PHYSICS

Paper 0972/11
Multiple Choice Core

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

General comments

Questions 4, **14**, **15**, **16**, **18**, **25**, and **29** were often answered correctly. However, **Questions 1**, **3**, **12**, **17**, **20**, **23**, **34** and **39** proved more challenging for many candidates.

Comments on specific questions

Question 1

The question was challenging for many candidates and only the strongest candidates recognised that there are two changes of direction in each complete oscillation of the pendulum.

Question 3

The most common response was **A** which showed that candidates understood that the ball is slowing down as it rises but did not recognise that the deceleration indicated that the acceleration was in the opposite direction to the speed. The second most common error was to choose option **C,** which shows that candidates thought that the speed increased as the ball rose.

Question 4

Many candidates recognised that the instrument used to measure mass is a balance.

Question 11

Candidates understanding of the term power was not secure, with almost equal numbers of candidates opting for option **A** (the key), **B** and **C**.

Question 12

This question proved challenging with many candidates selecting one of the incorrect options.

Question 15

Almost all candidates recognised that the diagram represented evaporation of a liquid.

Question 17

To solve this problem, candidates needed to recognise that the melting point of the required substance not only needed a boiling point greater than the boiling point of water (0°C) but also a boiling point of greater than the boiling point of water (100°C).

Question 20

Only stronger candidates knew that light travels as a transverse wave, and even amongst those that knew this basic fact, many did not know that the vibrations in a transverse wave are at right angles to the direction of travel of the disturbance.

Question 23

Many candidates did not read the question carefully enough and thought that option **A** was correct. However, candidates who read the question more carefully selected the correct option **B.**

Question 28

Only the strongest candidates answered this question correctly. Many candidates had little idea of the direction of the magnetic field at point near a magnet. Responses were spread across all four options.

Question 29

This was a well-answered question with almost all candidates recognising that a current in a metal wire is due to electron flow.

Question 30

Although most candidates recognised that the longer wires would have more resistance than the shorter wires, few recognised the inverse relationship between the resistance and the diameter of the wire.

Question 37

The structure of the atomic nucleus was not well known, with many candidates unable to identify the correct statement.

Question 39

Many candidates did not appear to take notice of the word ‘not’ which was emboldened in the question, and so selected an incorrect answer.

PHYSICS

Paper 0972/21
Multiple Choice Extended

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

General comments

Questions 1, **4**, **6**, **7**, **11**, **14**, **25**, **36** and **39** were answered very well. **Questions 8**, **10**, **13**, **23**, and **27** proved more challenging for many candidates.

Comments on specific questions

Question 6

This question had several steps to reach the correct answer, and most candidates successfully negotiated these steps.

Question 7

This was usually answered correctly, and candidates had a firm understanding of simple balancing problems.

Question 8

This was not well understood by many candidates. Most candidates simply added the three forces, unaware that when adding vectors direction must also be considered.

Question 10

This question proved challenging and the most common choice of response was option **A**, zero.

Question 11

Candidates showed an excellent understanding of efficiency.

Question 13

Although many candidates gave the correct answer, it was clear that many had difficulty in working with powers of ten. This is a skill which needs regular practise throughout the course.

Question 23

Many candidates did not read the question carefully enough and thought that option **A** was correct. However, candidates who read the question more carefully selected the correct option, **B**.

Question 27

It was apparent that relatively few candidates had seen the experiment in which a steel rod (which has been carefully demagnetised) is placed parallel to the Earth's magnetic field and is hammered. Before hammering the rod will not attract small pieces of demagnetised iron (e.g. pins), but afterwards it will pick them up.

PHYSICS

Paper 0972/31
Theory Core

Key messages

Some candidates are unclear about what does or does not count as a significant figure. Centres should encourage candidates not to round to 1 significant figure and set practise exercises on this topic.

Centres should encourage candidates to ensure that working and answers to numerical questions are as clear as possible. Candidates should write all answers, particularly those including numbers, clearly to ensure they are legible.

