PHYSICAL SCIENCE

Paper 0652/11
Multiple Choice

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

Chemistry

General comments

Overall the examination performed well with candidates gaining marks well distributed across the range.

Questions 2, **8** and **9** proved to be very straightforward with the majority of candidates giving the correct response. **Questions 11** and **17** were more challenging with less than half of the candidates answering correctly.

Comments on specific questions

Question 1 The most common incorrect response to this was option **D**, where candidates did not realise that condensation is an exothermic process.

Question 3 Candidates knew that covalent bonds share electrons, however some incorrectly chose option **A**.

Question 5 A number of candidates chose option **D**. They obviously knew that the reaction was exothermic but did not know the meaning of 'oxidation', mistakenly thinking that the wood is reduced to ash.

Question 6 A number of candidates chose option **D**. Using more acid might make the curve higher, but as the concentration was the same the curve would not be steeper.

Question 10 Some candidates did not realise that for a covalent bond **two** non-metals must react and hence incorrectly chose option **B**.

Question 11 Option **A** was the most common incorrect response from candidates who knew about the reactivity of rubidium but did not know the trend in melting points in Group 1.

Question 13 Option **D** was chosen by some candidates who presumably did not realise the significance of a metal only existing as a compound.

Question 16 Candidates sometimes appeared to misread ' statement 3', reading it as two parts hydrogen to one part oxygen, and hence choosing option **C**.

Question 17 The most popular choice for this question was option **B**, which is incorrect. It appears that candidates did not know that the burning of coal is a significant source of sulfur dioxide.

Question 18 Candidates knew that methane is obtained from high in the column but some missed option **A** and chose instead option **B**.

Physics

General comments

The most challenging physics questions were **25**, **26**, **27**, **28**, **30**, **34** and **35**.

Comments on specific questions

Question 21 The majority of candidates answered this question on the use of a stopwatch correctly.

Question 22 There was a significant improvement in candidates' understanding of speed / time graphs this year. Candidates who thought the graph was a distance / time graph incorrectly chose option **A**.

Question 23 Option **A** was chosen by a considerable number of candidates, as some did not realise that X and Y had the same mass but different volumes.

Question 24 Although the majority of candidates answered this question on stability correctly, a considerable number chose option **A**, possibly because the two angles made the lamina look symmetrical at first glance.

Question 25 There was considerable confusion over types of energy.

Question 26 Only a minority gave the correct response to this question. Candidates should be reminded of the importance of reading each question carefully, as a large number chose option **D**.

Question 27 This question required an understanding of the process of convection. Although many candidates were able to answer this correctly, some seemed to think that boiling point was somehow involved.

Question 28 Candidates found this the most challenging of the physics questions. A large majority incorrectly chose option **C**, mistakenly calculating the frequency as 2.0 Hz. It is possible that some believed that the two values (of frequency and wavelength) could not be the same.

Question 29 The majority of candidates answered this correctly, showing a much better level of knowledge of refraction ray diagrams. The most common incorrect answer was option **C**.

Question 30 Although a considerable number of candidates answered this correctly, there was widespread lack of knowledge of the names of different areas of the electromagnetic spectrum.

Question 31 There was better understanding of magnetism shown in this question with the vast majority answering correctly.

Question 32 Again, there was an excellent response to this question on electrostatics, with the vast majority answering correctly.

Question 33 This question concerned electrical meter readings in a circuit, and the majority of candidates answered correctly. However, a considerable number simply added two readings together to produce the third, so choosing option **D**. It is important for candidates to be able to recognise whether a meter is an ammeter or voltmeter by whether it is connected in series or parallel with other circuit components.

Question 34 Only just over half of the candidates recognised the V/I characteristic in this question.

Question 35 A large minority incorrectly chose option **A**, not understanding that adding resistors in parallel reduces total resistance.

Question 36 This question on electrical safety was answered well, with the majority of candidates choosing the correct answer.

Question 37 There was a sound understanding of the structure of the cathode ray tube, with the majority answering correctly.

Question 38 This question on ionising radiation was generally well answered, with the majority choosing the correct option.

Question 39 This question on half-life also showed an improvement over last year's performance.

Question 40 As in previous years, nuclear structure was well known by most candidates.

PHYSICAL SCIENCE

Paper 0652/12
Multiple Choice

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

Chemistry

General comments

Overall the examination performed well with candidates gaining marks well distributed across the range.

Comments on specific questions

Questions 3, **6**, **7**, **8**, **11** and **20** proved to be very straightforward with the vast majority of candidates giving the correct response. **Question 12** proved very difficult with only a minority selecting the correct response.

Question 1 Candidates knew that covalent bonds share electrons, however some incorrectly chose option **A**.

Question 2 The most common incorrect response to this was option **D**, where candidates did not realise that condensation is an exothermic process.

