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PHYSICAL SCIENCE

Paper 0652/01
Multiple Choice

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20	**A**	40	**D**

General comments

Candidates achieved a mean mark of 23.3 with a standard deviation of 5.85. These values are satisfactory but a bit lower than hoped. The Paper is intended, primarily, to discriminate between candidates in the grade C to grade G range. The Paper is also taken by candidates who achieve higher than grade C. This report concentrates more on the responses made by the grade C to G candidates. However, with only a small entry, inferences from the statistics for the individual questions may not be wholly valid and this should be borne in mind.

Candidates would appear to have been well prepared. Teachers and candidates are to be congratulated. Questions which the candidates seemed to find relatively easy (over 70% facility) were **Questions 2**, **21**, **24**, **25**, **26**, **28**, **33**, **34**, **35** and **39**. Candidates found **Questions 22** and **40** particularly hard.

Comments on specific questions

Question 1

Response **D** was the most popular amongst the lower scoring candidates and this is rather puzzling in view of the fact that the question refers to a “warm” table.

Question 2

This question did not discriminate well, probably due to the fact that it was found quite easy across the whole of the ability range.

Question 4

This was found to be on the hard side and some 30% of the lower scoring candidates chose **B** rather than the key, **C**. Seeing that the first two atoms in the table are both non-metallic is straightforward but it needed a little more insight to realise that the third atom is a noble gas and, therefore, also non-metallic.

Question 7

About 30% of the lower scoring candidates each chose either **B**, **C** or **D**. This seems to imply fairly wide-ranging confusion about the litmus test and the testing of gases.

Question 8

A question that did not discriminate particularly well. It seems that about a quarter of candidates across the ability range chose **C** with another 10% across the range choosing **D**. Do these figures indicate some general uncertainty about the behaviour of hydrogen and uranium as fuels?

Question 11

Nearly 60% of the lower scorers chose **B** but the character of an explosion is very rapid reaction over a short time period.

Question 12

Response **C** was quite popular with the lower scorers (40%), but it was also quite popular with the higher scorers (32%). See also **Question 7**.

Question 15

Although presented slightly differently, this question is essentially about recall of the characteristic properties of transition elements. Nevertheless, nearly half of the lower scorers chose **C**.

Question 16

A disappointingly hard question that did not discriminate well. The most popular choice across the ability was response **C**, candidates obviously forgetting that sodium + acid is violently reactive. Another disappointment is that quite a lot of candidates across the ability range continue to think that copper reacts with dilute acids.

Question 18

Another disappointing question with so many candidates across the ability range thinking that hydrogen is a product of the incomplete combustion of ethanol.

Question 20

This also was disappointing. Response **C** was the most popular across the ability range but, with response **B**, these two responses thoroughly outweighed the key, **A**. Admittedly, butene is likely to be unfamiliar but the syllabus is expressed in general terms, e.g. “describe the properties of alkenes in terms of addition of hydrogen” and “describe the formation of poly(ethene) as an example of addition polymerisation of monomer units”.

Question 22

The vast majority of candidates knew that they had to divide distance by time. The problem was that most of these did not convert minutes to hours first. Units are always important in Science questions, and candidates should be aware of the units in any question.

Question 27

This was not particularly well done, with under half answering correctly. What was surprising was that a quarter of candidates thought that work and power would be increased when lifting the lighter blocks. Possibly these candidates had some notion that by then the labourer would be tired and that this meant he would have to exert more effort.

Question 29

About two-thirds of candidates answered this correctly, but a quarter thought that frequency changes during refraction.

Question 30

In a similar manner, less than half realised that 200m is a wavelength, but almost as many thought that it is frequency. Candidates should know that metres cannot be a frequency.

Question 32

This was not answered correctly by as many as hoped, and 38% simply assumed that since there was attraction in both the situations in the stem, then when the metal rod is turned round, then both must be repulsions.

