates, although surprisingly many candidates were not aware that the bonding is covalent.

Paper 0652/03

Paper 3 (Extended)

General comments

This optional paper was successful in that realistic candidates for the higher grades could demonstrate positive achievement. These candidates showed in their answers what they had learned from the course and the skills they had acquired.

However, many candidates did not have the knowledge and understanding, nor the ability to use the information provided, to cope with problems which tested mainly the supplement to the syllabus and required higher skills for this extended-level paper. Many did not have sufficient mathematical skills to cope with calculations involving the rearrangement of an equation or the use of proportions. Few could cope with negative powers of ten. Many did not recognise phrases from the syllabus.

Often candidates were careless with the names of chemical substances and with their symbols, particularly the incorrect use of capital letters; all chemical symbols are shown on the Data Sheet. Some did not use subscripts or superscripts correctly in chemical formulae. Candidates lose marks if they use incorrect names or write symbols and formulae incorrectly.

A number of candidates were careless with the symbols for physical quantities and for their units; all these are listed in the syllabus. The mark for an answer involving a physical quantity, such as electric current, requires the numerical value with its correct unit. Candidates lose this mark if they write the unit incorrectly or omit the unit. Candidates should note that the symbol “m” stands for metre not mole ; the only abbreviation for mole is “mol”.

Many candidates were careless with their use of words such as atom and ion and molecule and element, often using one incorrectly for another. Some candidates carelessly wrote answers that contained contradictory statements so could not score marks for these answers.

It was clear from their answers that many candidates did not read the question carefully before attempting an answer or were unable to carry information given a line or two previously. By contrast, the answers of some candidates were written, neatly, giving the scientific information required in simple sentences with correct spellings and with calculations and equations set out clearly.

There was a very wide range of total marks gained on this paper. Every part of each question received the maximum range from zero up to full marks.

Comments on specific questions

Question 1

(a) Although there were some peculiar values suggested for the density of germanium, many candidates suggested an acceptable value obtained by a method of averaging. Most candidates correctly wrote that silicon has a giant-covalent structure and that the oxide of tin is amphoteric. Some candidates carelessly omitted ‘giant’ in front of ‘covalent’ and did not score this mark.

(b) Few candidates seemed to notice from the table of data that the melting points of these elements first decrease and then increase down the group. Most did not make clear in their answers that this increase lower down the group is due to the change of structure of the solid from giant-covalent to metallic, with different characteristics.

(c) Many candidates wrote incorrectly about isotopes, with their different structures in the nucleus, apparently not realising that the change from carbon-12 to carbon-14 would give only a small increase to the density of solid carbon. Other candidates wrote correctly about atoms being (much) closer together in the carbon with density 3.35 g/cm^3, requiring a different structure for the solid, compared with the carbon of density only 2.25 g/cm^3. Some correctly described the structures of the two allotropes, graphite and diamond, with diamond more dense than graphite, although this was not essential for full marks.

Question 2

(a) About half the candidates made a clear comparison when stating the difference between speed and velocity in terms of direction. Others wrote only about speed or about velocity and did not compare them in order to make the difference clear.

(b) A number of candidates did not use correct symbols for speed and acceleration in **(i)**, as in the syllabus. Some did not know that the change of speed needed to be calculated, then divided by the time taken, for the acceleration. Many could not write a correct unit, m/s^2 or ms^{-2}, for acceleration, incorrectly confusing these by writing m/s^{-2}. Many in **(ii)** incorrectly converted the mass into weight, or incorrectly multiplied the mass by the acceleration due to gravity, 10 m/s^2, instead of the value obtained in **(i)**, 2 m/s^2, to obtain 1200 N for the force. Some did not know the unit for force.

(c) Better candidates correctly wrote about some form of frictional force and the need for the engine to provide sufficient force to overcome this opposing force as well as accelerating the car. Most, incorrectly for this question, wrote about the lack of efficiency of the conversion of energy in the engine.

