PHYSICAL SCIENCE

Paper 0652/11
Core Multiple Choice

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

General comments

In the physics section no question was found to be particularly easy, but several were found more challenging. These were **Questions 30**, **35**, **38** and, especially, **32** and **39**.

Comments on specific questions

Question 1

The movement of gas particles as diffusion is well known by a majority of the candidates.

Question 2

The concept of nucleon number is well understood by many of the candidates.

Question 3

A significant proportion of the candidates thought that sodium chloride is a covalent compound and chose option **D**.

Question 4

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

Question 5

A majority of the candidates are able to calculate relative molecular mass.

Question 6

The vast majority of the candidates recognised that burning wood is an exothermic reaction but many of these candidates thought that the wood is reduced and chose option **D**.

Question 7

The factors that affect the rate of a chemical reaction are well understood by many of the candidates.

Question 8

A significant number of the candidates thought that water is a basic oxide and chose option **D**.

Question 9

The test for ammonia gas is well known by many of the candidates.

Question 10

There was evidence of guesswork even amongst the better candidates indicating that the trends shown by the elements in Group I are not well known.

Question 11

Many of the candidates identified element X as a non-metal and thought that it did not conduct electricity and chose option **B**.

Question 12

There was evidence of guesswork amongst the weaker candidates. The better candidates identified that metal Q is more reactive than copper and less reactive than the other metals from the displacement reactions.

Question 13

The metals present in bauxite and haematite are well known by the better candidates.

Question 14

The percentage composition of air is known by a majority of the candidates.

Question 15

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

Question 16

The use of basic slaked lime to neutralise acidic sulfur dioxide was known by many of the candidates but there was evidence of guesswork amongst the weaker candidates.

Question 17

The gaseous nature of methane was not appreciated by a majority of the candidates.

Question 18

A majority of the candidates recognised that the chemical properties shown by members of a homologous series are similar but the idea that they have the same functional group is less well known.

Question 19

The vast majority of the candidates knew that there is a colour change when bromine is added to limonene; however many of these candidates thought that bromine is colourless and selected option **B**.

Question 20

The formula of ethanol is well known by the better candidates.

Question 22

In this question about speed-time graphs, more candidates opted for **D** than the correct response **B**. This error involved multiplying the maximum speed by the total time of travel, as if the car were moving at its maximum speed throughout.

Question 24

A very common error here was failing to subtract the mass of the container before dividing mass by volume.

Question 26

Almost one in three candidates believed that using nuclear fission in a power station first involved transferring nuclear energy into chemical energy.

Question 28

Some candidates either failed to read the question carefully or did not realise that the lack of air on the Moon would prevent convection currents, leading them to opt for **C**.

Question 29

Option **D** was very popular in this question on waves; this value was found by multiplying the number of wave crests by the time, rather than dividing by it.

Question 30

Many candidates seemed unaware that some internal reflection always occurs, even when the angle of incidence is less than the critical value, and so opted for **B**.

Question 31

In this question the electromagnetic spectrum was presented in order of increasing wavelength, and this might have led to the popularity of option **B**; candidates need to look carefully at the information given in diagrams for questions.

Question 32

The range of human hearing is generally considered to be **20 Hz to 20 kHz.** Many candidates assumed that the frequency of 25 Hz was not audible to a human with normal hearing.

Question 34

Many candidates gave an answer indicating that they believe that like charges repel and opposite ones attract.

Question 35

There was evidence of guesswork from the less able candidates.

Question 38

Most knew that cathode rays were deflected upwards or downwards rather than sideways, but for most candidates the choice between these two options was guesswork.

Question 39

Candidates of all abilities believed the radiation (gamma rays) to be strongly ionising, presumably confusing the concepts of ionisation and penetration.

PHYSICAL SCIENCE

Paper 0652/12
Core Multiple Choice

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

Paper 0652/21
Extended Multiple Choice

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

General comments

No physics question was found to be particularly easy, but **Questions 32**, **40** and, especially, **25**, **26**, **29** and **36** caused considerable difficulty.