Questions 36 and 37

The action of fuses was not well understood in **Question 36**, and neither was the division of voltages in the similar **Question 37**.

Question 40

Half-life still causes confusion in the minds of many candidates. Less than a quarter answered this correctly. The majority spotted that four half-lives were involved, and simply multiplied by four.

Paper 0652/02
Paper 2 (Core)

General comments

The Paper was fairly challenging and allowed candidates to show their abilities. The vast majority were able to answer all of the questions, albeit with varying levels of success. It is encouraging that very poor scripts were relatively few, whilst the number of good and excellent scripts continues to increase.

Comments on specific questions

Question 1

This question, which tested candidates' knowledge of the basic structure of atoms, and their ability to interpret the meaning of atomic notation, was done well making it clear that the majority of candidates had a good understanding of this basic science.

Question 2

This quite challenging question caused very much more difficulty. It is disappointing that so few candidates were able to look at the diagram and see that there were two separate circuits (this, despite the relay being specifically in the syllabus). Although some candidates were aware that a magnetic field was set up in the iron core, very few understood that the steel armature would be attracted to the core closing the contacts.

The calculation in part **(b)**, however, was done very well - with most candidates using the correct unit.

Question 3

This question explored the candidate's knowledge and understanding of simple bonding, structural formulae and molecular masses. The dot-cross diagram was well done by the majority of candidates and, by and large, most candidates recognised it as co-valent bonding.

The structural formula for the alcohol molecule was not so well understood, with the majority of candidates just totalling up the atoms to give CH_4O and, while this does give the correct number of atoms, it does not show their grouping as CH_3OH does.

The calculation of atomic mass was done quite well, but a significant number of candidates added Proton (Atomic) Number, rather than Nucleon (Mass) Number.

Question 4

The diagram of the passage of light through the lens was generally well done - but candidates cannot expect to score full marks with free hand drawings; rulers and pencils should always be used for completing ray diagrams. The identification of the angle of incidence caused more problems than one might expect. Also, credit was lost by those candidates who did not take care in drawing the reflected ray so that their angle of reflection was not equal to the angle of incidence.

Question 5

Another question which explored candidates' understanding of bonding, although more challenging in this example. Whilst many candidates were able to give the structure of the ethane molecule, the double bond in ethane caused many problems. The effect of adding bromine to the two substances was quite well known. However, the first part of the question, the reaction of bromine and the iodide ion in potassium iodide caused major problems. Very few candidates tackled the question in terms of electron exchange, which limited the credit they could gain. Even then, few candidates really said anything which showed an understanding of the chemistry.

Question 6

This was a deceptively difficult question, and few candidates scored full marks. For a thermometer going up to 110°C, mercury must be used. The reading of 35 was generally done correctly, although some read it as 30.5. The explanation of the narrow capillary tube - in terms of improving sensitivity, not accuracy - was done very poorly. However, many candidates gave a good description of the cooling and contracting of the mercury.

Question 7

Knowledge and understanding of the Kinetic Theory of Matter is notoriously poor. Molecules do not think, therefore they cannot *want* to do anything. In part **(a)**, the energy is required to move the molecules apart and give them more *potential* energy. They do *not* increase their kinetic energy further whilst the substance is at melting point (the temperature remains constant!). The ink spreads out because of the random movement of both ink and water molecules; to give an answer naming the term *diffusion* does not answer the question that was set.

Question 8

Carelessness in drawing the direction of the waves in the shallow water cost many candidates credit. The direction of movement of the waves is always perpendicular to the wavefront and, to score this mark, candidates were required to show this with some accuracy.

Question 9

This question discriminated well at the C/D level, with those candidates scoring well. However, marks were lost in part **(c)** because candidates did not give a full description.

Question 10

It was pleasing that a large number of candidates recognised that there must be movement for work to be done. However, fewer linked the movement to the applied force. The calculation of weight was quite well done and most candidates recognised the box would fall with acceleration, if not constant acceleration, and once again many candidates continue to write, "-accelerating with constant speed".

