PHYSICS

Paper 5054/11
Multiple Choice

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

General comments

Some questions highlighted topics within the syllabus which candidates find harder to understand and where certain misconceptions very commonly arise.

The questions which proved the most accessible were **2**, **3**, **10**, **11**, **16**, **17**, **32**, **38** and **40**. That these questions tested a wide variety of topics from many varying sections of the syllabus, show that many candidates have sought to understand the entire syllabus content, rather than concentrating on their favourite or most easily understood ideas.

Candidates are advised to read the questions carefully and, where necessary, to calculate a numerical answer before looking at the alternative answers. Particular care should be taken when units are not given in their base forms.

Comments on specific questions

Question 5

The most significant two words in this question occur in the phrase *on man's* which appears twice in the table headings. As the man pushes the box along the ground, the force on the box is clearly to the right whilst the force on the ground is to the left. A very significant majority of candidates identified this but, of these, only a minority selected answer **B** which gives the directions of the forces *on* the man. Rather more chose answer **C** which gives the directions of the forces exerted *by* the man.

Question 6

This question deals with the behaviour of an object that is experiencing no resultant force. Whilst such an object might be at rest, it might also be travelling at constant speed in a straight line. Consequently, the train in answer **C** is experiencing no resultant force. That it is travelling uphill, merely ensures that the applied force must be of sufficient magnitude and direction to cancel out the effect of gravity as well as the other forces acting on the train. A common answer was **B**. Whilst the force of gravity on the Moon is less than that on Earth, it is not zero and a rock in free-fall will be accelerating towards the surface of the Moon.

Question 20

In this question a hot liquid that is cooling to room temperature and the horizontal section of the graph shows that a change of state is taking place at a temperature that is greater than room temperature. This change of state must be solidification; condensation is the change of state that occurs when a gas becomes a liquid. Whilst the solidification process is taking place, there is, inevitably, some liquid present and this liquid exposed to the atmosphere is evaporating.

Question 21

Most candidates realised that when a fixed mass of gas in a syringe is heated at constant pressure, its volume increases uniformly with the temperature. At 0 °C, however, the volume of the gas would still be greater than zero and the answer **A** cannot therefore be correct. It is at absolute zero that the volume of a gas can be considered to be effectively zero.

Question 22

The periodic time of this sound wave can be calculated using the frequency given as 0.020 s. The distance between a compression and the adjacent rarefaction is one half of the wavelength and so the time for the wave to cover this distance is half of the periodic time and the correct answer is 0.010 s (answer **A**).

Question 29

The material used for magnetic screening is iron. Many candidates were unfamiliar with this fact and *plastic* (answer **C**) was commonly selected.

Question 33

The correct answer here is **D**, a thermistor. The circuit is closed and the temperature of the thermistor begins to rise. The consequent decrease in the resistance of the thermistor causes the current in the circuit to increase until, a few minutes later, a new equilibrium is reached. If the box contains any of the other components, then the current increases initially, but does so extremely quickly before either reaching a constant value or decreasing.

Question 34

The charge on an α-particle is positive and so the current direction is from left to right. The application of the right-hand rule for the motor effect then gives the direction of the magnetic force on the beam of α-particles. The correct answer was only the second most frequently chosen, possibly suggesting an unfamiliarity with this part of the syllabus.

PHYSICS

Paper 5054/12
Multiple Choice

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

General comments

A very large number of candidates had clearly worked hard in preparation for the paper and had obtained a convincing and encouraging insight into the subject at this level. There were several questions where a very significant majority of the candidates selected the correct answer and the topics that these questions covered were from many different sections of the syllabus. It is clear that many candidates are making a great effort to study the subject in its entirety.

There were many questions which the candidates found more accessible than others and these included **3**, **7**, **8**, **10**, **11**, **18**, **27**, **33** and **37**. It was encouraging to see that the question on electromagnetic induction (question **30**) was well answered as this is a topic which candidates often find difficult.

Comments on specific questions

Question 6

This proved to be a question where the correct answer, **C**, was less popular than answer **A**. The dependence of kinetic energy on the speed of a moving object can easily be used to show that a distance-time graph of a car with constant speed has the same shape as one for a car with constant kinetic energy.

Question 9

There was more than one stage to this calculation and they each involved the calculation of moments due to different weights. The important point for candidates to remember is that all the moments must be taken about the same point.

Question 13

In order to obtain the correct answer here, candidates needed to know that the pressure of the atmosphere decreases with height. The effect of this on the mercury in the manometer could then be deduced. Many candidates selected the correct answer, but all of the incorrect alternatives were chosen by a significant number of candidates.

Question 14

Most candidates chose the correct answer; they were aware that the pressure in the ocean increases uniformly with depth. Since the atmospheric pressure is acting on the surface, the graph does not start at the origin.

Question 19

The mercury expands uniformly as temperature increases and so the correct answer can be obtained by the appropriate application of proportions. Many candidates did this but some did not correctly take into account the effect of the end section of the scale where a portion of the length corresponds to a temperature below 0 °C.

Question 20

The correct answer was commonly selected by candidates and it is clear that the precise meaning of the term *sensitivity* is properly understood by a large proportion of the candidates.

Question 24

In this question a hot liquid is cooling to room temperature and the horizontal section of the graph shows that a change of state is taking place at a temperature that is greater than room temperature. This change of state must be solidification; condensation is the change of state that occurs when a gas becomes a liquid. Whilst the solidification process is taking place, there is, inevitably, some liquid present and this liquid exposed to the atmosphere is evaporating.

Question 29

This relatively straightforward calculation of speed was complicated by the need to obtain a mean value for the time taken. In addition, a significant number of candidates chose the answer that implies that they had not doubled the distance of 200 m to obtain the total distance travelled.

Question 32

A large majority of candidates realised that, the sphere would end up being negatively charged. Most of these chose the correct answer, **A**. In situations such as this, it is always the negative charges (electrons) which move. Those who erroneously suspected that the positive charge moves away, chose an incorrect answer.

Question 34

Most candidates selected the correct answer, **C**. The transformer does rely, for its operation, on a magnetic field but no force is required to make the transformer work. Although they were very much in a minority, some candidates chose answer **D**, possibly because of this.

