PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



EXAM QUESTION PACK

TOPIC 6: MICROBIOLOGY AND PATHOGENS

CORE PRACTICALS

SCORE	PERCENTAGE
/39	%

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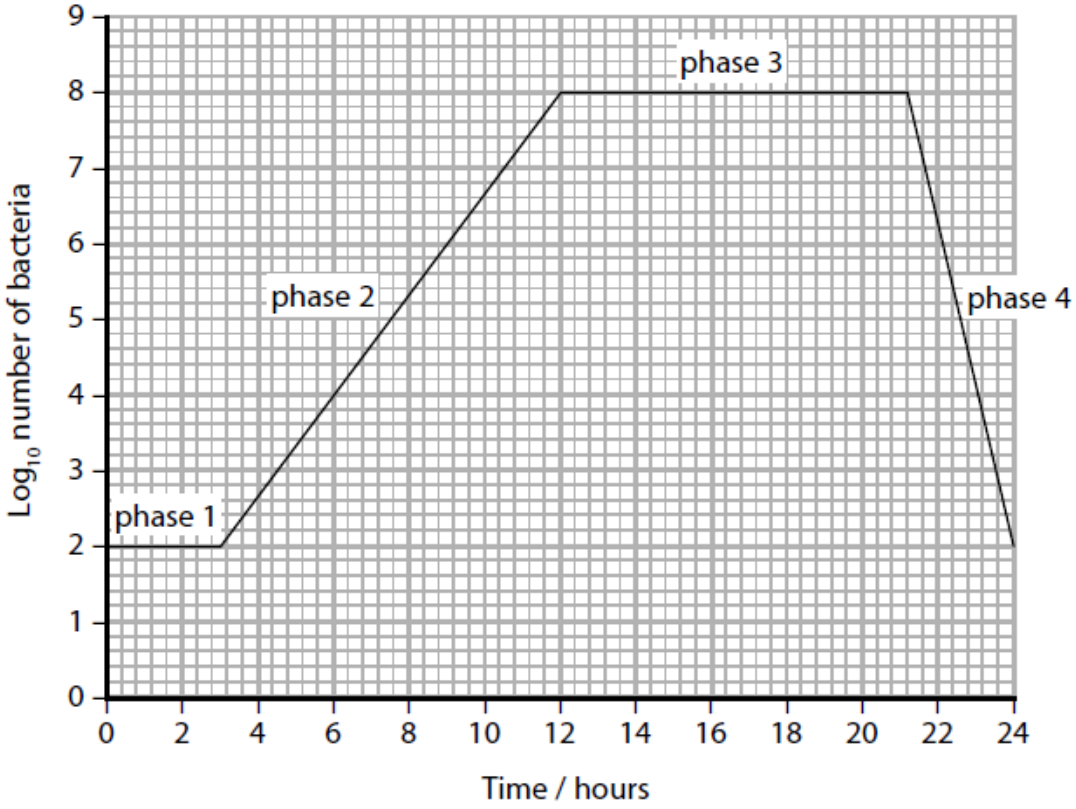
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Q1.

A broth culture for growing bacteria was set up.

Dilution plating was used to determine the number of live bacteria in the culture over a period of 24 hours.

The graph below shows the number of live bacteria in the culture during this 24-hour period.



(a) Which is the correct order of the phases 1 to 4 shown on the graph?

(1)

☒ **A** lag, log, death, stationary

☒ **B** lag, log, stationary, death

☒ **C** log, lag, death, stationary

☒ **D** log, lag, stationary, death

*(b) Evaluate the use of dilution plating and optical methods for determining the number of bacterial cells in a culture.

(6)

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(c) Calculate the growth rate constant (k) for phase 2 of this culture, using the formula:

$$k = \frac{\log_{10} N_t - \log_{10} N_0}{0.301 \times t}$$

(4)

Answer .....

(Total for question = 11 marks)

Q2.

Salmonella are Gram negative bacteria found in the large intestine of humans.

A scientist studied the growth of *Salmonella*.

(i) *Salmonella* was isolated from a mixed culture of bacteria, using streak plating onto selective media.

Explain why this is a suitable method for isolating the *Salmonella*.