Question 3

(a) Most candidates wrote an acceptable balanced equation showing the correct formula for methane. Some incorrectly wrote this equation in reverse. Some included, incorrectly, oxygen or water as a reactant. Some did not use the subscripts correctly. A few incorrectly wrote propane as $C_3 + H_8$.

(b) Many candidates drew a satisfactory 'dot-and-crass' diagram to show the C=C double bond of shared electrons and the four C-H single bonds of shared electrons, two on each carbon atom. Some incorrectly drew a diagram for methane or propane.

(c) Good candidates correctly compared the C=C double bond in ethene with the C-C single bond in ethane to explain **(i)**. Many correctly gave both parts of the comparison for **(ii)**, making clear that ethene (quickly) decolourises bromine-water whereas ethane does not. Some wrote incompletely about only one of these hydrocarbons.

Question 4

(a) Few candidates knew that 'fusion' was the process required for **(i)** and that this occurs in the Sun or other stars for **(ii)**. (Note that an error in **(i)** was not carried forward into **(ii)**.) Some of those who answered **(i)** correctly had very unrealistic ideas about where nuclear fusion could occur. Very few candidates made clear for **(iii)** that nuclei are positive and therefore repel each other.

(b) Most candidates wrote correctly about protons and neutrons, or equivalent statements, to explain the difference between the nuclei of isotopes of the same element for **(i)**. Some candidates did not give a complete answer and wrote only about the difference of the nucleon-number. Most could also interpret the nuclide notation correctly in **(ii)** to deduce the presence of one proton and one neutron in the deuterium nucleus. Although some candidates could write $E = mc^2$ correctly in **(iii)**, few knew that m is the loss of mass during the nuclear reaction and that it is essential to square the value for c. Very few coped successfully with the powers of ten in this calculation to obtain the value of 2.7×10^{-12}J for the energy released.

Question 5

(a) Few candidates wrote correctly about metallic bonding, clearly described in the syllabus as a lattice of positive ions in a 'sea of electrons', with the positive ions and negative electrons attracting each other. Most wrote a series of irrelevant statements about metals such as copper, even about alloys such as bronze.

(b) Few candidates made clear that the different sizes of ions of copper and tin in the lattice of the alloy mean that the layers in bronze do not slide over each other as easily as in copper or tin. Many incorrectly confused 'harder' with 'stronger'.

(c) Many candidates stated clearly that copper is a better conductor of electricity than bronze although some wrote, incorrectly for this situation, about conduction of heat. Fewer candidates made clear that wires made of copper are flexible whereas wires made of bronze would break if bent.

Question 6

(a) Candidates often did not use correct symbols for these electrical quantities, as in the syllabus. Many could not rearrange $P = IV$ to obtain the current. A large number forgot to change 3 kW into 3000 W. Some did not include the unit in the answer, 12 A.

(b) Again, many candidates did not use correct symbols for these electrical quantities, as in the syllabus. Many candidates managed to use their value from **(a)** for the current correctly to obtain an acceptable value for the resistance, although some did not include the unit in the answer, 20.8 ohms or 21 ohms.

(c) Although most candidates stated clearly for **(i)** that a longer wire would be required, many of these were confused in **(ii)** and did not seem to realise that a thinner wire, with smaller cross-sectional area, would be needed to increase the resistance of the heating coil.

Question 7

(a) A number wrote vague statements about galvanising in **(i)** and did not make clear that iron is coated with zinc. Some candidates explained correctly for **(ii)** that zinc is more reactive than iron but then wrote incorrectly about zinc 'rusting' or reacting with the iron. Few explained clearly that the zinc coating reacts with the corroding agent instead of iron, so the iron is protected by this sacrificial reaction of the zinc. Many knew in **(iii)** that aluminium has a protective layer of aluminium oxide on its surface yet did not explain that this exists because aluminium quickly reacts with oxygen in the air. Some wrote incorrectly about 'rust' on the surface of aluminium, apparently not realising that this particular corrosion refers only to iron.

(b) Few candidates stated clearly in **(i)** that hydrochloric acid would be required to react with the zinc oxide to form zinc chloride. Very few appeared to know for **(ii)** how to prepare a salt from an insoluble oxide and an acid so did not make clear that zinc oxide should be added to the hydrochloric acid until excess unreacted zinc oxide remains which is then filtered off to leave the filtrate as the required solution of zinc chloride. By the time they reached **(iii)**, often candidates had forgotten the information given about the effect of heating hydrated zinc chloride and did not state clearly that the solution should be left to crystallise at room temperature.

Question 8

(a) Few candidates in **(i)** correctly described a thermocouple as constructed, of two wires of different metals joined together at one end. Some confused a thermocouple with a bimetallic strip. More knew for **(ii)** that a thermocouple is suitable for measuring high temperatures or temperatures that change rapidly. Many thought incorrectly that a thermocouple would always be more accurate. As explained in the mark-scheme for **(iii)**, any one of conduction, convection, radiation was acceptable for the transfer of the heating energy through, or by, the air.

(b) Some candidates contradicted themselves in the answer for **(i)** by writing incorrectly about a 'dull silver' surface or a 'shiny black' surface instead of simply writing 'silvery' or 'shiny'. Many knew that 'infra-red' was the correct answer for **(ii)**.

Question 9

(a) Many candidates in **(i)** wrote down the correct values of 14 and 16 for nitrogen and oxygen but then used them incorrectly so did not obtain the correct answer of 30 for the relative molar mass of nitrogen oxide, NO. An encouraging number of candidates used their answer from **(i)** correctly in **(ii)** to obtain the number of moles in 150 g of nitrogen oxide and then the volume of this gas, 120 dm^3. Few stated clearly in **(iii)** that, using the equation, 5 mol NO(g) forms 2½ mol $N_2(g)$, volume 60 dm^3.

(b) Few candidates explained clearly that carbon monoxide is produced in car engines by the incomplete combustion of hydrocarbons.

(c) Despite considerable confusion, many candidates wrote acceptable statements about carbon monoxide preventing oxygen combining with haemoglobin in the blood.

Question 10

Very few candidates drew an acceptable ray diagram to show a converging lens with the object closer to the lens than the focus and with an upright virtual magnified image.

Paper 0652/05

Practical Test

General comments

About the same level of performance as last year, which means that candidates' performance was no more than adequate, with no very good answers. As in previous years it was clear that many were insufficiently prepared for a practical examination. Some elementary errors were made that would not be expected from well practised candidates. All parts of the paper were readily accessible although candidates made **Question 2** more difficult than it need have been by not using the correct units.

Comments on specific questions

Question 1

Although potassium hydrogencarbonate is not very soluble in cold water, it was allowed. Many failed to adequately describe how they came to their conclusion and so lost a mark. Although many correctly described the colour as green, a proportion failed to record the pH as 8 or 9. Boiling the solution of the hydrogencarbonate converted it into the carbonate and consequently the pH number increased. The marks were awarded for the colour change and a suitable pH value. Considering the simplicity of the tests in **(c)**, it was not well answered. A variety of answers were acceptable for the glowing splint test as long as it did not 'pop' or relight. It was necessary to record a suitable change in the limewater and name carbon dioxide to score the second mark. Part **(d)** was poorly answered. The sulphate test is described in the notes and it ought to have been a simple case of recording bubbling and no white precipitate. Despite the addition of ammonium chloride, it was not uncommon to identify such gases as hydrogen or chlorine. If ammonia was named it had to follow from red litmus turning blue. The last part of the question should have been very straightforward, given the necessary information. However, few were able to score three marks. Some actually heated the hydrochloric acid before adding solid P and measuring a temperature change, then concluding it was an exothermic reaction! The question asked for measurements and some temperatures were expected. Credit was given to those who reported that the test tube became cold.