Question 35

The bell in the circuit is operated by a switch and so it must be either on or off. It follows that changes to the switching mechanism cannot alter the loudness of the bell rings except to switch it off completely. It is only answer **C** that does not affect the switching mechanism; it affects the current in the bell.

Question 39

Most candidates realised that a beta-particle is an electron and the majority of these selected the correct range. There were candidates, however, who chose answer **C**; this answer does not include the correct range.

PHYSICS

Paper 5054/21

Theory

Key messages

- Candidates should set out answers to numerical questions giving a formula, numerical working, the answer to a sensible number of significant figures and the unit.
- Candidates should concentrate on answering the question that has been asked. Marks are only given for the specific answers required, not for comments on related matters. However, when asked to explain an answer, candidates should try to apply the physical principles that relate to the question.
- Complex mathematics, e.g. the use of the cosine rule and logarithms, often lead to mistakes when candidates are not sufficiently practised in their use. These methods do not need to be used and easier methods are more appropriate at this level.

General comments

A good number of candidates knew the definitions and equations tested in this examination. Candidates ned to realise that their responses should be clear and that the stages in their calculations should be shown; a number of candidates merely wrote down their final numerical answer without any working, and, as a consequence, did not always benefit from the full range of marks available. Where working is shown, credit can be given for any understanding demonstrated and candidates should be encouraged to show their working, as requested on the front of the paper.

Comments on specific questions

Section A

Question 1

(a) The definition of velocity in terms of speed and direction or rate of change of displacement was well known.

(b) Although the basic idea of a vector diagram was understood by most candidates, many diagrams contained vectors that were at right angles to each other, rather than being at 45° to each other. Even when the vectors to be added were correct, the wrong resultant was often drawn. The correct method, when adding vectors to produce a triangle is for the arrows on the vectors to be head to tail, and when producing a parallelogram, the resultant is the diagonal that lies between the two initial vectors. Many candidates tried to use the cosine and sine rule to calculate the resultant and its direction. There was no need to use this formula, as a simple scale drawing was more than adequate, and the use of these formulae sometimes led to mistakes, for example, where the cosine of 135° was used as a positive number. The errors caused were mainly because the mathematics involved was too difficult.

Question 2

(a) Voltage and current were often reversed. Weaker candidates sometimes gave the units or the meters rather than the quantities involved.

(b) Although the formula was well known, the performance of some candidates would have been improved if they had clearly differentiated between energy and specific heat capacity in the equation quoted. The unit for the final answer was known by many candidates, but when a candidate cannot remember the unit it can often, as here, be worked out from the S.I. quantities used in the calculation.

(c) The performance of some candidates would have improved by careful reading of the question and a realisation that the question asks how the hot air moves away from the block. Many answers mentioned radiation, which may occur, but is not involved with the movement of the hot air. Evaporation was often described as though air was escaping from the aluminium block.

Question 3

(a) Most candidates correctly suggested that the lens was converging or convex.

(b) Magnification was often described correctly either with a definition or with simple statements such as "how many times bigger the image is than the object". Weaker candidates incorrectly gave the ratio as the height of the object divided by the height of the image.

(c) Many candidates need to draw rays more carefully; joining and continuing a ray from the top of the image to the top of the object. The focal length can be read from the distance from the lens where this ray crosses the principal axis. Many candidates attempted to use the lens formula and, unfortunately as the image is virtual, the calculation is difficult. The lens formula is not in the syllabus and questions are not set that rely on its use and the answer can be obtained directly from the diagram. Only a few candidates were able to answer the last section of this question successfully. Even good answers often only included one extra ray from the top of the stamp, whereas the question asks for two.

Question 4

(a) Most candidates drew correct arrows on the field lines.

(b) There were many answers which showed some understanding of the concept of magnetic lines of force and many candidates were able to explain that the soft iron ensures that the field does not extend below the box. Good candidates recognised that the paper clips must be temporary magnets and will lose most or all of their magnetism.

(c) Candidates often did not recognise that, without magnetic screening, the electrons in the cathode-ray oscilloscope are deflected.

Question 5

(a) Although many diagrams showed both positive and negative charges on the sphere U, it was unusual to find these positive and negative charges to be equal in number, as they should be since U was initially uncharged.

(b) Whilst many candidates recognised that U must become positive, some answers did not recognise that the question asks what happens to the charges in the two spheres as they touch. The best answers suggested that part of the positive charge on C is neutralised. Repulsion of like charges was often successfully used to explain the repulsion of U and C. Candidates should be able to distinguish between poles and charges and should not suggest in an electrostatics question that that like poles repel.

Question 6

(a) Many answers correctly showed the forces on the coil. Sometimes the forces drawn were not on the correct sides of the coils.

(b) The explanation of why there is no turning effect was rarely convincing and candidates need to be able to distinguish between a motor and a generator, as answers often suggested that there is no cutting of field. The best answers explained that the two forces act through the same point and can have no moment.

(c) Diagrams often needed to be better drawn. Many diagrams did not show the split ring as two halves of a ring and often these halves were not shown connected to the coil or to the brushes correctly. Many candidates correctly suggested that the current reversed at some point in the rotation, but descriptions of how this causes a continuation of the rotation in terms of the forces on the sides of the coil were comparatively few in number.

Question 7

(a) Many candidates gave a higher value of the output voltage when the contact is at B, rather than at A.

(b) Although many answers correctly suggested that the resistance of the thermistor decreases as temperature rises, only the best answers then explained how a potential divider leads to a decrease in voltage. Many answers merely assumed that the current was constant, whereas it actually increases. In the calculation, the equation was well known, but the majority of answers used a total resistance of 1000 Ω and not 3000 Ω.

Question 8

(a) Many candidates gave a correct description of the particles and their numbers within the nucleus. A number of candidates incorrectly stated that there were also 53 electrons in the nucleus. Where it was clear that these electrons were circulating the nucleus there was no penalty. When describing what happens in radioactive decay, many answers defined half-life, which was not required, and did not describe the important properties, such as the emission of alpha, beta and gamma from the nucleus.

(b) The idea of randomness in radioactive decay was not always suggested, and the calculation in **(ii)** was a challenge to many candidates. Candidates needed to calculate an average initial count and then divide it by two for each of the three half-lives. Some candidates attempted to use the exponential function and decay constant. These were almost always unsuccessful because of errors in the mathematics. Marks were available for calculating the average and showing the principle of halving. Many candidates incorrectly halved the nucleon or proton number rather than any value of the count.