Question 4 A number of candidates chose option **D**. Using more acid might make the curve higher, but as the concentration was the same the curve would not be steeper.

Question 5 A number of candidates chose option **D**. They obviously knew that the reaction was exothermic but did not know the meaning of 'oxidation', mistakenly thinking that the wood is reduced to ash.

Question 10 Some candidates did not realise that for a covalent bond **two** non-metals must react and hence incorrectly chose option **B**.

Question 12 Both options **A** and **B** proved more popular than the correct answer. Candidates did not know the trend in melting points in Group 1.

Question 14 Option **D** was chosen by some candidates who presumably did not realise the significance of a metal only existing as a compound.

Question 15 Candidates sometimes appeared to misread ' statement 3', reading it as two parts hydrogen to one part oxygen, and hence choosing option **C**.

Question 16 The most popular choice for this question was option **B**, which is incorrect. It appears that candidates did not know that the burning of coal is a significant source of sulfur dioxide.

Question 20 Candidates knew that methane is obtained from high in the column but some missed option **A** and chose instead option **B**.

Physics

General comments

The most challenging questions were **25**, **26**, **27**, **28**, **29** and **34**. Candidates found **Question 30** very straightforward.

Comments on specific questions

Question 21 Candidates' understanding of speed / time graphs was secure. Candidates who thought the graph was a distance / time graph incorrectly chose option **A**.

Question 22 The majority of candidates answered this question on the use of a stopwatch correctly.

Question 23 Although the majority of candidates answered this question on stability correctly, a considerable number chose option **A**, possibly because the two angles made the lamina look symmetrical at first glance.

Question 24 Option **C** was chosen by a considerable number of candidates, as some did not realise that X and Y had the same mass but different volumes.

Question 25 Although many candidates were able to answer this correctly, some seemed to think that boiling point was somehow involved. More than half of the candidates chose option **A**.

Question 26 There was considerable confusion over types of energy.

Question 27 Only a minority gave the correct response to this question. Candidates should be reminded of the importance of reading each question carefully, as a large number chose option **D**.

Question 28 Although a considerable number of candidates answered this correctly, some of the candidates appeared to have guessed the order of the electromagnetic spectrum.

Question 29 A large majority incorrectly chose option **C**, mistakenly calculating the frequency as 2.0 Hz. It is possible that some believed that the two values (of frequency and wavelength) could not be the same.

Question 30 Almost all of the candidates answered this correctly, showing a much better level of knowledge of refraction ray diagrams.

Question 31 There was an excellent response to this question on electrostatics, with the majority answering correctly.

Question 32 This question concerned electrical meter readings in a circuit, and the majority of candidates answered correctly.

Question 33 Many candidates answered this question on magnetism correctly.

Question 34 A large minority incorrectly chose option **A**, not understanding that adding resistors in parallel reduces total resistance.

Question 35 This question on electrical safety was answered very well, with the majority of candidates choosing the correct answer.

Question 36 Only just over half of the candidates recognised the V/I characteristic in this question.

Question 37 There was a sound understanding of the structure of the cathode ray tube.

Question 38 As in previous years, nuclear structure was well known by most candidates.

Question 39 This question covered ionising radiation and was answered correctly by the majority of candidates.

Question 40 Less than half of the candidates chose the correct half-life from the graph.

PHYSICAL SCIENCE

Paper 0652/21
Core Theory

Key Message

Questions which required a one word or simple one phrase answer were generally done well. However, where a more detailed explanation was required the answers needed to contain more relevant detail. This can be seen in **Questions (1)(d)(ii)**, **8(a)** and **12(c)**.

General Comments

It was pleasing to see so many papers of good quality and so very few where candidates showed minimal knowledge. Clearly, much of the course has been taught well and the candidates themselves have worked hard to develop their understanding.

Comments on Specific Questions

Section A

Question 1

The most common error was in **(b)**. Those who answered correctly spotted that, to measure 25.0 cm^3 to the level of precision indicated by the '.0' a burette, not a beaker, must be used.

Question 2

(a) The vast majority of candidates gained credit here. Those who did not either misread the scale on the graph, giving 45 m/s, or incorrectly treated the graph as a displacement–time graph.

(b) Most candidates recognised that the car was decelerating. A few candidates stated that the deceleration was constant.

(c) It was pleasing that a sizeable number of candidates recognised that the distance travelled is equal to the area under the graph and then correctly calculated the value. Velocity–time graphs are important and for success candidates need practice in analysing them.

(d)

(i) This question tested an understanding of Newton's first law, sadly only a small minority understood that constant velocity means equilibrium and therefore the resultant force was zero.

(ii) This part of the question was intended to further explore the idea in **(i)**. The best candidates recognised that a moving vehicle has to do work against friction, even if the resultant force is zero.

(e) This was done quite well with many candidates recognising that the acceleration of car **A** was greater than that of car **B**.

