PHYSICS

Paper 0625/11
Multiple Choice (Core)

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

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Key messages

Candidates should be reminded to pay close attention to the units given in questions.

General comments

Many candidates found this paper very challenging. Although **Questions 11**, **17** and **19** were answered well they found **Questions 5**, **15**, **16**, **23**, **25**, **26**, **29**, **34**, **35**, **38** and **40** more difficult. In several questions candidates appeared to be unsure of the subject material.

Comments on specific questions

Question 5

The most common answer given was option **A**, 0.044 kg, showing that the majority of candidates failed to recognise that the question asked for the weight of water, not the mass. This emphasised that careful reading of the question is required.

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Question 11

Candidates answered this question well and recognised which forms of fuel are renewable / non-renewable.

Question 15

Very few candidates were aware that evaporation causes cooling. There are some dramatic experiments which can be done which emphasise this, for example the freezing of water by the forced evaporation of ethanol.

Question 16

Nearly half of the candidates thought that reducing the volume of a gas, at constant temperature, caused the average speed of the molecules to increase. Stronger candidates understood that a change in average speed of the molecules of the gas causes its temperature is to change.

Question 17

Candidates showed an understanding of the idea that as the temperature of the ring increases the diameter of the iron ring increases, as does the diameter of the hole.

Question 19

Although there was a lot of information for this question, most candidates answered correctly.

Question 23

Stronger candidates understood that refraction, which is caused by the change of speed of radiation as it moves from one medium to another, leads to a change in wavelength of the radiation.

Question 25

Only the strongest candidates answered this question correctly. There was some evidence of guessing, with each response being chosen in almost equal numbers. For some candidates it is possible that the layout of the spectrum caused some difficulty.

Question 26

Candidates were expected to know that the range of audible frequencies for humans is 20 Hz to 20 kHz. It seemed that difficulties arose in this question in combining this knowledge with the information given regarding the audible frequencies of dolphins.

Question 29

Most candidates thought that the ammeter read the current in the resistor R_1 when it was connected at points 1 and 2 only (option **B**) failing to understand that it also gives it at point 4, where the current has recombined after passing through the two arms of the parallel circuit.

Question 34

Stronger candidates understood the basic working of a potential divider and recognised that as the resistance across a voltmeter decreases so the reading on the voltmeter also decreases.

Question 35

The strongest candidates understood that it is the relative movement between a magnet and a conductor which leads to an e.m.f. being induced. Thus no relative movement, whether it be a strong or weak magnet means that there is no induced e.m.f. and, also that an e.m.f. will be induced if the relative movement is either away or towards each other.

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Question 38

This question was problematic for many candidates as many did not read the question carefully enough. These candidates did not recognise that the question asked for a comparison of the numbers of protons and electrons.

Question 40

Only the strongest candidates showed an understanding of half-life. There was some evidence of guessing, with all four options chosen in fairly equal numbers.

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PHYSICS

Paper 0625/12
Multiple Choice (Core)

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

Key messages

Candidates should be reminded to pay close attention to the units given in questions.

General comments

Candidates answered **Questions 6**, **10**, **27**, **31** and **34** well. However, they found **Questions 2**, **14**, **15**, **20**, **21**, **22**, **23**, **30**, **33** and **39** more challenging.

Comments on specific questions

Question 2

Only the strongest candidates answered this question correctly. Most candidates recognised the general pattern formed by the falling object, but the majority did not understand that (when air resistance is negligible), all objects fall with the same acceleration regardless of their mass.

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Question 6

Candidates showed a good understanding of the meaning and the calculation of density in this question.

Question 10

Candidates answered this question well and recognised which forms of fuel are renewable / non-renewable.

Question 14

Many candidates had difficulty interpreting the graph. It did not appear that they struggled with the concept that the particles with most kinetic energy are the most likely to escape in evaporation. The issue was to assume the peak of the graph coincided with the maximum kinetic energy of the particles.

Question 15

Many candidates equated a lower boiling point with a more rapid rise in temperature showing a lack of understanding of the concept of the thermal capacity.

Question 20

Candidates appeared to make two errors. The first was that they failed to spot that the second diagram showed that two more waves had been produced in one second. The second error was to apply the formula for wave speed, incorrectly.

Question 21

Few candidates showed a knowledge of critical angle and when it occurs. This is essential physics if an understanding of the action of such apparatus as optical fibres is to be understood.

Question 22

Only the strongest candidates answered this question correctly. The question really needed to be tackled by using a protractor to measure the angles, rather than trying to judge by eye.

Question 23

The question tested candidates' knowledge of the white light spectrum. Only stronger candidates recognised that violet light is refracted more than other colours.

Question 30

Obtaining information from graphs is an important skill which some candidates found challenging. In this case, many candidates did not recognise that the graph showed the total energy transferred by the heater, not the energy transferred per unit time. Care needed be taken in establishing what the variables were.

Question 33

Stronger candidates understood the basic working of a potential divider and recognised that as the resistance across a voltmeter decreases so the reading on the voltmeter also decreases.

Question 39

In order to answer this question successfully candidates needed to recognise that α-particles are not very penetrating and to understand the reason for this. As α-particles travel through a medium they cause a lot of ionisation. Each time they ionise an atom they lose energy and hence rapidly lose all their energy.

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PHYSICS

Paper 0625/13
Multiple Choice (Core)

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

Key messages

Candidates should be reminded to pay close attention to the units given in questions.

General comments

Candidates answered **Questions 8**, **14**, **17**, **23**, **26**, **29** and **36** well. However they found **Questions 20**, **22**, **30**, **31**, **32**, and **33** more challenging.

Comments on specific questions

Question 5

The common error in this question was to fail to recognise that the shape of an object can be changed by a force (as well as the motion and its speed).

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Question 8

Most candidates answered this question correctly and showed a clear understanding of the idea of the effects on the environment of using powered dryers.

Question 14

Candidates showed an understanding of the idea that as the temperature of the ring increases the diameter of the iron ring increases, as does the diameter of the hole.

Question 17

The question was answered very well. Candidates understood the practical nature of the question and were able to understand when a good conductor and a poor conductor were required.

Question 20

Only the strongest candidates answered this question correctly. Most candidates were not confident identifying angles of incidence. There was evidence of guessing and the most popular choice was option **C** (angles X and Y) rather than the key, **D** (angles X and Z).

Question 21

Only the strongest candidates answered this question correctly. The question really needed to be tackled by measuring the angles using a protractor to measure angles, rather than trying to judge by eye.

Question 22

This question proved challenging for many candidates. Even where candidates were aware of the physics of the situation there were two issues which candidates needed to recognise: the signal travels to the satellite and back, and the answers were given in kilometres rather than metres.

Question 23

This was a challenging question but was answered well by most candidates who showed a knowledge of the approximate wavelength of audible sound waves and then applied that in interpreting the diagram.

Question 30

This question was generally not answered well with the vast majority of candidates seemingly unfamiliar with the circuit symbol for a fuse.

Question 31

Only the strongest candidates answered this question correctly with the majority of candidates unaware that adding resistors in parallel reduces the circuit resistance and hence increases the overall current.

Question 32

The key to answering this question was to be familiar with circuit diagram symbols and to have a knowledge of their action. Recognising the symbol for either a bell or a thermistor directed candidates to the correct answer.

Question 33

Stronger candidates understood the basic working of a potential divider and recognised that as the resistance across a voltmeter decreases so the reading on the voltmeter also decreases.

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PHYSICS

Paper 0625/21
Multiple Choice (Extended)

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

Key messages

Candidates should be reminded to pay close attention to the units given in questions.

General Comments

There were some very strong performances and generally the standard was high. Candidates answered **Questions 1**, **3**, **5**, **9**, **17**, **20**, **25**, **30**, **25**, **31** and **37** really well. They found **Questions 22**, **23**, **27**, **32**, **34** and **40** more challenging.

Comments on specific questions

Question 1

Almost all candidates answered this question correctly.

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Question 3

Candidates were able to spot the units on the graph axes and relate the diagonal straight line to the nature of the motion.

Question 5

Candidates showed a full understanding of the relationship between mass and weight, with virtually all candidates answering correctly.

Question 9

Candidates were familiar with the equation defining momentum.

Question 17

Candidates had a clear understanding of the differences between boiling and evaporation.

Question 20

A large majority of candidates were able to identify the amplitude of the wave. However, a small but significant number gave the double amplitude.

Question 22

This question was challenging for many candidates. There was some evidence of guessing. Candidates needed to be aware that the diagram showed light incident on the glass-air boundary at the critical angle and then had to use the formula $n = 1 / \sin c$.

Question 23

Whilst a large majority of candidates were aware that infrared radiation has a longer wavelength than visible light, there was a significant minority who failed to recognise that all forms of electromagnetic radiation travel at the same speed through a vacuum.

Question 25

The vast majority of candidates showed they understood the principles of magnetic induction.

Question 27

Although nearly half the candidates were able to identify the correct response, there were many who showed little understanding of the electromotive force of a rechargeable battery and were under the impression that it referred directly to the energy stored in the battery.

Question 30

Almost all candidates answered this question correctly.

Question 31

Most candidates were able to answer this question correctly.

Question 32

Although this was a challenging question, almost half of the candidates were able to work through the physics and identified the correct response.

Question 34

This question was challenging for many candidates. However, stronger candidates understood that it is the relative movement between a magnet and a conductor which leads to an e.m.f. being induced. Thus no relative movement, whether it be a strong or weak magnet means that there is no induced e.m.f. A common

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error was to think that an e.m.f. will only be induced if the relative movement is towards each other and no e.m.f. is induced if the movement is away from each other.

Question 40

Only the strongest candidates answered this question correctly. A significant minority of candidates showed a lack of understanding of half-life. Amongst those who did show an understanding, over half failed to reduce the raw count (shown on the graph) to take account of background radiation.

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PHYSICS

Paper 0625/22
Multiple Choice (Extended)

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

Key messages

Candidates should be reminded to pay close attention to the units given in questions.

General comments

There were some very strong performances and generally the standard was high. Candidates answered **Questions 1**, **4**, **6**, **8**, **11**, **12**, **18**, **20**, **24**, **25**, **26**, **28**, **31** and **37** really well. They found **Questions 3**, **23**, **27**, **29**, **35** and **40** more challenging.

Comments on specific questions

Question 1

Almost all candidates answered this question correctly.

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Question 3

Although nearly half of the candidates answered this question correctly, nearly as many opted for option **C** which showed that candidates did not understand that (when air resistance is negligible), all objects fall with the same acceleration regardless of their mass.

Question 6

This question was answered extremely well and the vast majority of candidates were able to cope with a two-stage calculation, i.e. Stage 1: calculation of the acceleration of the object. Stage 2: use of the formula for force, mass and acceleration.

Question 8

Candidates were familiar with the concept that if there is no resultant force on an object and no resultant couple then the object is in equilibrium.

Question 12

Candidates showed a good understanding of the meaning of power.

Question 24

Candidates were able to apply the formula for wave speed and, generally, managed the use of powers of ten.

Question 23

This question was challenging for many candidates. Some candidates did not appear to recognise that all electromagnetic radiation travels at the same speed in a vacuum.

Question 24

The vast majority of candidates were able to link the loudness and pitch of sound to amplitude and frequency respectively.

Question 25

The vast majority of candidates showed they understood the principles of magnetic induction.

Question 27

This question was challenging for many candidates. However, stronger candidates were able to identify the correct response, but many other candidates showed little understanding and were under the impression that it referred directly to the energy stored in the battery.

Question 29

Only the strongest candidates answered this question correctly. Candidates needed to recognise that when the diameter is decreased by a factor of 2 the cross sectional area is decreased by a factor of 4 and the resistance is increased by a factor of 4.

Question 35

Although a small majority recognised the direction of the field due to the current carrying conductor was in the vertical direction, less than half of those gave the correct answer.

Question 40

This question proved challenging and although most candidates showed an understanding of half-life, the majority failed to reduce the raw count (shown on the graph) to take account of background radiation.

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Paper 0625/23
Multiple Choice (Extended)

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

Key Messages

Candidates should be reminded to pay close attention to the units given in questions.

