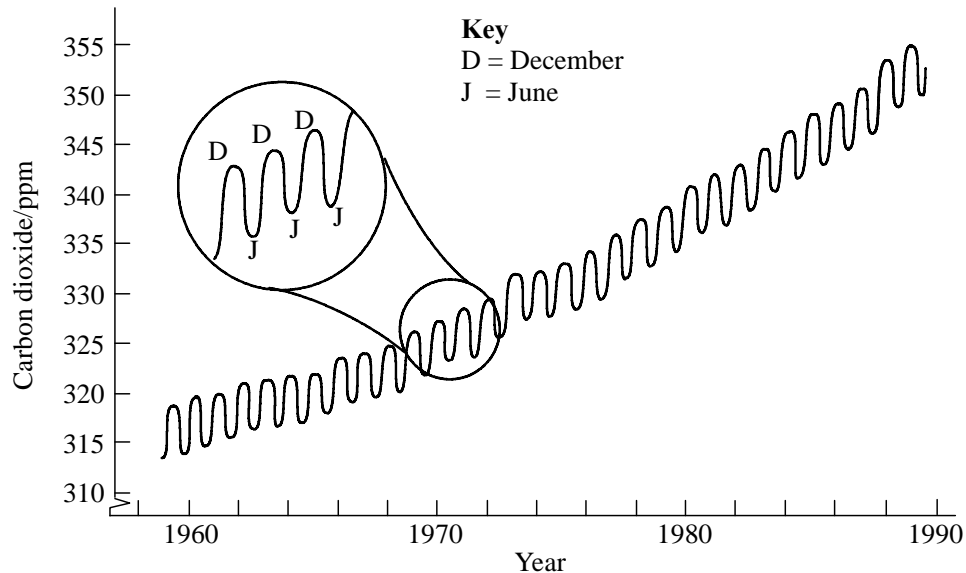


Part 1: Multiple Choice Question 1-20 (1 point per question)

1. The graph below shows changes in the concentration of carbon dioxide in the atmosphere.



- The fluctuations in the graph are due to
- increased use of fossil fuels in winter.
 - seasonal changes in the amount of photosynthesis occurring.
 - daily changes in the amount of photosynthesis occurring.
 - biomass variations in phytoplankton.
2. Pigments are extracted from the leaves of a green plant. White light is then passed through the solution of pigments. What effect do the leaf pigments have on the white light?
- Green wavelengths are absorbed and red and blue wavelengths are transmitted.
 - Green and red wavelengths are absorbed and blue wavelengths are transmitted.
 - Red and blue wavelengths are absorbed and green wavelengths are transmitted.
 - Blue wavelengths are absorbed and green and red wavelengths are transmitted.
3. Which two colours of light does chlorophyll absorb most?
- Red and blue
 - Green and blue
 - Red and yellow
 - Red and green

4. What is needed in photosynthesis to convert carbon dioxide into organic molecules?
- A. Light and hydrogen from the splitting of water
 - B. ATP and hydrogen from the splitting of water
 - C. ATP and oxygen from the splitting of water
 - D. Light and oxygen from the splitting of water
5. How is the proton gradient generated in chloroplasts during photosynthesis?
- A. Flow of electrons from carrier to carrier in the thylakoid membrane causes pumping of protons across the thylakoid membrane.
 - B. Light causes protons to flow through protein channels in the thylakoid membrane.
 - C. Light splits water molecules in the stroma, causing the release of protons.
 - D. Protons are pumped across the thylakoid membrane using energy from ATP.
6. Why is the action spectrum for photosynthesis similar to the absorption spectra of photosynthetic pigments?
- A. Photosynthetic pigments have the same optimum temperature as the enzymes used in photosynthesis.
 - B. The amount of energy absorbed by photosynthetic pigments is equal to the activation energy for photosynthesis.
 - C. Plants absorb the same photosynthetic pigments for use in photosynthesis.
 - D. Only wavelengths of light absorbed by pigments can be used in photosynthesis.
7. Which of the following describes the photosynthetic pigment in which electrons become excited during the light dependent reaction?
- A. Chlorophyll a.
 - B. Green.
 - C. Carotenoids.
 - D. Red and blue.