Question 3

(a) Correct answers demonstrated an understanding that a compound must contain at least two elements. Others candidates were not precise enough in reading the question, giving a diatomic element such as nitrogen for their example of a covalent *compound*.

(b) It is important that candidates read the question carefully. Many candidates described the bonding processes (transfer of electrons / sharing electrons) rather than describing the properties of ionic and covalent compounds. Others simply stated that ionic bonds are between metals and non-metals and that covalent bonds are those between two non-metals.

(c) The vast majority of the candidates showed a good knowledge of electronic structure. The most common error was to attempt to draw the magnesium atom bonded to another atom.

Question 4

(a) Candidates need to know that bauxite is the ore of aluminium. Some candidates indicated that they misunderstood what is meant by an ore; another metal (such as lead) being given as the answer.

(b) The most able candidates recalled that aluminium is more reactive than carbon. Fewer went on to explain that carbon would, therefore, not displace it. The extraction of metals is an important industrial process and it is important that candidates understand the chemistry of them.

Question 5

This question tested candidates' familiarity with simple experimental procedures.

(a)

(i) There were some good answers. Many candidates needed to include more specific details in their answers; 'To get an accurate reading,' is not sufficient as an explanation. Candidates need to explain *why* the suggested change will get a more accurate reading; in this case mixing the ice ensures that it is at a uniform temperature.

(ii) The best answers did not confuse melting with the process of temperature rise. An example of a good answer would be 'Room temperature is higher than the melted ice so energy is transferred from the surroundings'. Many candidates assumed, incorrectly, that during the first two minutes the ice was melting. Some of those that had some idea of why the temperature rose did not give enough detail, saying, for example, 'It is no longer in the freezer'.

(b) This section tested candidates' understanding of melting point as well as the ability to take a reading from a graph. In general it was well done. When reading from the negative parts of graphs, candidates must ensure that they include the minus sign in their answers.

(c) The final part of the question required candidates to understand that when a substance melts, there is still an energy input despite the temperature remaining constant. This energy increases the potential energy of the molecules, rather than the kinetic energy.

Question 6

(a) This question was quite well done. The most common error was in the calculation of the masses of one mole of the water and nitrogen. Candidates must be very careful when writing down chemical symbols, ensuring that their writing is clear and that the correct case is used; there was a tendency to use lower case 'f' for the symbol for fluorine.

(b) Candidates need to have the basic knowledge of the correct symbols of ions and to be able to use the Periodic Table to work out the numbers of electrons on different ions.

Question 7

(a) This question, which required candidates to deduce how many protons and neutrons are in a specific nucleus, was done well, with many candidates gaining full credit.

(b)

(i) Candidates need to know the nature of α, β and γ-radiations as well as their properties. Many gave the properties of a β, such as its penetrating ability, others simply described it, incorrectly, as a 'radioactive particle'. Examiners were looking for the description of a β-particle as a fast moving electron.

(ii) This question tested candidate's understanding of radioactive decay, and required candidates to understand the changes that are taking place in an atom when radioactive decay occurs. Candidates need to fully understand the implications of α-decay and β-decay.

Question 8

(a) Candidates should be made aware that the nature of a fuel is to be flammable; and that being flammable is not a disadvantage of Hydrogen as a fuel. An awareness of the possible use of hydrogen as a future source of energy has relevance beyond the confines of a simple academic course. Hydrogen is the cleanest possible fuel – water is the only product of its combustion, and it is plentiful (there are oceans of it). The major disadvantage is economically high cost of isolating hydrogen from water.

(b) Balancing chemical equations is an important step in developing an understanding of chemistry. Candidates are expected to be able to give the equation for the combustion of hydrogen to form water. Candidates will not develop the skill of balancing unknown equations without continual practice in writing and balancing equations.

(c) Candidates need to be precise in their answers. Here many candidates had an idea of the test required, but spoilt their answers by saying a glowing splint, rather than the correctly described 'lit' splint should be placed in a test tube of hydrogen.

(d) The best candidates recognised that the product of the reaction between hydrogen and nitrogen is ammonia. Of those who did, only a very few knew the process is the Haber process. It is an important industrial process, one which illustrates an industrial use of chemistry and one which candidates should be aware of.

Question 9

(a) Many candidates were aware that the vibrations in the rubber band were the source of the sound, but few went on to explain that the band transferred this vibration to air molecules thereby forming a sound wave. Candidates need to be encouraged to give full, rather than half, explanations.

(b)

(i) There were some good efforts here, with most candidates realising that the amplitude of the waves would decrease and the most able also recognising that the frequency would remain the same.

(ii) Candidates need to know, understand and learn basic definitions; without a full comprehension of a term like 'frequency' they will be unable to communicate their understanding of wave behaviour.

