

GCE
AS and A Level

Human Biology

AS exams 2009 onwards
A2 exams 2010 onwards

Unit 6X: **Specimen EMPA**

Version 1.0





EXTERNALLY MARKED PRACTICAL ASSIGNMENT (EMPA)

GCE HUMAN BIOLOGY 2406

HBI6X

SPECIMEN PAPER

INTRODUCTION

We have limited fossil evidence of our human ancestors. Without complete skeletons, it has been difficult to determine the height of these ancestors but the discovery of preserved footprints may provide a method of doing this. At a site in Africa, early hominids walked in volcanic ash. The ash later became rock and the footprints were preserved. You will investigate whether or not it is possible to use measurements from feet to estimate the height of a person.

You will investigate whether there is a link between foot size and height.

TASK 1 - Preliminary Investigation

- 1 Devise a method for determining
 - the length of a foot
 - the width of a foot
 - the surface area of the bottom of a foot
 - the height of a person
- 2 Identify whether there are differences in measurements between the left and right foot.
- 3 Obtain measurements from **three** different samples (people) for the length and width of both right and left feet. (It is acceptable to use other members of the group to meet this requirement.)

QUESTIONS ON TASK 1

Answer the questions in the space provided.

You may do this while you carry out your investigation or at the end of your investigation.

- 1 Describe and justify your method for measuring the length of a foot.

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(2 marks)

- 2 (a) Record your results in the table.

Person (sample) number	Right foot		Left foot	
	Length	Width	Length	Width
1				
2				
3				

(2 marks)

- 2 (b) Using your data, explain whether foot length or width is the more reliable measure of foot size.

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(2 marks)

- 2 (c) Suggest why there might be a difference between the measurements for the left and right foot of the same person.

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(2 marks)

- 2 (d) In this investigation, is it necessary to calculate mean foot length from the three measurements? Explain your answer.

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(2 marks)

GCE HUMAN BIOLOGY 2406**SPECIMEN PAPER****EMPA: HBI6X****TASK SHEET 2**

In this step you will investigate whether or not there is a correlation between height and foot size. Foot size will be determined by the surface area of the whole of the bottom of the foot.

TASK 2

Collect data, from an appropriate number of people, using the methods you produced in the preliminary investigation (Task 1). You should measure:

- the height of a person in cm.
- the surface area of one foot of that person in cm².

You must decide:

- how to collect the data,
- the number of samples (people) to include,
- how to control or monitor variables that might influence the data to be collected.

TASK 3 – Use of an appropriate statistical test**You should:**

- determine whether there is a correlation between foot size and height,
- state the null hypothesis to be tested,
- choose and state an appropriate statistical test to be used,
- state the reason for the choice of this test,
- make appropriate calculations so that the null hypothesis can be accepted or rejected.

GCE HUMAN BIOLOGY 1406/2406

ISA HBI6X SPECIMEN

Candidate Results Sheet TASK 1



Centre Number

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Candidate Name

Candidate number

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Results

Present your results in an appropriate form in the space below.

GCE HUMAN BIOLOGY 1406/2406

ISA HBI6X SPECIMEN

Candidate Results Sheet TASK 2



Centre Number

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Candidate Name

Candidate number

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Results

Present your results in an appropriate form in the space below.

THE EMPA TEST: A2 SPECIMEN HBI6X

SECTION A

These questions are about your investigation into the footsteps of our ancestors.

When you answer these questions you should use your copy of **TASK SHEETS 1 and 2**, your table and the results of your statistical analysis.

Answer **all** questions in the spaces provided.

1 hour 15 minutes

- 1 The investigation examined whether there was a correlation between two variables. In this investigation, what was the dependent variable? Explain your answer.

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(1 mark)

- 2 Identify **two** variables you controlled when selecting the sample for measurement of foot length and height

Variable 1
Variable 2
(1 mark)

- 3 One way of determining height is to measure the length of the body when lying down. Suggest **one** advantage of this method.

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(1 mark)

4 Reliable data are obtained if the sample used in an investigation is random.

4 (a) Give **two** reasons why you believe your data is reliable.

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2.....

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(1 mark)

4 (b) In your investigation, did you obtain a random sample? If so, describe how. If not explain why.

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(1 mark)

5 This question is about the statistical test you used to analyse your data and your null hypothesis.

Give the null hypothesis for your investigation.

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Give the value of the test statistic, the value calculated from the statistical test you used.

Test statistic =

Is your null hypothesis accepted or rejected? Explain your answer.