Comments on specific questions

Question 1

This proved to be an easy question for a majority of the candidates.

Question 2

The concept of nucleon number is well understood by a large proportion of the candidates.

Question 3

The idea that magnesium chloride is an ionic compound and is formed by the transfer of electrons from magnesium atoms to the chlorine atoms is well understood by the candidates.

Question 4

The fact that electrons are able to move within the structure of graphite is well known by many of the candidates.

Question 5

This proved to be an easy question for a majority of the candidates.

Question 6

This proved to be another easy question for a majority of the candidates.

Question 7

The vast majority of the candidates are able to calculate the relative atomic mass,

Question 8

The vast majority of the candidates recognised that burning wood is an exothermic reaction but a significant number of the candidates thought that the wood is reduced in the reaction and chose option **D**.

Question 9

The concept of an acid being a proton donor is not well understood by a large number of the candidates.

Question 10

There was evidence of widespread guesswork amongst even the better candidates

Question 11

The test for ammonia gas is well known by a large proportion of the candidates.

Question 12

The relationship between the number of outer electrons and group number is well known by the candidates.

Question 13

The trends in properties shown by Group VII, and therefore also shown by Group VI, are not understood by many of the candidates.

Question 14

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

Question 15

Ideas about redox reactions are understood by many of the candidates but there was evidence of some guesswork amongst the weaker candidates.

Question 16

The use of a low density metal to manufacture aircraft bodies is understood by a majority of the candidates.

Question 17

The type of reaction in a catalytic converter where nitrogen oxides are removed from car exhaust fumes is not well known by the candidates.

Question 18

A majority of the candidates recognised that the chemical properties shown by members of a homologous series are similar but the idea that they have the same functional group is less well known.

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Question 20

The vast majority of the candidates knew that there is a colour change when bromine is added to limonene; however, many of the weaker candidates thought that bromine is colourless and selected option **B**.

Question 25

Candidates struggled to obtain the correct multiplying distance from the diagram, resulting in a significant proportion of wrong answers.

Question 26

This was the Physics question that candidates found the most challenging on the paper. Candidates needed to remember that the kinetic energy equation contains a v^2 to obtain the right answer.

Question 29

A very common choice in this question on a thermal radiation was **D**. Candidates needed to remember that a good absorber of thermal radiation is also a good emitter of thermal radiation and that poor absorbers are also poor emitters, as demonstrated in many commonly-used school laboratory experiments.

Question 32

Many candidates seemed unaware that some internal reflection always occurs, even when the angle of incidence is less than the critical value, and so opted for **B**.

Question 36

Candidates found this question challenging. Many chose distractor **C**, which was constructed by failing to convert milliamps to amps and failing to convert minutes to seconds, indicating that the candidates likely did not notice that the units for the quantities given were not standard amps and seconds.

Question 40

Candidates of all abilities believed the radiation (gamma rays) to be strongly ionising, presumably confusing the concepts of ionisation and penetration.

PHYSICAL SCIENCE

Paper 0652/22
Extended Multiple Choice

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1	**C**	21	**D**
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3	**D**	23	**C**
4	**B**	24	**B**
5	**C**	25	**B**
6	**C**	26	**D**
7	**D**	27	**D**
8	**B**	28	**B**
9	**C**	29	**A**
10	**A**	30	**A**
11	**D**	31	**C**
12	**C**	32	**C**
13	**D**	33	**C**
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Question 40

Candidates of all abilities believed the radiation (gamma rays) to be strongly ionising, presumably confusing the concepts of ionisation and penetration.

PHYSICAL SCIENCE

Paper 0652/31
Core Theory

Key messages

Candidates need to make sure that they have learnt basic facts and equations.

General comments

There were some very good scripts and many where candidates showed a sound knowledge of physical science over a considerable area of the syllabus.