General comments

The majority of candidates were well prepared for this exam. The majority were able to apply their knowledge and understanding of physics to the questions set to produce correct responses.

Candidates should ensure their responses are worded as clearly as possible and relate to the content of the questions. In some cases, candidates stated a property had changed but failed to state how it had changed, i.e. increased / decreased.

Comments on specific questions

Question 1

(a) The vast majority of candidates answered this correctly, giving the correct answer as 12.0 s.

(b) The majority of candidates answered this question correctly. The most common error was to forget to subtract 96 from 100.

(c) The majority of candidates scored full credit for an answer of 8.3 m / s. The most common error was to use the wrong time or a wrong distance.

(d) Many candidates found this item challenging. The main source of error was in comparing the whole race rather than between 3.0 s and 6.0 s.

Question 2

(a) The vast majority of candidates answered correctly. The most common error was failing to read the question carefully enough and simply writing the mass reading on the top pan balance.

(b) With allowance for an error carried forward, the vast majority of candidates scored full credit here. The most common error was to recall an inverted form of the equation for density.

(c) Most candidates answered this well. The most common error which resulted in candidates not gaining full credit, was failing to convert the mass from grams to kilograms.

Question 3

(a) (i) The majority of candidates scored full credit. The most common source of error was adding the three forces. Centres should ensure that candidates do not use directions such as east or west as their answer.

(ii) Candidates found this item challenging. Only stronger candidates were able to describe energy transfers from kinetic energy to thermal energy as a result of friction in the brakes.

(b) The vast majority of candidates answered this question well. The calculation of the moment of a force was well understood by most candidates. However, they did not always recall the correct unit, with the vast majority writing N / m or N / cm.

Question 4

(a) Almost all candidates were able to correctly sequence the main stages in the operation of a coal-fired power station.

(b) This question was answered well by many candidates.

(c) (i) and (ii) The concepts of work done and output power were not well understood. Only the strongest candidates gained full credit here.

Question 5

(a) (i) The majority of candidates answered this fully correctly. The most common errors were to either invert the equation for pressure, or to simply multiply the force and the area.

(ii) Candidates found this question difficult, with only the very strongest candidates awarded full credit. The pressure reading on a U-tube manometer was not well understood by most candidates.

(b) This was generally well answered, but often preceded by an answer about what happens to the pressure when the temperature rises. Weaker candidates failed to give an answer about what happens to the pressure when the temperature decreases.

Question 6

(a) The vast majority of candidates scored full credit as the simple kinetic molecular model of matter was well understood.

(b) The majority of candidates answered this fairly well. The most common error was in using the limits of the thermometer rather than the information given in the question in attempting to calculate the temperature indicated by the thermometer.

Question 7

(a) (i) Only the strongest candidates answered this question correctly. The majority of candidates gave an answer of 40° instead of 50°.

(ii) Lack of precision often resulted in only partial credit here. Candidates should be encouraged to use a ruler and protractor for reflection diagrams. A significant number of candidates failed to answer on **Fig. 7.1**, and drew a new diagram in the space below.

(b) (i) Very few candidates were able to identify 12 cm as the focal length of the lens.

(ii) Few candidates calculated the image distance as 21 cm.

(iii) Only the strongest candidates gave two correct properties of the nature of the image. Generally, ray diagrams for thin lenses were not well understood by most candidates.

Question 8

(a) (i) Very few candidates correctly identified microwaves as the electromagnetic wave used for a mobile phone signal.

(ii) The vast majority of candidates answered this correctly.

(b) (i) Most candidates answered this question well. A common error was to give the upper limit of the range as 20 000 kHz.

(ii) The majority of candidates gained at least partial credit here. The most common error was a contradiction such as "*the wave for note B has a lower frequency and a shorter wavelength*".

Question 9

The majority of candidates scored full credit. The most common error was to state that metal bar RS was made from a non-magnetic material.

