SPECIMEN

GENERAL CERTIFICATE OF SECONDARY EDUCATION

B763

FURTHER ADDITIONAL SCIENCE B

Cameras

CONTROLLED ASSESSMENT
TEACHER GUIDANCE

INSTRUCTIONS TO TEACHERS

- This document is confidential to teachers and must not be released to candidates.
- For details of the level of control required for this assessment refer to Section 5 of the specification.
- Internally assessed marks must be submitted by 15 May.
- This document consists of **16** pages. Any blank pages are indicated.

Teacher guidance – Cameras

Introduction

Controlled assessment tasks for GCSE Further additional Science require candidates to:

- develop hypotheses and plan practical ways to test them, including risk assessment
- manage risks when carrying out practical work
- collect, process, analyse and interpret primary and secondary data, including the use of appropriate technology to draw evidence-based conclusions
- review methodology to assess fitness for purpose
- review hypotheses in light of outcomes.

This controlled assessment consists of one task divided into three parts. The task is centred on a particular idea, that of how the images produced by cameras are focused. This idea is investigated through Parts 1, 2 and 3. The parts should be taken in this order.

Preparing for the assessment

It is expected that before candidates attempt this controlled assessment task they will have received general preparation in their lessons. The details of practical techniques, the development of skills associated with these techniques, and the methods and choice of equipment for the task should be covered when teaching the particular part(s) of the specification which the controlled assessment task relates to, and should be completed prior to setting the task.

Further advice on the conduct of controlled assessment tasks can be found in the *Guide to Controlled Assessment* for this specification, published on the OCR website.

From their work in Module P5, candidates will be familiar with convex lenses, the effect they have on diverging and parallel beams of light, and their use in a range of optical instruments (P5h). Candidates should also be familiar with using a convex lens to focus the image of a distant object on a screen.

Candidates should be made aware of the:

- health and safety issues
- need to provide a quantitative evaluation of the data collected
- sources of experimental errors.

Assessment of the quality of written communication

The quality of written communication is assessed in Parts 2 and 3 of this controlled assessment and indicated by a pencil symbol (✎) for the information of candidates. Candidates should be advised that where the pencil symbol occurs, their quality of written communication will be assessed. Further information about the assessment of quality of written communication may be found in the specification.

Part 1 – Research and collecting secondary data

- Research activities **1.5–2 hours**

Candidates are given the Part 1 stimulus material which requires them to carry out research using books/internet/surveys. They will need to plan how they are going to carry out the research and collect their results for use in Part 2 and Part 3. The research can be carried out during lessons or as a homework exercise.

Candidates complete Part 1 under limited control. The work of individual candidates may be informed by working with others and work may be completed out of the classroom but candidates must provide an individual response. Teachers may give generic, informal feedback while the work is being completed but may not indicate what candidates need to do to improve their work. Candidates should not be given the opportunity to redraft their work, as this is likely to require an input of specific advice. Candidates should be made aware of the time allowed for carrying out this part of the task. Candidates' access to resources is determined by those available to the centre and/or to candidates at home.

The research information should be brought into the classroom. The candidate working individually should use the information to address the issues on the stimulus sheet. The candidate's individual work must be carried out under supervised conditions and retained by the teacher.

All work should be recorded on loose-leaf paper, and may be hand written or word processed.

The candidate's work should be available for Parts 2 and 3. They may not redraft the work completed in Part 1.

The information will be used by the candidates to answer specific questions in the answer booklet and should be attached to the answer booklet for Part 3 so that it can be marked.

Part 1 ends with the collection of the candidates' work and research.

Candidates require the Part 1 stimulus material below.

Cameras

Part 1 stimulus material: Research and collecting secondary data

A simple camera, like the one shown in the picture below, has a convex lens that forms a real image on a film that is sensitive to light.

You are going to do some research into cameras.

You should find out:

- how the convex lens forms the image
- the conditions, under which a convex lens forms real images
- what the camera's bellows are used for
- why a 'fixed-focus' camera in a mobile phone does not need bellows.