General Comments

There were some very strong performances and generally the standard was high. Candidates answered questions **1**, **3**, **4**, **5**, **11**, **18**, **24**, **35** and **37** really well. They found questions **7**, **12**, **14**, **27**, **29**, **34**, **39** and **40** more challenging.

Comments on specific questions

Question 1

Almost all candidates answered this question correctly.

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Question 3

The question was answered well with a large majority of candidates showing they understood how to calculate acceleration.

Question 4

Most candidates showing an understanding of the difference between mass and weight and answered this question correctly.

Question 7

Only the strongest candidates answered this question correctly. Many candidates did not realise that the centre of mass of a uniform beam is at its centre and that the weight may be considered to act at this point.

Question 12

The question was challenging for many candidates as it had stages. Stage 1 was to accurately calculate the gradient of a relevant section of the graph. Stage 2 was to convert the units of this to m / s. Stage 3 was to insert this into the potential energy formula. Stronger candidates were able to work their way through the problem to gain the correct answer.

Question 14

In answering this question many candidates found the volume of the tank and so the total mass of oil in the tank, with some going on to find the weight of oil but then incorrectly assuming this was the pressure on the base.

Question 27

Stronger candidates understood that e.m.f. is the energy given to each unit of charge as it passes through a power supply and were able to identify **2** as a correct statement. They then recognised that if the current is the same in the two circuits, the supply with twice the e.m.f. will supply twice the energy per unit time.

Question 29

This question proved challenging for many candidates as it was a three stage calculation. Stage 1 was to calculate the charge passing through the circuit in 1.0 hour; stage 2 was to use the formula for energy, potential difference and charge; stage 3 was to convert the answer to kilocoulombs. Most candidates missed out step 1.

Question 34

The vast majority of candidates recognised that the movement of the conductor was in a vertical direction. Unfortunately, the majority of these were unable to apply Fleming's right-hand rule and chose the wrong vertical direction.

Question 39

This question caused problems for many candidates. The most common incorrect option chosen was **B**, the electron. This was probably because candidates saw that the layout of the equation (ignoring the incoming neutron) looked fairly similar to that of β-decay. Stronger candidates worked through the equation logically looking at proton numbers and then the nucleon numbers and concluded that the emitted particle had the proton number 1 and the nucleon number 1.

Question 40

This question proved challenging and although most candidates showed an understanding of half-life, the majority failed to reduce the raw count (shown on the graph) to take account of background radiation.

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PHYSICS

Paper 0625/31
Core Theory

Key messages

- It is important that candidates read the questions carefully in order to understand exactly what is being asked.
- In calculations, candidates must set out and explain their working correctly. If poor or no working is shown, when an incorrect final answer is given, it is often impossible for credit to be given for those parts that are correct.
- Greater clarity and precision was needed when answering questions requiring a description or explanation.
- In order to improve their performance candidates should practise applying their knowledge to new situations by attempting questions in support materials or exam papers from previous sessions.

General comments

A high proportion of candidates were well prepared for this paper. Equations were generally well known by many candidates, but a significant number struggled to even recall the equations.

Often candidates were able to apply their knowledge and understanding to fairly standard situations. On occasions, when asked to apply their knowledge to a new situation, they became confused and displayed a lack of breadth of understanding. More successful candidates were able to think through the possibilities and apply their knowledge when the question asked for suggestions to explain new situations. Less successful candidates found difficulty in applying their knowledge to new situations, did not show the stages in their working and did not think through their answers before writing.

The questions on electrical quantities, force on a current-carrying conductor in a magnetic field and radioactivity were generally not well answered by candidates. There were a significant number of candidates who either did not read the questions carefully enough, or gave answers that were related to the topic being tested, but did not answer the question as it had been set.

The English language ability of the majority of the candidates was adequate for the demands of this paper. There were a very small number of candidates, who struggled to express themselves adequately.

Comments on specific questions

Question 1

(a) The vast majority of candidates answered this question correctly. Weaker candidates gave responses such as 1.12. A few simply gave the reading as it appeared on the stopwatch.

(b) This was answered well with most candidates gaining full credit. Those who did not, usually gained partial credit for working. A small number of weaker candidates divided 54 by 120.

(c) Many candidates gained full credit for calculating the distance as 35 (m). A much smaller number gave the distance as 28 m and more gave answers of 49, 7 or 21 to gain partial credit. Most of the others knew that distance travelled = average speed × time or that distance is the area under the graph. Not all, however, knew how to work out the area under this line.

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Question 2

(a) (i) This item was answered well by the majority of candidates. The experiment is clearly one that is familiar to many candidates. Almost all gained credit for measuring the mass and the volume and stating how these are used to calculate the density. The majority also gave details of how to measure the mass of the liquid.

Weaker candidates struggled with the science. Common errors were using the measuring cylinder to measure mass, not measuring the volume, not making it clear that it was the mass of the liquid that was required and confusing mass, volume and density. Some candidates thought the balance measured density directly. Many used the terms "measure" and "calculate" as if they had the same meaning.

(ii) The majority of candidates knew an acceptable unit of density, with most giving g/cm^3 as their answer. A small minority gave the unit as cm^3 or cm^3/g.

(b) (i) The majority of candidates gave sensible answers relating to the density of the polythene block and the water. Weaker candidates suggested that polythene was lighter than the water. It was very rare to see considerations of upthrust being equal to weight.

(ii) This item was challenging for many candidates with almost as many candidates multiplying the mass by 10 as dividing it by 10. Candidates knew that g had to be in answers somewhere but mass = weight × g was seen almost as often as weight = mass × g. A number of candidates also divided g by the mass.

Question 3

(a) The majority of candidates calculated the correct answer of 28.8 N and almost always stated that the force was upward. However, many were unsure of how to calculate the resultant of three co-axial forces. Candidates performed various arithmetical functions on a selection of the numbers on the diagram and seemed to be quite random in their choice of direction. Relatively few clearly stated 45.4 as part of their working and many showed little or no working.

(b) The concept tested in this item was not well understood by the vast majority of candidates with very few answering correctly.

Question 4

(a) This was very well answered by almost all candidates. The experiment was well known and most candidates knew all the salient details and scored full credit. Generally candidates answered in concise language – a clear sign that they were well prepared for this topic.

(b) This question was answered well. Almost all candidates knew that the process was evaporation and most candidates went on to give a convincing explanation.

Question 5

(a) The vast majority of candidates were able to correctly complete the flow diagram for the geothermal power station.

(b) Many candidates gained partial credit, but many did not seem to be familiar with a geothermal power station and gave vague references to ideas in their answers such as: clean, expensive, cheap, easy to build, eco-friendly (or not).

Question 6

(a) Almost all candidates gave the correct answer. Responses from weaker candidates were usually 0.3 or 26, but these were given by very few candidates.

(b) The majority of candidates gained at least partial credit. Weaker candidates gave responses such as "insulating the tanks" or "use warm water" and some that lacked practicality e.g. "move it closer

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to the sun" or "cover the pipe with an insulator".

(c) Many candidates gained partial credit but only the most able scored full credit. The most common response was radiation and some referred to infra-red radiation. Conduction was commonly seen but few specified that it referred to transfer through the pipe. Centres should remind candidates that when talking about transfer of thermal energy, it is a good idea to state where the transfer is occurring.

Question 7

(a) (i) This was well answered by the majority of candidates. A few candidates gave the correct colours but in the wrong order and a small minority mentioned purple or brown.

(ii) This question proved challenging for many candidates, with almost as many arrows pointed to the left as pointed to the right.

(b) (i) Most candidates drew a ray that was correctly refracted at the first face. A small minority showed the ray passing into the prism undeviated or showed refraction beyond the normal.

The refraction at the second face proved to be much more challenging with a majority showing refraction in the wrong direction.

A number of candidates drew rays being dispersed – sometimes with little regard to the appropriate refraction.

(ii) The vast majority of candidates gained credit here but weaker candidates gave answers such as reflection, dispersion or diffraction.

Question 8

(a)(i) Most candidates gave a sensible measuring instrument with "metre rule" the most common. Weaker candidates gave answers such as "meter" or "meter tape". Trundle wheels were rarely mentioned and were more often described than named.

(ii) Most candidates had the idea of echoes formed by reflection of sound but often expressed this in very vague terms such as "hits the wall and comes back". A small number of weaker candidates thought that echoes occur in large open spaces.

(b) The majority of candidates scored full credit with answers of 340 m / s. However many others gave answers of 170 m / s and 85 m / s often without any working shown.

Question 9

(a) (i) The majority of candidates gained full credit but common mistakes were to write "alpha" and "beta" or to shorten microwaves to "micro" which was insufficient for credit. It is important that candidates do not use abbreviations when adding labels.

(ii) Only the strongest candidates answered this correctly with almost as many candidates circling "gamma ray" as those circling "radio".

(b) Many candidates gave reasonable precautions. However a large number indicted that goggles, gloves and a lab coat were all the protection needed.

Question 10

(a) Most candidates answered correctly. A common error was to label the variable resistor.

(b) A number of candidates found this question challenging, with almost as many candidates giving A as the unit for electrical current as those who gave I and Ω. Similar mistakes were made for V and the electrical quantities, with "ammeter" and "voltmeter" amongst the most common errors.

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(c) The dependence of resistance on length was well known, although “shorter wires have bigger resistance” was a common incorrect response.

The dependence of resistance on cross-sectional area was less well known. A large number of candidates thought that thicker wires have greater resistance.

Question 11

(a) (i) Many candidates produced a well-drawn series circuit containing a recognisable cell and switch. Often, the cell had a line through the centre. The most common mistake was to try to incorporate the edges of the paper into a circuit that had no connection with the wire, or a cell symbol and switch drawn on to the line representing the wire without any attempt at a circuit.

(ii) and (iii) Only stronger candidates gained full credit for this question. The shape of the magnetic field was not well known. “From north to south” was a very common response but most efforts involved an attempt to describe the field around a bar magnet. Many candidates recognised that reversing the current would have no effect on the shape of the magnetic field.

(b) The majority of candidates found this item challenging. Only a small minority showed a wire between the poles of a magnet. These generally went on to answer the rest of the question well, but some confused the force on the conductor with electromagnetic induction. The majority gave a variety of circuits (most often the diagram given in the question).

Question 12

(a) (i) and (ii) The majority of candidates wrote “alpha” as one of their answers but rarely gave it for both.

(b) (i) Many candidates found this item challenging with “alpha”, “beta” and “gamma” suggested in roughly equal numbers, but “heat” and “infrared” were also given by weaker candidates. Many who gave beta then found it difficult to explain that the reading would change depending on the thickness of the foil.

(ii) Many candidates failed to read the question carefully enough and gave responses about the thickness of the aluminium rather than the reading on the meter.

(iii) Candidates who considered what happens to the rollers answered well and gave creditworthy responses. Many gave answers such as “the foil needs to be thicker” without considering how this may come about.

(iv) The vast majority of candidates answered correctly by giving 38 as the number of protons. Weaker candidates thought that the answer was 52.

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Paper 0625/32
Core Theory

Key messages

- In calculations, candidates must set out and explain their working clearly. If poor, or no working is shown when an incorrect final answer is given, it is often impossible for credit to be given for those parts that are correct.
- Greater clarity and precision was needed when answering questions requiring a description or explanation.
- In order to improve their performance candidates should practise applying their knowledge to new situations by attempting questions in support materials or exam papers from previous sessions.
- Candidates should use the marks at the end of a question as a guide to the form and content of their answer.

General comments

A high proportion of candidates were well prepared for this paper. Equations were generally well known by the vast majority of candidates.

The questions on transfer of thermal energy, use of thermal energy in nuclear power stations to generate electricity, transformers and radioactivity topics were generally not well answered by candidates. There were a significant number of candidates who either did not read the questions carefully, or gave answers that were related to the topic being tested, but did not answer the question.

Often candidates were able to apply their knowledge and understanding to fairly standard situations. On occasions, when asked to apply their knowledge to a new situation, they became confused and displayed a lack of breadth of understanding. More successful candidates were able to think through the possibilities and apply their knowledge when the question asked for suggestions to explain new situations.

The English language ability of the vast majority of the candidates was adequate for the demands of this paper. However, there was a small minority who struggled to express themselves adequately.

Comments on specific questions

Question 1

(a) The majority of candidates correctly identified the accelerating and decelerating sections of the speed time graph. A few candidates identified the horizontal section as representing stationary instead of constant speed.