Question 10

(a) (i) Very few candidates answer this question correctly. The most common error was to draw the voltmeter in series with the wire, whilst those candidates who remembered it should be connected in parallel drew the voltmeter in parallel with the variable resistor.

(ii) The majority of candidates answered this well. The most common errors were to state beta particles or just charged particles.

(iii) The majority of candidates stated that the size of the current would decrease, but only the strongest linked this to an increase in the resistance of wire CD compared to XY.

(iv) This was usually answered correctly. The most common error was to simply write voltage.

(b) (i) The majority of candidates correctly calculated the combined resistance as 16.1 ohms.

(ii) The vast majority of candidates did not realise that the current in the variable resistor was the same as the current in wire CD.

Question 11

(a) (i), (ii), (iii) The majority of candidates gained at least partial credit for this question. The most common error was in determining the nucleon number, with many candidates adding the number of electrons to the number of nucleons to give an answer of 10.

(b) Many candidates found this calculation challenging. The concept of half-life was not well understood by most candidates.

Question 12

(a) The majority of candidates gained at least partial credit for this question. The most common error was in stating that the current in circuit A was somehow transferred to the heater in circuit B.

(b) The vast majority of candidates gained full credit by calculating the output voltage of the transformer as 15 V. The most common error was not to recall the transformer equation, but to try and determine the output using a form of ratios.

PHYSICS

Paper 0972/41
Extended Theory

Key messages

- For calculations, candidates should be advised to first write the relevant equation in the learned form, then, if necessary, rearrange it so that quantity asked for is the subject, substituting in the numbers from the question or calculated in a previous part and once the calculation is performed, to write down the correct answer to at least the appropriate number of significant figures and following it with the correct unit.
- Sometimes, a quantity given in a question needs to be converted to a base quantity before the substitution is made. This is very commonly the case when the quantities in the question are expressed in centimetres, grams or minutes.

General comments

Occasionally there were candidates who seemed to be familiar with much if not all of the syllabus but who gave answers that did not deal with the specific question that was asked. They indicated an understanding of the topic in general but did not mention the exact points that the question demanded. Candidates should be reminded to the read all questions carefully.

The mark allocation for each part gives an indication of the style of answer that was required and combined with the command word used, provides enough information for candidates to be able to decide what is needed. The more discursive questions can usually be answered with direct and exact statements that need not be complete sentences, provided the meaning is clear and correct.

Comments on specific questions

Question 1

(a) This part was extremely well answered with almost all candidates obtaining the correct answer. The most common error was giving an incorrect unit. Of the incorrect units supplied, the most frequently given was kg / m / s.

(b) (i) This was commonly misunderstood. The command word in the question was “state”. However, many candidates attempted a calculation of some sort which was unnecessary and did not lead to the correct answer.

(ii) Many candidates did not understand what was required by this question. Some stronger candidates attempted to draw a scale diagram. Some candidates who drew an accurate diagram and made the correct measurements, presented a numerical answer to only 1 significant figure. A greater precision was needed for full credit.

Question 2

(a) Most candidates realised that the velocity of the ball would increase during this period of time, but fewer gave any indication of the significance of the term “uniformly”. There were candidates who did not understand what was happening and some stated very clearly that the ball would decelerate when it entered the liquid. Answers which described what happened after the short period of time mentioned in the question were ignored provided that they did not contradict a correct answer already offered.

(b) Most candidates were able to gain some credit in this part and some candidates gained full credit. There were candidates who confused the decreasing acceleration of the ball with a deceleration and this often led to a further confusion concerning the variation in the resistance force that was acting. It was not always clear which stage of the motion was being referred to. Some answers did not clearly separate the motion as terminal velocity was being approached, from the motion when the ball was travelling at terminal velocity.