Section B

Question 9

(a) The definition or meaning of pressure was known by many candidates, but it was better to define this as the force per unit area rather than the force on a certain area. Many candidates incorrectly explained that pressure increases with depth because surface area decreases or that the density of the water is larger. Simple explanations, such as the increased weight of water, were comparatively rare.

(b) The descriptions of energy changes within an electrical pump needed to be relevant to what happens inside the pump. Although the pump was stated as being electrical, and is clearly producing a fountain of water, many candidates suggested that the water was acting as a renewable energy source and producing electrical energy from potential energy. Candidates should try not to write down lists of energies, but state that, for example, electrical energy changes to kinetic energy in the moving parts of the pump or in producing the water, and that some heat is also produced.

(c) The formulae for density, work and power were well known and it was unusual to find a candidate who was not able to calculate the mass of water. Weaker candidates found difficulty in using the idea of one hour as the time when finding the power.

(d) Many candidates found it difficult to describe how to measure density. The mass of the water must be measured by subtracting two masses or by using the tare function on a balance. Simple details, such as the instrument used to measure the volume, were often lacking.

Question 10

(a) Many candidates were able to define wavelength successfully.

(b) Descriptions of the motion of a molecule of air due to sound needed to refer to the motion. Many answers merely referred to the arrangement of the molecules in the diagram and not to their actual movement. Good answers described the longitudinal vibration of the molecules and even suggested that molecules A and B move in opposite directions as they are half a wavelength apart.

(c) There were many good answers showing understanding of the experiment, although a significant number of candidates did not know any experiment to show that a medium is needed to transmit sound waves. Such candidates attempted to answer the question by describing the action of a loudspeaker or other source of sound.

(d) The calculations involving sound were usually good, although a number of candidates needed to recognise that the sound travels to and from the wall when calculating the speed. The formula relating speed, frequency and wavelength was well known and changing the wavelength from millimetres into metres was usually, but not always, correct. The last section proved the most challenging, but many candidates were able to answer this question correctly and realised that the distance required was half the wavelength.

Question 11

(a) The definition of potential difference was well known and stated as the work done or energy produced per coulomb of charge passing through the lamp.

Many answers correctly explained that the graph is not a straight line. Good answers then suggested that this is because the resistance of the filament lamp increases or that the temperature increases.

Many candidates knew the basic equations for charge and energy, and often the only error in the calculation was in converting hours into seconds. The question asks in **(iii)4** why the answer obtained is only an estimate and this proved a challenge to most candidates. Only a few answers suggested that the battery may still have some energy stored even when the torch was not producing any light. Other correct answers included the idea that the current or voltage is unlikely to be constant during the whole discharge time of the cell.

(b) The most common correct answer was to suggest that two cells in parallel last longer than a single cell. In some answers there was no explanation of why this occurs, either, in the case of the cells lasting longer because each cell in parallel has half the current of a single cell or that the two cells together have twice the energy.

(c) Candidates commonly drew the wrong circuit symbol for an LED and the switch in the circuit was often placed in a position where it where it did not switch all the cells on and off. The circuit diagram needed to combine the four cells to produce a total e.m.f. of 3.0 V. This can be achieved by having two sets of two parallel cells connected in series, or with three cells in parallel connected to the fourth cell in series. Many answers showed cells connected together in such a way that they would discharge themselves without passing any current through the LED.

PHYSICS

Paper 5054/22

Theory

Key messages

- Candidates should set out answers to numerical questions giving a formula, numerical working, the answer to a sensible number of significant figures and the unit.
- Candidates should concentrate on answering the question that has been asked. Marks are only given for the specific answers required, not for comments on related matters. However, when asked to explain an answer, candidates should try to actually apply the physical principles that relate to the question and not merely state them.
- Candidates should take care in marking and drawing distances particularly when drawing ray diagrams with a ruler. They should not write over sections of their answers that have been rubbed out.
- Complex mathematics, for example in radioactive decay does not need to be used; easier methods are much more appropriate at this level.

General comments

A good proportion of candidates had clearly been well prepared for this paper, and standard definitions and concepts were generally well known. Equations were also generally stated correctly, and it was encouraging that most candidates were able to rearrange the relevant equations correctly.

There were occasions, when candidates had to apply their knowledge to a new situation, where it would be helpful for explanations to be more logical; starting from fundamental principles and applying them to the situation. More practice in applying knowledge and understanding to unfamiliar situations might deepen candidates' understanding and improve their performance.

Although the majority of candidates attempted the questions in a sensible manner, others needed to read each question carefully and ensure that they actually answer each part of the question. In particular, when asked to "describe" and "explain" they should structure their answer accordingly and they should know the difference between these two command words.

The English language ability of the vast majority of the candidates was more than adequate for the demands of this paper. Weaknesses in spelling and grammar are not penalised by Examiners who seek to give credit for correct physics responses. It is helpful if candidates realise that their responses should be clear and that the stages in their calculations should be shown. A number of candidates merely wrote down their final numerical answer, without any working, and, as a consequence, did not always benefit from the full range of marks available. Candidates should be advised to plan their answers, but they should avoid writing their answers in pencil, rubbing the pencil marks out and then writing over the rubbed-out sections in ink. Reading such answers can be very difficult.

Question 11 was the least popular question in ***section B***, but some very good answers were seen to this question.

Comments on specific questions

Section A

Question 1

(a) The majority of answers correctly suggested that D was the larger force and gave an adequate reason. A few explanations were not quite sufficient, as a reference to acceleration or a resultant force forwards was needed. A good understanding was shown of the nature of resistive forces, as either friction or air resistance and that the driving force is larger than the resistive force because there is acceleration in the forward direction. A number of candidates insisted that the two forces were equal because of Newton's third law of motion. Candidates should realise that B and D are not a Newton's third law pair, as these two forces act on the same object.

(b) The calculations of weight and acceleration were encouraging, although some candidates failed to give the correct, or any unit, for the acceleration.

(c) An encouraging number of answers correctly stated that, as direction was changing, then so must velocity and acceleration. Other correct answers described the centripetal force as being towards the corner. There was a slight confusion with centrifugal force in some answers and explanations involving centrifugal force are best avoided at this level. In general, candidates showed good understanding that acceleration requires a change of either velocity or direction.

