General Certificate of Education
Advanced Level Examination
June 2011

Biology BIO6T/Q11/task

Unit 6T A2 Investigative Skills Assignment
Task Sheet

An investigation into the effect of competition for oxygen on the growth of yeast

Introduction

Yeast is a single-celled fungus which reproduces by division to form new cells. The yeast cells require oxygen for reproduction. The concentration of available oxygen can be altered by growing the yeast in conical flasks of different sizes. A yeast culture grown in a small flask has less oxygen entering the culture solution than the same sized culture grown in a large flask.

Before you started your investigation, yeast cultures were grown in two different-sized conical flasks.

- The smaller flask was completely filled with culture solution containing yeast cells.
- The larger flask contained the same volume of culture solution as the smaller flask. It also contained the same initial number of yeast cells.

The mouths of both flasks were loosely stoppered with cotton wool. Both flasks were then incubated at a temperature of 25 °C for 48 hours. You are required to measure the population density of yeast cells in both flasks using the method described.

Materials

You are provided with

- access to a yeast culture in a large flask and to a yeast culture in a small flask
- 250 cm^3 sterile beaker
- sterile measuring cylinder
- sterile water
- sterile glass rods
- sterile graduated pipettes or syringes
- spreader in sterilising solution
- 2 sterile agar plates
- marker pen
- acetate grid
- sticky tape and scissors

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

Outline Method

Read these instructions carefully before you start your investigation.

Session 1

1. Shake the sample of yeast culture from the small conical flask.
2. Take 1 cm^3 of the yeast culture and add it to a 250 cm^3 beaker.
3. Add 200 cm^3 of sterile water to the beaker.
4. Stir the mixture and immediately remove 0.1 cm^3 of the diluted yeast culture from the beaker using a 1 cm^3 graduated pipette or syringe.
5. Lift the lid of an agar plate carefully so you can just put the tip of the graduated pipette or syringe through the small gap.
6. Put the 0.1 cm^3 of the diluted yeast culture onto the agar keeping the lid as near the plate as possible.
7. Shake the spreader to remove excess sterilising solution if necessary. Use the sterile end of the spreader to spread the yeast culture evenly over the agar.
8. Close the lid. Label the plate clearly at the edge to show the size of the conical flask from which the yeast culture was taken.
9. Repeat steps 1 to 8 with the large flask.
10. Put small pieces of sticky tape on the edges of the plates to hold the lids on.
11. Incubate the plates for 24 hours.

Session 2

12. Turn one agar plate upside down so that its base faces upwards.
13. Place the acetate grid on the base of the agar plate.
14. Select 15 separate 10 mm squares at random. Count the number of yeast colonies in each of the 15 squares.
15. Repeat steps 12 to 14 with the second agar plate.
16. Record your data in a suitable table on the Candidate Results Sheet: Stage 1.

You must decide for yourself

- how to select the squares you will count at random.

Do not write outside the box

ISA BIO6T/Q11 Candidate Results Sheet: Stage 1

An investigation into the effect of competition for oxygen on the growth of yeast

Centre Number | | | | | | Candidate number | | | | |

Candidate Name.....

Record your data in a table in the space below.

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

There are no marks awarded for the table at A2.

ISA BIO6T/Q11 Candidate Results Sheet: Stage 2

An investigation into the effect of competition for oxygen on the growth of yeast

Centre Number | | | | | | Candidate number | | | | |

Candidate Name .....

Analyse your data with a suitable statistical test. You may use a calculator and the AQA Students' Statistical 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.

1 State your null hypothesis.

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(1 mark)

2 (a) Give your choice of statistical test.

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(1 mark)

2 (b) Give a reason for your choice of statistical test.

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(1 mark)

3 Carry out the test and calculate the test statistic. Show your working.

(1 mark)

4 Interpret the test statistic in relation to your null hypothesis. Use the words *probabiity* and *chance* in your answer.