(4)

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(ii) The scientist made a broth culture of *Salmonella* at a concentration of 5×10^3 cells per cm^3.

Ten hours later the concentration of *Salmonella* was 4×10^6 per cm^3.

Calculate the exponential growth rate constant (k) for this culture of *Salmonella* using the formula

(3)

$$k = \frac{\log_{10} N_t - \log_{10} N_0}{0.301 \times t}$$

Answer .....

(iii) In this calculation, the scientist did not allow for the time that the *Salmonella* spent in the lag phase.

Explain the effect that this will have on the calculated value for the growth rate constant.

(3)

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(Total for question = 10 marks)

Q3.

Aseptic conditions are used when growing bacteria in laboratories.

Justify two methods, other than UV radiation, for ensuring aseptic conditions.

(2)

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(Total for question = 2 marks)

Q4.

Streak plating is used in microbiology to separate individual species of bacteria from a mixed liquid culture.

(a) Describe how streak plating can be used to isolate individual bacterial colonies from a mixed liquid culture.

You may use a diagram in your answer.

(5)

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(b) Explain why agar plates should be incubated below 30°C in a school laboratory.

(2)

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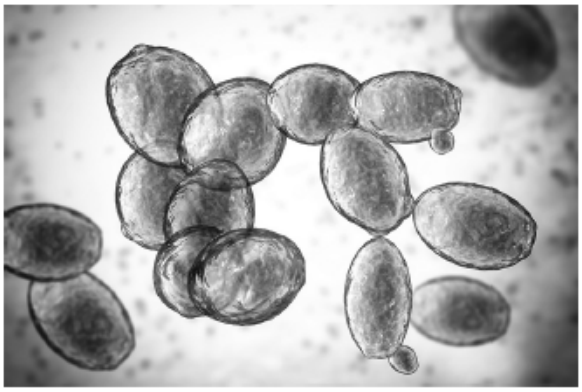
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(Total for question = 7 marks)

Q5.

Yeast, *Saccharomyces cerevisiae*, is a single-celled organism used in brewing and baking.

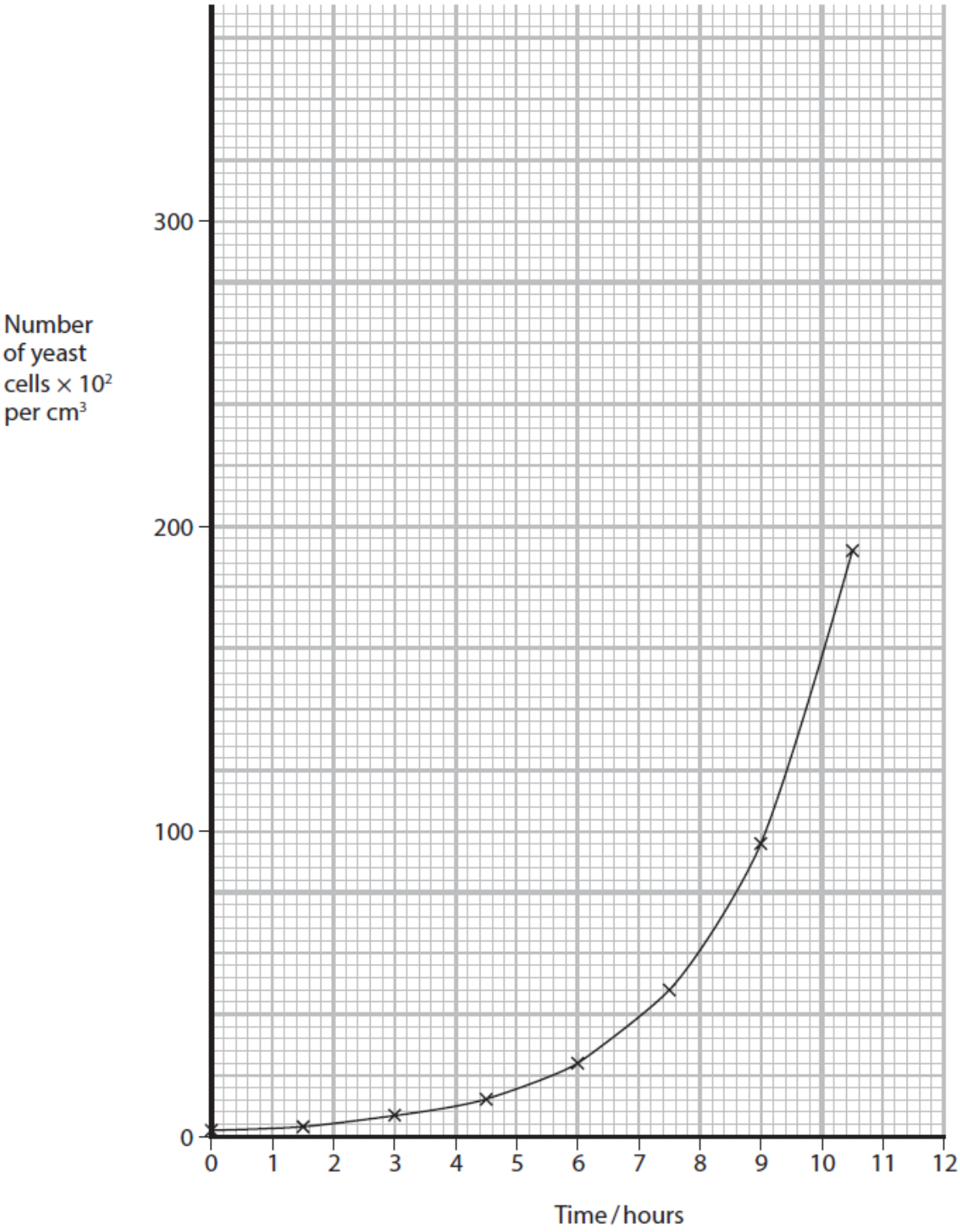
The photograph shows yeast cells seen using a light microscope.