(b) Many candidates correctly used the area under the graph or average speed × time to calculate distance. Weaker candidates attempted to use the speed formula but did not use average speed.

(c) The strongest candidates gave the steeper gradient as their answer. Weaker candidates stated that less time was spent accelerating than decelerating, which was insufficient.

Question 2

(a) Most candidates correctly calculated the total weight. Weaker candidates neglected to convert mass to weight or overlooked the fact that there were 8 logs.

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(b) (i) The majority of candidates correctly used length × area to calculate volume. Weaker candidates used length or area for volume. Stronger candidates then went on to calculate the correct value for density of 550 (kg / m^3)

(ii) Most candidates correctly identified the log as having lower density than water, but many stated it had a higher density or commented on surface area.

Question 3

(a) (i) Most candidates used the correct formula and went on to calculate the correct answer. Some candidates wrote the correct formula but then got confused and divided by 0.5. Weaker candidates could not recall the correct formula. Several candidates gave the unit as N / m.

(ii) Many good examples were given. However, some answers were too brief. Candidates should remember that a question starting with "describe" requires more than a one word answer.

(b) This question part was answered well by those who understood the formula for moments. Most correct answers indicated the use of a longer bar.

Question 4

(a) (i) Almost all candidates demonstrated that they could read the thermometer correctly at 38(°C).

(ii) Most candidates identified expansion of liquid as the correct response.

(b) Many candidates did not read the question carefully enough and gave convection as the answer. The question was asking about heat transfer through the beaker to the water not through the water.

(c) A few candidates gave very clear step by step accounts of how convection takes place. However, many candidates gave very vague responses and some described conduction.

Question 5

(a) A minority of candidates gave the correct answer. Many measured it with a ruler instead of using the scale stated.

(b) (i) Most candidates used a ruler to draw a ray parallel to the principal axis to the lens which then passed through the principal focus to the right of the lens.

(ii) Most candidates correctly drew the ray straight through the centre of the lens with a ruler.

(iii) The position of the image was usually identified correctly. The fact that the image was inverted was sometimes overlooked.

Question 6

(a) A few candidates gave good descriptions about how thermal energy is used to generate electricity. Many wrote about other types of power station such as geothermal or fuel burning and described how the thermal energy was produced. Some described solar energy or fusion. A common misconception was that the turbine produced electricity directly, rather than by a generator which was turned by the turbine.

(b) A few candidates gave good answers about nuclear waste and storage. Many described issues to do with fuel burning power stations. Some thought that living things near a nuclear power station would be seriously affected by normal day-to-day operation.

Question 7

(a) (i) Most candidates correctly identified microwaves.

(ii) A minority of candidates recognised that the speed of all electromagnetic waves is the same. Many thought it would be some lower value.

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(iii) Only the strongest candidates were able to correctly link the parts of the electromagnetic spectrum to wavelength, giving the correct answer of ultraviolet, x-ray or gamma ray.

(b) (i) Most candidates gave a good answer for use of x-rays, usually related to scanning broken bones. Candidates were less confident about use of gamma rays. Most correct answers were about their use for treating cancer.

(ii) Most candidates correctly identified cell or DNA damage. Many did not go on to explain about ionising / high frequency / high energy radiation.

Question 8

(a) (i) Most candidates demonstrated good knowledge of the production and propagation of sound waves.

(ii) This was answered well by most candidates.

(iii) Most candidates answered this question correctly.

(b) (i) Most candidates were able to interpret the scale and answered well giving 1000 (Hz).

(ii) Most candidates answered correctly with answers in the range 10 001 to 30 000 (Hz).

(iii) Most candidates gave good responses indicating that elephants can hear below 20 Hz but humans cannot.

(iv) A few candidates correctly identified the term as ultrasound. Most did not seem familiar with the term.

Question 9

(a) (i) Almost all candidates correctly identified electrons as the particles flowing through wires.

(ii) Almost all candidates were able to correctly calculate the value for resistors in series as 18 (Ω).

(iii) The strongest candidates were able to calculate the potential difference correctly. However, some wrote the correct formula but then divided by 0.5.

(b) Many candidates correctly indicated that the current would increase. Some only stated that it would change. Few went on to explain that this was because the total resistance would decrease.

Question 10

(a) (i) The stronger candidates identified that the balloon loses electrons.

(ii) Most candidates identified the charge on the rod as positive. Fewer explained that like charges repel.

(b) A few candidates identified both copper and silver as materials which allow charges to move easily.

Question 11

(a) (i) Most candidates correctly identified Q as the secondary or output coil.

(ii) The stronger candidates stated that P was made of iron and was known as the core.

(iii) A few candidates correctly stated that an alternating or changing magnetic field is produced in in part P.

(iv) The strongest candidates correctly stated the relationship between the number of turns on the primary coil and whether the transformer is a step-up or step-down transformer.

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(b) Stronger candidates correctly stated that transmission at high voltages was more efficient and related this to smaller current in the wires. However, many candidates thought that high voltage would transmit electricity faster.

Question 12

(a) Most candidates correctly identified X as the element symbol. Fewer went on to identify the proton number and nucleon number.

(b) (i) The stronger candidates were able to correctly calculate the mass remaining as 3 (mg).

(ii) Many candidates correctly identified the beta particle as a negatively charged electron but few went on to describe its speed/energy or mass.

(iii) Very few candidates were able to describe that a neutron changes into a proton when a beta particle is emitted.

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Paper 0625/33
Core Theory

Key messages

- Candidates should note both the number of marks available and the space allocated for responses, as these factors provide a clear indication of the type of answer expected. For example, for a two-mark question, two distinct points should be given.
- In calculations, candidates should set out and explain their working clearly. Credit may be given for correct working even if the final answer is incorrect.
- Before starting their response, candidates are advised to read the question carefully, paying attention to the command words to ensure they focus their answers as required.

General comments

For many of the candidates, the non-numerical questions posed more of a challenge than numerical questions.

Some areas of the syllabus were better known than others. In particular, moments, thermal energy transfers, electric circuits and electromagnetism were not well understood.

Equations were generally well known by all but the weakest candidates. Many candidates understood how to apply equations to fairly standard situations well.

A noticeable number of candidates struggled to express themselves in English adequately.

Comments on specific questions

Question 1

(a) Many candidates correctly calculated the time in seconds. The most common errors were to either give the answer in minutes and seconds or to omit the hundredths of a second.

(b) A number of candidates answered this question well. Weaker candidates often used an incorrect equation, i.e. speed = distance × time or converted km to m incorrectly.

(c) (i) This was answered correctly by almost all candidates.

(ii) Many candidates recognised that finding the area under the graph was equal to the distance travelled and usually gained full credit. A common error was to rearrange the average speed formula incorrectly.

Question 2

(a) A number of candidates answered this question well. Weaker candidates often converted kg to g incorrectly. Also, many candidates with an incorrect answer did not write down the intermediate stages of their calculation and so could gain no credit for any correct workings. Candidates should be encouraged to show their working for all stages of a calculation.

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(b) A number of candidates gained partial credit for this question. Only the strongest candidates gave ways to ensure the readings were accurate. Candidates should be reminded to read the question carefully to ensure they focus their answers on what the question requires.

Question 3

(a) (i) Most candidates were successful, often writing the correct answer without any working.

(ii) Many candidates knew that the acceleration due to gravity was a constant. However, a number thought it varied with time.

(b) (i) This part was answered well by most candidates.

(ii) Many correct answers were seen here. A common error was resultant force = 1.5 N.

Question 4

This question proved challenging for almost all candidates. A large number thought that moment = force ÷ distance from pivot. There were a number of blank responses to this question.

Question 5

(a) A large number of candidates answered this question well. Weaker candidates often used an incorrect equation, i.e. force = pressure ÷ area or gave no response.

(b) The majority of candidates gained partial credit by recognising that the pressure would increase. Several also went on to attribute this to faster moving molecules and harder or more frequent collisions with the can walls.

Question 6

(a) Many correct answers were seen for both parts.

(b) Many answers were basically the question paraphrased or were based on evaporation. However, a few candidates recognised that the water was hotter at the beginning and therefore contained more energy.

(c) This was answered well by stronger candidates. Candidates needed to show an understanding that a dull black surface is a better radiator or emitter than a shiny white surface. Many based their answers incorrectly on absorption rather than emission of thermal energy.

Question 7

(a) (i) This part was answered well by most candidates. A common error for A was gamma-rays.

(ii) Most candidates correctly identified the type as X-rays.

(b) Many candidates gave the correct answer. There were also a large number of answers stating that electromagnetic waves can travel through a vacuum. This answer could not be credited because this information was given in the stem of the question.

(c) (i) This was well answered by the majority of candidates. A common error was radio waves.

(ii) Most candidates correctly answered this part.

Question 8

(a) Some confusion between the terms used in this question was apparent. However many correct answers were seen to all three parts.

(b) Most candidates knew that frequency or pitch was part of the answer. Although many quantified the range of human hearing, they also needed to state that ultrasound was above this range.

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Question 9

(a) Most candidates had sufficient understanding of magnetism to know that the magnet needed to be stroked along the rod. This mark was often awarded on the diagram drawn by the candidate. A considerable number of candidates described and drew electromagnets which did not answer the question.

(b) Many candidates knew to place the rod near a known magnet to see if the rod attracted or repelled without explicitly stating that repulsion was required.

(c) Most candidates who gave an answer to this question were correct, but there were a significant number of candidates who did not give a response.

Question 10

(a) (i) Very few candidates knew this was a variable resistor. Many thought it was a thermistor and that the circuit was used for temperature control.

(ii) Answers seen to this question were often very brief and a number of candidates did not give an answer at all. Very few scored more than partial credit, usually for use of $V = IR$.

(b) (i) This part was answered well with most candidates scoring full credit.

(ii) A common error was rounding down the answer from **(i)**, giving 11 A for the value of fuse to be used.

Question 11

(a) Only the strongest candidates answered this question correctly. The vast majority merely drew arrows to show the current direction in the coils themselves.

(b) Solenoid was a common answer here. Electromagnet was seldom seen.

(c) A number of candidates did not answer this question. Of those who did, many thought that the current would flow through the core, armature and springy metal to the motor itself.

Question 12

(a) The majority of candidates answered correctly.

(b) Many correct answers were seen. However some candidates just copied the numbers from the table headings.

(c) (i) Many correct answers were seen. A common misconception was that alpha particles pass through paper rather than being stopped by it.

(ii) Most candidates gained some credit here, usually for the cancer risk. A considerable number of candidates were also aware of the damage to DNA and of the ionising property of alpha particles.

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Paper 0625/41
Extended Theory

Key messages

- In numerical work involving the use of a formula, candidates should write down the formula rather than beginning by writing down numbers. Credit can usually be awarded for the statement of a correct formula, but if any of the numbers that are written down are wrong, and with no formula, no credit is awarded.
- Candidates should note the command words used in the questions and should ensure they follow these instructions. For example in **Question 5(b)(iv)** candidates were asked to "state and explain". Many candidates, in answering this question, only made a statement and did not include an explanation.

General comments

The paper allowed candidates of all abilities to apply their knowledge and demonstrate their capabilities over questions of variable difficulty. There were few examples of wrong or missing units in numerical answers in this session.

Comments on specific questions

Question 1

(a) An application of the syllabus item 'Calculate acceleration from the gradient of a speed-time graph' was required. Very few candidates recognised that this involved drawing a tangent to the graph at time = 30 s and calculating its gradient. Most candidates merely divided the speed at 30 s by 30 and failed to gain any credit.

(b) Many candidates could not interpret the lower gradient of the graph at time 100 s as showing that the acceleration had become less than the acceleration at time 10 s. Suggestions that this was caused by less driving force or greater resistive force, and thus a lower resultant force, were often not clearly stated.

(c) A clear statement or implication that the area under a graph is distance travelled gained credit. Many candidates went on to correctly calculate the area of the trapezium or the sum of the areas of a rectangle and a triangle.

Question 2

(a) Rather than stating the correct energy form as "chemical", a number of answers quoted "electrical" or "kinetic".

(b) (i) Writing down "mgh" gained partial credit. Correct substitution and calculation with the correct unit for the energy meant full credit was frequently awarded. Some candidates failed to state the formula and of these a few substituted the time as one of the numbers.

