Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use
Total Task 2

General Certificate of Education
Advanced Level Examination
June 2012

Human Biology HBI6X/PM2

Unit 6X A2 Externally Marked Practical Assignment

Task Sheet 2

To be completed before the EMPA Written Test

For submission by 15 May 2012

For this paper you must have:
- a ruler with millimetre measurements
- a calculator.

Allergies and the food we eat

Introduction

Some doctors believe that vitamin C (ascorbic acid) helps protect the body from allergies. Many of the foods we eat contain vitamin C. The way that a food is stored or cooked before it is eaten affects the mass of vitamin C in the food.

Task 2 - Finding whether the mass of vitamin C in potato is affected by cooking

In Task 2, you will investigate whether cooking affects the mass of vitamin C in potato. You will compare the mass of vitamin C in solutions made using raw potato and using cooked potato.

Materials

You are provided with

- a potato
- access to a balance
- access to a blender/liquidiser
- water
- starch solution
- iodine solution
- measuring cylinder
- two large beakers
- 10 cm^3 syringe (for use with the iodine solution)
- two conical flasks
- dropping pipette
- two graduated pipettes or syringes (for use with the potato solutions)
- pipette filler (if graduated pipettes are used)
- funnel
- cloth for filtering
- knife
- Bunsen burner
- means of lighting the Bunsen burner
- tripod and gauze
- timer
- marker pen

You may ask your teacher for any other apparatus you require.

Outline Method

Read these instructions carefully before you start your investigation.

Preparing your raw and cooked potato solutions

1. Label two large beakers **A** and **B**.
2. Add 200 cm^3 of water to each beaker.
3. Carefully peel the potato and cut it in half.
4. Cut small pieces from one half of the peeled potato to obtain 30 g of potato. Put the pieces into the water in beaker **A**.
5. Repeat with the other half of potato and put 30 g of potato in the water in beaker **B**.
6. Pour the contents of beaker **A** into a blender and blend for 10 seconds.
7. Pour your blended mixture through a cloth placed over a funnel and collect the filtrate back in beaker **A**. This filtrate is your **raw** potato solution.
8. Use the Bunsen burner to heat beaker **B** until the water starts to bubble. Turn off the Bunsen burner and leave to cool for about 10 minutes.
9. When cool, pour the contents of beaker **B** into a blender and blend for 10 seconds. Rinse beaker **B**.
10. Pour your blended mixture through a cloth placed over a funnel and collect the filtrate back in beaker **B**. This filtrate is your **cooked** potato solution.

Finding the volume of iodine required

11. Put 10 cm^3 **raw** potato solution (beaker **A**) and 5 drops of starch solution into a conical flask.
12. Fill a 10 cm^3 syringe with about 10 cm^3 iodine solution. Record the starting volume in the syringe.
13. Add a small volume of the iodine solution to the **raw** potato solution. Swirl the contents of the flask allowing them to mix. Repeat until the reaction is complete. The reaction is complete when the mixture changes colour and remains coloured for longer than 20 seconds.
14. Record the final volume of the iodine solution.
15. Repeat steps 11 to 14 using your **cooked** potato solution (beaker **B**).
16. Repeat steps 11 to 15 so that you have 5 sets of data for both your raw and cooked potato solutions.

You will need to decide for yourself

- what volume of iodine solution you should add each time
- when the reaction is complete.

Turn over ▶

Presenting data

Complete the sentence below with the value that your teacher gives you. You will need this information to complete the processing of your data.

1 cm^3 of iodine solution reacts with ____________ mg vitamin C.

6 Record the results of your investigation in an appropriate table in the space below.

(4 marks)

7 Analyse your data with a suitable statistical test. You may use a calculator and the AQA Students' Statistics Sheet that has been provided.

You are provided with a sheet of graph paper. You may use this if you wish.

Hand in this sheet at the end of the practical session.

7 (a) State your null hypothesis.

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(1 mark)

7 (b) Give your choice of statistical test.

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(1 mark)

7 (c) Give a reason for your choice of statistical test.

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(1 mark)

Question 7 continues on the next page

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7 (d) Carry out the test and calculate the test statistic. Show your working.

(1 mark)

7 (e) Interpret the test statistic in relation to your null hypothesis. Use the words *probability* and *chance* in your answer.