Comments on specific questions

Question 1

(a) Most candidates were able to identify the measuring cylinder. A significant minority described the balance as *scales*.

(b) Most candidates were able to calculate the mass of liquid. Fewer candidates were able to calculate the density of the liquid and give the correct unit.

Candidates from some Centres gave the unit as g/cc. This abbreviation for centimetre cubed is no longer used and should be avoided.

mass of liquid = 154 (g)
density of liquid = 1.30 g/cm^3

(c) Many candidates did not recognise this experiment and could not describe how convection currents are formed.

Question 2

The question was generally done well with many candidates scoring most of the marks. Common errors were to think that hydrocarbons are a mixture of different gases, and a failure to recognise that the fraction with the longest carbon chain is called bitumen.

Question 3

(a) There were some good answers to this question. The most common mistake was to confuse a solar cell (which converts solar energy into electrical potential energy) with a solar heating system (which will convert the solar energy into thermal energy).

(b) (i) Few candidates demonstrated an understanding of nuclear fission. Of those that did, some discussed the splitting of the atom, not the splitting of the nucleus.

(ii) Candidates produced vague answers here that were not specific enough to gain credit. 'It creates (or does not create) pollution' was a common example. Candidates needed to make it clear that the pollution is from the escape of radioactive isotopes or from the production of fewer gases like carbon dioxide which add to global warming, as both types of energy production can be considered to create pollution.

A statement that 'a nuclear power station gives out much more energy than a coal fired station', may or may not be true and so could not be credited. However, a statement that a nuclear power station gives out more energy per unit mass of fuel consumed is correct.

Similarly, it is not enough to say that nuclear power is 'more expensive', as the cost of the fuel in a nuclear power station is currently less than that of a coal-fired station in many countries when considered per unit of energy produced. A statement that it is more expensive to build or decommission a nuclear power station than it does a coal-fired power station shows an understanding of the science.

Question 4

(a) A fair number recognised that the water rose up the test tube as the iron reacted with the oxygen in the air. Fewer linked the percentage rise with the idea all of the oxygen in that sample of air had been reacted.

Many candidates did not recognise that the main gas remaining in the test tube was nitrogen, common errors being carbon dioxide, hydrogen and iron oxide.

(b) The balancing of the equation, which was not easy, was done remarkably well. Many candidates also recognised that this was an example of oxidation.

(c) Many candidates answered that aluminium is less reactive than iron.

Question 5

(a) (i) Few candidates recognised that the angle of incidence is equal to the angle of refraction.

(ii) Only a small percentage of candidates were able to show the path a ray of light takes when it travels through a parallel sided block.

(b) Most candidates thought that either the ray continued along in a straight line or travelled parallel to the block surface.

Question 6

(a) (i) A good number of candidates recognised that the hydrogen gas escapes through the thistle funnel, and came up with various solutions to the problem.

(ii) There were also good suggestions for speeding up the reaction. However, it is important that candidates to make it clear the change that is being suggested. For example, 'increasing the concentration' is not clear – it must be 'increasing the concentration of the acid'.

(iii) The majority knew the test for hydrogen although a few candidates did not gain the mark by hedging their bets and giving more than one result of the test.

(b) (i) Attempts to explain what is meant by fuel were quite varied, with some excellent responses and others lacking clarity of thought.

(ii) Candidates should know that the only substance produced by the combustion of hydrogen in air is water.

(iii) The question asked why it was <u>difficult</u> to use hydrogen as a fuel for cars**.** Candidates often did not address the question asked in their answers.

Question 7

(a) Candidates found this question challenging.

(b) Candidates appeared unfamiliar with the concept of background radioactivity, the nature of an α-particle is and the random nature of radioactive emissions.

Question 8

This question was done well with many getting 5 or more of the available marks. The major difficulties encountered were in identifying the ion of sodium and deciding the physical state of Argon and fluorine at room temperature.

