

### Microbiology Exam

**Exercise 01 (07.5 pts): Answer all parts of the following questions completely.**

**1. What are the taxa in Carl Woese's classification, and on what basis did he classify them? 2pts**

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**2. What is the role of gas vacuoles in bacteria, and are they present in all bacterial species? 1.5pts**

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**3. Which reference work is known as the "Bible of bacteriology," and why is it given this title? 1.5pts**

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**4. Explain why the length of the lag phase can vary considerably during growth? 2.5 pts**

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**Exercise 2 : (4.5 Pts)**

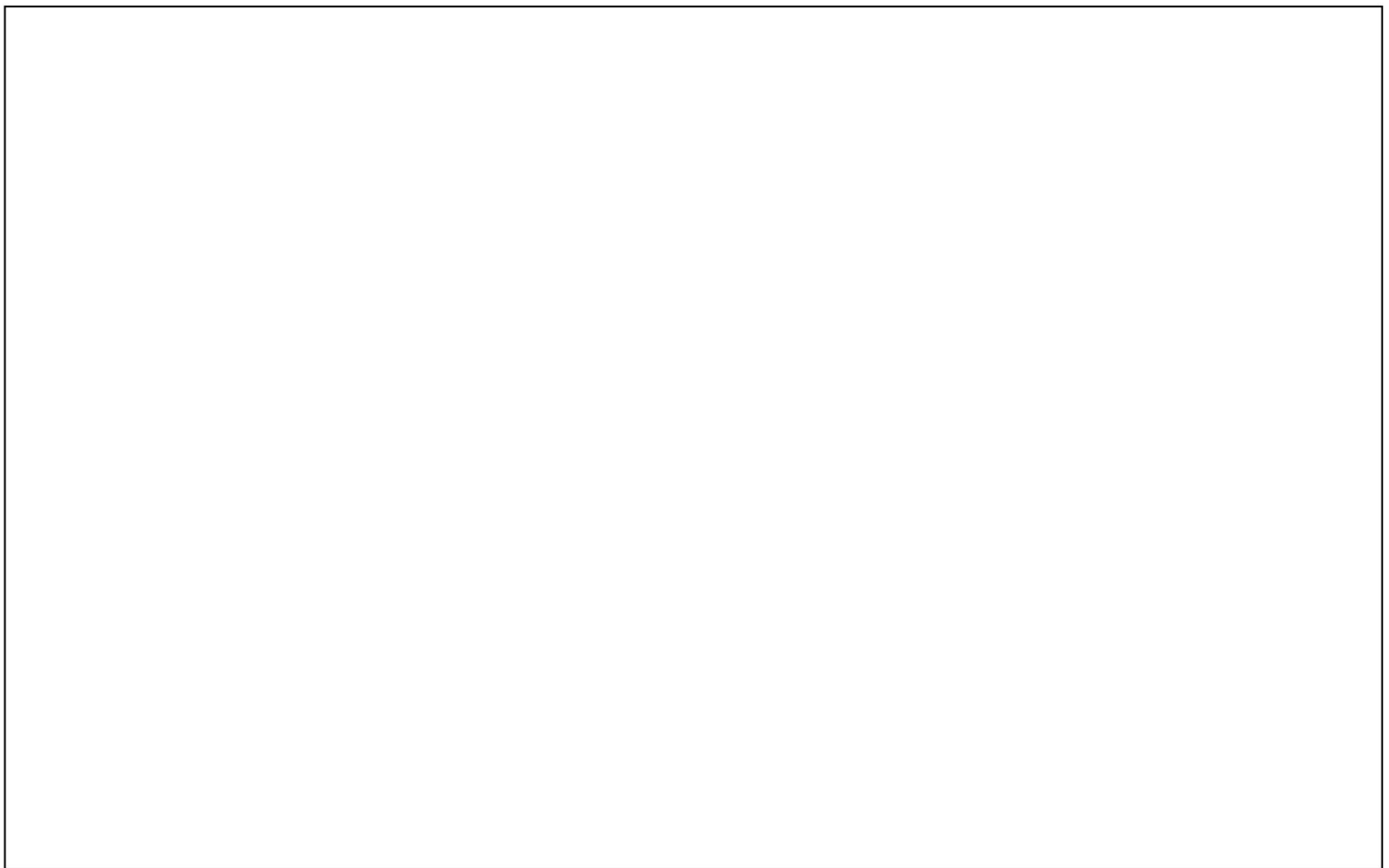
**- Define bacterial sporogenesis and specify under which conditions it occurs?**

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**- Name two spore-forming species?**

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**- Illustrate the different stages of bacterial sporulation.**