(ii) Many candidates gained credit for writing down an acceptable version of the formula for efficiency and for calculating the output power. Few candidates also calculated the efficiency, often through confusing power and energy.

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(c) Some of the advantages and disadvantages quoted for an oil-fired power-station, those to do with cost and efficiency, were regarded as invalid due to their dependence on particular design features and the comparative ages of the two systems. Acceptable advantages of oil-fired systems usually referred to their non-dependence on weather conditions. Acceptable disadvantages included the pollution caused, the need for transportation of fuel or the fact that oil supplies will eventually run out.

Question 3

(a) (i) A number of candidates incorrectly calculated the numerical value of the weight, usually through the wrong use of g. Some candidates gave the incorrect unit.

(ii) Most candidates used pressure = force / area or weight / area and calculated the pressure correctly. Some candidates used mass instead of force or weight, not realising that the weight calculated in **(i)** was the force in **(ii)**.

(b) Only stronger candidates answered this question correctly. Common incorrect answers involved the weight of the container.

(c) Many candidates answered this question correctly and gained full credit.

Question 4

(a) (i) Most candidates answered this question correctly.

(ii) Most candidates gained at least partial credit for this question with many gaining full credit.

(b) Almost all candidates gained partial credit for stating that molecules collide with the walls of the box, but few candidates moved beyond this. However, some correctly added that these molecules changed their momentum in doing so. Incorrect ideas such as the suggestion that momentum is lost in the form of energy were seen. Very few candidates made the link between rate of change of momentum and force or stated that the pressure on the walls of the box is the force divided by the area of the walls.

Question 5

(a) (i) Confusion of the terms refraction and reflection led to some candidates quoting rarefaction, diffraction or total internal reflection.

(ii) If refraction had been the answer to **(i)**, the explanation needed to refer to change of speed, change of refractive index or change of optical density in passing from air to glass. Candidates often mentioned only change of medium or change of density however.

If reflection was given in **(i)**, a reference to the surface of the glass or the boundary was required.

(b) (i) A high number of wrong placements of one or both the principal foci were seen.

(ii) Many candidates drew a ray passing through the centre of the lens without deviation, and another that passed through one of the positions of F, including a wrongly placed one. For some of these candidates, it was sometimes not clearly shown that the image was inverted.

(iii) The height of the image was correctly stated by many candidates.

(iv) Many answers suggested the image was real, but failed to give an explanation.

Question 6

(a) (i) Most answers were drawn correctly. However, some candidates drew arcs which were clearly not centred on the centre of the gap and others had inaccurate spacing of the arcs. Candidates who used compasses tended to gain full credit.

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(ii) Only the strongest candidates answered this question correctly. Although most knew that the wavefronts had straight sections, they often showed them longer than the width of the gap, or increasing in length as their distance from the gap increased. The sections of the wavefronts adjoining the straight sections were sometimes not curved, showing too much curvature or extending as far as the barrier.

(b) Many answers failed to describe an experiment and just showed the final wave diagram. Some diagrams showed rays rather than wavefronts or showed refraction rather than reflection. Stronger answers described a container for the water, a description of a barrier or how wavefronts were produced.

Question 7

(a) Most candidates correctly identified the presence of free electrons as the relevant feature. Occasional incorrect answers referred to a single electron or ions instead. Others described a solid's particle structure without accounting for what makes metals good conductors.

(b) (i) Much of the working was unclear and many candidates clearly struggled with the idea of involving two proportionalities. Some candidates confused cross-sectional area with diameter or radius, and squared one of the factors of 2. Nevertheless, a number of stronger candidates answered correctly.

(ii) Often with the benefit of an error in **(i)** carried forward, a majority of answers gained full credit. Some candidates having calculated 1/R, failed to invert their answer. A few candidates incorrectly added the resistor values.

(c) (i) Correct answers of 3E were given by stronger candidates. Many answers quoted numerical values.

(ii) Based upon their answer to **(b)(ii)**, even if this was wrong, many candidates ticked the correct box.

Question 8

(a) Many candidates gained full credit by using the correct formula and numbers allowed. Partial credit was awarded if 60 or 260 was used rather than 200, the correct value.

(b) Often with the benefit of the wrong energy in **(a)** carried forward, credit for the correct numerical answer could be given. Wrong statements of the unit of the specific latent heat of fusion often occurred.

(c) Many candidates did not consider the situation carefully enough and suggested heat loss from the water. Stronger candidates correctly referred to heat transfer into the water.

Question 9

(a) Some candidates suggested the given procedure would work and gained no credit. However, many stated the steps would not work, and then went on to explain should be done instead, gaining full credit.

(b) (i) Partial credit could usually be given for suggestions that the coil would turn or rotate. Statements that the rotation would be clockwise were less common. For full credit, candidates could explain that a force acts upon a current carrier in a magnetic field or explain the function of the split ring. The latter was the more frequently chosen option.

(ii) Many candidates answered this question correctly and gained full credit. .

Question 10

(a) This question proved challenging for many candidates. The strongest candidates suggested that an alternating current produces a changing magnetic field for credit. References to voltage or current being induced in the secondary coil were more common.

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(b) (i) A large majority of candidates wrote down the correct formula and used it correctly.

(ii) Rather fewer candidates than in **(i)** were familiar with the formula relating to equal power in the coils of a transformer operating with notional 100 per cent efficiency. Even with the correct formula quoted, wrong manipulation of the numbers sometimes produced the wrong current.

(iii) With the correct current, or the wrong current in **(ii)** carried forward, many correct maximum numbers of lamps could be credited. However, particularly for those who had calculated the wrong current, many candidates divided that current by the fuse rating and gave an incorrect answer.

Question 11

(a) A large majority of candidates stated the correct particle numbers.

(b) Many candidates gained full credit, but some wrote down the product nucleus as Rn instead of Po, and less frequently, a wrong alpha symbol.

(c) Most candidates correctly recognised that 7.6 days equalled 2 half-lives, requiring 2 successive halving of the initial number of Rn nuclei. The more challenging calculation of the number of alpha particles emitted was achieved by quite a small number of candidates.

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Paper 0625/42
Extended Theory

Key messages

- It is essential that candidates show their working and write down the equations used. In particular, candidates sometimes remembered the symbols for three quantities of an equation as a triangle. Such symbol triangles are not acceptable as evidence of working and are ignored by examiners.
- Candidates would benefit from more practice in applying their knowledge in unfamiliar situations. This would deepen candidates' understanding and improve their performance in the examination. Many candidates, when asked to apply their knowledge to a new situation, become confused and unable to use what knowledge they had. This was most evident in responses to **Questions 6(c)** and **10(a)(iii)**. Similarly, in **Question 4(c)** some candidates thought it was a familiar situation but failed to read the question carefully and made an incorrect response.

General comments

Most candidates had prepared well for this paper. Equations were generally well known but the use of equations and the quantities represented were not always understood. There were frequent examples where candidates substituted numbers from the question in the wrong place in equations. This applied particularly to **Question 2(b)** where candidates needed to remember and apply two equations correctly.

Generally candidates followed the rubric of the questions. On some occasions, candidates chose two or more answers when asked to make a choice from a section. Candidates must not try to maximise their chances by giving more than one answer to a question or choosing an answer that might cover two situations. Similarly candidates in nearly all situations must commit to an answer. Conditional answers using e.g. "could" or "might", will often not gain credit.

The use of units by most candidates was good, but a significant minority failed to give the correct unit for wavelength in **Question 6(b)**.

Physics is a practical subject and candidates are encouraged to gain wide practical experience. This is not only helpful as preparation for the practical based Papers 5 and 6 but also helps to deepen their understanding for the Theory Papers. For example, the answers given by many candidates to **Question 5** gave the impression that they had never carried out an experiment involving thermal radiation and quite possibly had never even seen a demonstration. Sometimes it appeared that candidates had tried to remember facts by rote without the supporting understanding of the physics. Without proper understanding candidates are invariably going to misapply learned data and fail to gain credit

Overall the English language ability of the vast majority was adequate for the demands of this paper.

Comments on specific questions

Question 1

(a) (i)1 Most candidates drew the correct straight line from the origin to (10,50). The most common error was to draw a line from the origin to top right of the grid.

(i)2 Most candidates gave the correct answer as gradient, but a large proportion gave inadequate answers such as speed / time. A common error among weaker candidates was to give area under the graph.

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(ii) This was generally well answered and most candidates knew that they had to find change of velocity divided by time. Errors included a wide combination of velocities (9, 5, 4 or 1) and times (10 or 20). A significant number gave the incorrect answer of $0.9\,m/s^2$.

(b) (i) Many candidates drew a correct line but a significant number lost credit through inaccuracy, and others simply drew a line from (0,50) to (100,0).

(ii) The majority of candidates gained full credit, a significant number through the allowance of error carried forward calculating the area beneath their incorrect line in **(i)**.

Question 2

(a) Stronger candidates gained full credit but many others did not because they made unclear statements about density instead of referring to the average or overall density of the cylinder.

(b) Most candidates gained full or most of the credit for a good attempt knowing the correct physics. There were a wide number of alternative methods and candidates made a correspondingly wide variety of errors in their calculation. Very often the setting out of the working was almost impossible to follow and so it was often not possible to give credit for working.

(c) Only stronger candidates gained full credit with the most common successful explanations linking the weight to the force of the sea water.

Question 3

(a) This question was generally well answered with many candidates gaining full credit. The most common error was to write a correct equation and then to fail to square the velocity.

(b) Stronger candidates usually related the increase in kinetic energy to the work done on the aircraft and usually gained full credit. It was also completely acceptable to determine the acceleration and then use $F = ma$ to reach the correct answer. However, many candidates attempting this approach made errors in the calculation of acceleration.

Question 4

(a) (i) and (ii) The majority of the candidates answered this question well with most able to competently draw the arrangement of atoms in a gas. The sketches of the solid arrangement were more variable. Many had disregarded the instruction to use circles approximately the same size as those in **Fig. 4.1** and, whilst this in itself did not lose credit, it did lead to some sketches with varying sizes of atoms. This usually led to haphazard irregularities in the structure which together with too large gaps between atoms, made the diagram look more like a liquid.

(b) (i) This question was generally well answered.

(ii) There were many vague answers given, which often did little more than repeat what was in the question. It was essential to state that the forces were attractive, which could be achieved by using the word “bonds”, and also to state that the forces were between atoms or molecules.

(c) Some candidates gave the impression that seeing the mention of a gas-filled balloon; they assumed that the question would be about gas pressures and volumes. They gave answers in terms of the pressure increasing until it burst, focussing on answers discussing the collisions of atoms with the walls of the balloon. Candidates must ensure that they answer the question as it has been asked.

Question 5

Stronger candidates described an acceptable experiment gaining all or nearly all of the available credit. Credit was available for good detail but this was rarely seen, e.g. it was insufficient to state that the distance of each can from the heater should be the same. It was necessary to state how this should be done.

Many methods were totally impractical showing little understanding of the physics involved, and some were possibly lethal, with suggestions such as putting the electric heater in a metal can full of water. Some

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candidates did not have water in their cans and measured the temperature of the metal can. A small number described an emission experiment or put too great a distance between heater and cans.

Some candidates lost credit for not stating the expected results.

Question 6

(a) This was generally well answered but a minority of candidates answered with a clear contradiction e.g. two different frequencies ringed or transverse and longitudinal ringed.

(b) Nearly all candidates quoted the correct equation but weaker candidates often incorrectly manipulated or used a speed from **(a)** rather than the correct speed of X-rays 3×10^8 m / s. A number of candidates gave either an incorrect unit for wavelength or no unit.

(c) Many candidates answered well recognising the essential point about the difference in frequency of exposure between patient and dentist. Other answers here were muddled, frequently stating that the X-rays would be stopped by the teeth and therefore cause no harm to the patient. There were also a significant number who talked about the danger from the rays increasing with distances and therefore the dentist would be harmed more than the patient who was closer. Very few candidates gave an answer using the idea of benefit outweighing the danger.

(d) Many candidates gained full credit but there was often confusion between microwaves and heat, e.g. candidates stating that the door prevented escape of heat.

Question 7

(a) Generally this was well answered. However, some candidates used the term "density".