Question 11

Too few candidates explained oxidation in terms of exchange of electrons; also, many failed to link it to the example given. Part **(b)** required candidates to explain that energy is released in the combustion of hydrogen - thereby making it useful as a fuel, and the final part required candidates to explain that the only product of combustion was water.

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. Some did not recognise phrases from the syllabus, others did not have sufficient mathematical skills to cope with calculations involving the rearrangement of an equation or the use of proportions. Many did not realise, when a calculation yielded an impossible answer, that there must be a mistake.

In some cases 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.

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 often 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

(a) Few candidates stated clearly that the covalent bonding in nitrogen is between the atoms in the N_2 molecule and that the weak forces (of attraction) between these molecules causes the low boiling point of nitrogen.

(b) Few candidates stated clearly that they would expect arsenic to form an amphoteric oxide because this element is midway down the group so its oxide would be expected to be both acidic and basic.

(c) Some candidates confused the physical property of melting with the chemical property of reactivity and wrote incorrectly about the force (of attraction) between the nucleus and its outer electrons. Few of those who stated in some way or other that antimony has a smaller ion than bismuth could go on to explain that the metallic bonding (the force between the cations and the sea of electrons) in antimony is stronger than in bismuth because antimony ions have the same charge as bismuth ions (hence the higher melting point of antimony).

(d) Many candidates wrote a formula that included an incorrect symbol for phosphorus; others incorrectly included oxygen or water in the formula. Few successfully wrote PCl_3 or PCl_5.

Question 2

Often candidates used incorrect symbols in their equations despite the expressions for kinetic energy and gravitational potential energy being stated clearly in the syllabus.

(a) Few candidates made clear that acceleration involves the change of velocity (or speed). Many correctly calculated the acceleration as 11/0.3 to obtain 36.7 m/s^2.

(b) While candidates frequently correctly stated kinetic energy as $\frac{1}{2}mv^2$, some incorrectly used the acceleration instead of the speed of 11 m/s. Not all those who correctly obtained 4.5375, or 4.5, included joules (J) as the unit.

(c) Although many stated correctly the gravitational potential energy as "mgh" some then used incorrect values for these quantities, including changing the mass into grams. Many did not seem to realise that this maximum gravitational potential energy (2.025 or 2.0 J) *must* be less than the maximum kinetic energy calculated in **(b)** so that if their answers to **(b)** and **(c)** showed the opposite then a mistake had been made.

(d) While candidates in **(i)** could give a satisfactory explanation, at this level, of efficiency they could not discuss clearly in **(ii)** that the conversion from kinetic energy to potential energy is not efficient in this case; only a few candidates stated clearly that the gravitational potential energy gained is much less than the maximum kinetic energy when the ball is thrown up (only about 45%).

Question 3

(a) Candidates wrote correctly that the dark-brown bottle prevents light reaching the silver nitrate stored in the bottle yet few stated clearly that light reduces silver ions (Ag^+) to silver (Ag).

(b) Many candidates wrote correctly that sodium is very reactive with air or water yet few stated clearly that the liquid paraffin covers the sodium, is inert and keeps air and water away from the sodium. Some wrote incorrectly about sodium 'rusting'; only iron rusts.

(c) While candidates wrote correctly that anhydrous copper(II) sulphate easily reacts with water to form hydrated copper(II) sulphate, the colour changing from white to blue, some were careless and wrote incorrectly about 'copper' instead of 'copper sulphate'. Few stated clearly that the desiccator keeps the air dry around the copper sulphate.

(d) Many candidates confused the physical property of evaporation with the chemical property of reactivity. Few stated clearly that bromine is a very volatile liquid and that its vapour is poisonous (or equivalent comments).

Question 4

(a) Only a few candidates drew a satisfactory ray diagram, using correctly the measurements given. Some of these were careless in drawing the virtual rays.