You will need to:

- write a detailed list of all the sources you used
- write up the information you have found for use in Part 2 and Part 3.

Part 2 – Planning and collecting primary data

- Planning **1.5–2 hours**
- Practical **1 hour**

Candidates are given the Part 2 stimulus material which requires them to formulate a hypothesis, plan and carry out an investigation to collect primary data. Candidates also need access to their individual work from Part 1.

Candidates may work in groups of no more than 3 (2 is recommended) and may collaborate in the development of the plan and the conduct of the investigation. During planning candidates may wish to trial procedures they plan to use, at the discretion of the centre. They are required to provide a risk assessment of the procedures they have planned. **Candidates must record their hypothesis, plan and results individually.** The investigation should be planned and conducted in supervised lessons and written work should be collected in and redistributed if more than one lesson is required.

Teachers are responsible for ensuring appropriate health and safety procedures are carried out, including a risk assessment for the task, prior to candidates attempting the practical work. It is the centre's responsibility to ensure the safety of all candidates involved in any investigation.

Candidates complete Part 2 under limited control. The work of individual candidates may be informed by working with others but candidates must provide an individual response. Teachers may give generic, informal feedback while the task is being completed but may not indicate what candidates need to do to improve their work. Candidates should not be given the opportunity to redraft their work, as this is likely to require an input of specific advice. Candidates should be made aware of the time allowed for carrying out this part of the task. Candidates' access to resources is determined by those available to the centre.

All work should be recorded on loose-leaf paper, and may be hand written or word processed. It should be collected in and redistributed for Part 3 and should be securely attached to the answer booklet for Part 3 so that it can be marked.

In their investigations, candidates will need to make choices about: the variables to be measured and controlled, the range of object distances to be used, the number of replicates to be made and the apparatus to be used.

Candidates must not be instructed or advised in these areas except where they affect safety, use of resources or timescale.

Part 2 ends with the collection of the raw data by the candidate. The work is collected and retained by the teacher. It is processed and analysed in Part 3.

Candidates require the Part 2 stimulus material below.

Cameras

Part 2 stimulus material: Planning and collecting primary data

Daisy uses a convex lens to focus an image of a bright object on a screen.

She finds that when she moves the bright object, either closer to the lens or further away from it, the image is blurred.

She has to change the distance between the lens and the screen, to make the image sharply focused again.

Suggest a hypothesis to explain these observations.

Explain your reasons for suggesting this hypothesis.

Plan an experiment to test your hypothesis.

Do your experiment and record your results to use in Part 3.

Part 3 – Analysis and evaluation

- Analysis and evaluation **1.5–2 hours**

Part 3 is completed independently under supervision. Candidates will process and analyse the results of their research and the investigation. They will evaluate their data and the methods used to collect it. They will then draw and justify a conclusion and review their hypothesis. They will be asked to comment on any issues of safety within the practical work. If more than one lesson is necessary then all booklets must be collected in and given out again for subsequent lessons.

Candidates will need access to their individual responses from Part 1 and Part 2.

Candidates complete Part 3 under high control. Candidates must complete all work independently. Teachers may give generic, informal feedback while the task is being completed but may not indicate what candidates need to do to improve their work. Candidates should not be given the opportunity to redraft their work, as this is likely to require an input of specific advice. Candidates should be made aware of the time allowed for carrying out this part of the task. All work should be recorded on the answer booklet provided or on loose-leaf paper (such as graph paper), and may be hand written or word processed. All loose sheets should be securely attached to the answer booklet for Part 3 so that it can be marked.

In processing data, candidates will have opportunities to use mathematical and graphical skills such as:

- calculating means
- quantitative treatment of spread of data to determine the level of uncertainty
- drawing a graph with correct scales and accurate plotting to show the relationship between image and object distances.

Candidates must not be instructed or advised in these areas.

Candidates require the answer booklet for Part 3.