Question 10

(a) Most candidates recalled that the Group VII elements are called halogens.

(b) Virtually every candidate was able to state another member of the halogen family, displaying an understanding of the term 'Group'.

(c) There was a general understanding that one of the main uses of chlorine is in purifying water, some referring to drinking water, others water in swimming pools.

(d) Just as there was a good understanding of the concept of Group number, the answers to this section showed a good understanding of the term 'Period'.

(e) More candidates found this part challenging. Few candidates explained that chlorine needed to be bubbled through the bromide solution, demonstrating a lack of practical experience. Most answers described the chlorine as simply being 'added' to the bromine, neglecting to explain what would be observed as a result. Exposure to practical chemistry will help to cement ideas like this in a way that pure theory cannot.

(f) Whilst a reasonable number of candidates were able to surmise that the bromine atom has 35 electrons, very few were aware that the ion has 36. Candidates need to be able to extrapolate from basic knowledge.

Question 11

(a) The majority of candidates recognised component **X** as a lamp (or bulb); a significant minority did not. Candidates must learn the circuit symbols before sitting an examination.

(b)

(i) Candidates needed to recognise that this was an example of two resistances in series. Repeated practice in interpreting circuit diagrams and in building and measuring straightforward circuits before the examination will help candidates analyse circuits during the examination.

(ii) Some candidates answered this well. Other candidates were unable to use the equations or made arithmetical errors. Where the working is clear, partial credit can be given but where it is not clear or actually absent, no credit can be given. Candidates must be encouraged to write their working before giving an answer.

(iii) The most common error in this part was to use the total resistance in the circuit rather than the resistor alone. Once more, where the working is clear, partial credit can be given for an attempt to substitute in the formula $V = IR$.

Question 12

(a)(b) The majority of candidates recognised the homologous series as alkanes, although few were able to identify the next member of the series or to give its formula. A common mistake was to give the generic formula for the homologous series, which showed good knowledge but in this case, the formula for propane was specifically asked for and required. Candidates must read questions carefully so that they give the answer asked for.

(c) A good number of candidates recognised that ethanol is not a hydrocarbon because of the inclusion of the oxygen in its structure. Few, however, went on to state that hydrocarbons consist of hydrogen and carbon only. This is another instance where candidates needed to give more detail in their answers.

Question 13

(a) Few candidates were able to draw the field between two magnetic poles. Some drawings showed promise but were not precise enough. Points to remember when magnetic fields are drawn are that every line should start and finish on a pole, lines must never touch or cross and the direction of the field is from the north seeking pole to the south seeking pole.

(b) While many candidates recognised that closing the switch completed the circuit, few went on to either state that there is a power supply in the circuit or to comment that mercury is a conductor. This is another example, as in the previous question, where a complete answer is required.

(c)(d) This is a challenging question that required candidates to have an understanding of the three dimensional interaction between currents and magnetic fields. To gain understanding, candidates need to have carried out experiments themselves, showing the three dimensional nature of the interaction between currents and magnetic fields. If that is not possible, demonstrations or computer simulations are an alternative.

A word of warning, this particular experiment should <u>not</u> be attempted; it is used here only to test understanding. Mercury is a dangerous substance, the arcing when the copper rod disconnects from the mercury is likely to cause vaporisation, with the added hazard of inhalation.

PHYSICAL SCIENCE

Paper 0652/22
Core Theory

Key Message

Questions which required a one word or simple one phrase answer were generally done well. However, where a more detailed explanation was required the answers needed to contain more relevant detail. This can be seen in **Questions (1)(d)(ii)**, **8(a)** and **12(c)**.

General Comments

It was pleasing to see so many papers of good quality and so very few where candidates showed minimal knowledge. Clearly, much of the course has been taught well and the candidates themselves have worked hard to develop their understanding.

Comments on Specific Questions

Section A

Question 1

The most common error was in **(b)**. Those who answered correctly spotted that, to measure 25.0 cm^3 to the level of precision indicated by the '.0' a burette, not a beaker, must be used.

Question 2

(a) The vast majority of candidates gained credit here. Those who did not either misread the scale on the graph, giving 45 m / s, or incorrectly treated the graph as a displacement–time graph.

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(b) It is important that candidates read the question carefully. Many candidates described the bonding processes (transfer of electrons / sharing electrons) rather than describing the properties of ionic and covalent compounds. Others simply stated that ionic bonds are between metals and non-metals and that covalent bonds are those between two non-metals.

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(i) There were some good efforts here, with most candidates realising that the amplitude of the waves would decrease and the most able also recognising that the frequency would remain the same.

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(a) Most candidates recalled that the Group VII elements are called halogens.

(b) Virtually every candidate was able to state another member of the halogen family, displaying an understanding of the term 'Group'.

(c) There was a general understanding that one of the main uses of chlorine is in purifying water, some referring to drinking water, others water in swimming pools.

