Field study and the examination – rivers

Examination specifications inform you about the structure of the work you will do:

- detailing the content
- indicating the geographical skills that are required
- summarising the assessment.

Once you have investigated the specification, it may actually be best to start your fieldwork with the sort of questions you are likely to be asked in the examination. These are easily available via your teacher or on the examination board website, along with the mark schemes. Knowing the sort of questions you are going to be asked and the type of answer required should make you think about how to organise your own fieldwork, ie make sure your fieldwork is capable of answering the questions you have in front of you.

Preparation – before you go out on fieldwork

Past experience indicates that:

- examination questions have to be sufficiently broad so all candidates can have access to the questions having done a variety of fieldwork
- river studies are very common.

AS

It is necessary to have fieldwork experience for the AS examination papers where your investigative skills will be tested and generic field work questions asked. These may require you to link your experience to resources, such as giving reasons for the choice of sampling sites on a river found on an OS map extract.

You will almost certainly be required to state the aim of your fieldwork and give a hypothesis for 4 marks, for instance:

- **Aim.** To investigate the properties of a river channel (1 mark) and find out how it relates to the model of a river (1).
- **Hypothesis.** River X will illustrate the typical characteristics of a model river (1), getting wider, deeper, faster and more efficient downstream (1).

AS questions will ask you to *outline* or *describe* stating *advantages/disadvantages* of, for example, sampling techniques, a method of data collection or how you used an ICT skill. There could be a question on the risk assessment you carried out for your chosen topic. It is likely the questions will cover basic skills, investigative skills, cartographic skills, graphical skills, ICT Skills and statistical skills. Even the longer questions carry no more than 8 – 10 marks.

A2

The A2 fieldwork examination specification will require you to have undertaken more detailed fieldwork. The questions will focus on analysis and evaluation of the fieldwork as well as assessing fieldwork skills again. Questions will be more demanding, requiring perhaps 24 lines of writing for 12 marks, or 12 lines of writing for 6 marks, so the command words in each question: ‘explain’, ‘assess’, ‘analyse’, ‘evaluate’, mean you will have to craft a response that gives all the details, develops an analysis, creates an explanation and leads to an assessment or evaluation of the fieldwork.

Again, you will be expected to state the aim and hypothesis of your fieldwork. Suitable aims include:

- To investigate the fluvial dynamics of a named river channel
- Assess how six bridges on a named river affect the flow of water (implies a comparative study).

This may not be awarded any mark; you are informing the examiner about what your answers refer to. The question may require you to explain why the location of your fieldwork was appropriate for the investigation. You not only need to give a detailed statement about the location, but also state how it was suitable for the investigation, linking to theory and with reference to the fieldwork actually done.

If a question requires you to ‘assess’ the usefulness of a method of investigation you must select a methodology that can be discussed in some detail: how the method worked, the difficulties encountered in measuring, how you overcame the difficulties and the advantages of the method. You may be asked to analyse the strengths and limitations of the method. For a top level response you need detailed reference to the advantages and disadvantages, cross references to the aims, the overall suitability of the method and how the data contributed to the whole study. You need to work your way through the question to show that you have fully assessed the usefulness.

Any question related to the overall evaluation of the fieldwork must refer to the aim and hypothesis and the theory used in your work. Without such references, you will limit the marks you are able to obtain. State your overall conclusions, relate these throughout your answer to the aim and then discuss them in relation to the theory, ending with an overall evaluation of the investigation.

A separate question/section may test your statistical skills (usually Spearman's Rank Correlation Coefficient, Chi Squared, Mann-Whitney U test). This is why it is essential to have understood these statistical tests during your A2 course as well as applying one or more to your fieldwork. Know how hypotheses can be generated from a table of data, and why it might be necessary to test the data if no clear pattern can be seen. You will not be expected to go into any mathematical processing but you are likely to be given the result of that processing and then asked about its level of significance in relation to the concept of the Null Hypothesis. You may also be asked about the reliability of the data.

A popular synoptic question is to evaluate the importance of statistical techniques in developing geographical understanding. You need to demonstrate that you know how and why statistical tests are used, the variety of tests available and where each one is most applicable; the importance of the Null Hypothesis, the various levels of significance that can be used and how it can all lead on to geographical explanation. This follows on to geographical understanding by integrating the statistics and geographical explanation.
with the aim, hypothesis and theory, then refers to other work that could be undertaken to further geographical understanding.

The better responses to all the questions indicate candidates have followed all the steps required in the fieldwork investigation and subsequently understood the process because the responses are clearly articulated, planned and detailed with high level of spelling, punctuation and grammar.

Collecting data during fieldwork

Textbooks provide background reading with factual data about river processes, models and theories as well as exemplifying, using a variety of case studies. There are fieldwork books to give you ideas about how to conduct a survey of a river in order to assess the fluvial dynamics. For river studies you need to understand the following:

- they are linear features
- their spatial characteristics change downstream
- there are several fundamental concepts to know
- above all, they are dynamic.