Question 2

(a) The formula for pressure was well known and used correctly. A significant number of candidates gave the unit of their answer as Pa rather than N/cm^2, but had not converted their area into m^2. There was no requirement to give the pressure in Pa and many candidates encountered problems in converting cm^2 into m^2.

(b) Successful arguments used the idea that the volume of oil moving between the pistons is the same or that the work done by the forces is the same. Other answers unsuccessfully attempted to use pressure arguments to suggest why the large piston moves through a shorter distance.

(c) Most answers demonstrated a reasonable familiarity with the concept of efficiency. The complete idea of efficiency in terms of the fraction of input energy that is turned into useful output energy was not always clear and many answers were of the form "efficiency is the output energy of a system", rather than a comparison, as a ratio or a percentage, of useful energy output to energy input. Explanations in terms of power and work were also common and successful.

Question 3

(a) It was helpful when candidates gave some detail in their answers, for example "railway tracks" was often given as an example where expansion is useful and also where it causes a problem; good answers suggested, for example, that fixing or riveting bolts to a railway track is an example of the use of expansion and the bending or buckling of a railway track is a problem. It was often clear, in the examples quoted, that expansion was useful, e.g. in a thermometer, but otherwise some detail was necessary.

(b) It was encouraging to find many good answers where an increase in molecular vibration led to the molecules being further apart. Some answers were less clear, stating, for example, that the molecules themselves expand, or that bonds are broken, rather than simply that the distance between the molecules increases.

(c) Most candidates were correct in at least one of the two statements. Although there are exceptions to the general rule, solids are considered to expand slightly less than liquids and gases to expand much larger than liquids.

Question 4

(a) The general understanding of the motion in a transverse wave, wavelength and amplitude was very good. Some candidates would improve by taking more care in drawing the distances involved; in particular the wavelength drawn was often significantly less than the correct length on the diagram. Some answers suggested that the hand moves backwards and forwards, but the largest number of errors were made in drawing the amplitude. This was often wrongly drawn as the distance between the top and bottom of the wave.

(b) Most answers made sensible suggestions about timing a number of waves being that pass a point, but only the best answers then divided the number of waves by the time taken. A large number of candidates merely measured the number of waves created in one second, which is difficult as the frequency is likely to be less than 1Hz.

(c) Although most answers correctly suggested that the student should make slower movements of his arm, a surprising number of candidates suggested that moving the hand higher and lower or faster produces a larger wavelength.

Question 5

(a) A good knowledge was shown of the electromagnetic spectrum with only a few answers incorrectly suggesting that sound or radioactive particles such as alpha rays are in the electromagnetic spectrum. A few weak candidates gave common properties of the components of the electromagnetic spectrum, such as “can travel in a vacuum” rather than the name of other components of the spectrum.

(b) Some candidates showed a good understanding of refraction by explaining that blue light slows most when entering glass because the refractive index of blue light is larger than red. This then causes the larger deflection for blue in the prism. Other candidates merely suggested that glass has a higher refractive index than air, but did not explain why this caused dispersion in the prism and they may not have realised that different colours have different refractive indices. A good understanding was shown of the different wavelengths and frequencies of red and blue light but this did not always lead to an explanation of dispersion.

Question 6

(a) The majority of answers gave a correct distance in **(i)**, usually within the focal length of the lens. However, most answers incorrectly gave a value in **(ii)** just larger than the focal length. It was apparent by the drawings made in a few very good answers that some candidates had worked out that the width of the beam was greater than 1 cm at a distance of more than 2f from the lens, but such answers were uncommon.

(b) Diagrams could often have been improved if drawn with slightly more care and accuracy. Common faults were to draw a ray that did not quite pass through the focal length, or that was slightly bent as it passes through the optical centre. Explanations of why the diagram shows the image to be more than 11 cm from the lens were usually encouraging, often as they suggested that the rays do not meet on the diagram. Those candidates who had drawn the correct ray diagram commonly described the image correctly in **(iii)**.

Question 7

(a) There were many correct answers giving the direction of the force, although many candidates did not realise that the needle was midway between the magnet's poles and so field lines and the force are horizontal at this point. Only a few very good answers mentioned that a moment is created or that the force acts at a distance from the pivot and thus causes a turning effect. Many candidates only gave an explanation of why there is a force rather than why this force causes the magnet to turn.

(b) Candidates who produced a good diagram to help their explanation usually scored well. However, it was apparent that some answers would improve if candidates were able to explain logically and sequentially the sequence of actions involved in using a compass to plot field lines. Often, compasses were placed at random and their directions marked, rather than the compass moved on from one position so that the compass was moved so that its tail was next to the previous position of its head. A few candidates described the use of iron filings only.

Question 8

(a) The charge and mass of the particles in the nucleus were well known. However, some answers gave only one particle in **(i)** or **(ii)**, which indicated a misunderstanding of the question.

(b) A reasonable number of candidates appreciated that beta decay leaves the nucleon number unchanged, but increases the proton number by 1. A large number of candidates obtained the correct age of the piece of wood, usually by halving the original number twice to obtain the final number. They then realised that the time involved was two half-lives. A common mistake was to try to halve the half-life itself and some candidates were not able to deal with the powers of ten involved in the question. A number of answers attempted to use complicated equations, for example with $(1/2)^n$, but the solution of these equations often led to errors and they do not need to be used at this level.

Section B

Question 9

(a) The speed-time graph was generally drawn well. However, the speed axis in some answers was discontinuous and sometimes a speed of 2.4 m/s was actually plotted as 2.8 m/s.

(b) The technical language used in explaining the idea of uniform acceleration was generally encouraging, with correct expressions involving rate of change of velocity being common.

(c) The majority of candidates correctly explained that the time taken for deceleration was shorter than the time for acceleration or that the speed-time graph was steeper in the deceleration phase.

(d) The concept of obtaining the distance covered from the area beneath the speed-time graph was understood by most candidates. Some errors were made in obtaining the correct values or by finding the distance travelled in 9.0 s rather than 8.0 s. Various numerical methods were used to calculate the area.

(e) The formula for potential energy was well known, with only a few candidates giving the wrong unit or failing to give any unit to their answer. A number of candidates did not realise that the answer to **(ii)** requires a comment about the apparent loss of energy.