Question 2

The majority of candidates failed to record the length in millimetres and the current in milliamps and paid the penalty for not doing so. The question and the table were absolutely clear that these were the units to be used and failing to do so was inexcusable. In fact using centimetres and amperes amounts to changing the question, which is never acceptable. The candidate's figures in the first column were assumed to be in millimetres even though many appeared to use centimetres. Examiners must mark what is written not what they think a candidate meant. However, it was still possible to plot a graph even if the units were incorrect. Plotting was usually accurate but few allowed for the extrapolation to 1000mm and consequently failed to score the mark in **(e)**. An easy mark for substituting the correct figures in the equation was usually scored but few were able to score the accuracy mark because of their inability to correctly measure the current flowing through 1000mm of wire. The accuracy mark was awarded to those who calculated the resistance to within 10% of the Supervisor's value. Very few had any idea how to connect a voltmeter or ammeter into a circuit and few scored any marks in the last part.

Paper 0652/06

Alternative to Practical

General comments

All candidates completed all questions on the paper. Centres should remind candidates that working should be shown in calculations (e.g. **Question 1 (b)(i)**) and that information provided in questions is designed to help with their answers e.g. in **Question 2** many candidates scored low marks because they did not appear to read the information in the table of results carefully enough. There is still an apparent weakness in some Centres related to chemical analysis, **Question 7** being particularly poorly answered by many candidates. Improvements were noted in the overall ability of candidates to read scales on measuring instruments and in questions involving calculations. A continuing weakness in some candidates appears to be in their ability to draw conclusions from information and explain results.

Comments on specific questions

Question 1

(a)(i) The vast majority of candidates correctly calculated the distance as 40cm. Errors were only apparent for very weak candidates when it seemed that they did not understand the question and subtracted the two figures in the question.

(ii) Again most candidates correctly calculated the distance as 40cm.

(iii) Most candidates realised that the two masses must be equal. Occasional errors were produced only by those candidates who had failed to calculate the correct distances in **(i)** and **(ii)**.

(b)(i) Again a majority of candidates correctly calculated the mass of the load as 120g by using the Principle of Moments. Marks were awarded for the working in this question and a number of candidates gave the answer without showing working out and lost marks. Centres should advise candidates to show working in calculations.

(ii) Most candidates correctly measured the length of one side of the cube although calculation of the volume was less well answered with frequent incorrect answers of 16 instead of 64.

(c)(i) Most candidates drew the arrow correctly pointing toward the pivot.

(ii) Those candidates who had correctly identified the direction of movement of the mass in **(i)** were able to explain their answer in terms of the effect of the water on the load e.g. load was lighter in water/water produced upthrust etc.

Question 2

(a) Many candidates correctly identified potassium carbonate as the more soluble of the two compounds but failed to score the mark by giving an insufficient explanation in terms of the difference in solubility in *cold* water. Some candidates simply rewrote the results in the table without comment.

(b)(i) Although most candidates realised that the potassium carbonate solution was alkaline some quoted a pH value that was too high - many giving 12, 13 or 14 as their answer. Weaker candidates seemed to guess the pH, some giving values in the acidic range 1-6.

(ii) Candidates who knew the pH colour range well, realised that the pH increased when the potassium hydrogencarbonate was heated.

(c) The limewater test for carbon dioxide seemed well known and most candidates correctly identified the gas in this part of the question. A common error from weaker candidates was to give hydrogen as the answer.

(d) Again many candidates correctly identified ammonia. Some candidates lost the mark by quoting 'ammonium'.

(e) This was generally well answered by the more-able candidates, many of them scoring both marks by reference to the gas and the precipitate. Weaker candidates were unable to answer the question, often just stating that there would be a different colour.

(f) Very few candidates scored all three marks on this question. Although many wrote about measuring the temperature of the reaction few stated that the temperature of the acid should be recorded *before* the solid was added and then again afterwards. Some candidates suggested adding the solids to *water* although the question clearly stated that acid was being used. Weaker candidates thought that the solid should be heated and its temperature measured.

Question 3

Large numbers of candidates appeared to have little knowledge of the techniques of chromatography and were unable to answer any part of this question.