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(3 marks)

- 6 What conclusions can you make about the correlation between surface area of the foot and height? Use examples from your data to support your answer.

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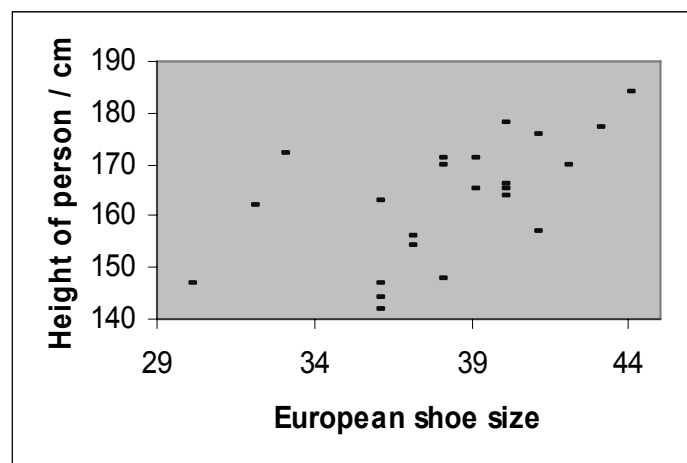
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(3 marks)

- 7 Shoe size is another measure of foot size. A student recorded the height and shoe size of a number of people. The **Figure 1** shows their results.

Figure 1



- 7 (a) What type of graph is shown in **Figure 1**?

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(1 mark)

- 7 (b) The student looked at the graph and concluded that there was no correlation between shoe size and height. Explain how a statistical analysis might be used to determine whether this conclusion was valid or not.

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(3 marks)

HBI6X EMPA

SECTION B RESOURCE SHEET

INTRODUCTION

The sizes of some parts of the body show a relationship to each other. Studies of these relationships have revealed information that helps manufacturers of clothes and shoes and has applications to medicine and health care.

When only parts of a body are discovered, forensic scientists can estimate the height of the person from the length of the foot. The length of a foot is approximately 15% of the height a person. This estimate works best with an adult because the ratio for body parts is different in growing children.

Resource A

351 pregnant women were studied to see if correlations existed between shoe size and height and those requiring medical assistance when giving birth. This could make it possible to quickly identify pregnant women with a narrow hip width who might require medical assistance when giving birth. **Table 1** and **Table 2** show some results.

Table 1

	UK shoe size		
	4 and below	4 ½ to 6	6 ½ and above
Number of pregnant women in group	57	Data not given	Data not given
Percentage of group requiring medical assistance	21	10	1

Table 2

	Height / cm		
	Below 150	155 - 170	Above 175
Percentage of group requiring medical assistance	12	8	25

Resource B

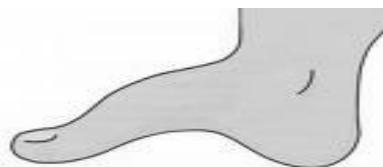
The effects of obesity on feet were investigated using pre-school children. **Table 3** shows some data from this investigation.

Table 3

	Group of children	
	Overweight / obese	Non-overweight
Number of people in group	19	19
Mean age / years	4.3 ± 0.9	4.3 ± 0.7
Mean height / m	1.07 ± 0.1	1.05 ± 0.1
Mean BMI / kg m^{-2}	18.6 ± 1.2	15.7 ± 0.5
Mean height of foot arch / cm	0.9 ± 0.3	1.1 ± 0.2

Figure 1 shows the foot arch measured during the investigation.

Figure 1



SECTION B

You should use the information on the resource sheet and your own knowledge to answer the questions.

Answer **all** questions in the spaces provided.

Use the information provided and your own knowledge to answer the following questions.

- 8 The severed foot of an adult, found at the scene of a crime, measured 28.6 cm in length. What height would the forensic scientist calculate for the person it came from?

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(1 mark)

- 9 Use both **Resources** to consider the reliability of the following statements.

- 9 (a) Shoe size and height can be used to predict women who may have narrow hips.

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(5 marks)

9 (b) People who are obese have flatter feet.

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(4 marks)

10 The Body Mass Index (BMI) is a measure of body fat. It is calculated by dividing the weight of a person by their height squared.

10 (a) The units for BMI are given as kg m^{-2} . Explain why.

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(2 marks)

10 (b) The BMI for non-overweight children is given as 15.7 ± 0.5 . Explain what information this provides.

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(2 marks)

- 10** (c) Explain how you could use this data to determine the mean weight for the non-overweight group of children

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(1 mark)