



Culturing and measuring microorganisms: practice questions

8 questions · 29 marks · mark scheme at the back

For Pearson Edexcel International AS Biology XBI11 and International A Level Biology YBI11. **A Level only** is IA2 content (Units 4 to 6), not needed for the International AS.

Name

Total / 29

1 UNIT 4 STYLE [1 mark]
A Level only

Why are agar plates incubated upside down in a school laboratory?

- A. ☐ Condensation collects in the lid and cannot drip on to the agar
- B. ☐ It gives the bacteria more oxygen
- C. ☐ It stops the agar drying out
- D. ☐ It kills any contaminating fungi

2 UNIT 4 STYLE [4 marks]
A Level only

A student prepares a plate of bacteria using aseptic technique. Explain two precautions that should be taken, giving a reason for each.

3 UNIT 4 STYLE

[3 marks]

A Level only

A broth culture of yeast was diluted using a serial dilution, 1 cm³ into 9 cm³ each time. 0.1 cm³ of the tube diluted to 10⁻³ was spread on agar. After incubation 74 colonies grew. Calculate the number of colony-forming units per cm³ in the original culture. Give your answer in standard form.

Answer = ...

4 UNIT 4 STYLE

[4 marks]

A Level only

Compare and contrast dilution plating with turbidity measurement as methods of finding the growth of a bacterial population.

5 UNIT 4 STYLE

[1 mark]

A Level only

In which phase of the growth curve of bacteria in a closed culture is the rate of cell division equal to the rate of cell death?

- A. ☐ Lag phase
- B. ☐ Exponential phase
- C. ☐ Stationary phase
- D. ☐ Death phase

In core practical 13 a student measured the absorbance of yeast cultures every hour. Explain why a sample of sterile broth was used in the colorimeter, and why the culture was swirled before each sample was removed.

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Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1] A Level only

A A (1)

2. [4] A Level only

- sterilise the agar plates and loop before use (1) to kill all microorganisms / so that only the chosen organism grows (1)
- flame the loop until red hot and cool it before use (1) kills contaminants; a cool loop does not kill the culture (1)
- flame the neck of the bottle / work near a Bunsen flame (1) updraught carries airborne microorganisms away / kills microorganisms at the neck (1)
- open the Petri dish lid only slightly and briefly (1) to stop airborne microorganisms entering (1)
- tape the lid with short strips (1) so that oxygen can enter and anaerobic pathogens do not grow (1)
- incubate at 25 °C, not 37 °C (1) to reduce growth of human pathogens (1)
- disinfect the bench / wash hands (1) to reduce contamination of culture and infection of worker (1)
- Max 4

3. [3] A Level only

- $74 \div 0.1 = 740$ (cfu per cm^3 of the diluted sample) (1)
- $\times 10^3$ (dilution factor) (1)
- 7.4×10^5 cfu per cm^3 (1) (allow 7.4×10^5 without working for 3)

4. [4] A Level only

- both can be used to estimate the number of bacteria / both can be used over time to follow growth (1)
- dilution plating counts only living cells (1) whereas turbidity counts living and dead cells (1)
- dilution plating needs incubation / takes a day or more, but turbidity gives an immediate reading (1)
- turbidity does not destroy the sample / can be repeated on the same culture, dilution plating uses up samples (1)
- turbidity needs a calibration curve to convert to cell numbers (1)
- Max 4

5. [1] A Level only

C C (1)

6. [7] A Level only

- (a) lag phase (1)
- cells are adjusting to the medium / synthesising enzymes, with no division yet (1)
- (b) change in $\log_{10} = 6.0 - 3.6 = 2.4$ (1)
- generations = $2.4 \div 0.301 = 8$ (allow 7.97) (1)
- $k = 8 \div 4 = 2.0$ generations per hour (1)
- (c) stationary phase / number of living cells constant (1)
- nutrients limiting / toxic waste accumulating (1) so the rate of cell division equals the rate of cell death (1)
- (c) max 2; Max 7 overall

7. [6] A Level only

- independent variable: set up water baths at several temperatures (at least five, over a suitable range such as 20 to 40 °C) (1)
- same volume of sterile broth and same starting yeast concentration / volume of inoculum in each flask (1)
- dependent variable: measure absorbance in a colorimeter / count cells / dilution plating at regular intervals (1)
- plot cell number or absorbance against time and compare gradients / calculate growth rate constant (1)
- repeat at least three times and calculate means (1)
- control other variables, for example pH, glucose concentration, aeration, same strain (1)
- use aseptic technique / sterile pipettes and equipment (1)
- use a harmless strain / risk assessment / lab coat and gloves (1)
- autoclave or disinfect cultures before disposal / use no more organisms than needed / dispose of cultures responsibly (1)
- Max 6

8. [3] A Level only

- sterile broth acts as a blank / sets zero absorbance (1)
- so that the absorbance recorded is only due to the yeast cells (1)
- swirling resuspends the cells (1) so that the sample is representative / cells settled at the bottom would give an inaccurate reading (1)
- Max 3