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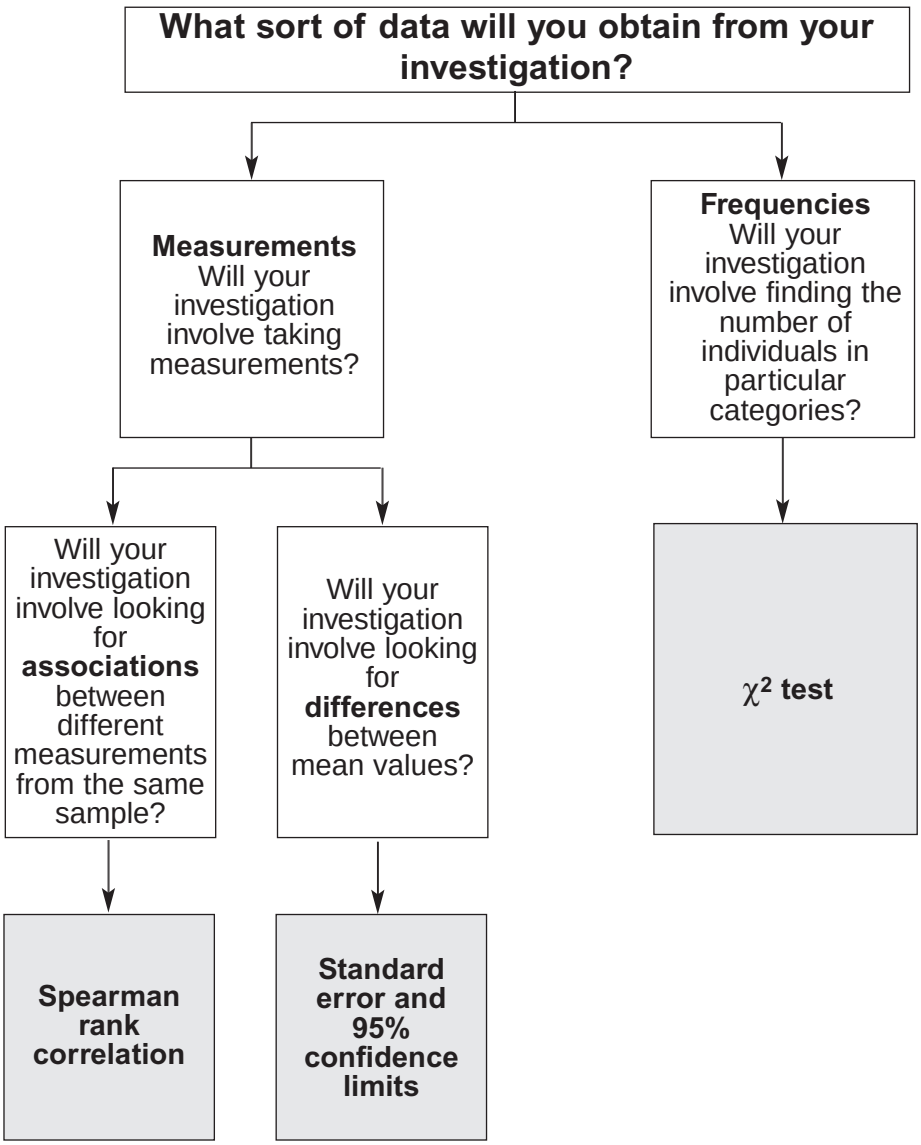
(2 marks)

6

END OF QUESTIONS

AQA Students' Statistics Sheet (version 3)



Standard error and 95% confidence limits

Calculate standard error, SE, for each sample from the following formula

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

where SD = standard deviation
and n = sample size

95% confidence limits = $2 \times SE$ above and below the mean

For use in the ISA and EMPA assessment

The χ^2 test

The chi-square (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 results you observe in the investigation
and E represents the results you expect.

Table showing the critical values of χ^2 at P = 0.05 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

Spearman rank correlation test

Calculate the value of the Spearman rank correlation, r_s, from the equation

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

where n is the number of pairs of items in the sample and D is the difference between each pair of ranked measurements.

Table showing the critical values of r_s at P = 0.05 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

For use in the ISA and EMPA assessment