(c) (i) and (ii) There were many completely accurate answers to these two parts and the two equations were well known by nearly all the candidates. The most common reason for full credit not being awarded was not converting the mass in the question to kilograms before calculating the two answers. When using the equation for kinetic energy, there were candidates who either omitted the squared term when substituting the numbers or, having performed the substitution correctly, did not square the speed when calculating the answer. A few candidates did not supply the correct unit for either one or both answers.

(iii) A few candidates realised what was being asked for, but there were many who did not. Common incorrect answers included "because they are two different quantities" or "because gravitational potential energy is dependent on g".

Question 3

(a) Most candidates used the distance 0.200 m in the expression $h\rho g$ rather than the correct value 0.400 m. Other sources of inaccuracy included not adding the atmospheric pressure to hydrostatic pressure or less commonly, finding the difference between these two pressures.

(b) (i) Some candidates calculated either the fully correct answer or used an incorrect value from **(a)** completely correctly, but many did not. A common source of error was to ignore the effect of the atmospheric pressure on the right-hand side of the piston when determining the resultant force.

(ii) There were more fully correct answers to this part, and it was generally quite well answered. There were candidates who either omitted a unit from the final answer or who used an incorrect one and the most common of these was N.

Question 4

(a) This part was quite well answered with the majority of candidates providing two or three molecular differences between a liquid and a gas. Nearly all candidates were able to supply one difference. An occasional error arose when candidates described one molecular feature of a liquid in one part of the answer and then when referring to the opposite feature also attributed this to a liquid. A few candidates listed the differences between a liquid and a solid.

(b) Many candidates stated, in some way, that the molecules speed up when a liquid is heated but a smaller number of candidates made any reference to an increase in the molecular separation.

(c) (i) Many candidates were able to supply a satisfactory answer to this part.

(ii) A significant majority of candidates were able to score full credit for this part. A common error was what is essentially the power-of-ten error of calculating the mass of the liquid in grams but using the unit J / kg for the final answer. There were also other unit errors, and these included supplying a final answer unit of J / (kg°C) which is the unit of specific heat capacity.

Question 5

(a) This question proved challenging and many candidates interpreted conduction to mean any thermal energy transfer process. Answers in terms of convection and radiation were more common than those that referred to conduction using free electron movement. A few candidates who recognised that free electron conduction was being asked for gave an answer that described the conduction process by which vibrating atoms collide with their neighbours but substituted the word electron for atom.

(b) Only the strongest candidates answered this question correctly. Even though the temperature of the cooking oil was 120°C, many candidates supplied answers in terms of the thermal absorption property of a brightly polished, shiny surface rather than in terms of its emission property. Some candidates took the shiny surface to be the inside of the cooking container.

(c) Only a few candidates answered the question by stating that the energy would be lost at a smaller rate. Answers in terms of evaporation were not unusual but were rarely correct.

Question 6

(a) Although many candidates correctly stated that the wave speed decreased as the wavefronts crossed the boundary and were awarded some credit, a much smaller number of candidates were able to explain how the decrease in speed resulted in a change of direction. Those who did gained full credit.

(b) (i) Most candidates approached this part in the correct way and scored some credit. Two common errors were using the speed in m / s but keeping the wavelength in cm and using the distance from the diagram as the complete wavelength rather than half of it.

(ii) Many candidates found this question challenging and only a minority realised that the two angles could be used to supply the ratio of the speeds in the two sections of the shallow tank. There were candidates who attempted to use the equation $v = f\lambda$ again even though the new wavelength was not supplied. This often led to the original speed being given as the final answer. There were candidates who made the correct calculation but then gave the answer to 1 significant figure and were not awarded full credit.

Question 7

(a) The correct material was almost always underlined or indicated in some other way. Where credit was not awarded, it was usually because at least one other material had also been underlined. In this situation, soft iron was the most frequent incorrect selection.

(b) (i) Few candidates stated what is meant by the direction of a magnetic field. The most frequent suggestion was that it was the direction of the force on a positive charge. Presumably such an answer is the consequence of a magnetic field being confused with an electric field.