Question 9

(a) Many candidates struggled to recognise the circuit diagram symbol for a variable resistor. Only a few understood that increasing the resistance of the variable resistor decreases the current in the circuit.

(b) (i) Most candidates knew the circuit diagram symbol for a voltmeter, but fewer knew that it should be connected in parallel across the voltmeter.

(ii) The calculation of the current in the circuit required candidates to change the subject of the equation. Many candidates found this difficult.

(c) Many candidates were able to show the second resistor in series with the original resistor. Fewer recognised that the current in the circuit would increase with the introduction of the second resistor.

Question 10

(a) Some candidates struggled to express themselves when answering this question. A few candidates were able to explain that a native metal is a pure metal that is found in the Earth's crust.

(b) A fair number of candidates were aware that the (most common) ore of aluminium is bauxite. Fewer understood why carbon cannot be used to extract it from its ore.

Although there were some good answers as to the uses of stainless steel, many were far too vague. The answer 'In medicine' is not specific enough, whereas the answer 'making medical instruments, such as forceps' can gain credit.

Question 11

(a) The question required candidates to use their knowledge of the properties of magnets and magnetic materials in order to identify three metal bars. A large number of candidates were able to complete the task successfully.

(b) Most candidates were able to correctly label the poles induced on the nails and also to give a good explanation as to why the bottom ends of the nails were pushed apart.

Question 12

(a) Most candidates had some idea of the meaning of a homologous group, although few gave a full description.

(b) Many good attempts were made at drawing the structure of ethanoic acid from the formula.

(c) This presented a neutralising reaction between an unusual acid and sodium hydroxide, rather than the more commonly-known hydrochloric acid. This confused many candidates.

(d) Most candidates suggested a sensible pH for ethanoic acid. Attempts at explaining how the pH could be checked were not done so well.

PHYSICAL SCIENCE

Paper 0652/32
Core Theory

Key messages

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Comments on specific questions

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(c) This presented a neutralising reaction between an unusual acid and sodium hydroxide, rather than the more commonly-known hydrochloric acid. This confused many candidates.

(d) Most candidates suggested a sensible pH for ethanoic acid. Attempts at explaining how the pH could be checked were not done so well.

PHYSICAL SCIENCE

Paper 0652/41
Extended Theory

Key messages

Candidates need to make sure that they have learnt basic facts and equations.

General comments

There were some very good scripts and many where candidates showed a sound knowledge of physical science over a considerable area of the syllabus.

Candidate answered **Questions 1**, **5** and **7** well. They struggled on **Question 3** in particular, but also on **Questions 6**, **8** and **10**.

Comments on specific questions

Question 1

(a) (i) Most candidates made an attempt to calculate the gradient of the graph. The most common errors were to ignore the fact that there was a speed of 0.4 m/s at time $t = 0$ and to manipulate the figures to get an answer of 9.8 or 10 m/s^2.

acceleration = 9.6 m/s^2

(ii) This was done well, with most candidates successfully using their result from part **(a)(i)** to find the force on the ball.

force = 1.4 (N)

(iii) Those who had completed the first two sections, generally completed the task by calculating the work done by the gravitational field on the ball. A relatively common error was to think that the two pieces of information given in the stem of the question were needed to complete this calculation.

work done = 6.0 J

(b) The first section was done well with most candidates understanding that the decrease in gradient was the evidence required to indicate the acceleration was decreasing. The second part was not completed as well as the first; many recognised that the decrease in acceleration was related but missed the important idea that the air resistance increases as the speed increases.

Question 2

(a) The vast majority of candidates recognised that the Group number of an element is equal to the number of electrons in the valence shell.

(b) (i) This section caused problems for candidates who did not realise that 1 mole of chlorine gas (Cl_2) would produce 2 moles of hydrogen chloride gas and therfore, to produce 10 moles of hydrogen chloride, 5 moles of chlorine is needed.

volume = 5 dm^3

(ii) The important point in this section was to recognise that the light provides the energy to trigger the reaction.

