

A Level Biology A
H420/01 Biological Processes

Question Set 5

5 (a)

A student carried out an investigation into the production of CO₂ in five different species of yeast.

The yeast cells were placed in different environments and the CO₂ production was measured.

Table 20 shows the results of the experiment. The mean values for these data are also represented as a graph in Fig. 20.

Conditions		Carbon dioxide produced (bubbles min ⁻¹)				
		Species				
		<i>S. cerevisiae</i>	<i>C. krusei</i>	<i>C. albidus</i>	<i>C. albicans</i>	<i>A. pullulans</i>
Aerobic	Trial					
	1	23	18	34	12	22
	2	18	17	20	15	21
	3	23	19	32	26	24
	4	24	23	26	13	22
	5	25	19	28	14	26
	6	15	17	29	12	22
	7	16	19	20	15	25
	8	17	23	36	13	27
	9	23	19	20	10	27
	10	25	17	19	13	25
	11	25	16	34	11	25
	12	23	16	20	11	25
Standard deviation		4	2	7	4	2
Anaerobic	Trial					
	1	12	6	22	8	34
	2	10	9	29	22	36
	3	12	10	19	6	29
	4	13	12	34	12	32
	5	15	7	25	19	28
	6	9	8	19	10	26
	7	10	9	23	14	27
	8	15	10	27	9	29
	9	15	5	35	6	35
	10	14	7	26	7	20
	11	15	8	19	21	30
	12	11	9	25	13	34
Standard deviation		2	2	5	6	5

Table 20

Using the information in Table 20, calculate the standard deviation for the number of CO₂ bubbles produced by *A. pullulans* in anaerobic conditions.

Write the answer into the space provided in Table 20. Give your answer to **one** significant figure.

$$SD = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

Show your working.

[3]

$$\bar{x} = \frac{360}{12} = 30$$

$$(34-30)^2 + (36-30)^2 + (29-30)^2 + (32-30)^2 + (28-30)^2 + (26-30)^2 + (27-30)^2 + (29-30)^2 + (35-30)^2 + (20-30)^2 + (30-30)^2 + (34-30)^2 = 228$$

$$SD = \sqrt{\frac{228}{11}} = 4.55 = 5$$

5 (b)

Fig. 20 is a graph showing the mean values of the data from Table 20.

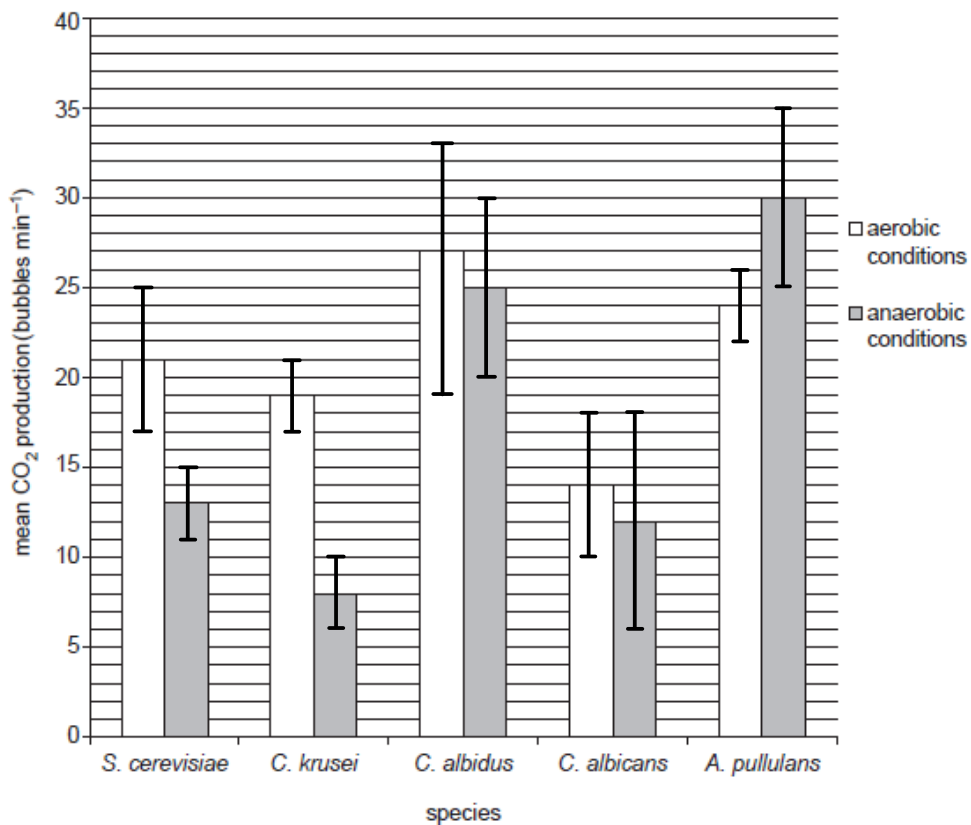


Fig. 20

Plot the standard deviations for all data on Fig. 20.

[Answer on Fig. 20]

[2]

- 5 (c) Calculate the mean percentage change in CO₂ production for *S. cerevisiae* when moving from anaerobic to aerobic respiration. Give your answer to **four** significant figures.

Show your working.

$$\frac{21-13}{13} \times 100 = 61.54\%$$

[3]

- 5 (d) (i) The student drew the following conclusions:

1. All the yeast I investigated produced more CO₂ during aerobic respiration than anaerobic respiration.
2. There is a significant difference between the CO₂ production in aerobic and anaerobic conditions in *C. albicus*.

[2]

For each conclusion, state and explain whether the student is correct.

Conclusion 1 is incorrect because *A. Pullulans* produced more CO₂ in anaerobic conditions.

Conclusion 2 is incorrect because the standard deviations for aerobic and anaerobic conditions overlap.

- 5 (d) (ii) The student found the following definitions of errors in a text book:

Random errors:

mistakes during measurements caused by low-resolution equipment

Systematic errors:

repeated inaccurate measurements in the same direction caused by problems with equipment

Which type of error is suggested by the student's data? Justify your answer.

Random error because the standard deviations vary in size, with large standard deviations recorded for some experiments.

[1]

- 5 (e) Anaerobic respiration in yeast cells requires enzymes.

Which organelle is responsible for synthesising these enzymes?

Ribosomes

[1]

Total Marks for Question Set 5: 12

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