(b) The better candidates correctly wrote down properties of the image produced by a lens used as described in the text: virtual; upright; magnified. Some carelessly wrote contradictory properties so could not be given the mark.

(c) Candidates knew that a lens used in the way described in the first sentence of this question would be a magnifying glass, as stated in the syllabus.

Question 5

(a) Some candidates wrote incorrectly about negative ions holding the positive ions together. Others wrote vague statements about 'forces' or 'electrons'. Only a few candidates stated clearly that the lattice of positive ions is in a 'sea of electrons', as stated in the syllabus.

(b) Some candidates wrote excellent answers about the relative size of the particles, the layers of these particles, these layers sliding over each other and also compared correctly the pure metal and the alloy in order to explain why pure metals are more malleable than alloys. Many wrote incorrectly about ‘atoms’ or ‘molecules’, even ‘elements’, instead of the correct ‘ions’ for the particles. Others wrote incorrectly about the particles in the (solid) metal being more able ‘to move about freely’ than in the alloy and did not write about the layers in the lattice sliding over each other.

(c) A number of candidates incorrectly wrote ‘beryllium’ or ‘magnesium’ for **(i)** instead of going further down Group II for a correct suggestion. In **(ii)** many thought incorrectly that the sample of pure metal would ‘contract’ or ‘shrink’ because it would become colder; others stated incorrectly that the metal would ‘rust’ (a property only of iron). A few candidates wrote correctly for **(ii)** that bubbles of gas would be produced and that the metal would ‘disappear’ or ‘dissolve’.

Question 6

Candidates showed considerable lack of understanding about the use of an oscilloscope and about electromagnetic induction, although both of these are described clearly in the syllabus.

(a) Many candidates did not seem to realise that, in this experiment, the ‘horizontal’ parts of the trace represent zero voltage; few candidates deduced correctly the values for the magnitude of the voltage at A (0.40 V) and at B (0.50 V).

(b) Few candidates stated clearly that the changing magnetic field through the coil, as the magnet enters or leaves the coil, induces an e.m.f. in the coil. (In this particular experiment, any current flow is negligible.)

(c) Only the most able candidates related the positive voltage induced at A and the negative voltage induced at B with the opposite changes of magnetic field through the coil as the magnet enters the coil at A and leaves the coil at B. More wrote correctly about the greater magnitude of the voltage at B and the shorter time occupied by this part of the trace being caused by the magnet moving faster as it leaves the coil than when it entered. Few wrote correctly about the zero voltage shown between A and B in terms of there being no change of magnetic field through the coil when the magnet is inside the coil.

Question 7

(a) Candidates wrote incorrectly about isotopes of copper and of calcium. Only a few candidates answered **(i)** correctly by stating that the ionic charge or oxidation number of copper in copper(II) carbonate is +2 or that its ‘valency’ is 2. Few made clear for **(ii)** that the calcium ion can have only a +2 charge or wrote an acceptable equivalent comment.

(b) Few candidates could calculate correctly the amount of HCl for **(i)** as 0.05 moles. Because of the 1:2 ratio in the chemical equation the answer for **(ii)** is half that for **(i)**: 0.025 moles of copper carbonate. Many candidates in **(iii)** confused the chemical symbols in $CuCO_3$ and in the A_r values given, or misunderstood the subscript 3 in the formula, so did not calculate the correct value of 124 for the M_r of copper(II) carbonate. Candidates knew that in **(iv)** they had to multiply together their answers from **(ii)** and **(iii)** yet did not seem to recognise an impossible answer for the mass of copper(II) carbonate reacting with only 50 cm^3 of dilute acid. A few candidates calculated correctly for **(iv)** that 0.025 x 124 = 3.1 g although some then omitted the unit of mass and did not score this mark.

Question 8

(a) Candidates were often unable to explain e.m.f. satisfactorily despite clear statements in the syllabus that “e.m.f. is defined in terms of the energy supplied by a source in driving charge round a complete circuit” and “is measured in volts”.