(d) Just as there was a good understanding of the concept of Group number, the answers to this section showed a good understanding of the term 'Period'.

(e) More candidates found this part challenging. Few candidates explained that chlorine needed to be bubbled through the bromide solution, demonstrating a lack of practical experience. Most answers described the chlorine as simply being 'added' to the bromine, neglecting to explain what would be observed as a result. Exposure to practical chemistry will help to cement ideas like this in a way that pure theory cannot.

(f) Whilst a reasonable number of candidates were able to surmise that the bromine atom has 35 electrons, very few were aware that the ion has 36. Candidates need to be able to extrapolate from basic knowledge.

Question 11

(a) The majority of candidates recognised component **X** as a lamp (or bulb); a significant minority did not. Candidates must learn the circuit symbols before sitting an examination.

(b)

(i) Candidates needed to recognise that this was an example of two resistances in series. Repeated practice in interpreting circuit diagrams and in building and measuring straightforward circuits before the examination will help candidates analyse circuits during the examination.

(ii) Some candidates answered this well. Other candidates were unable to use the equations or made arithmetical errors. Where the working is clear, partial credit can be given but where it is not clear or actually absent, no credit can be given. Candidates must be encouraged to write their working before giving an answer.

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(c)(d) This is a challenging question that required candidates to have an understanding of the three dimensional interaction between currents and magnetic fields. To gain understanding, candidates need to have carried out experiments themselves, showing the three dimensional nature of the interaction between currents and magnetic fields. If that is not possible, demonstrations or computer simulations are an alternative.

A word of warning, this particular experiment should <u>not</u> be attempted; it is used here only to test understanding. Mercury is a dangerous substance, the arcing when the copper rod disconnects from the mercury is likely to cause vaporisation, with the added hazard of inhalation.

PHYSICAL SCIENCE

Paper 0652/31
Extended Theory

Key Message

Candidates must, when solving problems, remember to work logically and show the working clearly so that Examiners can see what is being attempted.

General Comments

There were some excellent papers which showed a genuine understanding of the science involved. Overall, the depth at which candidates worked showed a marked improvement on earlier years.

Comments on Specific Questions

Section A

Question 1

(a) Most candidates answered this well. Those who did not tended to record the value 45 m/s, possibly as a result of misreading the scale on the graph.

(b) This was well done with many candidates not only getting the correct answer and unit, but also setting out the calculation in a clear manner. If candidates use negative indices to express the unit they must be very careful not to use a solidus as well.

(c)

(i) Most candidates were able to calculate the acceleration of **B** using data taken from the graph

(ii) The formula $F = ma$ was known by most candidates and was correctly applied

(iii) Most candidates needed to recognise that the force provided by the engine does some work against friction forces as well as accelerating the car.

(d) Candidates needed to recognise that the car with a steeper graph had a greater deceleration. As both cars have the same mass, the car with a greater deceleration produces the greater braking force.

Question 2

(a)

(i) Candidates continue to find the writing and balancing of chemical equations difficult, however there were a significant number who gave a fully correct answer. Of those who got part way in writing the equation, the most common error was to forget that nitrogen is diatomic.

(ii) There was a good knowledge that oxidation is the addition of one or more oxygen atoms and that reduction is the loss of oxygen. For candidates to gain full credit candidates needed to show understanding by linking oxidation / reduction to this particular reaction.

(iii) Many candidates thought this through well and gave a clear description of the evidence – giving specific examples such as the elimination of the nitrogen oxide and the consequent increase in the percentage of nitrogen gas.

(iv) Candidates must study the table carefully to identify a different reaction, such a study reveals that the amount of water vapour increases and it can be concluded that this was due to the reaction between oxygen and hydrogen.

(b)

(i) There was a general understanding of the principles of protecting steel by the method of galvanisation. Many of the answers were of excellent quality and apart from a minority who confused galvanising with alloying, candidates performed well here.

(ii) A full answer to this requires more than a simple statement that steel rusts if paint is scratched. It also requires a comparison with the effect of scratching the zinc.

Question 3

(a) Candidates need to be encouraged to think explanations through thoroughly. Many realised that the vibrations of the rubber band are the basic cause of the sound production. A full explanation needs more than this; the vibration of the rubber band causes the air particles to vibrate and a sound wave is formed which travels through the air.

(b) The calculation required clear thought and a familiarity with the practical set up. Many candidates thought it was a calculation involving $v = f\lambda$. Practice using the apparatus will teach candidates that waves rarely fill an exact number of divisions. The approximate use, as in this case, of one division per wave will not give an answer of sufficient accuracy.

Question 4

(a) The first two parts of the question were done reasonably well, although a number of candidates thought the light acted as a catalyst. Candidates needed to give more detail than a simple 'it breaks bonds' for the first part. Few candidates were able to give the ionic equation for the reaction; many tried giving an equation of the complete reaction; others confused as to whether the electron was given up or taken in by the silver atom.

