A Level Biology B

H422/03 Practical skills in biology

Question Set 3

1. (a) (i) A researcher investigated the effect of water temperature on the metabolic rate of a fish species.

For this investigation, the researcher used a type of respirometer attached to data-logging equipment containing an electronic sensor.

The electronic sensor measured any changes in the oxygen concentration of the water, which were used to calculate the metabolic rate of the fish.

Each of the following was included in the procedure for this investigation:

- Ten individual fish of the same species were used.
- The rate of oxygen consumption of each fish was measured.
- The temperature of the water was changed and the measurements repeated.
- After each set of measurements, the respirometers were flushed (cleaned and rinsed with hot water).

The rate of oxygen consumption was also measured in clean, empty respirometers. These measurements of oxygen consumption were too small to affect the outcome of the experiment.

The oxygen concentration of water can be measured using a number of different methods.

Give **one** advantage of using an electronic sensor with a data-logger.

[1]

(a) (ii) State **two** of the control variables necessary in this experiment.

[2]

(a) (iii) Suggest why the respirometers were flushed after each experiment.

[1]

(b) (i) Table 3.1 shows some of the results from this investigation.

Temperature of water in respirometer (°C)	Mean metabolic rate(mg O_2 kg^{-1} $hour^{-1}$)
10	86.0
16	131.6

Table 3.1

The standard deviation, *s*, for both means is 8.3.

A Student *t*-test can be performed to compare the mean metabolic rate at each temperature and determine if the two are significantly different from each other.

State the null hypothesis for this test.

[1]

(b) (ii) Calculate the variance (s^2) for these means.

[1]

(b) (iii) Using the formula below, calculate the *t* value for the data in Table 3.1.

$$t = \frac{|\overline{x}_A - \overline{x}_B|}{\sqrt{\frac{s_A^2}{n_A} + \frac{s_B^2}{n_B}}}$$

Show your working. Give your answer to **three decimal places**.

[3]

(b) (iv) Using Table 3.2 and your answer to **(b)(iii)**, comment on the mean metabolic rates for 10 °C and 16 °C.

Degrees of freedom	Level of probability		
	0.05	**0.01**	**0.001**
8	2.306	3.355	5.041
10	2.228	3.169	4.587
18	2.101	2.878	3.922
20	2.086	2.845	3.850

Table 3.2

[3]

(c) The background research for this investigation into the effect of temperature on the metabolic rates of fish included information about increasing surface sea temperatures.

It has been predicted that surface sea temperatures will continue to increase throughout the21st century.

Suggest **two** limitations of trying to link the results of this laboratory investigation with the likely consequences on marine fish as surface sea temperatures increase.

[2]

Total Marks for Question Set 3: 14

OCR
Oxford Cambridge and RSA

Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact The OCR Copyright Team, The Triangle Building, Shaftesbury Road, Cambridge CB2 8EA.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge