General Certificate of Education
Advanced Level Examination
June 2010

Biology BIO6T/Q10/task

Unit 6T A2 Investigative Skills Assignment
Task Sheet

The effect of body temperature of an invertebrate animal on its rate of movement

Introduction

The body temperature of many animals changes with the temperature of the environment. If the environmental temperature rises, so does the body temperature of the animal.

You will measure the rates of movement of the animals you are given at two temperatures. You should determine whether the rates of movement are significantly different.

Materials

You are provided with

- woodlice or maggots
- Petri dish with lid
- ruler
- plastic teapoon, spatula or blunt forceps to move animal
- permanent marker pen
- large container to act as a water bath
- water at 30 °C or equipment to heat the water in the large container
- stopwatch
- boiling tubes
- thermometer
- AQA Students' Statistics Sheet (version 2) included at the back of this Task Sheet

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

Outline method

Read through all the instructions before you start your investigation.

Setting up your apparatus

1. Draw a line with the marker pen across the outside of the base of the Petri dish. This should divide the circular base into two equal halves.
2. Draw another line at right angles to the first line, so that the base of the Petri dish is divided into quarters.

Collecting your data at room temperature

3. Place one animal in the Petri dish. Put the lid on to prevent its escape.
4. Wait until the animal reaches the edge of the Petri dish.
5. Count how many times the animal crosses a line on the base of the dish in 2 minutes. If the animal stops moving for more than 5 seconds, do not record the data collected. Start again with another animal.
6. Repeat steps 3 to 5 using different animals until you have sufficient data for your statistical test.

Collecting your data at 30 °C

7. Use the large container provided to set up a water bath at 30 °C. The exact temperature needs to be between 28 °C and 32 °C.
8. Float the Petri dish in the water bath.
9. Place five animals in a boiling tube.
10. Place the tube in the water bath and leave for 5 minutes.
11. Remove the Petri dish from the water bath.
12. Transfer one animal from the tube into the Petri dish. Replace the lid and refloat the Petri dish in the water bath. You should not get the inside of the Petri dish wet.
13. Collect the data in the same way as in steps 4 and 5 above.
14. Remove the Petri dish from the water bath and take the animal out.
15. Repeat steps 12 to 14 using different animals until you have used all 5 animals from the boiling tube.
16. Repeats steps 8 to 15 until you have data for the same number of animals as you used at room temperature.

You will need to decide for yourself

- how many animals to use
- what temperature readings to take during the investigation
- what other factors you need to control or monitor.

ISA BIO6T/Q10 Candidate Results Sheet: Stage 1

The effect of body temperature of an invertebrate animal on its rate of movement

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.

(No marks are awarded for for the table at A2)

ISA BIO6T/Q10 Candidate Results Sheet: Stage 2

The effect of body temperature on the rate of movement

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

Candidate Name .....

Analyse your data with a suitable statistical test. You may use a calculator and the Students' Statistical Sheet that has been provided at the back of the Task Sheet to perform this test.

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 reasons for your choice of statistical test.

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(1 mark)

3 Calculate the test statistic.

(1 mark)

4 Interpret the test statistic in relation to your null hypothesis.

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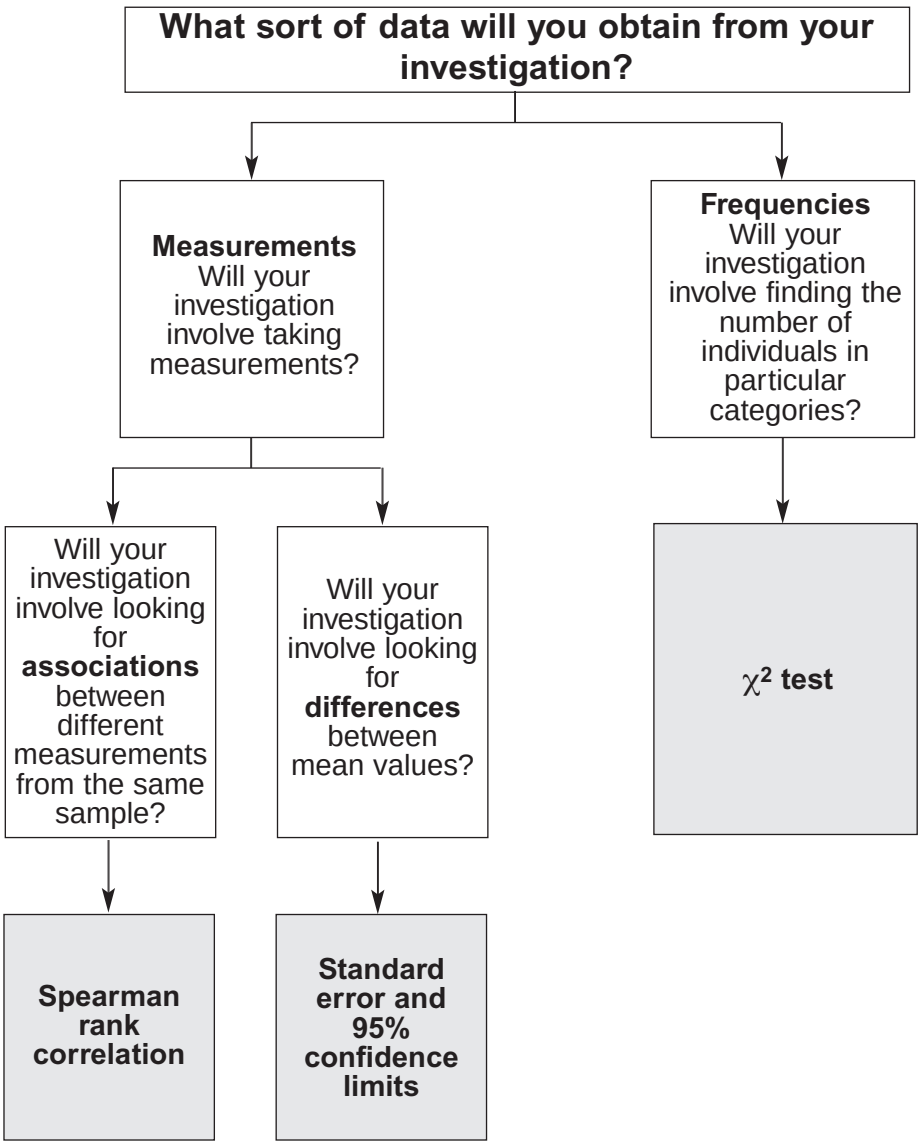
(2 marks)

6

AQA Students' Statistics Sheet (version 2)



Standard error and 95% confidence limits

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
and n = sample size

95% confidence limits = 2 × 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 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