(f) Some very good answers were seen, for example where the cable or ground was marked at equal distances in the middle section and the girl was timed as she moved between these distances. However, more detail was required in a large number of answers, which often only measured one distance and one time interval or repeated the run, appearing to time exactly the same distance twice. This may have shown that the speed was the same when the run is repeated, but did not show that the speed was constant in the middle section.

Question 10

(a) The question asks candidates to describe how water in a pan loses heat by conduction and convection. There were many good answers. Many candidates did not apply their knowledge to the question itself, but instead, described how the water itself cools down internally. Much credit could be gained in such answers, when the description described how the energy involved in molecular collisions was passed on from molecule to molecule or when hot fluid rises. Other answers did not answer each section specifically and included explanations that involved several different methods of heat transfer and even evaporation, when their answers should have been about conduction or convection. Some candidates gave standard answers without taking into account the particular circumstances of the question.

(b) Many answers successfully suggested that black surfaces emit more thermal radiation or more infra-red radiation. Some candidates only suggested that black emits more heat and some suggested that black is a better absorber or conductor and so absorbs more heat from the hot water, which was not accepted. Most candidates suggested that, when the pans were covered, the loss of heat was reduced, and it was encouraging that a large number of answers gave sufficient detail, relating this to a drop in convection or evaporation and described the effect of this reduced heat loss on the results of the actual experiment.

(c) The definition of specific heat capacity was well known, although a number of candidates had difficulty in producing a complete definition. The equation was usually given correctly, although there was sometimes confusion between energy and specific heat capacity. It appears better to express thermal energy as E or Q rather than C, giving the equation, for example, as $E = mc\Delta T$ or other variations, rather than $C=mc\Delta T$. Other common errors were to use the time of 8 minutes as a temperature rise, confusing T in the equation with time. There were a number of errors in reading the temperature difference from the graph; a common error was to assume that the initial temperature was 100 °C rather than 94 °C. However, it was encouraging to find many candidates correctly using a mixture of equations and observations from the graph to obtain the correct answers.

Question 11

(a) The symbols for an ammeter and voltmeter were almost universally correct, but very often at least one meter was in the wrong position. The ammeter was most often placed incorrectly, and candidates should realise that it is in series with the lamp rather than the power supply in the circuit shown.

(b) Many answers correctly suggested that the resistor R limits or reduces the current. Other answers were vague when suggesting that R controls the current. Many candidates recognised that the limiting effect of R would protect the filament lamp, preventing it blowing or burning out. It was encouraging when candidates realised that, since the power supply has a voltage of 18V and the lamp a working voltage of 12 V, if the movable contact is at the top of the potential divider the lamp will blow.

(c) Although there were many correct drawings of the current-voltage graph for a lamp, it was comparatively unusual for the graph to be drawn with a bend in the correct direction, without it becoming horizontal or having a negative gradient; some graphs for a filament lamp were even drawn as a straight line. Answers to **(ii)** were mixed, with some candidates, when comparing the lamp and the fixed resistor, successfully stating that the resistance of the lamp increases at high currents and temperatures, whereas the fixed resistor has a constant resistance; others failed to suggest that a fixed resistor produces a straight line graph or wrongly suggested that the straight line was horizontal or vertical, i.e., parallel to one of the axes. Statements that the lamp does not obey Ohm's law were not generally helpful.

(d) The calculations were encouraging, as good use was made of the equation relating potential difference, current and resistance. Simple mistakes were, however, made when the voltage across the 50 Ω resistor was taken to be the full 18 V of the supply, rather than the voltage across the lamp which was stated to be 12 V. The most common error was to give the value of current in R as the current in the 50 Ω resistor, rather than adding on the current in the lamp.

PHYSICS

Paper 5054/31
Practical Test

Key messages

- Candidates should ensure that they are familiar with the apparatus listed in the syllabus; that they are able to use the apparatus in order to obtain accurate measurements, and that they are able to follow instructions with care.
- Candidates should be reminded to include a unit with any measured or calculated quantity.
- The majority of measurements are taken to two or three significant figures and so the answers to calculations should be quoted to the same degree of precision.
- The data plotted on a graph should always occupy as much of the page as possible, but the scale used should be easy to follow so that data can be easily read from the graph.
- Candidates should be reminded to check all plotted points, especialy those that that lie some way from the best fit line.
- Most quantities in Physics vary continuously, so a smooth curve or best fit line through plotted data should be drawn. Lines joining points dot-to-dot are rarely appropriate.

General comments

Candidates were required to record their measured values within an appropriate range. For example, in **Question 1**, Supervisors were asked to provide half-metre rules with a mass in the range 40 g to 60 g. Allowing for some experimental error, candidates were expected to give a mass in the range 30 g to 70 g. There was a similar situation in **Question 2**, where the focal length of the lens was specified to be in the range 14.5 cm to 15.5 cm, so that a relatively small range of focal lengths was expected. If Supervisors are unable to provide materials in the specified range, then a note of this should be written on the *Report on Practical Physics* (found in the Confidential Instructions) so that due allowance can be made. **Question 4** emphasised the need for candidates to processes their results, which made the paper slightly more challenging for weaker candidates.

Comments on specific questions

Section A

Question 1

(a) Many candidates realised that they had to measure the height of the string above the bench in order to check that the section AB of the string was horizontal. However, some candidates only measured the height at one point rather than two, and others used an inverted set square with the point on the bench rather than using the set square to check that the measurement was vertical. The better candidates showed the metre rule at two points on the diagram with the set square being used between the metre rule and the bench to check that the metre rule was vertical.

(b) It was expected that the distance, l would be in a very narrow range of between 47.8 cm and 48.2 cm and the majority of candidates obtained a value in this range. However, only the best candidates recorded their measurements to the nearest mm. Candidates are expected to take measurements appropriate to the precision of the instrument used.

(c) Many candidates obtained a reasonable value for the mass of the half-metre rule. Some candidates omitted the unit; others gave the value of the mass to an inappropriately large number of significant figures.

Question 2

(a) If the screen had been translucent and the image had been viewed through the screen, then the left hand side of the object would have been on the right hand side of the screen. However, the screen was being viewed from the same side as the object so the left hand side of the object would appear as an image on the left hand side of the screen. Under normal viewing conditions it would be expected that the image would be laterally inverted, but for this arrangement it is not. However, lateral inversion was allowed for one of the properties of the image. A surprising number of candidates did not follow the instructions and said that a diminished image had been formed.

