

TOPIC: AUTOTROPHIC NUTRITION

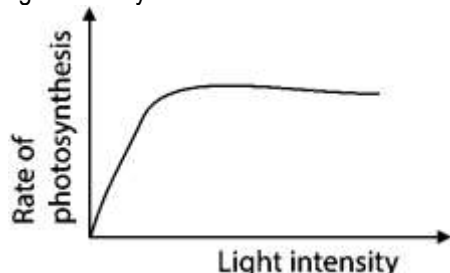
Time: 2 ½ hours

Attempt all questions in this paper

SECTION	MARKS
A	
B	
TOTAL	

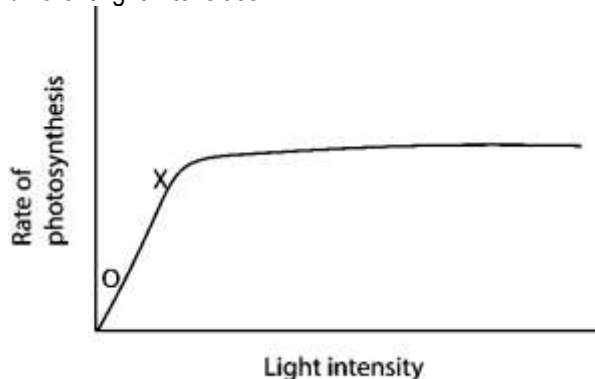
SECTION A. (40MARKS)

1. The figure below shows the rate of photosynthesis against light intensity.



Which one of the following statement is the cause of the flattening of the curve?

- Photosynthetic pigments are saturated
 - Too much carbon dioxide is available
 - The plant has attained its maximum rate of photosynthesis
 - There is a factor other than light which is limiting photosynthesis
2. Which of the following does not occur during photorespiration?
- Oxygen is used up
 - Wasteful loss of carbon as carbon dioxide
 - Carbon dioxide is used up
 - Wasteful loss of energy
3. The graph below shows the rate of photosynthesis at different light intensities.



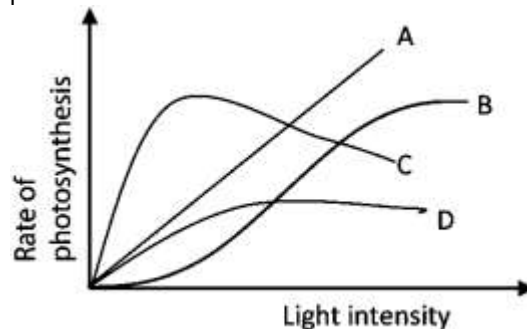
The factor limiting the rate of photosynthesis between O and X is

- Light intensity
 - Carbon dioxide.
 - Temperature
 - oxygen
4. C3 are less efficient than C4 plants in fixing carbon dioxide at low carbon dioxide and high oxygen partial pressure because
- C3 plants use more energy
 - In C3 plants, energy is lost

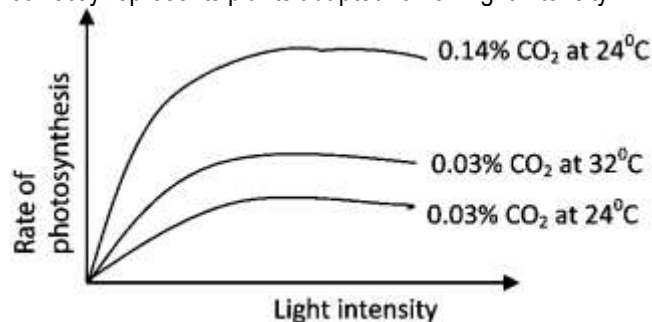
C RuBP carboxylase is inactivated by high oxygen partial pressure

D PEP carboxylase has high affinity for oxygen.