(ii) Many candidates were able to suggest that the beam of electrons would be deflected by the magnetic field, but few candidates were able to apply the Fleming left-hand rule (or any other appropriate rule) correctly. Common answers suggested a deflection towards one of the magnetic poles and a deflection out of the page was more frequently suggested than a deflection in the correct direction.

(c) Many candidates had a clear idea of what was expected in this part and full credit was often awarded. A small number of candidates offered explanations in terms of the penetration properties of the different types of radiation. Such an approach did not answer the question as it was set.

Question 8

(a) Although some candidates were able to give a definition equivalent to the one in the syllabus, many candidates were not.

(b) (i) and (ii) The calculations in both parts were almost always approached in a suitable manner and they were very often completely correct. When candidates were not awarded full credit, it was most frequently because the equation $V = IR$ was rearranged incorrectly or because the unit supplied with the answer in **(ii)** was not suitable. Sometimes the unit given was the J and on other occasions, it was because the prefix did not correspond to the numerical value. An example of the latter would be the answer *1920 kW*.

(iii)1 The approach to this part was often correct but answers were not always sufficiently quantitative, and answers highlighted a few common misunderstandings involving current. Some candidates stated that the original current would now be shared equally between the two parallel resistors and other stated that the current in both of the parallel resistors would be equal to the original current.

(iii)2 Very few candidates deduced a value for the maximum total current that the electric heater would require and then went on to use it when suggesting a suitable fuse rating. The majority of candidates felt that a fuse rating greater than 20 A would be needed and gave explanations that suggested that the purpose of the fuse in a circuit was not in fact understood.

Question 9

(a) (i) This was often correct, but many candidates did not give an answer that was an observation.

(ii) The answers given to this part were of variable accuracy. Some candidates stated the two conditions accurately and succinctly. Other candidates were uncertain of what was required and produced answers that were either not related to what was being asked or were a mixture of one correct and one irrelevant answer.

(b) Many candidates were awarded some credit for indicating how light or infrared radiation travels along an optical fibre or for making an accurate reference to total internal reflection. Many candidates gave no more details and made no reference to the use of such fibres in communication technology. Occasionally candidates mentioned the light or infrared signal being encoded or carrying a message.

Question 10

(a) There were some good answers here with many candidates able to state what was meant by background radiation and almost all candidates suggested one source. A few candidates offered incorrect explanations in terms of microwave ovens or radio signals or thermal radiation.

(b) (i) Almost all candidates realised that alpha-particles were being emitted by the sample and most of these gave an acceptable explanation. An answer such as "*because alpha-particles are weakly penetrating*" did not relate directly to the question as it had been set and was too vague for credit.

(ii) There were many good answers and full credit was often awarded. Sometimes an error occurred when the daughter isotope was given the symbol Po rather than Pb. There were candidates who positioned the nuclide symbol for the alpha-particle on the same side of the equation as the nuclide symbol for the polonium-208 nucleus and added them.

PHYSICS

Paper 0972/61
Alternative to Practical

Key messages

- Candidates need to have 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 experience 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 showed evidence of having experience of similar practical work. Some candidates appeared to have learned sections from the mark schemes of past papers and wrote responses that were not appropriate to the questions in this paper. For example, see **Questions 2(d)(ii)** and **3(f)**.

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

It is expected that numerical answers will be expressed to a number of significant figures which is appropriate to the data given in the question or a measurement carried out by the candidate.

Comments on specific questions

Question 1

(a) (i)–(iv) The majority of candidates successfully recorded the *l* and *w* values in cm. The volume calculation was correct in most answers. Most candidates gave the mass to the nearest g. The density needed to be given correctly and with the unit g / cm^3. A few candidates tried to convert to kg / m^3 which would have been acceptable but most who attempted the conversion did so incorrectly.

(b) (i) Most candidates recorded the volume correctly.

(ii) Candidates were expected to give the value of density to two or three significant figures.