(c) (i) Relatively few candidates were able to give the equation for the reduction of silver bromide. The most common error was to forget that the halides are diatomic.

(ii) This was not done well. Many candidates simply repeated the information given in the question. Only a few realised that the silver gains electrons as it is reduced and that the metallic silver is dark in colour.

Question 3

Many candidates struggled with parts of this question. Most did not know that the process releasing energy in the Sun is nuclear fusion.

Those who recognised it was nuclear fusion were largely unclear of the mechanics of the process. Many thought it was atoms or molecules (not nuclei) that fused together to form new atoms.

A few candidates knew the mass-energy equation and worked through the problem successfully; the majority multiplied the speed of electromagnetic radiation and the rate of loss of mass without squaring the speed.

(c) Energy = 3.6×10^{24} J

Question 4

(a) The vast majority of candidates knew that nonadecane is a member of the alkane series.

(b) This was not answered well by many candidates. It was common to see that a lubricating process was given as the other use despite this use being mentioned in the question.

(c) (i) Relatively few candidates were able to determine the correct unknown hydrocarbon.

(ii) Common errors here were to include the need for a catalyst (which is not a condition for cracking), or simply referring to ‘pressure’, without establishing that it is high pressure that is needed.

(iii) Most candidates recognised that a catalyst increases the rate of a reaction. Some better candidates included the idea of an alternate pathway with a lower activation energy.

(d) This question discriminated well.

Question 5

(a) Candidates do need to be familiar with the construction of a thermocouple.

(b) This was intended to be a challenging question. It was encouraging that many candidates were able to make a start on the calculation, some were able to take it a step further and a significant number were able to fully complete the task without any errors.

temperature = –13.6 °C

(c) There were some very good suggestions for situations in which a thermocouple thermometer is more suitable thermometer is more suitable than a liquid in glass thermometer. Candidates found more difficulty in explaining why their chosen situation was so suitable. It is no good giving a situation such as ‘measuring very high temperatures’ and then an explanation that simply says the thermocouple has a large range! An explanation that it is made from metals and the metals high melting points would be more suitable.

Question 6

(a) The majority of candidates had little problem with this section.

(b) (i) This question discriminated well. Some candidates made a promising effort but were not precise enough, making comments such as 'it has four bonds'. Without specifying the nature of 'it' – which could be an atom, or could be graphite or diamond – comments using unspecified pronouns, with no clue as to what the pronouns stood for, could not be awarded marks.

(ii) Most candidates recognised that graphite has a layered structure and these layers can slide over each other. Fewer candidates gave further detail, such as the bonds between layers being weak.

(c) The question asked for a word equation yet many candidates gave a balanced equation!

(d) Most candidates demonstrated some knowledge of oxidation, although the wording was not always very clear.

Question 7

(a) Most candidates were able to draw in a suitable continuation of the marked ray showing the correct refraction.

(b) This was completed less well. The majority of candidates were unable to identify the critical angle; similarly, only a few recognised that the ray would be totally internally reflected.

(c) The calculation of the refracted angle was done well by a fair number of candidates
.

angle of refraction = 27.4°

Question 8

(a) This question was done very well, with the majority of candidates gaining both marks.

(b) Although the majority of candidates recognised that this was due to the protective oxide layer that forms on aluminium, a number stated that it was because aluminium was more reactive than zinc.

(c) Most candidates recognised that aluminium is a good choice for aircraft bodies because it has a low density although some spoilt their answer by saying it is light, which is technically incorrect (a large mass of aluminium may not be 'light'). Another common response was 'it is unreactive' which is incorrect, although it would be correct to say aluminium resists corrosion (because of the oxide layer).

(d) This was done quite well, with a good number recognising the activity of aluminium is greater than that of carbon.

(e) Most candidates recognised that aluminium oxide is amphoteric.