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(2 marks)

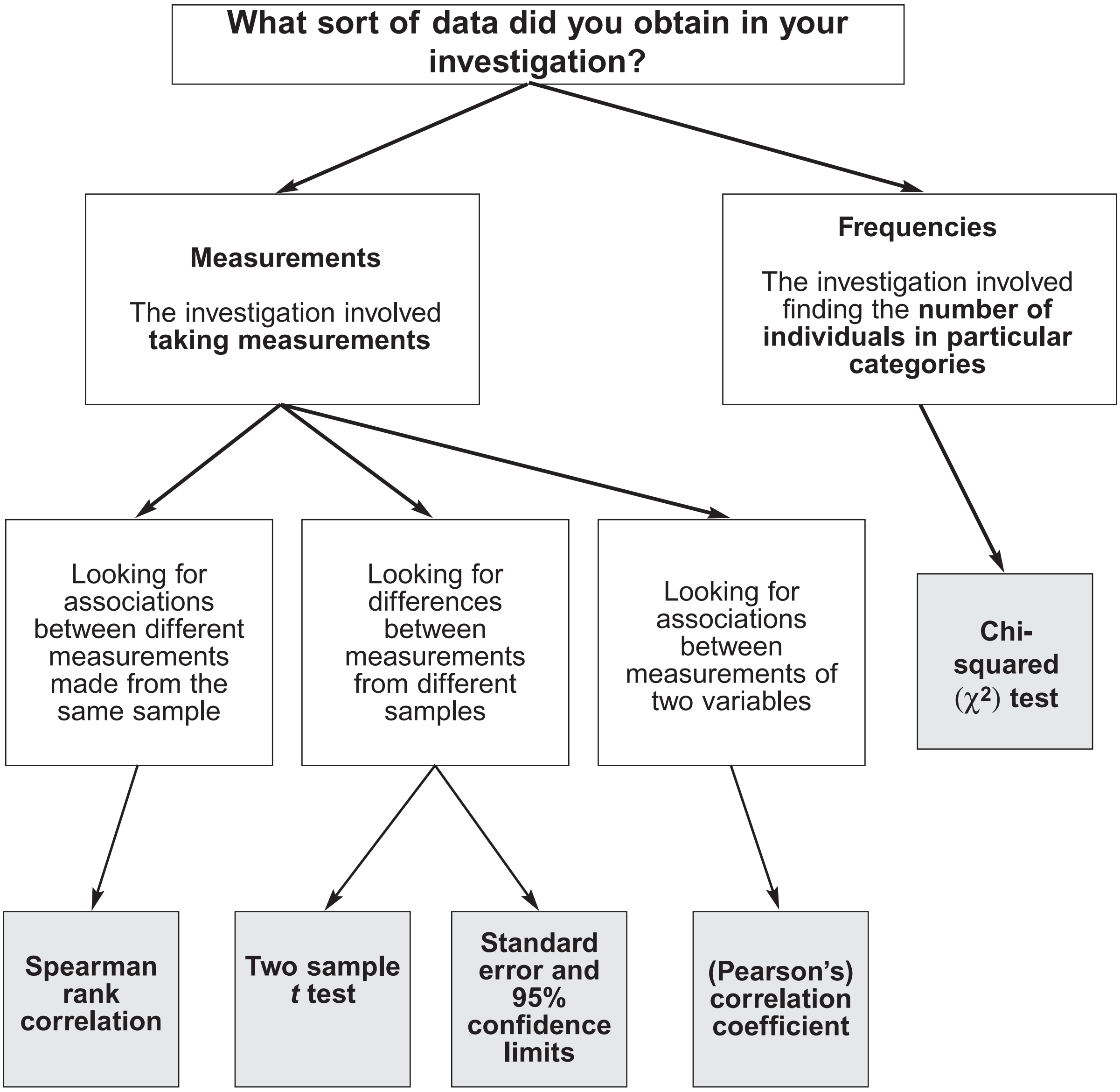
10

END OF TASK 2

Do not write outside the box

You may use this if you wish.

Students' Statistics Sheet



For use in the A2 ISA and EMPA assessment

Statistical tests and tables of critical values

Tables of critical values

A table of critical values is provided with each statistical test. If your calculated test statistic is greater than, or equal to, the critical value, then the result of your statistical test is significant. This means that your null hypothesis should be rejected.