(b) Candidates were expected to find the spacing between the images by using more than one division on the object, for example, measure the distance on the screen between the image of the 4 cm division on the object and the image of the 7 cm division. This distance would have been of the order of 12 cm so that the spacing for one division would have been 12 cm / 3 (= 4 cm). This technique was only used by the best of candidates and often had to be deduced from the working that was shown **(b)(ii)**.

Candidates were instructed to place the object at the 0.0 cm mark and the screen at the 100.0 cm mark. The position of the lens was then to be adjusted to form a magnified image of the object on the screen. There were many cases where it was obvious that a diminished image had been obtained or that the lens and the screen had been moved closer together. This resulted in the wrong values for v and m and this error was not carried forward to the final value for f.

Question 3

(a) The majority of candidates obtained a correct value for the voltage. The only mistakes that were made were either that the unit was omitted or the voltage was only quoted to the nearest volt, for example 2 V. A common error with the current measurement was that the wrong unit was used, for example, 65 A, rather than 65 mA.

(b) If the current was measured in mA, candidates were credited for a correct power calculation given in mW. Unfortunately, a number of candidates did an incorrect conversion from mA to A and therefore lost the mark for the subsequent calculation of power. There were a relatively small number of candidates who omitted the unit or used the wrong unit for power. As significant figures were penalised in **Question 1**, there was no penalty for using incorrect significant figures here. However, powers were often quoted to one significant figure, possibly because candidates were confusing significant figures and decimal places.

(c) A small decrease in voltage and a large increase in current were expected with resistor R_2 was added in parallel with R_1 and many candidates obtained results showing this.

(d) Candidates were expected to calculate the new value of the power and comment on the change in at least two of the three quantities, voltage, current and resistance.

Section B

Question 4

(c) The mark for part **(b)** was awarded in the table on page 10 and a sensible value for m was included in the calculation on page 12. Some candidates used a combination of minutes and seconds in their table; others gave the unit ° rather than °C for temperature. Some candidates abbreviated minutes to ‘mins’, which was accepted; others used ‘m’, which was not accepted as it can be confused with the metre.

Most candidates obtained a reasonable set of values of temperature and time. Only a small number of candidates interpolated between the divisions of the thermometer to obtain a least one temperature measurement to a precision of better than 1 °C. Good candidates took temperature readings every half minute, which was required for a mark.

(d) Graph plotting skills were generally good with many candidates awarded full marks for their graph. It was expected that the temperature axis would not start at the origin because the lowest temperature achieved was often in the region of 50 °C. A minority of candidates started their axis at (0, 0). The most common error was the use of a scale that was based on 3 cm, which is inappropriate and makes the checking of plotted points more difficult. Weaker candidates lost the mark for the line because they joined the points dot to dot rather than drawing a smooth curve through their points.

(e) Good candidates drew a tangent at the correct point and used a large triangle when determining the gradient of the graph. A number of candidates did not draw a tangent and used two points on the curve to find the gradient. This is not an acceptable method to find the gradient of a curved graph at a point.

(f) Supervisors reported that the 80 cm^3 mark on the beakers did not give a very accurate volume so the allowed range values for *M* was much wider than initially anticipated.

(g) The majority of candidates could make a correct substitution of their values, but often failed to gain credit for their calculation because of an incorrect unit. Most candidates had a rate of change of temperature that was measured in °C/min which would have given a power loss in J/min, but most candidates gave this in Watts even though they were obtaining answers of the order of 1200 W, which was too large for this context.

(h) Good candidates gave suitable precautions that they had taken. A number of candidates stated that they had repeated their readings, but there was often no evidence of this in the table.

PHYSICS

Paper 5054/32
Practical Test

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Question 4

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Most candidates obtained a reasonable set of values of temperature and time. Only a small number of candidates interpolated between the divisions of the thermometer to obtain a least one temperature measurement to a precision of better than 1 °C. Good candidates took temperature readings every half minute, which was required for a mark.

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(f) Supervisors reported that the 80 cm^3 mark on the beakers did not give a very accurate volume so the allowed range values for *M* was much wider than initially anticipated.

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(h) Good candidates gave suitable precautions that they had taken. A number of candidates stated that they had repeated their readings, but there was often no evidence of this in the table.

PHYSICS

Paper 5054/41
Alternative to Practical

Key messages

- Candidates should be discouraged from giving a list of answers when only a single statement is required. This was particularly noticeable in **Question 1 (b)**. Candidates may lose the mark if the list contains an incorrect response in addition to the correct answer.
- Candidates should avoid creating scales based on multiples of three (or other odd numbers).

General comments

There were some sections in this paper that the candidates found challenging, such as, understanding where voltage is dropped in a series circuit in **Question 1 (d)(i)** and in making an estimate of a value in **Question 3(a)(i)**.

Many candidates performed well in **Question 4** which required a description of an experiment and in **Question 2** which required them to explain and comment on possible errors and how to avoid them in taking readings from a thermometer in a beaker of water.

The graph work was generally good with many candidates able to draw a best fit smooth curve.

Comments on specific questions

Question 1

This question required candidates to demonstrate an understanding of voltmeters and how they are used.

(a) Most candidates were able to state that the quantity being measured was voltage or potential difference. An alternative acceptable answer was electromotive force (e.m.f.), but this was not often seen. Some candidates lost the mark for giving the unit volt rather than the quantity measured.

Weaker candidates often stated ‘electricity’ or any other quantity or unit, the most common being ‘ohms’.

Candidates should be discouraged from writing more than one response, as lists will be penalised if there is an incorrect response given, e.g. the candidate who wrote *‘potential difference, voltage, volts’* lost the mark for including volts in the list.

(b) Most candidates scored the mark here for reading the meter correctly. A few candidates lost the mark by omitting the unit. In this instance, the response 3.60 V was not penalised for too many significant figures as the scale could be read to 0.05 V.

(c) This mark was gained by many candidates, with the most common correct responses being that the digital voltmeter has no parallax error or no needle to stick. Some explained that the digital meter is a direct reading or stated that it was easier to read. Easier to use was not sufficient.

Responses such as ‘they are more accurate’ were common, but were ignored.