Materials required:

- Part 1 and Part 2 stimulus materials and answer booklet for Part 3, supplied by OCR
- marking criteria supplied by OCR in the specification
- candidates' work for Parts 1 and 2
- A4 sheets of 2mm graph paper.

Apparatus suggested:

For each candidate or group of candidates:

- converging lens with a suitable focal length (e.g. 15 cm)
- holder for lens
- movable white screen
- metre rule
- illuminated object (e.g. hole in opaque material covered with gauze and illuminated from the rear).

Candidates plan their own investigation and may therefore require access to other apparatus at the discretion of the centre.

Notes to help teachers and technicians with this controlled assessment

Candidates should be shown how to measure the approximate focal length of a convex lens using a distant object method.

Teachers are advised to try out the experiment prior to candidates undertaking the task.

Marking the controlled assessment

The task will be marked by the centre using the **marking criteria** given in the specification. For each skill, mark descriptors are given at each of four levels. Marking is by 'best-fit' to the criteria.

All three parts should be marked together when candidates have completed Part 3. Except for Part 1, candidates should not take work out of the classroom/laboratory.

This Teacher Guidance document contains the marking criteria from the specification with exemplification. The first row for each skill quality shows the marking criteria given in the specification. The second row exemplifies how some aspects of these criteria may be applied in the context of this specific task. These points are for guidance only.

For further information about the award of marks, please see Section 5.4.2 in the specification.

Candidates should not be given access to the additional guidance for the task.

Assessment objectives (AOs)

Each of the skill qualities to be assessed addresses one or more of the assessment objectives and these are shown in the marking criteria. The overall balance is shown in the table below.

Assessment Objective	Total
AO1: Recall, select and communicate their knowledge and understanding of science	5
AO2: Apply skills, knowledge and understanding of science in practical and other contexts	10
AO3: Analyse and evaluate evidence, make reasoned judgements and draw conclusions based on evidence	33
Total	**48**

Marking criteria

Skill quality	0	1–2 marks	3–4 marks	5–6 marks	AO
Researching collect secondary data including the use of appropriate technology	*	Some information collected and used from at least two sources.	Relevant information collected from at least three sources; information presented clearly and all sources identified.	Range of relevant sources identified and judgement used to select those appropriate to the task. Information collated and presented clearly in appropriate formats, including a full bibliography.	**AO1 – 1** **AO2 – 3** **AO3 – 2**
Additional guidance Part 1 Research Part 3 Question 6		*Information collected could include that a lens changes the path of rays of light and bellows are used to move the lens.*	*Information collected could include that a lens makes rays of light converge and form a real image when an object is a long way from the lens; bellows used to vary the distance between lens and film to produce a sharp image; the image is normally in focus in a 'fixed-focus' device.*	*Information collected could include ray diagrams to show the formation of real images; the need to change the distance between lens and film as the distance between lens and object changes; an appreciation that a 'fixed-focus' camera is normally used to photograph objects that are relatively distant from the lens.*	

* No evidence of achievement for this quality, or evidence insufficient for the award of 1 mark.

