

2024학년도 연세대학교 면접시험

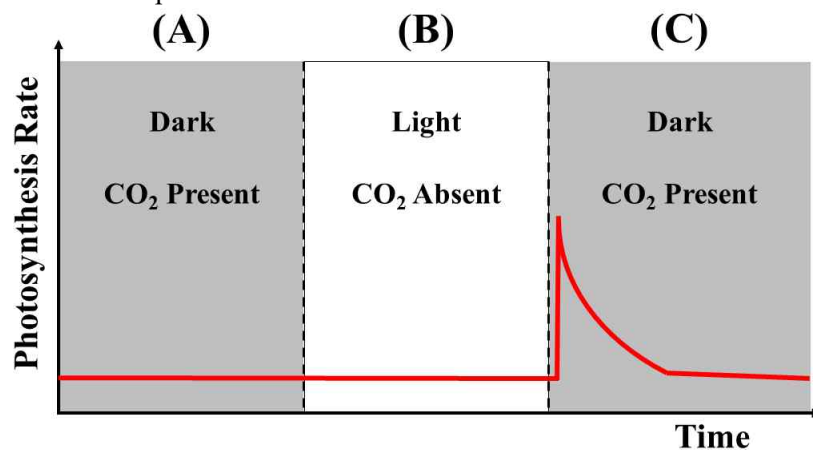
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※ **Instructions.** Read the passages below and answer the following questions.

[Passage 1] Carbon forms the framework of the organic molecules essential to all organisms. Photosynthesis and respiration are the two key processes of the carbon cycle in the ecosystem. Photosynthetic organisms utilize CO_2 to produce organic molecules, which return to the environment by respiration of all organisms. Some organic molecules sediment and turn into fossil fuels over a long time, which eventually return to the atmosphere by combustion. Rapid industrialization since the late 18th century resulted in the emission of large volumes of greenhouse gases to the atmosphere, causing elevation of the mean temperature of the earth (global warming).

[Passage 2] The two stages of photosynthesis are known as the light reaction and the dark reaction (requiring no light, also known as the Calvin cycle). The light reaction collects the energy stored in solar rays in the production of NADPH and ATP molecules, and the Calvin cycle utilizes these molecules for the synthesis of glucose by reduction of CO_2 .

[Passage 3] Andrew A. Benson obtained results similar to that shown in the figure below in his 1949 experiment. Photosynthesis did not occur in the absence of light despite the presence of CO_2 . However, a short burst of glucose production was observed when CO_2 was presented following an irradiation step.



[Passage 4] Cellular respiration utilizes the energy released by decomposition of organic molecules in the synthesis of ATP molecules. Cellular respiration involves the following stages: glycolysis, pyruvate oxidation, TCA cycle, and oxidative phosphorylation. High energy electrons released during glycolysis, pyruvate oxidation, and TCA cycle produce many ATP molecules moving through the electron transfer chain in the oxidative phosphorylation stage.

*framework: 골격, organism: 생명체, photosynthesis: 광합성, (cellular) respiration: (세포) 호흡, carbon cycle: 탄소 순환, ecosystem: 생태계, sediment: 퇴적물로 쌓이다, fossil fuel: 화석 연료, combustion: 연소, industrialization: 산업화, greenhouse gas: 온실 기체, elevation: 상승, global warming: 지구 온난화, light reaction: 명반응, dark reaction: 암반응, Calvin cycle: 캘빈 회로, solar ray: 태양광, synthesis: 합성, glucose: 포도당, reduction: 환원, irradiation: 빛을 비추, photosynthesis rate: 광합성 속도, decompose: 분해되다, organic molecules: 유기물, glycolysis: 해당 과정, pyruvate oxidation: 피루브산의 산화, TCA cycle: TCA 회로, oxidative phosphorylation: 산화적 인산화, high energy electron: 고에너지 전자, electron transfer chain: 전자 전달계.

- [Question 1]** From the perspective on the carbon cycle provided in passage 1, explain why global warming accelerates with heavy use of fossil fuels. **[15 Pts]**
- [Question 2]** Refer to passages 2 and 3 on photosynthesis and answer the following questions. The photosynthetic dark reaction does not require light, however, it will not occur when the plant is in the dark as shown in **(A)** of the figure in passage 3. Explain the reason why. Provide the reason for the glucose production in the dark in the experiment shown in **(C)** of the figure in passage 3. **[40 Pts]**
- [Question 3]** Refer to passage 4 on cellular respiration and identify: **i)** the molecule accepting the electrons and **ii)** the molecule donating the electrons. To what molecules do the respective electron accepting and donating molecules transform after the respiratory reaction? Explain the principle behind the ATP synthesis in oxidative phosphorylation. **[45 Pts]**