(b) (i) Generally this was well answered but a minority of weaker candidates had the right idea but were careless and did not draw the upper ray exactly through F_2.

(ii) Stronger candidates answered this well and gained full credit by carefully extending the lines from **(i)** back in straight lines. A few candidates drew an accurate intersection but added an incorrect image or no image.

(iii) Candidates who had drawn careful diagrams invariably gained full credit on this question.

(iv) A wide variety of answers was seen but stronger candidates stated that the image was virtual and gave a valid reason.

Question 8

(a) (i) and (ii) These questions were well answered by the majority of candidates.

(b) The vast majority of candidates gave absolutely no working for this question. Many drew the correct line on the graph and so gained full credit. In many answers candidates drew an incorrect line and may well have been using some correct physics but, as no working was shown, could not be given any credit.

(c) (i) This was generally well answered.

(ii) Stronger candidates gave the correct response of an increased gradient or words to that effect. A significant minority stated that the second line was above the first which was insufficiently precise.

Question 9

(a) (i) Only the strongest candidates gained credit here. A minority correctly explained how a force is exerted on the coil but failed to show how the force caused a turning effect.

(ii) Many candidates correctly ticked the required boxes and gained full credit. A minority failed to read the instructions and placed more than one tick in a column. This is always a contradiction that gains no credit.

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(b) (i) Many candidates gained full credit for stating that the galvanometer was deflected and adding the less obvious observation that the reading returned to zero.

(ii) The majority of candidates recognised there would be a magnetic field, but only the strongest answers linked this to the direction of the field such that it opposed the motion of the magnet.

Question 10

(a) (i) and (ii) These questions were generally well answered.

(iii) Nearly all candidates stated that the plastic sheet would be held in place although a minority then gave explanations that were far too vague. A small number gave a valid statement about forces between charges but then failed to relate that to holding the sheet in place.

(b) Generally candidates drew an appropriate diagram and gave a valid answer in terms of repulsive forces. However, a small minority drew the spheres further separated but suspended from vertical threads. Merely drawing outward arrows did not answer the question and gained no credit.

Question 11

(a) This was generally well answered although a minority added 4 and 2 to reach numbers of 239 and 94.

(b) (i) As well as many good correct answers, there were many statements that applied to radioactive decay as much as to nuclear fission.

(ii) Stronger candidates answered this clearly and correctly. However, while candidates were not expected to know the detail of the design of a nuclear reactor, many thought the purpose of the thick concrete was to contain radioactive atoms rather than absorb ionising radiation.

(iii) Many of the advantages and disadvantages quoted were far too vague with imprecise statements like “good for the environment” or “polluting”.

(c) There was a wide spread in the quality of responses from merely recognising that two half-lives were involved to completely correct answers. A significant minority quoted the value of 1.2×10^9 atoms, which is the number of atoms that have not decayed, as the final answer. This should have been subtracted from 4.8×10^9 atoms, to give the number of atoms that have decayed.

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Paper 0625/43
Extended Theory

Key messages

- The different parts of this paper use specific command words to indicate to a candidate the sort of answer that is expected. The syllabus describes in detail what these words imply although the list is not exhaustive. A command such as "State" is likely to require a briefer answer that "Explain" or "Describe". Sometimes, the command includes two words such as "State and explain". In a case such as this, there will be credit available for both parts of the instruction and it is important that an answer addresses the two different points. A second indicator that candidates should consider is the mark allocation at the end of each part. This will give guidance on the number of points or length of answer which is expected for the question.

- It is important for candidates to spend some time reading the questions carefully to ensure that they answer the question exactly as it has been set.

General comments

Candidates who had a thorough grasp of the syllabus performed well. There are very commonly a few questions that ask a candidate to write down a specific point from the syllabus that is seen as essential knowledge. The higher scoring candidates usually gave the expected answer to such questions but others seem less well prepared. It is important that candidate are familiar with the syllabus in its entirety.

Comments on specific questions

Question 1

(a) A number of candidates quoted an appropriate expression for acceleration but only a minority used it correctly in this context. A common error was to substitute 0 into both the numerator and the denominator and then to give an answer which itself was 0. There was no compensatory credit for candidates who did this without stating an expression for acceleration.

(b) (i) This part was generally tackled well and many candidates obtained full credit.

(ii) This was only occasionally correct. Many candidates referred to air resistance or gave a description of what is meant by a change in acceleration.

(c) Most candidates had some idea of how to approach this question with the area under the graph being referred to quite commonly. The calculation was not always performed accurately however, and several candidates misread the graph and used 4000 m / s as the final speed rather than 4100 m / s.

Question 2

(a) (i) Although full credit was awarded to many candidates, there were many others who wrote down the correct expression for kinetic energy but did not square the speed when calculating the answer. There were even candidates who did this after substituting numbers into the expression and including the square.

(ii) Most candidates answered correctly. The answer was often correct absolutely or through the error carried forward procedure.

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(b) (i) Air resistance or friction were often referred to but the rest of the explanation was often not given carefully enough.

(ii) Many candidates achieved partial credit for mentioning gravitational potential energy or thermal energy but full credit was only awarded to stronger candidates who mentioned both.

Question 3

(a) (i) The answer 50 000 Pa was very frequently given with only a minority of candidates then adding the atmospheric pressure to this value.

(ii) Many candidates misinterpreted what was expected here; some divided the previous answer by 10 and some quoted the atmospheric pressure. A few candidates obtained credit for their answer by adding the atmospheric pressure to an incorrect answer from **(i)**. A number of candidates did not answer this question.

(b) Most candidates scored some credit here but there were those who did not give an explanation for the bubbles rising to the surface and others who made no reference to the inverse proportion between the pressure and the volume of the bubble.

Question 4

(a) Only a small number of candidates recognised this as a question on cooling by evaporation. A common explanation referred to air molecules that were being blown across the surface transferring coldness to the molecules at the surface of the water.

(b) Convection was commonly referred to and some credit was often obtained for other relevant remarks. Convection is best explained without referring to the molecules at all and credit was not awarded for answers that stated that the surface molecules contract and become denser. It is the water that contracts and becomes denser.

(c) (i)1 This definition was occasionally correct.

(i)2 Only the strongest candidates answered this question correctly.

(ii) Almost all candidates incorrectly stated that with less mercury in the bulb, the range would decrease.

Question 5

(a) (i) Many candidates had the essential features of a correct diagram. Sometimes the straight line sections were of equal lengths whilst others only had the path changing direction where it met the circle drawn on the paper. This circle represented the limit of what can be seen through the microscope and it was not the wall of a physical container.

(ii) Many very good answers were seen but full credit was not always awarded. It was the random movement of the air molecules that caused the observed movement of the smoke particles. Describing the movement of the smoke particles did not answer the question as it was asked.

(b) Although many candidates gave answers that partially explained the movement of the piston, few answers made all the points required. In particular, many explanations stated that the molecules in the cylinder produced a reduced pressure but did not state how this explained the movement of the piston to the left.

Question 6

(a) The majority of answers gave a good, clear diagram of a longitudinal wave. Indicating a distance that represented the wavelength proved more problematic for some candidates. A common approach was to indicate the distance between two adjacent wavefronts in a conventional longitudinal wave diagram rather than the distance between two adjacent compressions or two adjacent rarefactions.

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(b) (i) Only the strongest candidates answered this question correctly. Most candidates suggested an increase or a decrease more or less at random.

(ii) This was answered correctly more often than the previous part but there were some candidates whose answers to **(i)** and **(ii)** were the wrong way around.

(c) The speed of light was often supplied here. Sometimes a frequency or a wavelength was quoted.

Question 7

(a) Many candidates supplied answers that made no reference to wavefronts and no credit could be awarded. In general, candidates gave answers that referred to refraction in a much more general way.

(b) Although some candidates realised that this question concerned the definition of refractive index in terms of the ratio of the speeds in the two mediums, other did not recognise this and either omitted this part or attempted to apply the more usual definition that uses the sine ratios of two angles.

Question 8

(a) (i) This part was well answered, but a few candidates did not mark the location of the lens at the position where the ray crossed the principal axis.

(ii) Most candidates added a suitable second ray to the diagram.

(iii) Full credit was often not obtained in this part. Sometimes no answer was supplied, sometimes the diagram was poorly drawn and the answer was not within the acceptable range and sometimes an inappropriate distance was measured.

(iv) This question proved challenging for many candidates and was sometimes left blank. Candidates who had drawn a real image sometimes described it as virtual. Some candidates described the image as magnified, perhaps not understanding the meaning of the word “enlarged” which was given in the question.

(b) There were several good answers but bringing the water in the fishbowl to the boil or similar answers were not awarded any credit.

Question 9

(a) This was generally correctly answered. However, occasionally, a candidate calculated 80 W but then added 20 W to it.

(b) (i) Most candidates gained full credit here.

(ii) This part proved rather challenging and few candidates were awarded full credit. A large number of candidates stated that the reading on the voltmeter would not change but many candidates who realised that the reading would decrease did not explain why.

(c) (i) Only a very few candidates gave a complete answer here and answers in terms of force, voltage or power were quite frequently seen.

(ii) Full credit was very commonly awarded.

Question 10

(a) (i) Many candidates were aware that there would be a reading on the galvanometer but fewer stated that in due course, the reading would drop to zero.

(ii) Credit was very rarely awarded in this part. Only a small minority of candidates made any reference to the Lenz law and few of these gave a sufficiently detailed answer.

(b) (i) This was very often correct but the inverse ratio was supplied by some candidates.

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(ii) This was very commonly correct.

Question 11

(a) (i) This was very often correct.

(ii) This was very often correct.

(iii) This was very often correct.

(b) (i) Most candidates drew a downward curve but there were a few straight lines, a few upward curves and some trajectories that had no clearly defined shape.

(ii) Most candidates tackled this part in the correct way although not all reached the final answer. The answer of 9.0×10^5 particles was very common but this is the number of nuclei remaining which have not emitted an alpha particle.

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PHYSICS

Paper 0625/51
Practical Test

Key messages

- Candidates need to have had a thorough grounding in practical work during the course, including reflection and discussion on the precautions taken to improve reliability and control of variables.
- Candidates should be aware that, as this paper tests an understanding of experimental work, explanations and justifications will need to be based on practical rather than theoretical considerations.
- Numerical answers should be expressed clearly, to the appropriate number of significant figures and with a correct unit, where applicable. Candidates should know that these techniques will be tested at some point in the paper.
- Candidates should be ready to apply their practical knowledge to different situations. Questions should be read carefully to ensure that they are answered appropriately.

General comments

The aim of the examination is to enable candidates to display their knowledge and understanding of practical physics techniques, including the following:

- plotting graphs
- tabulating readings
- manipulating data to obtain results
- drawing conclusions
- dealing with possible sources of error
- controlling variables
- handling practical apparatus and making accurate measurements
- choosing the most suitable apparatus.

It is assumed that, as far as possible, the IGCSE course will be taught so that candidates undertake regular practical work as an integral part of their study of physics. Questions on experimental techniques were answered much more effectively by candidates who clearly had regular experience of similar practical work and much less successfully by those who, apparently, had not.

The practical nature of the examination should be kept in mind when explanations, justifications or suggested changes are required as, for example, in **Questions 1(c)**, **1(d)**, **2(d)**, **2(e)** and **3(d)**.

Comments on specific questions

Question 1

(a) The majority of candidates successfully recorded the time in s, within the range expected. Most calculated the period correctly although some multiplied by 10 instead of dividing by 10. Many candidates calculated T^2 correctly but a significant number doubled the value of T. Relatively few candidates correctly gave the unit s^2. The value of g was usually correctly calculated.

(b) Most candidates recorded suitable values here and obtained a value of g between 8 and 12 (m/s^2), the accepted range. Candidates who had carried out the work with great care were credited for having both g values within the range 9–11 (m/s^2).

(c) Some candidates wrote precautions here rather than responding to the question about changes to improve accuracy. Using additional d values and counting more oscillations were the expected

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answers. Repeats of the original measurements could not be credited as this did not answer the question as it had been set.

(d) One of a number of suitable precautions could be used here. Most candidates chose to describe perpendicular viewing of the scale. This needed to be clearly expressed to gain credit. Vague references to vertical, horizontal, parallel or eye-level were not precise enough. Other good answers such as how to use a set square as an aid to measure *d* were seen less often.

Question 2

(a) Most candidates recorded the potential difference to at least 1 decimal place, and the current to at least 2 decimal places. Most also calculated the resistance correctly.

(b) Candidates were credited here for connecting the voltmeter correctly and so obtaining a new resistance value within 10 per cent of the first value.

(c) In this section candidates were credited for using the correct units for potential difference, current and resistance. The answer for the combined resistance was expected to be given correctly and to 2 or 3 significant figures.

(d) Here candidates were required to make a judgement based on their own results. The statement needed to be clear, saying that either the results support the suggestion or they did not. The justification then needed to match the statement with wording that showed a clear understanding of the concept of results being within, or beyond, the limits of experimental accuracy.

(e) Candidates were expected to complete the diagram showing three resistors in parallel with the variable resistor in series with the resistor combination. One voltmeter should then be shown in parallel with the resistor combination. Common errors here included drawing a thermistor in place of the variable resistor, drawing three voltmeters and, less commonly, three resistors in series. Candidates needed to plan their circuit diagrams carefully as a component drawn over an existing line could not be credited. For example, a resistor with a line through it changes the symbol to that of a fuse.

Question 3

(a) Many candidates completed the table correctly with values within the permitted ranges. Some calculated $u + v$ instead of the product uv.

(b) Most candidates labelled the graph axes correctly and drew them the right way round, choosing a suitable scale. Plotting was generally accurate. Candidates should use neat crosses for the plots, or neatly circled dots so that the accuracy of the plotting is clear. Many candidates drew a well-judged straight line but some candidates drew a 'dot-to-dot' line whilst others drew a straight line that did not match the plots.

(c) Here candidates needed to clearly show the triangle method on the graph, with a large triangle using at least half the distance between the extreme plots. Many candidates achieved this.

(d) Successful candidates made a relevant suggestion from their experience. Some candidates appeared to be relying on answers they had learned from other questions that were not appropriate for this question. For example, using a darkened room is not a difficulty in this experiment. A difficulty could be that the room is too bright.

Question 4

Many candidates answered this planning question well. Those who followed the guidance in the question were able to write concisely and addressed all the necessary points. Most candidates explained a relevant experiment. However few wrote about any kind of measurement of the air gap which is a key part of the experiment. Construction of a table of readings helped some candidates to organise their thoughts and to write clearly about how to carry out the investigation. The table needed to include columns relevant to the description. Typically columns for size of air gap, temperature and time, all with appropriate units were included.

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Credit was available for sensible suggestions of possible variables that should be kept constant. For example, the starting temperature of the water and volume of water used. Credit was also given for other useful suggestions such as use of a lid.

Candidates were expected to explain how to reach a conclusion from their suggested readings. Candidates needed to be aware that this is not the equivalent to making a prediction about the expected results.

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PHYSICS

Paper 0625/52
Practical Test

Key messages

- Candidates need to have a thorough grounding in practical work during the course to perform well in this examination. Candidates should have as much personal experience of carrying out experiments themselves, as possible. The practical work should include reflection upon and discussion of the significance of results, precautions taken to improve reliability and control of variables.

- Centres are provided with a list of required apparatus well in advance of the examination date. Where Centres wish to substitute apparatus, it is essential to contact Cambridge to check that the change is appropriate and that candidates will not be disadvantaged. Any changes must be recorded in the Supervisor's report.

General comments

The aim of the examination is to enable candidates to display their knowledge and understanding of practical physics techniques including the following:

- handling practical apparatus and making accurate measurements
- tabulating of readings
- graph plotting and interpretation
- manipulating data to obtain results
- drawing conclusions
- understanding the concepts of results being equal within the limits of experimental accuracy
- dealing with possible sources of inaccuracy
- control of variables
- choosing the most effective way to use the equipment provided.

The majority of candidates were well prepared and able to demonstrate their ability and understanding across the whole of the range of practical skills being tested. All parts of every practical test were attempted and there was no evidence of candidates running short of time. The majority of candidates were able to follow instructions correctly, record observations clearly and perform calculations accurately. Units were well known and were almost always included, writing was neat and legible and ideas were expressed logically. However many candidates seemed less able to derive conclusions backed up by evidence, or to present well thought out conclusions.

The gathering and recording of data presented few problems for any candidates. There was evidence of some candidates not having the use of a calculator.

The ability to record readings to an appropriate precision, usually reflecting the measuring instrument being used, or to quote a derived result to an appropriate number of significant places, caused difficulty for many candidates. There were also many instances where a candidate had repeated a measurement and had overwritten their first answer. Candidates should be encouraged to cross out completely and to rewrite their answers so that there is no ambiguity. Some candidates still find difficulty in choosing an appropriate scale to plot their graphs and in drawing a best-fit line to display their data.

There were instances this year of Centres disadvantaging their candidates by not supplying the correct apparatus. This was often apparent in **Question 3**, where candidates' results indicated the lens they had been given did not have a focal length of 15 cm. Where this was not mentioned in the report from the Supervisor, it was difficult to award credit. It is important to provide details of changes made to the specified apparatus, and possibly specimen results if appropriate so that Examiners can give full credit to candidates'

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results that lie outside the expected tolerance values. Cambridge should agree major changes to apparatus in advance of the examination date.

<u>Comments on specific questions</u>

Question 1

(a) Most candidates drew carefully around the base of the cup and took one measurement of the diameter of the base, despite the instruction given in the question which was to take measurements. Some candidates took more than one measurement from the diagram judging by the number of diameters drawn on their diagrams. Few of these candidates actually recorded these extra measurements and calculated a mean, and so consequently could not be credited for this. Answers were expected to be given to the nearest millimetre, and so answers such as 5 cm were not accepted. If a length, when measured with a rule with millimetre graduations, is an exact number of centimetres, such as 5, then candidates must write down 5.0 cm.

The mean diameter of the cup was usually calculated correctly. However many candidates quoted their answers to one or three significant figures, or incorrectly rounded.

(b) The vertical height of the cup was usually measured correctly and the calculation of the volume of the cup was performed accurately. Although significant figures were not penalised here, it was common to see the volume of the cup quoted to six significant figures. Candidates should quote their numerical answers to no more significant figures than the data is presented to them in the question.

(c) The density calculation was generally performed correctly, with the answer given to a suitable number of significant figures, as requested in the question. Most candidates gave the correct unit for density. The most common incorrect answers were cm^3 / g and Pa.

(d) By far the most popular correct answer was stating that the mass of the cup had been ignored, or words to that effect. A smaller number of candidates focussed on the fact that the diameter of the circle was difficult to measure as its centre had not been marked, and this obtained credit also. Few candidates commented on the obvious difficulty of measuring the vertical height of the cup, *h*.

Question 2

(a) Almost all candidates recorded a sensible value for the room temperature. However some weaker candidates did not include the unit or gave an incorrect unit.

(b) The table of results was usually completed correctly. Occasionally, candidates did not include units in the table headings. There was the occasional arithmetical slip in the time column when increasing the times in increments of 30.

(c) The choice of scales was usually good, but candidates often ignored the instruction given in the question that the value of the room temperature would need to be marked on the *y*-axis. Truncated scales that started at a higher *y*-axis temperature at the origin than the recorded value of their room temperature were often used.

Occasionally scales that increased in inconvenient increments, such as 3 or 7, etc. were seen. Choosing such scales makes the plotting the points much harder and reading the scales more difficult.

Plots were generally correct, even for those candidates who had chosen unusual scales. However, there were many instances where plots were very thick crosses. The best-fit line proved difficult to draw, and only the strongest candidates produced carefully drawn, smooth curves. Many attempts were just of a series of line segments or attempts at a best-fit straight line, when the trend of the points was obviously a curve. The concept of best-fit is clearly still not well understood by all. It was quite common for candidates to choose a suitable scale, plot the points correctly and then make no attempt at drawing a best-fit curve through them. There were, however, some excellent, carefully drawn, smooth curves produced by candidates – and best-fit straight lines, when it was appropriate.

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(d) As stated in **(c)**, many candidates did not draw the required horizontal line on their graph, because they had not left room to do so. A minority of candidates drew a cross or marked a dot on the *y*-axis instead of the line that had been asked for.

(e) Candidates provided sensible suggestions as to how the rate of cooling of the water could be increased. However, some candidates did not read this question carefully enough and provided answers dealing with heat losses and insulation. Many candidates incorrectly thought that increasing the time of cooling would increase the rate of cooling.

(f) This was well answered with the majority of candidates providing at least one sensible precaution. Avoiding parallax errors on its own did not receive credit. Where parallax was quoted, candidates needed to state how parallax errors in reading the thermometer are avoided. A common incorrect answer was the use of the term parallel viewing instead of perpendicular viewing. Some candidates incorrectly focussed on reducing heat losses which is clearly not appropriate here.

Question 3

(a) The image distance v_1 was measured and recorded by most candidates. Most answers were within the tolerance allowed.

Some candidates were confused by the substitution needed in the given formula to calculate the focal length f_1 of the lens. Rounding errors occasionally occurred, but the unit cm usually appeared somewhere in the answer and was given credit.

(b) The image distance v_2 was measured and recorded by most candidates. Most answers were within the tolerance allowed.

The value of f_2 was usually calculated correctly. There was credit awarded here to candidates whose value for f_2 was within 10 per cent of f_1.

(c) The mean value for the focal length was usually calculated correctly and most candidates followed the instruction and quoted their answer to an appropriate number of significant figures. Answers recorded to 2 or 3 significant figures were accepted.

(d) This question proved challenging with many candidates not offering any additional values for *U*. For those who gave additional values, most candidates gained partial credit, although many only gave two extra values. However, few candidates gained full credit and even the best candidates were reluctant to go up to 50 cm or beyond, and yet stay within the limit of 70 cm.

(d) The precautions to be taken when conducting an experiment to determine the position of the image of an object formed by a converging lens were well known. There were incorrect references made to moving the lens, despite it being obvious from the instructions given in the question that the position of the lens did not change as the screen was moved to obtain a sharply focussed image.

Question 4

Credit was available for a brief explanation of how candidates would set up the investigation. Most candidates explained, often from their diagram, that they would release the truck from rest at the top of the ramp. Occasionally the truck was given a push to start it – this was not accepted.

Far fewer candidates made the distance that needed to be measured from the bottom of the ramp until the truck came to rest clear enough for credit to be awarded. However, most candidates stated that the experiment would be repeated with the truck loaded with different masses. Some candidates used another truck of different mass and did not receive credit.

Many candidates did not appear to have read the question carefully enough because many stated the need for a stopwatch, as if they were performing a timing experiment, whereas all that they needed was a rule to measure the distance moved.

Many candidates were able to gain at least partial credit for listing the control variables in this investigation. Few candidates mentioned keeping the release position fixed however. Some candidates incorrectly thought, that by stating that the length of the ramp should be kept constant, this condition was fulfilled.

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Most candidates realised that the gradient of the slope should be kept constant and gained credit by stating that the number of blocks supporting the ramp should be kept constant.

The majority of candidates drew an appropriate table of results and gave relevant heading with units. A common incorrect answer was to label the unit of mass as ‘Newtons’ in the table heading.

Only a minority of candidates completely misunderstood the purpose of the investigation. A small number of candidates thought that the truck had to be pushed up the ramp.

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PHYSICS

Paper 0625/53
Practical Test

Key messages

- Candidates should be advised to read the questions through very carefully to ensure that they are answering the question as written, and not simply recalling the answer to a similar question.
- Candidates need to have had a thorough grounding in practical work during the course, including reflection and discussion on the precautions taken to improve reliability, and control of variables.
- Candidates should be aware that, as this paper tests an understanding of experimental work, explanations will need to be based on data from the question and practical rather than theoretical considerations.
- Numerical answers should be expressed clearly, to the appropriate number of significant figures and with a correct unit, where applicable. Candidates should know that these techniques will be tested at some point in the paper.
- Candidates should be ready to apply their practical knowledge to unusual situations. Planning questions require candidates to design an experiment to investigate a given brief.