(b) Few candidates could explain that the voltmeter must have a high resistance so that the current flow during the measurement is very small and there is negligible change in potential difference across the internal resistance of the cell.

(c) Candidates used the correct equation for **(i)**, I = V/R, yet did not use the total resistance of 102 ohms in the calculation for 0.0147 A; some carelessly omitted the unit or wrote down an incorrect unit for current. Most candidates for **(ii)** correctly multiplied their value from **(i)** for the current by a value for resistance to obtain the potential difference but did not use the resistance of the voltmeter, 100 ohms, to obtain 1.47 V; again, many omitted the unit. Some did not seem to realise either the impossibility of any answer for **(i)** greater than 0.75 A (the short-circuit current this cell could provide through its internal resistance) or the impossibility of the potential difference for **(ii)** being greater than 1.5 V (the e.m.f. of the cell). It was clear in **(iii)** that many candidates did not realise that all sources of e.m.f. have an internal resistance and so could not answer this part in terms of the potential difference across the internal resistance of the cell, due to the current flowing during the measurement, so that it would be necessary to use a voltmeter with a higher resistance to obtain a value closer to the e.m.f. of the cell.

Question 9

(a) Most candidates drew a satisfactory 'dot-cross' diagram for C_2H_4 to show the double shared-pair of electrons in the C=C bond and the single shared-pair in each of the four C-H bonds.

(b) Often candidates stated correctly that alkenes must have a C=C double bond yet not all made clear that therefore alkenes need at least two carbon atoms in the molecule.

(c) Some candidates incorrectly introduced oxygen or water as a reactant in **(i)**; others wrote the correct formula for each product then did not balance the chemical equation: the correct equation is $C_4H_{10} \longrightarrow 2C_2H_4 + H_2$. Many candidates in **(ii)** wrote correctly about the need for high temperature (or an equivalent statement) yet did not state a correct second condition such as the need for a catalyst or high pressure; some were too vague in their answers to score the marks.

Paper 0652/05

Practical Test

General comments

The standard was average with no very good answers but equally no really poor answers. There was no evidence that the time allocated was inadequate and all candidates attempted both questions. **Question 2** caused all candidates some difficulty and most did not appear to be familiar with the ideas being tested. With one exception (see later, **Question 2 (e)**), all the marks were used. At least fifty percent of the marks for the Paper were allocated for following instructions, collecting and using the data. Supervisors were helpful in recording their results, most important in **Question 2**.

Comments on specific questions

Section A

Question 1

(a) A very straightforward question and most were able to collect the necessary data and attempt to process it. A few candidates were unable to correctly complete the table. A small number did not place the ruler with the zero on the bench and some recorded their values in centimetres. Both were penalised although this did not prevent the completion of the question. The fact that the increase in length produced a negative value did not appear to worry such candidates. Inevitably a small number could not correctly convert a mass into a force. Again this did not prevent them from continuing the question and scoring further marks.

(b) Plotting was usually good, although some did not make use of the origin. Although in some cases the points were rather scattered, the question asked for a straight line and candidates were expected to appreciate the value of using the origin. A mark was given for making use of the origin.

(c) A good number had not read through the question before commencing and were consequently using scales that did not allow the reading in part **(c)** to be made directly. However, as the graph was linear the value could be obtained by other means.

(d) Few appreciated that the applied force was directly proportional to the extension and most simply made a statement that the extension increased with applied force. No marks were given for such a statement although one mark was awarded to those that stated there was a regular increase.

(e) Almost every candidate was able to draw a suitable straight line for a thicker wire.

(f) For three marks the candidate was required to state that the extension needed to be determined, the appropriate force read off from the existing graph and to show the way in which this force was turned into a mass. If multiplied by 100 the answer would be in grams whilst dividing by 10 produced an answer in kilograms. A number were confused by this calculation. A minority had no idea how to answer this part of the question.

Question 2

(a)(b) The majority of candidates found difficulty in interpreting the results of the practical work. None appreciated the importance of electron flow and hence the need to identify which metal acted as the negative. Whilst most decided magnesium was the negative metal, none really knew that zinc was the negative when coupled with copper. It is appreciated that there is some fluctuation in the voltage in this experiment and marks were awarded so long as the candidates values were within 0.2V of the Supervisor.

(c) Although magnesium was frequently cited as the most negative, few were able to explain. The second mark was awarded for appreciating that magnesium needed to be the negative in order to obtain a positive reading on the voltmeter. The size of the voltage did not decide which metal is the most negative.

(d) Some correctly gave the correct order of reactivity, probably remembered from theory rather than from experiment.

(e) The three most likely observations were; bubbling, black or brown deposit and a lessening of the blue colour. A rise in temperature was also a possibility. Perhaps it is worth mentioning that the statement that copper is deposited is not an observation. The explanations were often wide of the mark. Some mention of displacement would have scored one. It was hoped that the best candidates would have mentioned electron transfer from magnesium to copper ions. In the event this was clearly beyond even the best candidates.

(f) Many thought this part required an answer in terms of the displacement of metals from a solution of their ions. The question made no reference to aqueous solutions of the ions and this was either a misunderstanding or a vain hope of scoring some marks. Most of those who repeated the first experiment assumed that the larger the voltage the more negative a metal regardless of which metal was the negative.

Paper 0652/06

Alternative to Practical

General comments

Only a very small number of candidates failed to attempt all of the questions. **Questions 1** and **4** were generally well-answered with **Questions 2** and **5 (c)** seeming to provide the most difficulty for the candidates. As a general rule it seems that candidates struggled more with the chemistry questions than those for physics, particularly where specific knowledge was required e.g. pH colours and chemical reactions. Candidates should again be reminded about the need to express numerical answers to the required degree of accuracy and to take care when reading scales for scientific apparatus. On the whole candidates performed well on the Paper and there were some pleasing results from many scripts.

Comments on specific questions

Question 1

(a) Most candidates correctly read and recorded the three masses accurately. Common errors were 41.2 and 64.1 for the first two values. Many candidates read the third value as 28g instead of 28.0g and consequently lost this mark. Candidates should be reminded that it is important to record such values to one decimal place.

(b) Again whilst the majority of candidates recorded the volumes correctly, weaker candidates recorded them as 20.8, 10.2 and 50.6 cm^3 respectively.

(c) Most candidates substituted their values of mass and volume into the formula for density and calculated the value correctly as 0.5. Occasional errors in the calculation were noted when candidates inverted the two values. It was pleasing to note that the correct unit for density was also quoted by the vast majority of candidates, although weaker candidates guessed the unit and answers ranging from grams to centimetres were given.

(d) Although it was apparent that some candidates guessed their answer to this question, many clearly understood the relationship between floating/sinking and the relative densities of the object and water and therefore scored both marks.

(e) Many candidates gave the correct answer related to the more accurate transfer of water directly into the measuring cylinder. Answers related to water spillage or simply referring to the process being 'more accurate' did not score.

Question 2

(a) Most candidates recorded the results correctly in the table, although many again lost the mark for reading the magnesium/copper value as 2 rather than 2.0. Weaker candidates failed to understand the need to record the names of the metals in the correct columns and attempted to enter numerical values in every box.

(b) The correct metals, magnesium and copper respectively, were recorded by most candidates although some candidates reversed the answers and a significant number thought that magnesium was less reactive than zinc.

(c) Surprisingly few candidates scored this mark, most giving the order as zinc/magnesium/copper.

(d) Very few candidates scored three marks here, most giving answers related to different experiments (e.g. reaction with acid or air) rather than the one indicated in the question. Even very able candidates generally scored no more than two of the three available marks.