(Source: © Kateryna Kon/Shutterstock)

A student counted the number of yeast cells, at 90-minute intervals, growing in a liquid culture at 30°C.

The graph shows the results.



(i) Calculate the percentage increase in the number of yeast cells from 2 hours to 6 hours.

(2)

Answer ..... %

(ii) Predict the number of cells per cm^3 of the culture at 12 hours.

Assume that the culture continues to grow at the same rate.

(1)

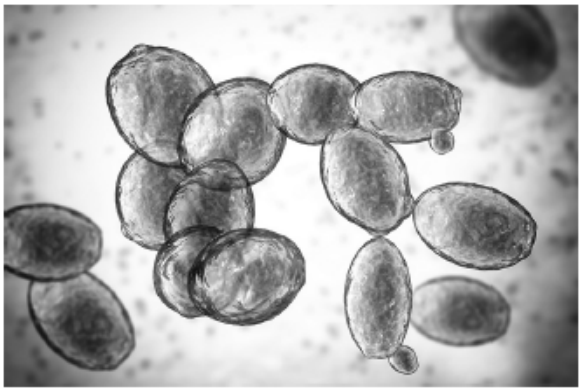
Answer ..... × 10^2 per cm^3

(Total for question = 3 marks)

Q6.

Yeast, *Saccharomyces cerevisiae*, is a single-celled organism used in brewing and baking.

The photograph shows yeast cells seen using a light microscope.



(Source: © Kateryna Kon/Shutterstock)

A student counted the number of yeast cells, at 90-minute intervals, growing in a liquid culture at 30°C.

The student counted the yeast cells using a haemocytometer.

The table shows the number of cells counted using a haemocytometer.

Time / hours	Number of cells						
	1	2	3	4	5	Mean	Standard deviation (SD)
0.0	1	2	2	1	2	1.6	0.5
1.5	2	3	3	3	2	2.6	0.5
3.0	4	9	9	3	7	6.4	
4.5	13	10	12	9	16	12.0	2.7
6.0	43	31	18	14	15	24.2	12.5

(i) The student calculated the standard deviations using the following formula.

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

Calculate the standard deviation for the sample at 3 hours.

(3)

(ii) The student concluded that the yeast population doubles every 90 minutes.

Comment on the validity of this conclusion.

(3)

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(Total for question = 6 marks)