Question 9

(a) (i) Many candidates did not use the idea that the current in the two branches was equal to the current coming into that junction.

current = 0.53 A

(ii) This was done rather better with the majority of candidates using their answer from the previous part to find the resistance of branch 2.

resistance = 5.7 Ω

(iii) This question continued to discriminate well.

resistance = 3.2 Ω

(b) (i) The most common error was to think that the resistance of the wire increased with increasing cross sectional area, rather than decreased.

length = 100 cm

(ii) **T**he majority of candidates knew the formula for calculating the power of the heater. However, a significant number of candidates did not identify the correct current to use.

power = 2.31 W

Question 10

(a) There were some good suggestions here although again, linguistic precision is needed in the answers. Vague answers such as 'from factory chimneys' will not gain credit.

(b) The most significant effect of the emission of nitrogen oxides into the atmosphere is not global warming, but the formation of acid rain.

(c) Few candidates answered this completely. Many recognised that when the oxides of nitrogen are reduced the product is nitrogen; a few went on to mention the oxidising of carbon monoxide by the liberated oxygen, which was allowed for credit. The majority did correctly suggest that carbon dioxide is the product of the catalytic converter when it removes carbon monoxide from exhausts.

Question 10

(a) The majority of candidates showed an understanding of the convention for describing nuclides.

(b) Whilst the majority of candidates knew this, a significant number did not know the structure of the α-particle.

PHYSICAL SCIENCE

Paper 0652/42
Extended Theory

Key messages

Candidates need to make sure that they have learnt basic facts and equations.

General comments

There were some very good scripts and many where candidates showed a sound knowledge of physical science over a considerable area of the syllabus.

Candidate answered **Questions 1**, **5** and **7** well. They struggled on **Question 3** in particular, but also on **Questions 6**, **8** and **10**.

Comments on specific questions

Question 1

(a) (i) Most candidates made an attempt to calculate the gradient of the graph. The most common errors were to ignore the fact that there was a speed of 0.4 m/s at time $t = 0$ and to manipulate the figures to get an answer of 9.8 or 10 m/s^2.

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(ii) This was done well, with most candidates successfully using their result from part **(a)(i)** to find the force on the ball.

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(iii) Those who had completed the first two sections, generally completed the task by calculating the work done by the gravitational field on the ball. A relatively common error was to think that the two pieces of information given in the stem of the question were needed to complete this calculation.

work done = 6.0 J

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volume = 5 dm^3

(ii) The important point in this section was to recognise that the light provides the energy to trigger the reaction.

(c) (i) Relatively few candidates were able to give the equation for the reduction of silver bromide. The most common error was to forget that the halides are diatomic.

(ii) This was not done well. Many candidates simply repeated the information given in the question. Only a few realised that the silver gains electrons as it is reduced and that the metallic silver is dark in colour.

Question 3

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Question 10

(a) The majority of candidates showed an understanding of the convention for describing nuclides.

(b) Whilst the majority of candidates knew this, a significant number did not know the structure of the α-particle.

PHYSICAL SCIENCE

Paper 0652/51
Practical Test

Key messages

When justifying a statement, candidates should refer to their data in detail when instructed to do so.

General comments

This paper was finished by nearly all candidates who were able to gain marks in both questions.

Comments on specific questions

Question 1

In parts **(a)(i)**, **(ii)** and **(iii)** most candidates obtained the relative temperature rises of the three reactions in the correct order. Fewer were able to describe the differences in what they observed. Many were content to write 'bubbles' or 'fizzing' for each of the three reactions, without attempting to distinguish between the rates at which the bubbling occurred. In part **(a)(iv)** most candidates correctly deduced that the gas given off was hydrogen and gave a correct observation. The temperature change was almost always calculated correctly.