Question 3

(a) The three values of height were read correctly by the more able candidates but there were many errors, candidates forgetting to convert the values to millimetres or misreading the scales.

(b) Most candidates correctly continued the values for Force, although some recorded the second value as 2 rather than 2.0 (in this instance this was not penalised however as long as the other two values were correct). Calculation of the extension also proved to be a problem for many candidates and some strange patterns were observed in the values quoted.

(c) Where candidates had entered the correct values into the table and calculated the extension correctly almost perfect graphs were generated and these candidates scored all three of the available marks. Occasionally candidates lost the mark for the line by not using a rule or by joining the plotted values in pairs rather than producing a line of best fit.

(d) A relatively small number of candidates used the required 'proportionality' explanation, thus many failed to score the mark.

(e) Very few correct answers were seen to this part of the question, with many candidates suggesting the use of a balance to measure the mass and not recognising that the question required use of the same apparatus – candidates should be reminded of the importance of reading the questions carefully. Only the most able candidates scored two marks.

Question 4

(a)(i) Many candidates knew that ammonia was an alkaline gas and scored the second mark although not all gave the correct colour, with incorrect answers ranging from 'red' to 'purple', and consequently failing to score the first mark. Very weak candidates guessed the answer and gave answers ranging from white to black.

(ii) Candidates who had recorded the colour in part **(a)** as red gave this colour as 'blue', mixing up the ph colour range. Most candidates correctly gave the colour as red.

(b) Most candidates gave the correct colour as 'green' and knew that the two gases would neutralise each other.

(c) About half of the candidates gave the correct answer as ammonia but less were able to provide an explanation in terms of relative density or 'size' of the particles. Weaker candidates gave 'hydrogen' as the gas.

(d) The majority of candidates gave a 'textbook' answer to this question in terms of movement of particles from regions of high to lower concentration/density. Only the very weakest of candidates were unable to score this mark.

Question 5

(a)(i) Most candidates made reference to diffusion to explain the production of the purple colour but very few scored the second mark by indicating that the potassium manganate had initially dissolved in the water.

(ii) Many candidates correctly referred to shaking, stirring or heating the liquid to speed up the process and scored both marks. However, a significant number of answers related to the more general methods of increasing reaction rates e.g. use of catalysts or crushing the potassium manganate which could not be credited.

(b) The vast majority of candidates correctly related the colour purple to an alkaline/basic substance and scored the mark.

(c) Although it was apparent that many candidates knew the significance of the word 'dilute' their answers were not related to the addition of water but to vague generalisations e.g. the liquid was not as concentrated, not as strong etc. Very few candidates scored the mark for this question therefore.

(d) Most candidates recognised that the green part of the solution was neutral but few scored the second mark by reference to the two substances 'reacting'.

(e) Although most candidates knew that the purple colour was 'alkaline' they failed to recognise and indicate that this was caused by an 'excess' of calcium hydroxide so failed to score the mark.

(f) Only two or three candidates wrote the correct word equation for the reaction. In most cases although realising that the reaction was acid/base producing salt/water the candidates failed to identify calcium ethanoate as the salt and gave answers such as calcium ethanoic or calcium ethate etc.

Question 6

(a) Most candidates gave the correct masses from the three results – occasional errors being 44.6, 94.4 and 109.4 i.e. effectively reading the scales 'upside down'.

(b)(i) Again the mass was generally calculated correctly from the values in part **(a)**.

(ii) Although most candidates correctly calculated the mass of sodium chloride they recorded it as 15g rather than 15.0g and consequently were not awarded the mark.

(c) Common errors here were 54.5 or 50.5 cm^3.

(d) Many candidates knew that mass and volume were needed to calculate density but failed to identify the results as parts of answers **(a)**, **(b)** or **(c)** and therefore did not qualify for the mark.

(e) Many pleasing answers were seen here, with large numbers of candidates scoring all three marks. Marks were lost when candidates failed to use the indicated apparatus and made reference to the use of a eureka can instead.