8. The energy lost from electrons during the electron transport chain drives which of the following processes?
- A. regeneration of RuBP.
 - B. carbon fixation.
 - C. chemiosmosis.
 - D. photolysis.
9. Which of the following statements describes a relationship between photosystem 2 and photosystem 1?
- A. Photosystem 2 produces ATP and NADPH that are used by photosystem 1.
 - B. Photosystem 1 produces ATP and NADPH that are used by photosystem 2.
 - C. The de-energized electron from photosystem 1 fills the void left by the newly energized electron from photosystem 2.
 - D. The de-energized electron from photosystem 2 fills the void left by the newly energized electron from photosystem 1.
10. Which of the following identifies an accessory pigment?
- A. Chlorophyll a.
 - B. Carotenoid.
 - C. Chlorophyll b.
 - D. Ferredoxin.
11. This is the enzyme that catalyzes the transfer of the electron from ferredoxin in the electron transport chain.
- A. ATP synthase.
 - B. NADP reductase.
 - C. RuBP Catalase (rubisco)
 - D. glycerate-3-phosphate

12. Which of the following identifies the two final products of the light dependent reaction?
- A. cytochrome complex and ferredoxin
 - B. plastoquinone and ferredoxin
 - C. NADPH and ATP
 - D. NADP^+ and ADP
13. Which of the following is **not** considered a limiting factor in photosynthesis?
- A. temperature
 - B. water
 - C. light intensity
 - D. concentration of carbon dioxide
14. Which of the following is an **indirect way** of measuring the rate of photosynthesis?
- A. production of oxygen
 - B. increase in biomass
 - C. uptake of carbon dioxide
 - D. all of the above
15. Which of the following is an alternative way to synthesize ATP using energy transferred between photosystems 1 & 2?
- A. photolysis
 - B. non-cyclic photophosphorylation
 - C. cyclic photophosphorylation
 - D. action spectrum

Questions 16-20 involve the following reactions.

- A. An unstable 6-C compound breaks down into two glycerate-3-phosphates.
- B. Two triose phosphates continue the cycle & reproduce RuBP used at the start.
- C. The glycerate-3-phosphates react with ATP & NADPH to form two triose phosphates.
- D. Ribulose biphosphate (RuBP), a 5-carbon compound binds to a CO₂ molecule.
- E. Two triose phosphates go out of the Calvin Cycle & synthesize glucose.

16. This reaction is also known as carbon fixation.

17. This reaction uses the final products of the light dependent reaction.

18. This reaction requires the RuBP Catalase (rubisco) enzyme.

19. This reaction requires the use of ATP to regain RuBP molecules from triose phosphates.

20. Which of the following presents a possible sequence of the above reactions in the Calvin Cycle?

- A. Reaction A → Reaction B → Reaction C → Reaction D
- B. Reaction A → Reaction C → Reaction B → Reaction D
- C. Reaction D → Reaction A → Reaction C → Reaction E
- D. Reaction D → Reaction A → Reaction C → Reaction B
- E. Both C and D

Part 2: Short Answer questions 21-26 (Points vary per question)

21. During photosynthesis in plants, light energy is absorbed by chlorophyll. This energy is then used to carry out photolysis, which supply substances that are needed to convert carbon dioxide into organic molecules such as glucose.

(a) State **two** factors in the environment of a plant, apart from light intensity, that can affect the rate of photosynthesis in the plant.

1.

2.

(2)

(b) Explain briefly **one** method for measuring the rate of photosynthesis in a plant.