The order of reactivity was usually deduced correctly from the candidates' observations in part **(b)(i)**, although the explanations were often not complete. Candidates were able to state the observations used to produce their order of reactivity but often were unable to give an adequate explanation. In part **(b)(ii)** the most common correct answer was the same mass or amount of metal. Candidates who stated that equal volumes of metal should be used did not appreciate that the densities of the metals were different. A common incorrect answer was to state that the same volume of acid should be used. References to surface area were rarely seen.

In part **(c)** most candidates suggested adding sodium hydroxide solution to test for the identity of metal **M** and correctly identified metal **M** as iron, as well as giving the correct observation. Occasionally, metal **M** was identified as being copper.

Question 2

For part **(a)** the column headings were usually written correctly.

The completion of the table was done well with candidates producing a full set of temperatures decreasing with time. Most candidates correctly recorded a smaller temperature drop for **Q**.

The majority of candidates understood why there should be a delay before recording the initial temperature of the water.

In part **(e)** candidates scored the first of the two available marks without much problem, but the second mark was often not gained. The instruction that candidates should make reference to their results was often ignored. Only the more able candidates compared the temperature drops of the beakers over the same time to justify their statements.

In part **(f)** the use of a lid to reduce the effect of evaporation from the surface of the beakers was almost universally known. Despite the instruction in the stem of the question that the experiment was repeated with the same apparatus, it was common to see suggested changes to the apparatus. Most candidates were able to state one variable that should be kept constant. It was rarer to see two correct variables.

PHYSICAL SCIENCE

Paper 0652/52
Practical Test

Key messages

When justifying a statement, candidates should refer to their data in detail when instructed to do so.

General comments

This paper was finished by nearly all candidates who were able to gain marks in both questions.

Comments on specific questions

Question 1

In parts **(a)(i)**, **(ii)** and **(iii)** most candidates obtained the relative temperature rises of the three reactions in the correct order. Fewer were able to describe the differences in what they observed. Many were content to write 'bubbles' or 'fizzing' for each of the three reactions, without attempting to distinguish between the rates at which the bubbling occurred. In part **(a)(iv)** most candidates correctly deduced that the gas given off was hydrogen and gave a correct observation. The temperature change was almost always calculated correctly.

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In part **(f)** the use of a lid to reduce the effect of evaporation from the surface of the beakers was almost universally known. Despite the instruction in the stem of the question that the experiment was repeated with the same apparatus, it was common to see suggested changes to the apparatus. Most candidates were able to state one variable that should be kept constant. It was rarer to see two correct variables.

PHYSICAL SCIENCE

Paper 0652/61
Alternative to Practical

Key messages

Candidates need to address the instruction contained in the question.

When entering values into tables, candidates need to look carefully at the degree of approximation already present and ensure that their entered values are consistent with the already-present values.

General comments

Radioactivity was poorly answered.

Comments on specific questions

Question 1

(a) Many candidates rounded up to 24°C, while others did not answer to the nearest 0.5°C.

(b)(i) The majority ordered the metals in descending reactivity order correctly, but only a few explained this ordering by addressing both temperature change and bubbling.

(b)(ii) 'Temperature' or 'volume of acid' were often referred to instead the form of the metals or the acid concentration.

(c) Some candidates suggested the use of a glowing splint to test for hydrogen.

(d)(i) The separation technique was well known

(d)(ii) Sodium hydroxide was given by about half of the candidates.

(d)(iii) Many candidates suggested that the metal was iron(II); other suggestions included copper, chromium and lithium.

Question 2

(a) Several candidates correctly identified sulphuric acid but then failed to interpret the occurrence of bubbles.

(b) There were frequent mentions of the correct answers but attached to the wrong letters.

(c) Some suggested barium chloride but justified it as the only solution not identified thus far; only a few linked the white precipitate to the sulphate ion in sulphuric acid.

(d) Only a handful of candidates correctly stated a copper salt; a few suggested the use of Universal Indicator but did not give the necessary colour changes. A small minority mentioned the pungent smell of ammonia.