**Exercise 3:** Choose the correct answer (08 Pts)

<p><b>1. Type of reproduction involves the growth of a smaller organism directly from the parent body</b></p> <ul style="list-style-type: none"><li>• A. Fragmentation</li><li>• B. Budding</li><li>• C. Sporulation</li><li>• D. Binary fission</li></ul>	<p><b>5. The main difference in true bacteria and mycoplasma is that it does not possess</b></p> <ul style="list-style-type: none"><li>• A. Flagella</li><li>• B. Cell wall</li><li>• C. ATP synthesis</li><li>• D. A capsule</li></ul>
<p><b>2. Which reproduction method occurs when hyphae detach from the parent organism?</b></p> <ul style="list-style-type: none"><li>• Budding</li><li>• B. Fragmentation</li><li>• C. Conjugation</li><li>• D. Sporogenesis</li></ul>	<p><b>6. Which of the following induces dimerization of Thymine base?</b></p> <ul style="list-style-type: none"><li>• A. X-rays</li><li>• B. U.V. rays</li><li>• C. <math>\gamma</math>-rays</li><li>• D. None of these</li></ul>
<p><b>3. The phenomenon where two distinct phases of microbial growth occur due to sequential utilization of different carbon sources.</b></p> <ul style="list-style-type: none"><li>• A. Log phase</li><li>• B. Diauxic growth</li><li>• C. Stationary phase</li><li>• D. Catabolite repression</li></ul>	<p><b>7. What is the smallest amount of a chemotherapeutic agent required to inhibit the growth of a microorganism <i>in vitro</i>?</b></p> <ul style="list-style-type: none"><li>• A. MBC (Minimal Bactericidal Concentration)</li><li>• B. MIC (Minimal Inhibitory Concentration)</li><li>• C. LD50</li><li>• D. IC50</li></ul>
<p><b>4. Most bacteria require vitamins as</b></p> <ul style="list-style-type: none"><li>• A. Growth Factors</li><li>• B. Sources of energy</li><li>• C. Sources of carbon</li><li>• D. Sources of electron donors</li></ul>	<p><b>8. What does the term <u>broad-spectrum antibiotic</u> mean?</b></p> <ul style="list-style-type: none"><li>• A. Effective only against Gram-positive bacteria</li><li>• B. Effective against both Gram-positive and Gram-negative bacteria</li><li>• C. Effective only against fungi</li><li>• D. Effective only against viruses</li></ul>

## Exam answer key

**Exercise 01** Answer all parts of the following questions completely.

**1. what are the taxa in Carl Woese's classification, and on what basis did he classify them. 2pts**

Carl Woese proposed a revolutionary classification of life into three major domains: **Archaea, Bacteria (Eubacteria), Eukarya**

This classification system divides the life based on the differences in the **16S ribosomal RNA (rRNA) structure** and as well as the cell's membrane lipid structure and its sensitivity to antibiotics. The main difference from earlier classification systems is the splitting of **archaea** from bacteria.

**2. What is the role of gas vacuoles in bacteria, and are they present in all bacterial species?. 1.5**

Gas vacuoles are intracellular structures that function as **buoyancy regulators** (flotation and environmental adaptation). They allow bacteria, **especially aquatic species** such as cyanobacteria, to adjust their position in the water column.

**3. Which reference work is commonly referred to as the "Bible of bacteriology" and why is it given this title? (1.5 Pts)**

**Bergey's Manual of Systematic Bacteriology.** It is called the "Bible of bacteriology" because it is the most authoritative and comprehensive **reference for bacterial classification** and identification, used worldwide by microbiologists.

**5. Explain why the length of the lag phase can vary considerably during growth? (2.5)**

The length of the lag phase can vary considerably, based on how different the conditions are from the conditions that the bacteria came from, as well as the condition of the bacterial cells themselves:

- This lag phase is generally seen while the inoculated bacteria adjust to the new culture fluid, but if one were to inoculate bacteria from one active culture into a culture fluid of the same composition at the same temperature then one often does not see a lag phase
- Damaged cells will have a long lag period, since they must repair themselves before they can engage in reproduction.
- The age of the bacteria;
- The size of the inoculum;
- The germ studied;