From this you can develop your aim and hypothesis, after which you will need to plan your work:

- location of river to be visited
- sites to be visited
- accessibility of sites (public footpaths, fishing rights)
- travel arrangements
- equipment needed
- recording tables prepared
- clothing and food needed
- risk assessment.

You have already read that you will have to state your aim and hypothesis in the examination and that you could be asked about risk assessment.

Before you start the fieldwork, try everything out in your garden or on the school field – literally have a ‘dry run’ or pilot study. This will help you develop teamwork and an understanding of what needs to be done and the time it will take. It may also lead you to alter aspects of your study, which will benefit the study in the long term.

Collecting sufficient and accurate data is crucial for later processing and meaningful conclusions. At least 10 sites are required for later, accurate statistical processing. Any fewer and your statistical test results become invalid and subsequent conclusions are meaningless.

How have you chosen each site along the river? Have you used random numbers or systematic sampling? Your choice will need to be justified in your write-up. Usually neither, as access is the crucial point followed by a sequence of reasonably spaced sites along 10 or 20 km of river, preferably with different stream orders. At each site you need to work logically and as a team. There is enough work at each site to keep at least five people busy collecting data.

Measure out the 10 metre distance over which you are recording and place two ranging rods, one at the start and one at the end of the 10 metre section. Take all readings facing upstream so the left bank is the left bank every time and it also involves least disturbance of the water (Figure 1a).

For measuring speed an orange is often used if placed gently in the river, at least 10 times, at different equally spaced intervals across the river. Again, any fewer, and results can be skewed. Record the time taken for the orange to travel 10 metres in seconds, 10 times. Add up the times and average e.g. 58 seconds. To find the velocity divide distance by time – in this case, 10 metres by 58 seconds, which gives a stream velocity of 0.172 metres per second.

Measuring the width of the stream at water level at the 5 metre point where you also measure the water depth (Figure 1a). The more depths you record, the more accurate your average depth will be. The width and depth readings of the water will enable you to reconstruct the cross-profile of the river as part of your processing and calculate the cross-sectional area. You should also measure the height of the banks above water level and the width between the tops of the banks. This will enable you to calculate the cross-sectional area when the river is flowing at full capacity before it floods, i.e. the bank full volume.

You could use a clinometer to measure the gradient in degrees over 10 metres between the ranging rods, but remember to place the ranging rods carefully on the bed of the river then measure the angle between the same heights/marks on the ranging rods. However, degrees will not give you much variation in results between sites. Better to use a tight string between the ranging rods and a ‘hang on’ spirit level (Figure 1b).

Bed load can be measured using alternative methods. A more qualitative approach is to use a chart for visual estimation of shape (Figure 2a). A quantitative approach is to measure the a, b and c axes on each pebble and use a Cailleaux card for the size of the sharpest corner on the a axis (Figure 2b, 2c). All these need recording, so averages and roundness can be calculated and then related to discussion about erosion in the river channel (Figure 3). You must always use the same type of rock as you go downstream so data is comparable. Different rock types erode at different rates, so, if you used varied rock types, this would falsify your data.

Sketches can be drawn and annotated; photographs can be taken for later annotation but the former demands greater observation and generates spatial awareness.
Figure 2a: Visual estimation of roundness and sphericity


Figure 2b: Pebble measurements

Figure 2c: Cailleaux card for measuring radius of curvature

A detailed written description of the site can be made to accompany your sketch and photographs and this may help explanation at a later date, especially the presence of a bridge, a weir, land drainage or sink holes. Once all the data has been collected at the first site collect up and check all the equipment and repeat your work at subsequent sites.

Safety
Never undertake this work alone, some of the exercises require at least three people so work together. Do not enter the river where the water is above knee height, as it is likely to be flowing too fast to stand upright. Your risk assessment should be carried out before you undertake the fieldwork but on-site risk assessment is essential before entering the river.

Processing data on your return
After collecting the data you are already in a position to explain why your methods were suitable and are aware of alternative methods.

The data needs to be processed, analysed, interpreted and initial conclusions drawn. You have already worked out velocity (0.172 m per second in our example). Now find out what volume of water is flowing down the river, ie the discharge, which is represented by the letter Q. Multiply width by average depth or calculate from an accurately drawn cross-section to give cross-sectional area (CSA) (Figure 4). Also work out the average for each pebble and the roundness, with 1000 being a perfectly rounded pebble and increasingly angular as the value decreases. Overall averages for each site can be worked out. Data for individual pebbles can be plotted on a Zingg Form/Shape graph (see Geofile 551).