(e) Quite a few candidates identified barium chloride but some then stated that the precipitate was cream or yellow.

Question 3

(a)(i) Several candidates did not recognise the unit symbol of time as s.

(b) **N**early all gave the correct temperatures.

(c) A small number of candidates realised that the thermometer would take time to indicate the actual temperature. Most referring to the water settling or cooling.

(e) A few thought that added insulation would increase the rate of cooling. Some of those who correctly identified a decrease or no significant effect on the rate of cooling simply quoted values from the table with no added explanation, thereby failing to justify their answer.

(f)(i) Most candidates suggested the addition of a lid. Few suggested a second improvement.

(g) Several candidates scored a mark for constant volume of water. Many of the answers made vague references to time and temperature – 'room temperature' or 'time intervals of readings' were expected.

Question 4

(a)(i) The majority of candidates did not heed the instruction 'to 1dp'.

(a)(ii) Some candidates restated their answer to **(a)(i)** without using the scaling factor.

(a)(iii) A minority of candidates inverted the triangle to find the image.

(b)(i) This was done well.

(b)(ii) The few who gained this mark usually suggested avoiding parallax error by reading the scale from directly above or from eye level.

(c)(i) There were several very good graph plots and curves. The vertical scale was wrongly interpreted sometimes, leading to mis-plotting.

(c)(ii) The minimum value of 60 was quoted by many candidates, but 30 was also quite popular.

(d) Nearly all candidates successfully performed the division by 4 and gave their focal length to an appropriate number of significant figures.

Question 5

(a)(i) Many candidates correctly identified a measuring cylinder as a piece of apparatus that both measured volume and was stable on a weighing machine.

(a)(ii) Most candidates suggested a beaker, with some mentioning a conical flask.

(b)(i) This was well answered.

(b)(ii) 77.20 was expected, to match the degree of accuracy of other entries in the table

(b)(iii) This was well answered.

(b)(iv) Candidates extended the curve carefully to reach their value.

(c)(i) Both variables needed to be linked in the answer, and in

(c)(ii) The reason for measuring the temperature was not realised by most candidates, who thought it was to find the rise in temperature, or to discover if the reaction was exothermic or endothermic. A few candidates stated that temperature affects rate.

(d)(i) Very few candidates suggested the measurement of gas volume as an alternative method of following rate of reaction.

(d)(ii) This was frequently blank or a diagram of a clock or thermometer.

Question 6

(a) Many gave the answer 4.0. Others did not read the instruction ‘to the nearest whole number’.

(b) Few candidates realised the function of the aluminium sheet.

(c) This was well answered

(d) There were some very good scales, plots and curves. Some candidates misinterpreted the vertical scale, leading to the wrong plotting of points. A few non-linear scales were seen, precluding the awarding of all marks except that for the drawing of the curve.

(e) Very few candidates answered with reference to their graph, combining safety with distance.

(e)(ii) Several correctly referred to the wearing of protective clothing.

PHYSICAL SCIENCE

Paper 0652/62
Alternative to Practical

Key messages

Candidates need to address the instruction contained in the question.

When entering values into tables, candidates need to look carefully at the degree of approximation already present and ensure that their entered values are consistent with the already-present values.

General comments

Radioactivity was poorly answered.

Comments on specific questions

Question 1

(a) Many candidates rounded up to 24°C, while others did not answer to the nearest 0.5°C.

(b)(i) The majority ordered the metals in descending reactivity order correctly, but only a few explained this ordering by addressing both temperature change and bubbling.

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(a) Several candidates correctly identified sulphuric acid but then failed to interpret the occurrence of bubbles.

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(c) Some suggested barium chloride but justified it as the only solution not identified thus far; only a few linked the white precipitate to the sulphate ion in sulphuric acid.

(d) Only a handful of candidates correctly stated a copper salt; a few suggested the use of Universal Indicator but did not give the necessary colour changes. A small minority mentioned the pungent smell of ammonia.

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