General Comments

The aim of the examination is to enable candidates to display their knowledge and understanding of practical physics techniques, including the following:

- plotting graphs
- tabulating readings
- manipulating data to obtain results
- drawing and justifying conclusions
- dealing with possible sources of error
- controlling variables
- making accurate measurement
- choosing the most suitable apparatus.

It is assumed that, as far as possible, the IGCSE course will be taught so that candidates undertake regular practical work as an integral part of their study of physics.

Questions on experimental techniques were answered much more effectively by candidates who clearly had experience of similar practical work and much less successfully by those who, apparently, had not. The breadth of candidates' experience of experimental work was apparent in the quality of their analysis of results and their comments on procedures. This was seen in the clear practical details given by some candidates in **Question 1(c)(ii)** and **Question 3(e)**.

Where explanations or justifications are required, candidates should base them on practical considerations, using data from the question. Theoretical responses are not usually adequate, particularly when reference to results is asked for. Good detail was seen in many of the answers to **Question 1(c)(i)** and **Question 2(d)**.

It is expected that numerical answers will include a matching unit and will be expressed to a number of significant figures which is appropriate to the data given in the question. These points were demonstrated in many of the responses to **Question 2(c)** and **Question 3(b)**. Candidates need to remember that use of a 'recurring' symbol, does not indicate the intended number of significant figures.

Each Practical Test will include a question in which candidates are asked to outline a plan for an investigation. Answers to these questions should be based on careful reading of the brief and the logical

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application of sound experimental practice. Many candidates showed good practical knowledge when answering **Question 4** but it was clear that a number had not been prepared for this or had limited experience of basic experimental work.

Comments on specific questions

Question 1

(a) Most candidates successfully recorded a set of temperature readings for the beaker with lid **A**. A small number started taking temperature readings straight away instead of waiting for the thermometer reading to stop rising first.

(b) The readings for the beaker with lid **B** showed the cooling rate to be less than lid **A** for nearly all candidates.

A small number of candidates either did not complete the headings or did not write the symbol for degrees Celsius correctly. The time column was usually correct but a small minority of candidates listed times in minutes instead of seconds.

(c)(i) Most candidates were able to identify which lid caused a greater rate of cooling. However, only about half of the candidates could justify this successfully by referring to the full range of results. Credit was not awarded to those that compared the temperature change in the first 30 seconds only, compared the final temperature readings without reference to the initial water temperature, or who gave theoretical responses.

(ii) The part of the question regarding changes to the apparatus was answered successfully by stronger candidates. Many candidates overlooked the requirement for the change to be to the apparatus only.

(d) Stronger candidates answered this question correctly. These candidates could identify what a graph line showing a directly proportional relationship would look like. It was more common for candidates to refer to a straight line than the fact that the line would pass through the origin.

(e) Most candidates were able to suggest a factor that should be kept the same. A common response was room temperature.

Question 2

(a) Nearly all candidates recorded readings of current that decreased and readings of potential difference that increased with increasing resistance. Candidates also gave readings to a suitable number of decimal places.

(b) The majority of candidates gave the correct units for the table heading.

(c) Most candidates calculated the power values correctly and gave their answers to a consistent number of significant figures – either two or three.

(d) Candidates needed to recognise that they were only required to describe the change in value rather than trying to identify an overall pattern. Where candidates recorded results that matched those that were expected, many recognised that the power increased at first and then decreased as the resistance continued to increase.

(e) This question proved challenging for many candidates. Responses needed to show that the resistance was the independent variable. The best responses identified the need for at least five different values for resistance or the need to draw a graph.

Question 3

(a) Most candidates recorded a suitable height for the triangular-shaped hole and suitable heights for the height of the image in the table.

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(b) The majority of candidates carried out the calculation successfully for their values of image height.

(c) Many well-drawn graphs were seen. Most candidates labelled the axes correctly and choose a suitable scale. Whilst plotting was generally accurate, some candidates had plots that were too large and using small crosses is always recommended. The graph line should have been straight and well-judged with roughly an even distribution of plots either side.

(d) Many answers lay within the expected range, with a clear large triangle shown on the graph. Triangles that were less than half of the graph line were not accepted.

(e) Identifying difficulties and suggesting improvements for measuring the height of the image proved to be difficult for many candidates. A small number of stronger candidates recognised that the screen would move when a ruler is placed against it, or that the hand and ruler would cast a shadow over the image. Those that gave these responses usually went on to suggest clamping the screen in place. An even smaller proportion described the use of a translucent screen.

Question 4

Nearly all candidates followed the instructions provided and drew a diagram to show how the equipment would be used. Unfortunately, many candidates were not clear on what a pulley was and often confused it with a force meter leading to an incorrectly drawn and labelled diagram.

There were two different methods for the investigation that could have been described – either using a force meter to measure the force required or using masses on the end of a string hanging from a pulley on the end of a desk. Despite no mention of distance in the question, many candidates described a method where they recorded a distance. There were other candidates who suggested the block was pulled a certain distance before measuring the force, which conflicted with what the question was asking for.

Those candidates who carefully used the bullet points given in the question normally answered well and ensured that all areas of the question were addressed. Some candidates neglected the need for a description of the variables to be controlled or a description of the graph that should be drawn however.

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PHYSICS

Paper 0625/61
Alternative to Practical

Key messages

- Candidates need to have had a thorough grounding in practical work during the course, including reflection and discussion on the precautions taken to improve reliability and control of variables.
- Candidates should be aware that, as this paper tests an understanding of experimental work, explanations will need to be based on data from the question and practical rather than theoretical considerations.
- Numerical answers should be expressed clearly, to the appropriate number of significant figures and with a correct unit, where applicable. Candidates should know that these techniques will be tested at some point in the paper.
- Candidates should be ready to apply their practical knowledge to unusual situations. Questions should be read carefully to ensure that they are answered appropriately.

General comments

The aim of the examination is to enable candidates to display their knowledge and understanding of practical physics techniques, including the following:

- plotting graphs
- tabulating readings
- manipulating data to obtain results
- drawing conclusions
- dealing with possible sources of error
- controlling variables
- making accurate measurements
- choosing the most suitable apparatus.

It is assumed that, as far as possible, the IGCSE course will be taught so that candidates undertake regular practical work as an integral part of their study of physics. This examination should not be seen as suggesting that the course can be fully and effectively taught without practical work. Some of the skills involved in experimental work, including graph plotting and tabulation of readings, can be practised without doing experiments. However, there are parts of this examination in which the candidates are asked to answer from their own practical experience. Questions on experimental techniques were answered much more effectively by candidates who clearly had experience of similar practical work and much less successfully by those who, apparently, had not.

The practical nature of the examination should be kept in mind when explanations, justifications or further developments are asked for as, for example, in **Questions 1(d)**, **1(e)**, **2(b)**, **2(e)** and **3(e)**.

Comments on specific questions

Question 1

(a) Most candidates measured the distance correctly in cm.

(b) Some candidates divided by 10 instead of multiplying by 10 to obtain *D*. The majority of candidates successfully recorded the time in s. Most calculated the period correctly although some multiplied by 10 instead of dividing by 10. Many calculated T^2 correctly but a significant number doubled the value of *T*. The value of *g* was usually correctly calculated.

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(c) Only a few candidates correctly gave the unit s^2. Candidates were expected to give their value for *g* to 2 or 3 significant figures.

(d) Some candidates wrote precautions here rather than responding to the question about changes to improve accuracy. Using additional *d* values and counting more oscillations were the expected answers. Repeats of the original measurements could not be credited as this did not answer the question as it had been set.

(e) One of a number of suitable precautions could be used here. Most candidates chose to describe perpendicular viewing of the scale. This needed to be clearly expressed to gain credit. Vague references to vertical, horizontal, parallel or eye-level were not precise enough. Other good answers such as how to use a set square as an aid to measure *d* were seen less often.

Question 2

(a) Many candidates recorded the potential difference correctly and most also calculated the resistance correctly. A significant number of candidates did not record the units of potential difference and current.

(b) Here candidates were required to make a judgement based on their own value for R_1 and the stated values for R_2 and R_3. The statement needed to be clear, saying that either the results support the suggestion or they do not. The justification then needed to match the statement with wording that showed a clear understanding of the concept of results being within, or beyond, the limits of experimental accuracy.

(c) Candidates were expected to give the correct total to 2 or 3 significant figures and to include the unit.

(d) Many candidates correctly ticked the third box but some chose one of the other two possibilities.

(e) Candidates were expected to complete the diagram showing three resistors in parallel with the variable resistor in series with the resistor combination. One voltmeter should then be shown in parallel with the resistor combination. Common errors here included drawing a thermistor in place of the variable resistor, drawing three voltmeters and, less commonly, three resistors in series. Candidates needed to plan their circuit diagrams carefully as a component drawn over an existing line could not be credited. For example, a resistor with a line through it changes the symbol to that of a fuse.

Question 3

(a) Many candidates completed the table correctly. Some calculated $u + v$ instead of the product uv.

(b) Most candidates labelled the graph axes correctly and drew them the right way round, choosing a suitable scale. Plotting was generally accurate. Candidates should use neat crosses for the plots, or neatly circled dots so that the accuracy of the plotting is clear. Many candidates drew a well-judged straight line but some candidates drew a ‘dot-to-dot’ line whilst others drew a straight line that did not match the plots.

(c) Here candidates needed to clearly show the triangle method on the graph, with a large triangle using at least half the distance between the extreme plots. Many candidates achieved this.

(d) Many candidates gained credit for obtaining a value for *G* within the tolerance allowed. Stronger candidates gained further credit for *f* equal to *G*, expressed to 2 or 3 significant figures.

(e) Successful candidates made relevant suggestions from their experience. Some candidates appeared to be relying on answers they had learned from other questions that were not appropriate for this question. For example, using a darkened room is not a difficulty in this experiment. A difficulty could be that the room is too bright.

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Question 4

Many candidates answered this planning question well. Those who followed the guidance in the question were able to write concisely and addressed all the necessary points. Most candidates explained a relevant experiment. However few wrote about any kind of measurement of the air gap which is a key part of the experiment. Construction of a table of readings helped some candidates to organise their thoughts and to write clearly about how to carry out the investigation. The table needed to include columns relevant to the description. Typically columns for size of air gap, temperature and time, all with appropriate units were included.

Credit was available for sensible suggestions of possible variables that should be kept constant. For example, the starting temperature of the water and volume of water used. Credit was also given for other useful suggestions such as use of a lid.

Candidates were expected to explain how to reach a conclusion from their suggested readings. Candidates needed to be aware that this is not the equivalent to making a prediction about the expected results.

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Paper 0625/62
Alternative to Practical

Key messages

- Candidates need to have a thorough grounding in practical work during the course to perform well in this examination. Candidates should have as much personal experience of carrying out experiments themselves as possible. The practical work should include reflection upon, and the discussion of the significance of results, precautions taken to improve reliability and control of variables.

- Candidates should be advised to read the questions through very carefully to ensure that they are answering the question as written, and not simply recalling the answer to a different question.

General comments

The aim of the examination is to enable candidates to display their knowledge and understanding of practical physics techniques including the following:

- handling practical apparatus and making accurate measurements
- tabulating of readings
- graph plotting and interpretation
- manipulating data to obtain results
- drawing conclusions
- understanding the concept of results being equal to within the limits of experimental accuracy
- dealing with possible sources of inaccuracy
- control of variables
- choosing the most effective way to use the equipment provided.

The majority of candidates were well prepared and the range of practical skills being tested were accessible to the majority of the candidature. Most candidates were able to draw upon their own personal practical experience to answer the questions. No part of any question proved to be inaccessible to candidates and there was no evidence of candidates running short of time. The majority of candidates were able to follow instructions correctly, record measurements clearly and perform calculations accurately. Units were well known and were invariably included, writing was legible and ideas were expressed logically. However, candidates seemed less able to derive conclusions from given experimental data and justify them.

The vast majority of candidates finished the paper and there were few papers with substantial numbers of unanswered questions. There were some scripts which showed an exemplary understanding of practical skills but equally, there were those which demonstrated a lack of graph skills, poor understanding of significant figures and a lack of comprehension of good practice in carrying out experiments.

Comments on specific questions

Question 1

(a) (i) The correct answer for the diameter was given by the majority of candidates, but only a small minority of these candidates provided evidence that more than one measurement had been taken. Many candidates had clearly taken more than one measurement from the diagram, judging by the number of diameters drawn on the diagram. However, few of these candidates actually recorded these measurements and calculated a mean, so consequently could not be awarded fill credit.