(d) (i) Very few candidates scored all three marks. Many scored one mark for knowing that the potential difference (p.d.) across AB was 4 V. A few candidates realised that the p.d. across DC was 2 V and only a very few candidates appreciated that there is no voltage drop across a connecting wire so the p.d. across AD must be 0 V.

(ii) There were some excellent responses, with candidates explaining that the current decreases if the resistance increases, so the voltage across DC would remain the same.

Some candidates clearly understood the situation and simply stated that as the cells had not been changed the voltage would be unchanged.

Question 2

This question involved the practical details of taking temperature readings to plot a graph. Candidates needed to understand the difficulties of assembling and using the apparatus to get accurate readings.

(a) (i) Most candidates were able to mark a horizontal line from the meniscus and show the position of the eye. Most candidates drew an optics eye which was looking towards the thermometer, or labelled the line. A few candidates drew the eye very close to the thermometer which was not accepted.

(ii) Although some candidates appreciated that the problem was the liquid level in the thermometer being below the rim of the beaker, many did not give sufficient explanation and simply stated ‘to avoid parallax error’. Candidates needed to explain why there may be parallax error here.

(iii) Many candidates did not give sufficient information in their answers. The idea that the reading on the thermometer would fall if taken out of the water was required.

(iv) Most candidates were able to read the temperature shown on the thermometer correctly. The most common incorrect response was 40.3 °C. Some candidates lost the mark by omitting the unit.

(b) (i) Candidates were required to put headings in the table. Each heading needs both the quantity and unit. The more able candidates gained both marks, but some failed to give the units. Amount of water was not accepted as an alternative to volume.

It was perhaps surprising that some candidates did not appreciate what measurements were being taken, and simply wrote ‘Beaker A’ and ‘Beaker B’ in the headings. Others thought it was a cooling curve and put time/s in one heading.

(ii) In general, the graph was well done with many candidates drawing a smooth curve through their points. However, candidates should be reminded that when choosing a scale, multiples of three are not acceptable, even if the values given in the table (as here) are multiples of three. It is important to be able to read values from the graph easily.

It is pleasing to see many candidates now using small neat crosses to plot the points, which is the preferred method. Those using dots often make them too big and lose the plotting mark.

(iii) Candidates with a sensible scale usually managed to read the value here correctly as 57 °C ± 1 °C.

(iv) Although most candidates appreciated that the beaker needed to be large enough to hold the 450 cm^3 water, some had not understood the experiment and gave answers such as ‘because the water is hot’ or ‘to allow room for the stirrer’.

(v) Few candidates gave the response that the experiment would take too long and gained the mark by simply stating that it would require too much water. Many candidates linked this answer to the previous question and said the beaker would not be large enough.

A surprisingly large number of candidates gave the unacceptable response that this was not possible because the graph did not go below 30 °C.

Question 3

This question required the candidates to be able to make a reasonable estimate and choose the most suitable equipment for a list.

(a) (i) It was disappointing that so few candidates were able to give an estimate of the volume of the marble. Candidates were required to obtain a value in the range required and give a suitable number of significant figures. Many candidates carried out a calculation without showing their working and ended up with values ranging from 1 to 5270.51 cm^3. Common incorrect answers were 7.8, 8 and 10.

As an estimate was required, it was expected to be given to no more than 0.1 cm^3, i.e. to between 0.5 and 1.0 cm^3. It was disappointing that some candidates, who gave an answer in the right range and to a suitable number of decimal places, then lost the mark by omitting the unit.

Some candidates averaged the volume values given in the table.

(ii) Many candidates were unable to suggest the most suitable measuring cylinder. With two marks available, candidates needed to give two clear reasons, based on the diameter of the marble and its volume. Most candidates scored one of the two marks.

(iii) Most candidates gave an excellent description of how to use the measuring cylinder to measure the volume of the marble.

(b) This part was well reasoned by many candidates and many used their knowledge of glass measuring cylinders to explain that they can break easily and then used the diagram to explain the flat meniscus made it easier to read in the plastic measuring cylinder.

Question 4

Candidates were required to describe an experiment with a convex lens. Candidates who were able to visualise how such an experiment could be carried out, and hence give practical details, were more successful in this question. Candidates are expected to have experienced a range of practical tasks and this will benefit them in this type of question.

It was pleasing to see many candidates score full marks in this question. There were many excellent diagrams showing the apparatus being used correctly.

The first two marks were for describing the apparatus used and how it was used. The third mark was for repeating with the lens reversed and the last mark for referring back to the prediction of the candidate.

Many took the obvious route of measuring the focal length using either a distant object or an illuminated object and plain mirror. Some of those using the plain mirror were confused as to how to use it correctly.

Some able candidates simply used an illuminated object to obtain a clear image on a screen and then reversed the lens. If the image was still in focus the focal lengths were the same. This simple approach could score full marks.

Some candidates lost the last mark by not referring back to the prediction. Others simply agreed with the candidate and stated the focal lengths would be different.

It is important to remind candidates to go back and read the question again to make sure they are actually answering the question asked.

PHYSICS

Paper 5054/42
Alternative to Practical

Key messages

- Candidates should be discouraged from giving a list of answers when only a single statement is required. This was particularly noticeable in **Questions 1(c)**, **2(e) (ii)**, **4(a)(ii)** and 4**(b)**. Candidates may lose the mark if the list contains an incorrect response in addition to the correct answer.

- Graph work was generally completed well, but candidates should avoid creating non-linear scales. Also, many candidates confused an inverse relationship between two variables with inverse proportionality.

- Terminology still causes problems for the weaker candidates with confusion between horizontal, vertical and perpendicular. Weaker candidates often just comment on something being ‘difficult to measure’ with no explanation as to why it is difficult. Also, just stating ‘makes it more accurate’ is not a sufficient answer without some more detailed explanation.

General comments

Many candidates demonstrated a good understanding of the practical details in each question and answered clearly, using good technical language.

On this Alternative to Practical paper, candidates need to be aware that accuracy in annotations on diagrams and in completing ray diagrams is important and many lost marks due to insufficient care in joining points or adding lines denoting a length.

Although many candidates were able to complete the numerical calculation in **Question 4(a)(i)** correctly, many were unable to measure the lengths accurately or give the final answer to two significant figures.