Skill quality	0	1–2 marks	3–4 marks	5–6 marks	AO
Planning develop hypotheses and plan practical ways to test them	*	Simple hypothesis or prediction relates to the data or information provided but does not identify a trend or pattern to be investigated. Outline plan includes equipment and techniques to be used. Plan provides a 'fair test'. No evidence of modifications of plan during the data collection phase. Plan shows limited structure with errors in spelling and punctuation.	Hypothesis provides a limited scientific explanation of the data or information provided. Plan gives sufficient detail for experiment to be repeated, including choices of: equipment and techniques; range and number of data points for the independent variable; number of replicates; other variables to be controlled with the aim of collecting quality data. Some consideration given to how errors will be minimised. No evidence of modifications of plan during the data collection phase. Plan structured clearly with occasional errors in spelling and punctuation.	Complex hypothesis provides a complete scientific explanation of the data or information provided and is capable of investigation. Comprehensive plan shows scientific understanding in making appropriate choices of: equipment, including resolution, and techniques; range and number of data points for the independent variable; number of replicates; control of all other variables, with the aim of collecting accurate data. Detailed consideration given to: how errors will be minimised; variables which cannot be controlled. Where appropriate, reasoned modifications made to the plan as evidence is collected. Plan structured coherently with few, if any, errors in grammar, punctuation and spelling.	**AO1–1** **AO2–3** **AO3–2**
Additional guidance **Hypothesis** Part 2 Hypothesis Plan		*Prediction such as the place where the image is in focus moves when the object moves.* *Plan includes, for example, measurement of object and image distances for a range of object distances.*	*Hypothesis could explain how light from an object is diverging less, when it reaches the lens, if the object is moved further from the lens, resulting in rays converging to a focus closer to the lens.* *Plan could include the number and range of object distances to be used; the equipment to be used; the number of replicates; an appreciation that the precise point of focus will be difficult to determine; reference to a real image not being seen if the object is too close to the lens.*	*Hypothesis could explain why the rays of light focus at different distances from the lens, when objects are placed at different distances from the lens, using ray diagrams to explain how images are formed.* *Plan could include an appreciation that the object must be placed further away from the lens than the focal point and that this will necessitate measuring the focal length of the lens; an appreciation that the image should be re-focused, before measuring image distance, for each replicate.*	

* No evidence of achievement for this quality, or evidence insufficient for the award of 1 mark.

Skill quality	0	1–2 marks	3–4 marks	5–6 marks	AO
Collecting data collect primary data including the use of appropriate technology	*	Results recorded clearly but not in an appropriate format.	Results tabulated to include all data expected, though not in the most appropriate format. Headings given but units not always correct.	Results tabulated clearly and logically, including use of correct headings and units; all data expected recorded to appropriate levels of precision.	**AO1–2** **AO2–4**
Additional guidance Part 2 Results		*For example: results could include object and image distances.*	*For example: results could include object and image distances, including replicates, presented in table(s).*	*For example: single table of results provided showing object and image distances, correct units used for all variables. Replicates are similar values, showing precision.*	
Managing risk manage risks when carrying out practical work including risk assessment	*	Limited understanding of risks in procedures with only standard laboratory safety features mentioned. Some teacher intervention required to ensure safety.	Some risks in procedures analysed and some specific responses suggested to reduce risks. Risks managed successfully with no significant incidents or accidents and no requirement for teacher intervention.	All significant risks in the plan evaluated. Reasoned judgements made to reduce risks by use of appropriate specific responses. Risks managed successfully with no incidents or accidents and no requirement for teacher intervention.	**AO3–6**
Additional guidance Part 2 risks in plan **and** in Part 3 evaluation in Q 4		*For example, a mention of standard laboratory safety features.*	*This could involve an appreciation that this is a low- risk task.*	*The reasons for the low level of risk could be discussed.*	

* No evidence of achievement for this quality, or evidence insufficient for the award of 1 mark.

Skill quality	0	1–2 marks	3–4 marks	56 marks	AO
Processing data process primary and secondary data including the use of appropriate technology	*	Some evidence of processing quantitative data: data presented as simple charts or graphs with some errors in scaling or plotting; use of one simple mathematical technique.	Graphical and mathematical techniques used to reveal patterns in the data: charts or graphs used to display data in an appropriate way, allowing some errors in scaling or plotting; correct use of more than one simple mathematical technique.	Appropriate graphical and mathematical techniques used to reveal patterns in the data: type of graph, scales and axes selected and data plotted accurately, including where appropriate a line of best fit; correct use of complex mathematical techniques where appropriate; appropriate quantitative treatment of level of uncertainty of data.	**AO3–6**
Additional guidance Part 2 Results table Part 3 Questions 1 and 3		*Processing and mathematical techniques could include attempts to calculate mean values of image distance.* *Presenting data could include a simple graph or chart to show relationship between object and image distance.*	*Mathematical techniques could include calculating mean values of image distance and determining appropriate scales for axes on graph.* *Graphical techniques could include a line graph drawn to show the relationship between object and image distances with few errors in scaling, plotting or line of best fit.*	*Graphical and mathematical techniques could include a quantitative treatment of spread of data and thus, the level of uncertainty; graph drawn with correct scales and accurate plotting to show relationship between object and image distances.*	

* No evidence of achievement for this quality, or evidence insufficient for the award of 1 mark.