**Exercise 2 : (4.5 Pts)**

**(A) Define bacterial sporogenesis and specify under which conditions it occurs?**

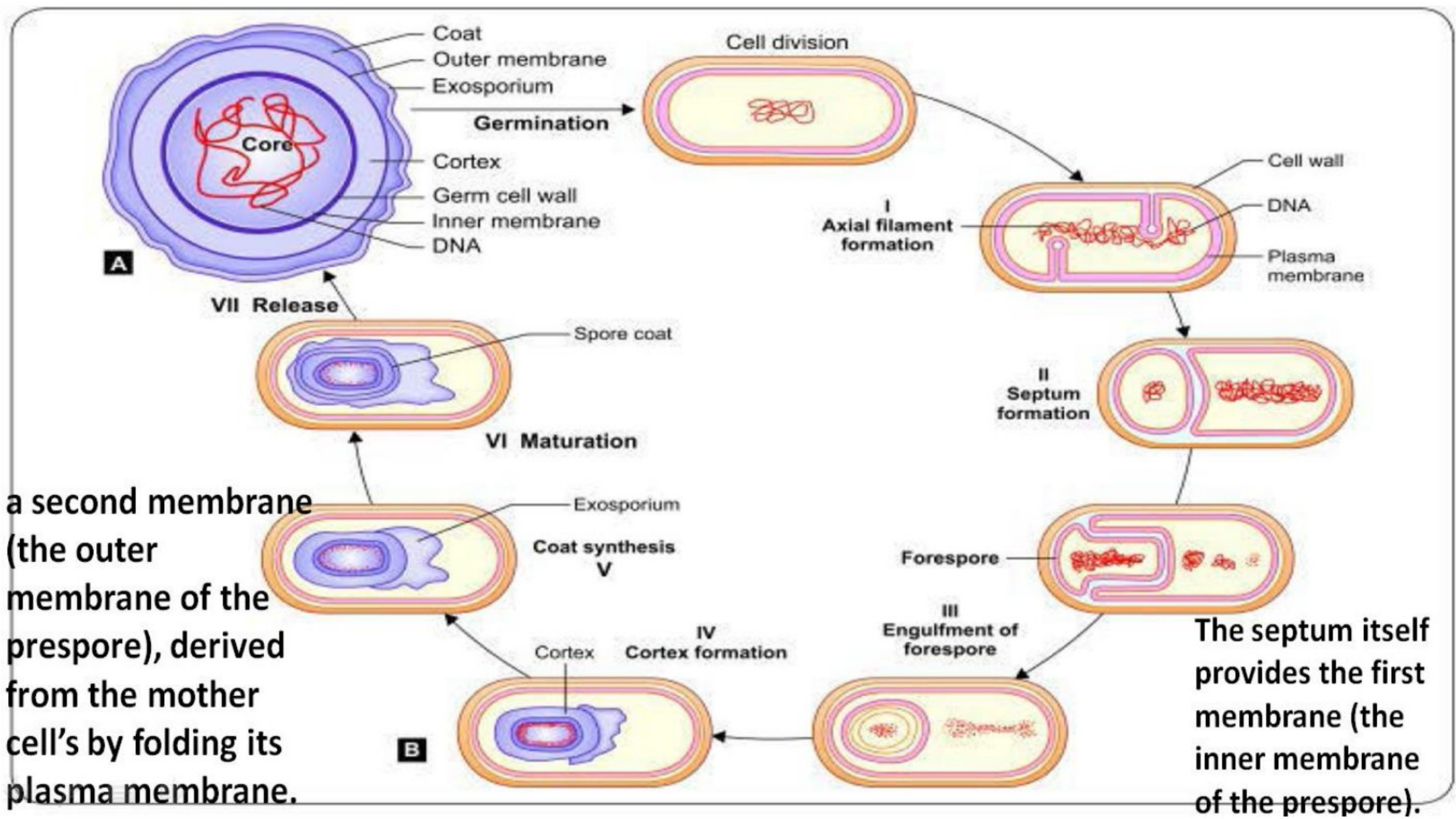
**(B) Name two spore-forming species?**

**(C) Illustrate the different stages of bacterial sporulation.**

**a. Bacterial sporogenesis (sporulation)** is the process by which certain bacteria **form endospores**, highly resistant dormant structures. The vegetative cell releasing a mature endospore

Sporogenesis occurs when environmental conditions **become unfavorable**, such as nutrient depletion, extreme heat, desiccation, radiation, or chemical stress.

**b. Two well-known spore-forming bacterial species are: Bacillus subtilis Clostridium botulinum.**



**Exercise 3 : Choose the correct answer (08 Pts)**

<p>1. What type of asexual reproduction involves the growth of a smaller organism directly from the parent body?</p> <ul style="list-style-type: none"> <li>• A. Fragmentation</li> <li>• <b>B. Budding</b></li> <li>• C. Sporulation</li> <li>• D. Binary fission</li> </ul>	<p>5. The main difference in true bacteria and mycoplasma is that it does not possess</p> <ul style="list-style-type: none"> <li>• A. Flagella</li> <li>• <b>B. Cell wall</b></li> <li>• C. ATP synthesis</li> <li>• D. A capsule</li> </ul>
<p>2. Which asexual reproduction method occurs when hyphae detach from the parent organism and live independently?</p> <ul style="list-style-type: none"> <li>• Budding</li> <li>• <b>B. Fragmentation</b></li> <li>• C. Conjugation</li> <li>• D. Sporogenesis</li> </ul>	<p>6. Which of the following induces dimerization of Thymine base?</p> <ul style="list-style-type: none"> <li>• A. X-rays</li> <li>• <b>B. U.V. rays</b></li> <li>• C. <math>\gamma</math>-rays</li> <li>• D. None of these</li> </ul>
<p>3. What is the term for the phenomenon where two distinct phases of microbial growth occur due to sequential utilization of different carbon sources?</p> <ul style="list-style-type: none"> <li>• A. Log phase</li> <li>• <b>B. Diauxic growth</b></li> <li>• C. Stationary phase</li> <li>• D. Catabolite repression</li> </ul>	<p>7. What is the smallest amount of a chemotherapeutic agent required to inhibit the growth of a microorganism <i>in vitro</i> called?</p> <ul style="list-style-type: none"> <li>• A. MBC (Minimal Bactericidal Concentration)</li> <li>• <b>B. MIC (Minimal Inhibitory Concentration)</b></li> <li>• C. LD50</li> <li>• D. IC50</li> </ul>
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