(b)

(i) The key to success in this part was the recognition that silver bromide is insoluble; this could be inferred from the equation. Those that recognised this described the subsequent separation well. To score the fourth marking point, candidates needed to state that to avoid the reduction of the silver ion, the silver bromide needed to be kept in the dark. Many candidates gained credit for stating that the potassium bromide should be added in excess.

(ii) Candidates need to set out their calculations in a logical manner, giving explanations where necessary. There were some good attempts at the calculation, with some candidates receiving full credit.

Question 5

This question explored, in a guided way, how a variable resistor can be used as a variable voltage supply. Candidates were not required to have met this concept before as this question tested their ability to understand information in a new context. The question exposed some weaknesses in candidates' understanding of electrical circuits.

(a) The question started with two straightforward calculations of current and resistance and this was generally done well.

(b) This followed up by asking candidates to show that the potential difference was a particular value when the slider was moved. This was also done well, although in a case where candidates are asked to show a value is correct, it is imperative that there is an explanation, or at the very least, that the complete equation is given. In this case the minimum that was accepted was $R = 3 / 0.125 = 24$ V

(c)

(i) The question then moved on to look at the effect of putting a lamp of fairly low resistance in the output from a section of the variable resistor. Candidates were required to show that the resistance of two resistors in parallel was equal to a certain value. The same comments as made in the previous part are relevant here. There were some excellent answers, but others were spoilt by a lack of rigour. It was not uncommon to see strings of incorrect equations.

(ii) At this point candidates needed to have real appreciation of the circuit; the previously calculated resistance should have been added to the resistance of the remainder of the variable resistance.

(iii) Candidates now needed to calculate the resistance across the bulb; candidates needed to recognise that the addition of the bulb alters the current in the circuit. Many candidates gave responses which indicated that they thought that the current through the circuit remained at the original 0.125 A.

(iv) The final part of the question required candidates to comment on the brightness of the bulb with an answer expected in keeping with their calculated potential difference in **(iii)**.

Question 6

(a) Many candidates were able to calculate the volume of carbon dioxide released in the reaction. Again, there were some candidates who did not set their calculation out in a logical manner.

(b)

(i) As in **Question 2** candidates were asked to link a general chemistry process to a particular reaction. In this question many candidates showed that they were able to recall the idea that acids are proton donors and bases are proton acceptors, but did not link this to the specific reaction given.

(ii) Relatively few candidates were able to identify the type of oxide described in the three cases.

Question 7

Electromagnetic induction continues to be an area of the IGCSE syllabus that many candidates find challenging. Candidates need to carry out the experiments themselves if they are to grasp that it requires relative movement between a magnet and coil for there to be an e.m.f. induced in the coil.

(a)

(i) The best answers made it clear that there was a deflection of the needle while the magnet was moving relative to the coil. Incorrect answers indicated that those candidates were under the impression that the mere presence of a magnet near a coil leads to there being a current in the coil.

(ii) Good answers involving the idea of the cutting of magnetic flux.

(b) Those who received credit in **(a)(i)** tended to answer this correctly.

(c) Candidates must read the question carefully. They were asked to state the observation (waves seen on the c.r.o. screen) and to explain it. Many answers stated that waves would be seen on the c.r.o. screen, but very few answers went further to link this to the changing flux due to the alternating current.

Question 8

(a)

(i) Most candidates were able to name the gases as noble gases, although a few thought they were halogens. Although some old text books might refer to them as Inert or Rare gases, modern terminology demands the use of 'Noble'.

(ii) Candidates need to be commended for their answers here. The idea of a trend was well understood. Very few fell into the trap of thinking that the boiling point increased going down the group.

(iii) There was confusion as to what was meant by a chemical property, with many comments referring to atomic structure. The property expected was that the Noble gases are unreactive; comments using words and phrases such as 'inert' were accepted even though they are not strictly correct and should be avoided.

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(i) The dot-cross diagram of the argon atom was done well by virtually all candidates.

(ii) This proved quite challenging with relatively few candidates gaining full credit. When a question asks for the name of an atom, the name, not the chemical symbol, must be given. Likewise, the precise charge (+1, −1, +2 etc.) was required for further credit, rather than just the commonly written positive or negative.

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(a)

(i) Candidates need to be encouraged to avoid trivia such as, ‘they both need heat’, rather than the important, but simple idea that in both boiling and evaporation liquid is converted into vapour.

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(b) The overwhelming majority of candidates made a sensible estimate of room temperature from the graph. However, it is worth noting that a careful analysis of the graph gives a value of rather less than 25 ^{o}C.