Skill quality	0	1–2 marks	3–4 marks	5–6 marks	AO
Analysing and interpreting analyse and interpret primary and secondary data	*	At least one trend/pattern identified and outlined correctly; an attempt is made to interpret the information linking primary and secondary data/information.	Main trend(s)/pattern(s) described and interpreted with reference to quantitative data and scientific knowledge and understanding, with some errors; reasoned comparison between primary and secondary data/information; any anomalous results identified correctly and implications discussed.	All trend(s)/pattern(s) described and interpreted correctly with reference to quantitative data and relevant scientific knowledge and understanding; links between primary and secondary data/information evaluated; level of uncertainty of the evidence analysed.	**AO3–6**
Additional guidance Part 3 Questions 2, 3 and 6		*For example: identification that as object distance increases the image distance decreases.* *An attempt to compare secondary and primary data.*	*For example: correlation between object and image distances could be described using quantitative data, with some explanation. A simple comparison with secondary data to identify whether similar or different trends are seen.*	*For example: relationship between object and image distances described using quantitative data, with scientific explanation. Notes that the change in image distance, when the object's distance changes, becomes smaller at higher object distances. Assesses uncertainty, e.g. considers variation in line of best fit, uses range bars, etc.* *A detailed quantitative comparison with secondary data.*	
Evaluating review methodology to assess fitness for purpose	*	Relevant comments made about the quality of the data and the method used. Answer is simplistic with limited use of specialist terms.	Comments made on the quality of the data, including accuracy and sources of, error, linked to the method of collection; limitations in the method of data collection identified and suggestions for improvement given. Information is relevant and presented in a structured format. Specialist terms are for the most part used appropriately.	Detailed and critical consideration given to the data and methods used to obtain them: sources of error and quality of the data discussed and explained, including accuracy, repeatability and uncertainty; limitations of the method identified and suggestions for improvements justified. Information is relevant, clear, organised and presented in a coherent format. Specialist terms are used appropriately.	**AO1–1** **AO3–5**
Additional guidance Part 3 Question 4		*For example: comments made about accuracy of measurement of object and image distances.*	*For example: the measurement of object distance could be identified as being more accurate than the measurement of image distances.*	*For example: comments could be made about the spread of values for image distances and any problems associated with identifying when the image is in focus.*	

* No evidence of achievement for this quality, or evidence insufficient for the award of 1 mark.

Skill quality	0	1–2 marks	3–4 marks	5–6 marks	AO
Justifying a conclusion draw evidence-based conclusions; review hypotheses in light of outcomes	*	Conclusion given and hypothesis reviewed using the data collected. Answers simplistic with little scientific understanding.	Conclusion given and justified and hypothesis reviewed based on an analysis of the data and information from research and investigation, demonstrating an understanding of the underpinning science.	Conclusion given and justified and hypothesis reviewed, based on a critical analysis of the data and information from research and investigation, and clearly linked to relevant scientific knowledge and understanding.	**AO3–6**
Additional guidance Part 3 Questions 5 and 6		*For example: a comment could be made about the truth or otherwise of the hypothesis, with limited reference to the data collected.*	*For example: scientific explanation of the relationship between object and image distances identified in the hypothesis. Explanation linked to experimental data and research.*	*For example: relationship linked to original hypothesis with a scientific explanation provided. The idea that the data collected can be linked to the properties of a 'fixed-focus' camera could be considered.*	

* No evidence of achievement for this quality, or evidence insufficient for the award of 1 mark.

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