Comments on specific questions

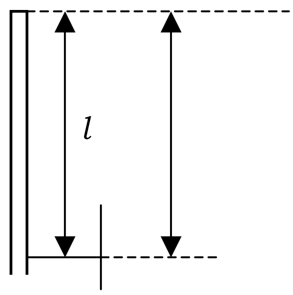
Question 1

This question concerned a simple experiment with a wooden rod being made to sink by adding a mass in the form of an elastic band. The candidates were required to plot a graph, describe the problems encountered and show an understanding of a fair test.

(a) (i) Although most candidates knew the distance to label was between the water surface and the top of the rod, many were not careful enough in making the labelling line to show the exact distance l.

If the candidates drew the labelling line from the water, then the lower end needed to actually touch the water, and the upper end should have a horizontal line level with the top of the rod (see diagram).

If the labelling line was drawn outside the beaker, then it should have horizontal guide lines drawn level with the water and the top of the rod. The labelling line should actually touch the horizontal lines as shown.



(ii) The most common correct response was that the rod would move.

A common response that was not credited was 'due to parallax error'. An explanation of why parallax error may occur was needed.

(iii) There were some excellent answers, but many lost marks by not giving a description of how they would measure l. Practical detail was required. Many simply stated 'repeat and find the average' or 'use two people' without giving any practical detail.

(b) (i) The graph was generally well executed. The most common error was to give a non-linear scale, labelling the 2 cm marks on the grid as 1, 3, 5, 7, etc. These candidates were able to gain the plotting marks as the error was outside the range of the points.

The third marking point for correct plotting requires the points on the graph to be plotted to within ½ a small square. Some candidates, who used dots, lost the mark as the dots were too large. The preferred method is to use a neat cross, which avoids this possible error. Most candidates were able to draw a best fit straight line with points above and below the line.

(ii) The first marking point was given for stating that it was an inverse relationship and the second for stating it was linear.

Many candidates believe that all inverse relationship graphs are necessarily inversely proportional and stated that it was a straight line and inversely proportional. Candidates giving this contradiction did not score the second mark.

(iii) Most candidates gained the mark here. Some surprising answers were seen, such as 0 and 7.

(c) Many candidates clearly understood the need for a fair test, and stating this gained the mark. Others identified the mass or weight of the elastic band as being the important quantity to keep constant. There were many instances of candidates giving a list of quantities.

Question 2

This question concerned use of an ammeter. It involved reading a scale accurately and describing how an ammeter is used in a circuit.

(a) Most candidates were able to give the correct answer. The candidates were not asked for the unit so should be reminded to avoid giving additional information that is not required in their answers.

(b) Many candidates were able to explain that the resistance of the ammeter would reduce the current in the circuit. Some, however, had no clear understanding and comments such as 'to avoid a short circuit' or 'so as not to damage the ammeter' were common.

(c) Candidates were expected to be able to read the ammeter to 0.01 A. Some candidate gave an answer of 0.68 A or 0.66 A which is to the nearest scale division and not correct. Answers to a higher precision, such as 0.667 A were not accepted. The unit was required. Some candidates lost the mark for omitting the unit.

(d) The most common correct responses seen were 'no parallax error' and 'needle does not stick'. Answers stating the digital meter was 'easier to read' were accepted, but 'easier to use' was insufficient.

(e)(i) Most candidates gained the mark here by stating a well learned fact that current is the same at all points in a series circuit.

(ii) Very few candidates were able to appreciate that the difference in the reading had to be due to differences in the calibration of the meters and not a difference in the current. Common answers were that the resistance of the meters were different or that it was because the one meter came after the resistor.

The most common correct answer was 'due to a zero error in the meters'.

Question 3

This question required the candidates to be able to draw a normal accurately and measure angles and lengths on a diagram.

(a) (i) The normal was generally drawn correctly, within the tolerance of about ± 1°.

(ii) Few candidates were able to draw the refracted ray accurately (within the tolerance of about ± 1°), but most candidates did gain this mark. Common mistakes were to draw the line at angles of 19° or 29°, showing incorrect use of a protractor. A few candidates drew the refracted ray to the left of the normal.

(b) (iii) Many candidates were able to follow the instructions and obtain values for AB and PB within the acceptable limits.

(v) Many candidates were able to measure AC and PC accurately.

(vi) Marks were awarded for a correct calculation from the candidates' answers to **(b)(iii)** and **(b)(v)**. The appropriate number of significant figures was two or three, in line with the raw data. Candidates lost the mark by giving too many or too few significant figures.

A considerable number of candidates lost the mark by leaving their answer as a fraction. A ratio should be quoted as a single number or as n:1. A few candidates lost the mark by giving their answer a unit.

(c) Most candidates were able to draw the line of the emergent ray parallel to the incident ray.

Question 4

Candidates were required to measure the three sides of a block of microscope slides and perform a simple calculation to find the volume of one slide. Candidates who were able to visualise how such an experiment could be carried out, and hence give practical details, were more successful in this question. Candidates are expected to have experienced a range of practical tasks and this will benefit them in this type of question.

(a) (i) In this question, candidates were asked to 'state clearly any measurements taken and show how the volume is calculated'. Some candidates lost marks by not giving all their working.

The first mark was awarded if the candidates gave the equation for volume of a cuboid or clearly showed their three measured values multiplied together.

Many candidates were unable to measure the sides to within 0.5 mm. Many lost this mark by just stating the height of one slide to be 0.1 cm, and not showing the measurement of the height of the ten slides. The most common incorrect answer was that the width of the slide was 7.5 cm.

The third mark was for clearly showing the height or the final volume divided by ten.

The final mark was for completing the calculation and giving the answer to two significant figures with the correct unit. Many lost the mark by being unable to round 1.976 cm^3 correctly to 2.0 cm^3. Some ignored the instruction and gave 1.976 cm^3; others just dropped the last two figures and gave 1.9 cm^3. Some candidates ignored the zero giving the answer as 2 cm^3.

(ii) The most common correct answer here was 'the slides are thin'. Common responses that did not gain the mark included 'the height was difficult to measure' and 'to make it more accurate'.

(b) Most candidates were able to give the name of the instrument used here, the most common being beam balance or spring balance. Some candidates, however, lost the mark by giving additional equipment such as measuring cylinder, beaker or water. A few candidates did not understand what was meant by a measuring instrument and gave the quantity mass.