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(ii) The mean diameter of the cup was usually calculated correctly, but many candidates gave their answers to one or three significant figures, or incorrectly rounded and so could not be awarded credit.

(b) The vertical height of the cup was usually measured correctly and the calculation of the volume of the cup was performed accurately. Although significant figures were not penalised here, it was common to see the volume of the cup quoted to six significant figures. Candidates should quote their numerical answers to no more significant figures than the data is presented to them in the question.

(c) The density calculation was generally performed correctly, with the answer given to a suitable number of significant figures. Most candidates gave the correct unit for density. The most common incorrect answers were cm^3/g and Pa.

(d) By far the most popular correct answer was stating that the mass of the cup had been ignored, or words to that effect. A smaller number of candidates focussed on the fact that the diameter of the circle was difficult to measure, as its centre had not been marked, and this obtained credit also.

(e) Generally, diagrams were well-drawn and indicated clearly that to obtain an accurate value for the volume of the water, the viewing must be perpendicular. Only a minority of candidates did not show the bottom of the meniscus well enough to gain full credit. There were some attempts at a 3D drawing of the meniscus. These did not gain credit because it was not possible to determine which was the top and which was the bottom of the drawn meniscus.

Question 2

(a) Almost all candidates recorded the reading shown on the thermometer correctly. Where mistakes were made, the most common incorrect answers were 20.3°C and 37°C.

(b) Fewer than half the candidates answered this question correctly. Many candidates focussed on the idea that the temperature in the beaker of water needed to settle down, rather than that the thermometer itself needed time for the liquid inside it to expand and reach the temperature of the hot water. The table of results was usually completed correctly. Occasionally, candidates omitted to include units in the table headings.

Weaknesses were seen in the standard of graph plotting. The choice of scales was usually good, but candidates often ignored the instruction given in the question, that the value of the room temperature would need to be marked on the *y*-axis. Truncated scales that started at a higher *y*-axis temperature at the origin than the recorded value of their room temperature were often used.

Occasionally scales that increased in inconvenient increments, such as 3 or 7, etc. were seen. Choosing such scales makes the plotting the points much harder and reading the scales more difficult.

Plots were generally correct, even for those candidates who had chosen unusual scales. However, there were many instances where plots were very thick crosses. The best-fit line proved difficult to draw, and only the strongest candidates produced carefully drawn, smooth curves. Many attempts were just of a series of line segments or attempts at a best-fit straight line, when the trend of the points was obviously a curve. It was quite common for candidates to choose a suitable scale, plot the points correctly and then make no attempt at drawing a best-fit curve through them. There were, however, some excellent, carefully drawn, smooth curves produced by candidates. The concept of best-fit was clearly not well understood by all candidates however.

(c) As stated in **(b)**, many candidates did not draw the required horizontal line on their graph, because they had not left room to do so. A minority of candidates drew a cross or marked a dot on the *y*-axis instead of the line that had been asked for.

(d) This was well answered with the majority of candidates providing at least one sensible precaution. Avoiding parallax errors on its own did not receive credit. Where parallax was quoted, candidates needed to state how parallax errors in reading the thermometer are avoided. A common incorrect answer was the use of the term parallel viewing instead of perpendicular viewing. Some candidates incorrectly focussed on reducing heat losses which was not appropriate here.

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(e) Most candidates provided sensible suggestions as to how the rate of cooling of the water could be increased. However, some candidates did not read this question carefully enough and provided answers dealing with heat losses and insulation. Many candidates incorrectly thought that increasing the time of cooling would increase the rate of cooling.

Question 3

(a) (i) The image distance ***v*** was measured correctly by most candidates. A common incorrect answer was 5.3 cm.

(ii) The idea of a scaling factor presented little difficulty and the majority of candidates multiplied their answer to **(i)** by 5. Occasionally the answer was divided by 5.

(iii) Some candidates were confused by the substitution needed in the given formula to calculate the focal length of the lens. Occasionally rounding errors occurred, but the unit cm usually appeared somewhere in the answer and was given credit.

(b) This question was well answered with most candidates giving their answer to a suitable number of significant figures.

(c) This question proved challenging with many candidates not offering any additional values for *U*. For those who gave additional values, most candidates gained partial credit, although many only gave two extra values. However, few candidates gained full credit and even the best candidates were reluctant to go up to 50 cm or beyond, and yet stay within the limit of 70 cm.

(d) The precautions to be taken when conducting an experiment to determine the position of the image of an object formed by a converging lens were well known. However, there were incorrect references made to moving the lens, despite it being obvious from the question that the position of the lens was fixed.

Question 4

Credit was available for a brief explanation of how candidates would set up the investigation. Most candidates explained, often from their diagram, that they would release the truck from rest at the top of the ramp. Occasionally the truck was given a push to start it – this was not accepted.

Far fewer candidates made the distance that needed to be measured from the bottom of the ramp until the truck came to rest clear enough for credit to be awarded. However, most candidates stated that the experiment would be repeated with the truck loaded with different masses. Some candidates used another truck of different mass and did not receive credit.

Many candidates did not appear to have read the question carefully enough because many stated the need for a stopwatch, as if they were performing a timing experiment, whereas all that they needed was a rule to measure the distance moved.

Many candidates were able to gain at least partial credit for listing the control variables in this investigation. Few candidates mentioned keeping the release position fixed however. Some candidates incorrectly thought, that by stating that the length of the ramp should be kept constant, this condition was fulfilled.

Most candidates realised that the gradient of the slope should be kept constant and gained credit by stating that the number of blocks supporting the ramp should be kept constant.

The majority of candidates drew an appropriate table of results and gave relevant heading with units. A common incorrect answer was to label the unit of mass as 'Newtons' in the table heading.

Only a minority of candidates completely misunderstood the purpose of the investigation. A small number of candidates thought that the truck had to be pushed up the ramp.

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Paper 0625/63
Alternative to Practical

Key messages

- Candidates should be advised to read the questions through very carefully to ensure that they are answering the question as written, and not simply recalling the answer to a similar question.
- Candidates need to have had a thorough grounding in practical work during the course, including reflection and discussion on the precautions taken to improve reliability, and control of variables.
- Candidates should be aware that, as this paper tests an understanding of experimental work, explanations will need to be based on data from the question and practical rather than theoretical considerations.
- Numerical answers should be expressed clearly, to the appropriate number of significant figures and with a correct unit, where applicable. Candidates should know that these techniques will be tested at some point in the paper.
- Candidates should be ready to apply their practical knowledge to unusual situations. Planning questions require candidates to design an experiment to investigate a given brief.

General comments

The aim of the examination is to enable candidates to display their knowledge and understanding of practical physics techniques, including the following:

- plotting graphs
- tabulating readings
- manipulating data to obtain results
- drawing and justifying conclusions
- dealing with possible sources of error
- controlling variables
- making accurate measurement
- choosing the most suitable apparatus.

It is assumed that, as far as possible, the IGCSE course will be taught so that candidates undertake regular practical work as an integral part of their study of physics. This examination should not be seen as suggesting that the course can be fully and effectively taught without practical work. Some of the skills involved in experimental work, including graph plotting and tabulation of readings, can be practised without doing experiments. However, there are parts of this examination in which the candidates are asked to answer from their own practical experience.

Questions on experimental techniques were answered much more effectively by candidates who clearly had experience of similar practical work and much less successfully by those who, apparently, had not. The breadth of candidates' experience of experimental work was apparent in the quality of their analysis of results and their comments on procedures. This was seen in the clear practical details given by some candidates in **Questions 1(c)** and **(d)(ii)** and **Question 3(e)**.

Where explanations or justifications are required, candidates should base them on practical considerations, using data from the question. Theoretical responses are not usually adequate, particularly when reference to results is required. Good detail was seen in many of the answers to **Question 1(d)(i)** and **Question 2(d)**.

It is expected that numerical answers will include a matching unit and will be expressed to a number of significant figures which is appropriate to the data given in the question. These points were demonstrated in many of the responses to **Question 2(c)** and **Question 3(b)(ii)**. Candidates need to remember that use of a 'recurring' symbol, does not indicate the intended number of significant figures.

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Each Alternative to Practical examination will include a question in which candidates will be asked to outline a plan for an investigation. Answers to these questions should be based on careful reading of the brief and the logical application of sound experimental practice. Many candidates showed good practical knowledge when answering **Question 4** but it was clear that a number had not been prepared for this or had limited experience of basic experimental work.

Comments on specific questions

Question 1

(a) Most candidates read the thermometer correctly. However, a small number read the scale as 20.1°C.

(b) A small number of candidates either did not complete the headings or did not write the symbol for degrees Celsius correctly. The time column was usually correct but a small minority of candidates listed times in minutes instead of seconds.

(c) Many candidates found it difficult to give specific precautions for ensuring temperature readings are accurate. Commonly accepted responses were either descriptions on how to avoid parallax error or ensuring the thermometer bulb was not touching the beaker. Incorrect responses referred to room temperature or repeat readings.

(d) (i) Most candidates were able to identify which lid caused a greater rate of cooling. However, only about half of the candidates could justify this successfully by referring to the full range of results. Credit was not awarded to those that compared the temperature change in the first 30 seconds only, compared the final temperature readings without reference to the initial water temperature, or who gave theoretical responses.

(ii) The question regarding changes to the apparatus was answered successfully by stronger candidates. Many candidates overlooked the requirement for the change to be to the apparatus only.

(e) Stronger candidates answered this question correctly. These candidates could identify what a graph line showing a directly proportional relationship would look like. It was more common for candidates to refer to a straight line than the fact that the line would pass through the origin.

(f) Most candidates were able to suggest a factor that should be kept the same. A common response was room temperature.

Question 2

(a) About half of the candidature drew the correct voltmeter symbol in parallel with the correct resistor. A common error was to draw the voltmeter in series.

(b) The majority of candidates gave the correct readings from the ammeter and voltmeter as well as providing the correct units. A small number misread the ammeter scale and gave the reading as 0.83 A.

(c) Most candidates calculated the power values correctly and gave their answers to a consistent number of significant figures – either two or three.

(d) Candidates needed to recognise that they were only required to describe the change in value rather than trying to identify an overall pattern. Many recognised that the power increased at first and then decreased as the resistance continued to increase.

(e) This question proved challenging for many candidates. Responses needed to show that the resistance was the independent variable. The best responses identified the need for at least five different values for resistance or the need to draw a graph.

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Question 3

(a) Most candidates measured the height of the triangular-shaped hole correctly. However, it appears that a small number of candidates did not use a ruler to do this successfully.

(b) The majority of candidates measured the height of the image and carried out the calculation successfully. However, some candidates gave answers to less than two significant figures.

(c) Many well-drawn graphs were seen. Most candidates labelled the axes correctly and chose a suitable scale. Whilst plotting was generally accurate, some candidates had plots that were too large and using small crosses is always recommended. The graph line should have been straight and well-judged with roughly an even distribution of plots either side.

(d) Many answers lay within the expected range, with a clear large triangle shown on the graph. Triangles that were less than half of the graph line were not accepted.

(e) Identifying difficulties and suggesting improvements for measuring the height of the image proved to be difficult for many candidates. A small number of stronger candidates recognised that the screen would move when a ruler is placed against it, or that the hand and ruler would cast a shadow over the image. Those that gave these responses usually went on to suggest clamping the screen in place. An even smaller proportion described the use of a translucent screen.

Question 4

Nearly all candidates followed the instructions provided and drew a diagram to show how the equipment would be used. Unfortunately, many candidates were not clear on what a pulley was and often confused it with a force meter leading to an incorrectly drawn and labelled diagram.

There were two different methods for the investigation that could have been described – either using a force meter to measure the force required or using masses on the end of a string hanging from a pulley on the end of a desk. Despite no mention of distance in the question, many candidates described a method where they recorded a distance. There were other candidates who required the block to be pulled a certain distance before measuring the force, which conflicted with what the question was asking for.

Those candidates who carefully used the bullet points given in the question normally answered well and ensured that all areas of the question were addressed. Some candidates neglected the need for a description of the variables to be controlled or a description of the graph that should be drawn however.

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