Turn your data into a variety of simple maps and graphs but also plot the parameters (width, depth, velocity, CSA, Q, gradient, average pebble size, average roundness) against distance downstream (drawn to scale on a graph, Figure 5). You can now find patterns and trends much more easily; describe and analyse these patterns linking back to your aims and hypothesis and also theory. This will generally reveal that most parameters, with the exception of gradient, increase downstream. You must describe the nature of the changes and reasons for them clearly.

Next, relate any two parameters to each other on a scattergraph to see if there is a possible relationship (Figure 6). Try as many comparisons as possible. If a relationship is obvious or appears possible, then set up a Null Hypothesis (there is no relationship between x and y) and carry out a Spearman’s Rank Correlation and test the result for your 10 sets of data at the 99% (0.712) and 95% (0.564) significance levels. If your result does not meet the 95% significance level then you must accept the

Figure 3: Pebble data and calculations – field results

Each column can be averaged and a variety of graphs drawn

<table>
<thead>
<tr>
<th>Pebble number</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>Mean size</th>
<th>Flatness</th>
<th>Radius</th>
<th>Roundness</th>
<th>Zingg Form</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>85</td>
<td>65</td>
<td>19</td>
<td>169 – 3</td>
<td>0.564</td>
<td>10</td>
<td>2.35</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>65</td>
<td>55</td>
<td>43</td>
<td>163 – 3</td>
<td>0.54</td>
<td>5</td>
<td>15.4</td>
</tr>
</tbody>
</table>

Figure 4: River study statistics table – field results

<table>
<thead>
<tr>
<th>Station number</th>
<th>Station name</th>
<th>Distance from source</th>
<th>Stream order</th>
<th>Velocity</th>
<th>Width</th>
<th>Mean depth</th>
<th>CSA (m²)</th>
<th>Discharge</th>
<th>Gradient</th>
<th>Hydraulic radius</th>
<th>Bankfull width</th>
<th>Mean depth</th>
<th>Bankfull CSA (m²)</th>
<th>Minimum Bankfull</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Askew Bridge</td>
<td>102</td>
<td>3</td>
<td>0.576</td>
<td>9.4</td>
<td>0.423</td>
<td>3.98</td>
<td>2.298</td>
<td>25</td>
<td>0.3826</td>
<td>131</td>
<td>1.413</td>
<td>18.5</td>
<td>10.6</td>
</tr>
</tbody>
</table>
Null Hypothesis that there is no relationship between x and y. If your result exceeds the 99% or the 95% level then reject the Null Hypothesis and rewrite it to say there is a relationship between x and y, then pursue an explanation for the relationship, but remember parameters are not causal, ie x does not necessarily cause y.

At this point the concept of the hydraulic radius (HR) may be helpful. Divide the CSA by the wetted perimeter (where the water is in contact with the bed and banks) – this will tell you how efficient a stream is. One that is wide and shallow will have a low HR, ie a lot of friction that slows the water; a deeper, narrower stream will have a higher HR, ie less friction and consequently greater velocity. Understanding the efficiency of a stream will relate to the theoretical concepts about rivers and why and how the dynamics of a stream change downstream and how they are all interrelated.

The above will enable you to draw meaningful conclusions in relation to your hypothesis and aims, discuss their validity, their limitations and relate your findings to theory. Your work should also enable you to answer any synoptic question asking about the importance of statistical techniques in developing geographical understanding.

Bibliography

Geofile 551 Coastal fieldwork (for details about pebble measurement, Cailleaux card, recording tables and Zingg form graph).

Geofile 588 Field work: the stages of investigation. Contains much generic material and useful fieldwork advice.

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**Figure 5: Velocity plotted against distance downstream**

![Graph](image1)

**Figure 6: Velocity plotted against discharge**

![Graph](image2)

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**Focus Questions**

**At AS level:**

1. Outline the aim and hypothesis of your river study and refer to the geographical theory or idea that formed the basis of your aim and hypothesis.
2. Describe the risk assessment that you carried out and how you mitigated the risks.
3. For one item of primary data collection, describe the strengths and weaknesses of the method.
4. Distinguish between qualitative and quantitative data collection, giving examples from your fieldwork.
5. Describe one technique used to present your results.
6. Evaluate your investigation. Refer to the overall strengths and weaknesses of the fieldwork, discuss the usefulness of the conclusions reached with reference to the hypothesis and aim, and suggest improvements.

**At A2 level:**

1. State the aim(s) of your investigation.
2. Describe the location of your fieldwork and explain why the location was appropriate for your investigation.
3. Analyse the risk assessment you carried out and justify the measures you undertook to minimise the risks.
4. Explain how one method of collecting data was suitable for the investigation analysing its strengths and weaknesses.
5. Justify an improvement that could be made to your data collection technique.
6. Assess one technique of data analysis that you used and state why it was appropriate for your investigation.
7. Evaluate the success of your fieldwork with reference to the aim and hypothesis that were developed from geographical theory. Consider the implications of your conclusions and improvements that could be made.