(c) The molecular kinetic theory of matter requires candidates to understand a simple model. Many candidates made sensible points regarding the molecules losing energy, the most able of them losing kinetic energy. A small minority showed a lack of understanding by saying that the individual molecules lost heat or thermal energy. Thermal energy can only be used on the macroscopic level; on a microscopic level it is the kinetic and potential energies of the molecules which must be referred to.

PHYSICAL SCIENCE

Paper 0652/32
Extended Theory

Key Message

Candidates must, when solving problems, remember to work logically and show the working clearly so that Examiners can see what is being attempted.

General Comments

There were some excellent papers which showed a genuine understanding of the science involved. Overall, the depth at which candidates worked showed a marked improvement on earlier years.

Comments on Specific Questions

Section A

Question 1

(a) Most candidates answered this well. Those who did not tended to record the value 45 m/s, possibly as a result of misreading the scale on the graph.

(b) This was well done with many candidates not only getting the correct answer and unit, but also setting out the calculation in a clear manner. If candidates use negative indices to express the unit they must be very careful not to use a solidus as well.

(c)

(i) Most candidates were able to calculate the acceleration of **B** using data taken from the graph.

(ii) The formula $F = ma$ was known by most candidates and was correctly applied.

(iii) Most candidates needed to recognise that the force provided by the engine does some work against friction forces as well as accelerating the car.

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PHYSICAL SCIENCE

Paper 0652/51
Practical Test

Key Messages

- Candidates should be able to read the display of a timing device and convert the display into seconds.

General Comments

Only a very small number of candidates did not complete the paper. The level of English in the responses was generally very good and there were few instances of a candidate misunderstanding a question.

Comments on Specific Questions

Question 1

The order of decomposition of the three carbonates varied from Centre to Centre but the mark scheme allowed for this and candidates were in no way penalised. A number of candidates simply copied the display of their stopwatch or stop clock without converting to seconds as instructed. This is an essential skill which was required in both questions on this paper. A small number of candidates recorded the changes in the limewater rather than any colour change to the carbonate as instructed. Parts **(a)(iv)** to **(b)(ii)** proved straightforward for most and better candidates were able to comment on the relationship or lack of relationship between the two lists in **(a)(iv)** and **(b)(ii)**. Due to unreacted acid in **(c)(i)**, it was necessary to add plenty of dilute sodium hydroxide to obtain a blue precipitate. Many candidates obtained a blue precipitate and then recorded it in an inappropriate way, such as "blue mass". The displacement reaction in **(c)(ii)** worked well allowing many to use the brown colour on the zinc as a piece of evidence for the identification of copper in **(c)(iii)**.

Question 2

The majority of candidates produced all fifteen results in the results table. Recording of the time for 10 oscillations was an issue in some cases as in **Question 1**, resulting in marking point 5 in **(a)** not being awarded. In addition many candidates gave the time to hundredths of a second when the instruction in **(a)(i)** told the candidates to record the time to 0.1 second. Averaging of the time for 10 oscillations was generally good. The calculation of the period, **T**, only required the average to be divided by ten; many candidates produced odd answers here and there were a number of rounding errors too. The relationship between the period and the angle of swing was commented on sensibly. Candidates were less confident in explaining that the relationship was not proportional although it was very encouraging that some suggested that the angle of swing divided by the period was not a constant value. The calculation in **(c)** was not carried out as well as expected: the main errors were the use of 30 cm instead of 0.30 m for the length, using a length not equal to 0.30 m, not squaring the period, **T**, or not rounding the value of $\mathbf{T^2}$ appropriately. Very few candidates were able to give the units for **g**. In **(d)(i)**, most candidates understood the reason for timing 10 oscillations rather than 1 oscillation and often went on to describe a timing related error for **(d)(ii)**. Giving the length of the pendulum as an error in **(d)(ii)** needed a qualification in terms of the pendulum bob and this was rarely seen. Measuring the angle of swing was accepted as an error; the method for the reduction of this error needed to be a check with a plumb line rather than simply the use of another pin.

PHYSICAL SCIENCE

Paper 0652/61
Alternative to Practical

Key Message

This paper is firmly associated with experience at the laboratory bench so candidates need to be able to demonstrate practical skills.

General Comments

Many candidates demonstrated their practical knowledge. Others showed poor appreciation of the principles and practice of science, especially in the chemistry questions. Candidates need to be reminded to read each question carefully; otherwise they may use incorrect units or give irrelevant information in their answers.

The number of significant figures is an area where candidates need to consider their answer, in general it should be the same as in the question or table, so, if 1.75 was already in the table all other answers should be similar e.g. 2.40 or 2.00. Zeros are important as they are a sign of accuracy. Rounding must also be correct; the calculator readout of 1.666666666 may be written as 1. 667, 1.67, 1.7 or even 2, depending on the precedent, but never as 1.66 or 1.6.