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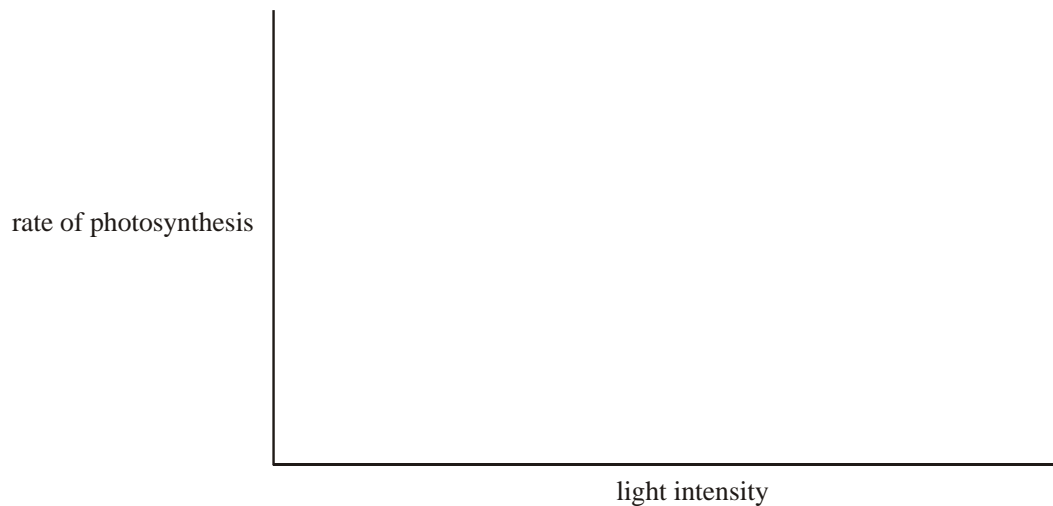
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(2)

(c) The rate of photosynthesis is affected by light intensity. Draw a line on the graph below to show the relationship between light intensity and the rate of photosynthesis.



(2)

(d) State the names of **two** products of photolysis in photosynthesis.

1.

2.

(2)

22. (i) State **two** products of the light-dependent reactions of photosynthesis.

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(2)

(ii) Explain the light-**independent** reactions in photosynthesis.

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(4)

23. (a) Draw and label the structure of the chloroplast as seen in the electron microscope.

(5)

24. Explain the reasons for

(a) large amounts of RuBP carboxylase in the chloroplast.

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(2)

(b) a large area of thylakoid membrane in the chloroplast.

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(2)

25. (a) State the main photosynthetic pigment in plants.

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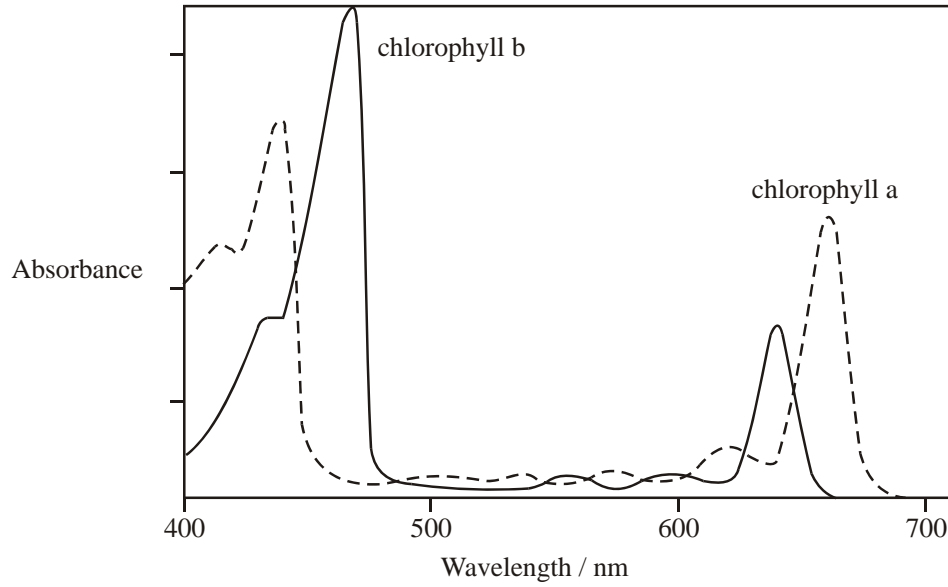
(1)

(b) State the **two** materials used to convert carbon dioxide to organic molecules in plants.

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(2)

26. The absorption spectrum of chlorophyll a and chlorophyll b are shown in the graph below.



(a) On the graph above, draw the action spectrum of photosynthesis for a green plant.

(1)

(b) Explain photophosphorylation in terms of chemiosmosis.

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