(c) Here candidates were required to make a judgement based on their own answers. The justification needed to be clear and consistent with the results to score credit. Most candidates scored partial credit, but many made a vague comment without showing any understanding of the concept of results being beyond the limits of experimental inaccuracy.

(d) Candidates were expected to know the best way to read a value from a measuring cylinder but significant numbers of candidates did not tick the appropriate boxes "perpendicular to the scale" and "in line with the bottom of the meniscus".

Question 2

(a) Most candidates recorded room temperature correctly.

(b) (i)–(iii) Many correctly completed tables were seen. Most candidates calculated the drop in temperature correctly and the average rate of cooling. However, there were some incorrectly rounded values for the rate of cooling.

(c) (i) and (ii) Most candidates completed the second table successfully. Candidates were expected to be able to work out the unit for the rate of cooling, °C/s, from the units for temperature and time.

(d) (i) and (ii) In **(i)** most candidates correctly calculated the temperature differences. In **(ii)**, candidates were expected to realise that when the temperature difference D was higher, the average rate of cooling R was greater. The justification required the values to be quoted in support of the conclusion.

(e) (i) and (ii) Most candidates knew that reading the scale at right angles is a precaution taken for accuracy. Some candidates explained clearly and concisely the need to thoroughly mix the hot and cold water. Some candidates gave a response that was too vague or missed the point.

Question 3

(a) Most candidates measured the height correctly, but some missed the unit, cm.

(b) Most candidates were able to complete the table with correct calculations for m. Candidates were required to give their values to two or more decimal places.

(c) Most candidates labelled the graph axes correctly and drew them the right way round. Some candidates ignored the instruction to start the y-axis at 20.0 cm and chose a scale that resulted in the plots occupying too small a proportion of the graph grid. Plotting was generally accurate. Candidates should use neat crosses for the plots, or neatly circled dots so that the accuracy of the plotting can be assessed. Many candidates drew a well-judged curve although some drew a 'dot-to-dot' line and others drew a straight line that did not match the plots.

(d) Candidates needed to show the method clearly on the graph and many did this by carefully drawing a horizontal line and a vertical line in the correct places. Most were able to read off the correct u value.

(e) Candidates who had carried out the calculations and graph plotting with care obtained a value for the focal length within the permitted tolerance.

(f) Candidates were expected to answer this part from their experience of lens experiments. Some suggested responses indicated a lack of familiarity. However, others were able to describe precautions, such as using a darkened room or ensuring the object lens and screen are vertical, with confidence.

Question 4

Candidates who followed the guidance in the question were able to write concisely and addressed all the necessary points. A significant number of candidates copied the list of apparatus given in the question. This was unnecessary and often introduced a vague explanation of the investigation.

Most candidates drew the correct symbols for the ammeter and voltmeter, but the voltmeter was placed in series with the other components by a significant number of candidates. Candidates needed to show clearly (using a simple label) the position in the circuit of the test wire.

Many candidates correctly suggested three, four or five different metals that could be tested. However, some candidates only listed two metals or included an insulator, e.g. plastic.

A concise explanation of the method was required. Candidates are not expected to list apparatus or standard precautions (for example, avoidance of parallax). Candidates should concentrate on the readings that must be taken. It may benefit candidates to plan their table of readings before writing the method to help them to consider the measurements that must be taken in order to address the subject of the investigation. Candidates were expected to include measurements of current and potential difference and the calculation of resistance. Candidates then needed to make it clear that the procedure is repeated with at least two more wires of different metals. A vague reference to repeats was not sufficient as it is not clear whether the candidate was referring to using different wires or repeating the measurements with the same wire.

Candidates were expected to identify at least one variable to keep constant. The length or diameter of the test wire were correct suggestions. Some candidates suggested keeping the potential difference and current constant. This meant that the experiment would not work.

Many candidates drew a suitable table. They were expected to include columns for type of wire, V (or potential difference), I (or current) and R (or resistance) with the last three including the appropriate units. Some candidates confused the symbol with the unit, for example heading a column current / I.