Spearman rank correlation test

Use this test when
- you wish to find out if there is a significant association between two sets of measurements from the same sample
- you have between 5 and 30 pairs of measurements.

Record the data as values of X and Y.

Convert these values to rank orders, 1 for largest, 2 for second largest, etc.

Now calculate the value of the Spearman rank correlation, r_s, from the equation

$$r_s = 1 - \left[\frac{6 \times \Sigma \mathrm{D}^2}{N^3 - N}\right]$$

where N is the number of pairs of items in the sample
D is the difference between each pair (X-Y) of measurements.

A table showing the critical values of r_s for different numbers of paired values

Number of pairs of measurements	Critical value
5	1.00
6	0.89
7	0.79
8	0.74
9	0.68
10	0.65
12	0.59
14	0.54
16	0.51
18	0.48

Correlation coefficient (Pearson's correlation coefficient)

Use this test when

- you wish to find out if there is a significant association between two sets of measurements measured on interval or ratio scales
- the data are normally distributed.

Record the data as values of variables X and Y.

Now calculate the value of the (Pearson) correlation coefficient, r, from the equation

$$r = \frac{\Sigma XY - [(\Sigma X)(\Sigma Y)]/n}{\sqrt{\{\Sigma X^2 - [(\Sigma X)^2/n]\}\ \{\Sigma Y^2 - [(\Sigma Y)^2/n]\}}}$$

where n is the number of values of X and Y.

A table showing the critical values of *r* for different degrees of freedom

Degrees of freedom	Critical value	Degrees of freedom	Critical value
1	1.00	12	0.53
2	0.95	14	0.50
3	0.88	16	0.47
4	0.81	18	0.44
5	0.75	20	0.42
6	0.71	22	0.40
7	0.67	24	0.39
8	0.63	26	0.37
9	0.60	28	0.36
10	0.58	30	0.35

For most cases, the number of degrees of freedom = $n - 2$

Turn over ▶

The *t* test

Use this test when
- you wish to find out if there is a significant difference between two means
- the data are normally distributed
- the sample size is less than 25.

t can be calculated from the formula

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{(s_1{}^2/n_1) + (s_2{}^2/n_2)}}$$

where $\bar{x}_1$ = mean of first sample
$\bar{x}_2$ = mean of second sample
s_1 = standard deviation of first sample
s_2 = standard deviation of second sample
n_1 = number of measurements in first sample
n_2 = number of measurements in second sample

A table showing the critical values of *t* for different degrees of freedom

Degrees of freedom	Critical value	Degrees of freedom	Critical value
4	2.78		
5	2.57	15	2.13
6	2.48	16	2.12
7	2.37	18	2.10
8	2.31	20	2.09
9	2.26	22	2.07
10	2.23	24	2.06
11	2.20	26	2.06
12	2.18	28	2.05
13	2.16	30	2.04
14	2.15	40	2.02

The number of degrees of freedom = $(n_1 + n_2) - 2$

Standard error and 95% confidence limits

Use this when
- you wish to find out if the difference between two means is significant
- the data are normally distributed
- the sizes of the samples are at least 30. For assessment purposes, five samples are acceptable providing that this is acknowledged either at a convenient place in the statistical analysis or in the conclusions.

Standard error
Calculate the standard error of the mean, SE, for each sample from the following formula:

$$SE = \frac{SD}{\sqrt{n}}$$

where SD = the standard deviation
n = sample size

95% confidence limits
In a normal distribution, 95% of data points fall within ± 2 standard deviations of the mean.

Usually, you are dealing with a sample of a larger population. In this case, the 95% confidence limits for the sample mean are calculated using the following formula

95% confidence limits = $\bar{x} \pm 2 \times \frac{\text{SD}}{\sqrt{n}}$ **OR** $\bar{x} \pm 2 \times \text{SE}$

The chi-squared test

Use this test when
- the measurements relate to the number of individuals in particular categories
- the observed number can be compared with an expected number which is calculated from a theory, as in the case of genetics experiments.

The chi-squared (χ^2) test is based on calculating the value of χ^2 from the equation

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

where O represents the observed results
E represents the results we expect.

A table showing the critical values of χ^2 for different degrees of freedom

Degrees of freedom	Critical value
1	3.84
2	5.99
3	7.82
4	9.49
5	11.07
6	12.59
7	14.07
8	15.51
9	16.92
10	18.31

The number of degrees of freedom = number of categories – 1

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