(a) Candidates were required to show that they understood that the coloured substance in the petals would *dissolve* better in ethanol. Answers related to the evaporation of the ethanol were not accepted. Only a minority of candidates answered this part of the question correctly.

(b)(i) Most of the candidates who attempted this part of the question scored at least one mark by showing the presence of a solvent. The most frequently lost mark was that relating to the container being closed. Candidates also lost the third mark by showing the level of solvent above the line rather than below it. Many weaker candidates failed to score at all simply copying the diagram given in the question.

(ii) More able candidates scored both marks on this part of the question. Very weak answers were seen where candidates drew multiple spots all over the paper, clearly not understanding the principles involved.

(c) Although a number of candidates realised that the filtrate should be added to an acid and an alkali, both marks were only awarded for named acids and alkalis. Many candidates thought that an indicator should be added to the filtrate to see if it changed colour, thereby missing the point of the question.

Question 4

(a) Most candidates correctly read the meter readings. Common errors were to read the values as 69, 48.5 and 43.5 respectively. Candidates should be reminded to look at the scales very carefully when answering this type of question.

(b) Although most candidates plotted the points on the graph correctly many failed to score the mark for the line which often either connected the points together in a zig-zag fashion or was not the line of best fit.

(c) Many candidates guessed this answer rather than extrapolating their graph to 1000 mm.

(d) This was most often calculated correctly from the candidate's answer to **(c)**. Errors were seen where the candidates omitted the 1000 from the calculation or transposed the values of E and I.

(e) This was very poorly answered with only a very few candidates scoring more than one mark. More able candidates drew an appropriate diagram showing the correct circuit but many weaker candidates simply connected the items randomly and often omitted an ammeter. The explanations given were often inaccurate and most candidates seemed to have little knowledge of the experiment in the question.

Question 5

(a) Very few candidates gave incorrect answers to this question. The most common error was to quote the initial temperature as 21 or 29°C.

(b) Almost all candidates correctly calculated the difference in temperature from their answers to part **(a)**.

(c) Again the majority of candidates calculated this value correctly.

(d) Most candidates divided their answer to part **(c)** by 3 and scored the mark.

(e) A correct explanation was required here to score both marks and although many candidates did not think that the answer would be accurate they did not realise that heat losses were responsible and therefore failed to score.

(f) The majority of candidates gave an answer related to the loss of water by evaporation which did not score. Only the more able candidates realised that the temperature would stop rising and that this would not allow an accurate calculation of the heat produced by the Bunsen burner.

Question 6

(a) The majority of candidates gave the correct time readings. Very occasional errors of 37 and 51 were seen.

(b) Most candidates correctly stated 'gravity' and scored the mark. Weaker candidates either provided no answer at all or stated 'kinetic' or 'potential' energy.

(c) Most candidates correctly identified X as the thickest oil based upon the results in the table. Weaker candidates thought that the fastest time was related to the thickest oil and gave Y as their answer.

(d) The answer required here needed to reflect the candidate's understanding of the concept of a 'fair' experiment. Simply stating that the plate needed to be clean because it would otherwise give poor results was not quite enough to score the mark.

(e) About 50% of candidates realised that the drops would be slower if smaller and correctly related this to the smaller mass or force involved.

(f) Answers to this question showed an improved understanding compared to previous years and many candidates provided answers related to the repeat of results and averaging. Weaker candidates suggested the use of more accurate clocks or a different glass plate for each oil, such answers failed to score any marks.

Question 7

(a) Many candidates scored at least one mark here by reference to the carbon dioxide. Some candidates also connected this to the presence of a carbonate in the mixture. A few candidates stated that copper was present but the answer required copper ions or a copper compound.

(b) Very few candidates scored this mark with many just guessing. A frequent incorrect answer was that Fe^{2+} ions were present.

(c) About 25% of candidates correctly identified chloride as present. Some candidates lost the mark by stating chlorine.

(d) Some candidates correctly identified copper ions as being present but once again the mark was lost by some who stated copper alone.