1.1.6 Culturing microorganisms

AQA GCSE Biology (Higher)
Question and answer notes

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How to use these notes

These notes cover everything you need to know for this part of the specification. They have been written in question-answer format to make them easier for you to study from.

In order to study successfully, I recommend you do the following for each question and answer:

- Read it carefully and make sure you **understand** it.
- **Memorise** the answer.
- **Practice** applying your understanding to past exam questions.

A good way to memorise information is to use **retrieval practice**. This is when you practise retrieving information from your memory. You could do this by making a flashcard for each question with the question on one side and the answer on the other. Or you could use a flashcard app. Alternatively, use a sheet of paper to cover up the answer so you can only see the question. Try to answer the question and then check how you did.

You should practise retrieving each answer from your memory until you can do it perfectly. Even once you can retrieve the answer perfectly, your ability to retrieve it will probably fade as time passes without practising. Therefore you will need to keep going back to the questions that you have previously mastered and practising them again. However, each time you re-learn the answer, the memory will be stronger and will last longer than the time before.

What process do prokaryotes use for cell division?
Prokaryotes carry out cell division using a process called binary fission.

What happens in binary fission?
In binary fission, the DNA molecules are replicated and the copies go to opposite ends of the cell. The cell then splits in two, with each cell receiving one copy of each DNA molecule. This produces cells that are genetically identical to the original cell and to each other.

What conditions do prokaryotes need to carry out binary fission quickly?
In order to carry out binary fission quickly, prokaryotes need enough nutrients and a suitable temperature.

How quickly can some bacteria carry out binary fission under suitable conditions?
Under the right conditions, some bacteria can divide by binary fission once every 20 minutes.

What are microorganisms?
Microorganisms are organisms that are too small to be seen without a microscope. This includes bacteria, most other unicellular organisms and some small multicellular organisms.

What is a culture?
A culture is a group of microorganisms being grown in a laboratory.

What are the two main ways of growing bacteria?
Bacteria can be grown in a nutrient broth solution or on an agar gel plate.

What is a nutrient broth solution?
A nutrient broth solution is a solution made by dissolving nutrients in water. If bacteria are added, they grow and divide in the solution.

What is an agar gel plate?
An agar gel plate is a Petri dish containing agar (a jelly-like solid) mixed with nutrients. If bacteria are added, they grow on the surface, forming large, visible colonies.

What is aseptic technique?
Aseptic technique is a set of steps taken to prevent contamination when preparing or working with a culture of microorganisms.

What equipment is needed to prepare a bacterial culture?
To prepare a bacterial culture, you need: a Bunsen burner, an inoculating loop, a bottle of nutrient broth solution with bacteria in it, an agar gel plate, tape, and an incubator.

What are the first steps for preparing a bacterial culture?
To prepare a bacterial culture, start by lighting the Bunsen burner. Then, if the inoculating loop is metal, pass it through the flame. If it is plastic, take it out of its packaging. Remove the lid from the nutrient broth solution bottle and pass the bottle neck through the flame. Place the end of the inoculating loop in the nutrient broth solution.

What are the final steps for preparing a bacterial culture?
Remove the inoculating loop from the bottle. Pass the bottle neck through the flame and put the lid back on. Partially lift the lid of the plate and use the loop to spread the bacteria on the agar. Remove the loop and close the lid. If the loop is metal, pass it through the flame. If it is plastic, dispose of it safely. Tape the lid onto the plate, turn the plate upside down, and place it in the incubator at 25°C.

Why must agar gel plates be sterilised before use?
Agar gel plates must be sterilised before use to kill any existing microorganisms that are living on the plate, which helps to ensure that only the bacteria you add to the plate will grow on it.

Why are bottle necks and metal inoculating loops passed through the flame?
Bottle necks and metal inoculating loops are passed through the flame to sterilise them, killing any microorganisms that might be on them. This prevents those microorganisms from contaminating the culture.

Why are agar gel plates stored upside down?
Agar gel plates are stored upside down to prevent condensation from the lid, which could contain microorganisms, from dripping onto the surface of the agar.

Why are agar gel plates incubated at 25°C?
Agar gel plates are incubated at 25°C, because this is well below 37°C - the temperature at which many pathogens of humans grow well. Therefore, it reduces the chances of those microorganisms growing.

Which kinds of chemicals can be investigated using cultures of bacteria?
Antibiotics and disinfectants (two types of chemicals which kill bacteria) can be investigated using cultures of bacteria.

How do you calculate the area of a bacterial colony or clear region?
To calculate the area of a bacterial colony or clear region, first measure its diameter with a ruler. Then divide this by 2 to get the radius. Then square this and multiply by π to get the area.

How do you calculate the number of bacteria in a population after a given amount of time?
To find the number of bacteria in a population, first divide the time they have been dividing for by the mean division time to get the number of completed divisions. Then, calculate 2 to the power of this number.