Comments on Specific Questions

Question 1

(a) Most candidates selected the correct cell, **Q**, as having the same sized electrodes the same distance apart.

(b) Despite being given a circuit diagram to follow many candidates did not gain credit on this part. Terminals were shown but rarely used, lines stopping short or joining the + or – signs. Other candidates drew lines from any part of the apparatus and few managed to connect the ammeter and battery in series with the voltmeter in parallel suggesting few candidates have had practical experience of these instruments.

(c) The scales of the ammeter and voltmeter were usually correctly read.

(d) When asked to explain how the electric charge travels from one electrode to the other, only a few candidates stated it was due to the movement of ions. Only the most able were able to explain the increased current in the more concentrated solution to there being more ions.

(e) Gas being given off, electricity moving, any named gas or named solid could not receive credit, as these are not observations as required by the question. A red-brown-pink deposit at the cathode and bubbles or effervescence at the anode were creditworthy answers.

Question 2

(a) The reading of the three analogue stopclock dials and the subsequent listing of carbonates in their speed of decomposition were both done well.

(b)

(i) The minimum required for the diagram was a funnel with a filter paper lining and a receptacle of some kind to catch the filtrate. Some candidates diagrams had a piece of filter paper hanging in mid-air with no funnel to support it. A significant minority drew distillation apparatus.

(ii)(iii) Candidates familiar with chemical analysis had no difficulty in identifying copper and its compounds. Some candidates appeared to have little laboratory experience and gave incorrect answers.

(c) A number of candidates drew the bubbles above the level of the liquid rather than from the metal; however credit was it the correct comparisons were stated.

(d) The question asked if the reactivity of the metals could be used to predict the speed of thermal decomposition of the carbonates, many candidates said ‘no’ instead of noting the inverse relationship; the more reactive the metal the slower the decomposition of the carbonate.

Question 3

(a) Candidates were required to read protractors for three angles and transfer them with the corresponding times to a table. Most candidates did this correctly however some ignored the labelling of the angle to be measured and read the protractor incorrectly. The times recorded were for ten swings, the final row of the table required these numbers to be divided by 10 to find the time for one swing. Most candidates did this correctly, but a significant number had answers that Examiners were unable to work out how they were calculated. Candidates are reminded that they should show their working. Most candidates then went on to calculate the average for their figures.

(b) The times in the table showed no pattern and were all within expected experimental error. Some candidates tried to see patterns that were not there.

(c) Most candidates realised the need to repeat the experiment to make the result more reliable, but taking the average was also required.

(d) Candidates had to convert the length of the pendulum, in centimetres, to metres. Although most candidates did this correctly, some candidates gave an answer of 30 000 m.

(e) The acceleration due to gravity was calculated using a formula supplied. Most candidates did this, although some did not square the denominator value shown by the formula.

Question 4

(a) Most candidates read the timer dial correctly and many multiplied by the speed of sound.

(b) The diagram clearly showed four waves and the scale showed 0.5 seconds and many candidates correctly recorded these figures in the table. The frequency was calculated, using the formula given, and then another formula allowed candidates to calculate the wavelength. Many candidates gained full credit, any errors were carried forward and if used correctly, partial credit was awarded.

(c) Most candidates drew good diagrams. Credit was not given where candidates drew their waves very carelessly or changed the smooth curves into sharp peaks.

(d) The expected answer, transverse, was rarely seen.

Question 5

(a) Some candidates could not picture what would happen if a gas-jar of soluble gas was opened in water as shown in the diagram. The expected answer, that some of the water would rise up the gas-jar, was not often seen. The explanation of resulting pressure difference being responsible was rarely seen.

(b) Use of an indicator to identify acidic and alkaline gases was reasonably well known, but as there are a number of indicators, any colours given for an unnamed indicator cannot receive credit. Similarly red litmus paper turning blue is acceptable as a test for an alkaline gas; red litmus staying red will not test for acidic gases as neutral substances would not change the colour either.

(c)(d) The tests for oxygen and hydrogen are reasonably well known, but it must be a glowing splint for oxygen and a lighted splint for hydrogen.

(e) By careful study of the original key, more able candidates could name ammonia and sulfur dioxide.

Question 6

(a) Candidates had to measure the lengths of two pieces of resistance wire. Most candidates gave correct answers within the required +/-0.1 mm tolerance.

(b)

(i) Almost all candidates knew that the ammeter should be in series and the voltmeter in parallel.

(ii) Most candidates were able to correctly read two analogue dials showing voltage and current, however a significant number gave 0.45 V instead of 4.5 V.

(iii) Candidates had to remember that resistance is found by dividing the voltage by the current, or they may have worked it out by looking at the example given, either way, this question presented few problems.

(c) Candidates answers indicated that they were sometimes confused by the comparative resistances of thick and thin wires, and long and short wires. Candidates should be aware that the thinner and longer the wire a greater resistance.