5. Photorespiration does not occur in C4 plants because they
- Use phosphoenolpyruvic acid for fixing carbon dioxide
 - Mainly grow at high altitudes
 - Are more abundant in cold region
 - Have succulent leaves which lower the internal temperature
6. Photosynthetic bacterial differ from green plants in that
- They lack chlorophyll
 - Their source of energy is through oxidation of hydrogen sulphide
 - Their source of energy is through oxidation of iron salts
 - Their source of hydrogen is hydrogen sulphide
7. Net primary productivity in C4 plants is higher than in C3 plants because



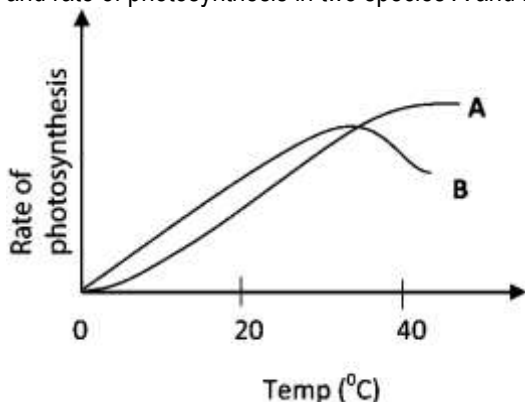
- C4 plants have a higher turn-over rate
 - Energy accumulates at a higher rate in C4 plants
 - Photophosphorylation occurs in C3 plants
 - The rate of respiration is higher in C3 plants
8. Which one of the following curves in the figure below correctly represents plants adapted for low light intensity?



Which of the following is illustrated in the figure below?

- with increase in light intensity, the rate of photosynthesis increase until temperature becomes a limiting factor.
- Rate of photosynthesis increases with an increase in the carbon dioxide concentration

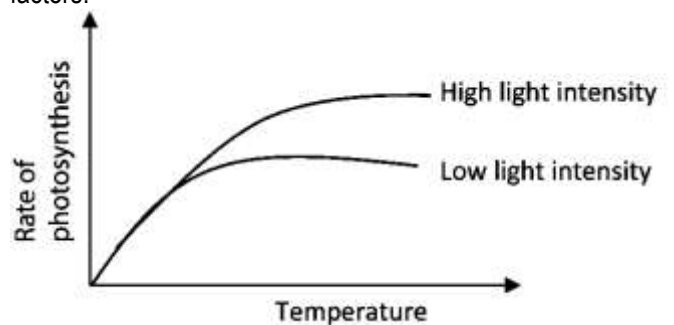
- C. C with increase in light intensity, the rate of photosynthesis increases indefinitely
 D. Rate of photosynthesis increases with an increase in light intensity until carbon dioxide becomes a limiting factor.
9. Which of the following is likely to occur if a photosynthesizing plant was suddenly removed from light?
 A Reduction in PGA
 B Accumulation of PGAL
 C Accumulation of PGA
 D. No change in amount of PGAL
10. In which part of the following parts of a chloroplast are water splitting enzymes mostly located?
 A Stroma
 B. Intergranal lamellae
 C Cytoplasm
 D Grana
11. Etiolation in plants is usually a response to
 A Insufficient nutrients
 B Low temperature
 C Insufficient light
 D. Too much water.
12. In photosynthesis, the major advantage of the C4 pathway is to
 A Fix carbon dioxide in the Calvin cycle
 B Concentrate carbon dioxide in the cells of leaves
 C Fix carbon dioxide from the atmosphere into the leaves
 D Store carbon dioxide in form of organic acids
13. During the light stage of photosynthesis, water is important in that it
 A Gives of oxygen
 B Provides hydrogen that reduce NAD
 C Reduces carbon dioxide to carbohydrates
 D Provides electrons
14. Figure below shows the relationship between temperature and rate of photosynthesis in two species A and B.



Which one of the following is correct conclusion from the results?

- A B is a shade plant while A is a sun plant
 B A has a lower compensation point than B
 C A has a higher optimum temperature for photosynthesis than B
 D Photorespiration does not occur in A but occurs in B
15. Which of the minerals nutrient are constituents of chlorophyll?

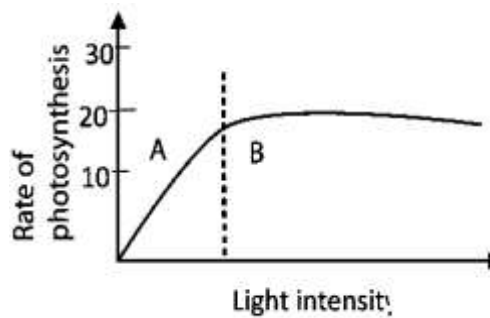
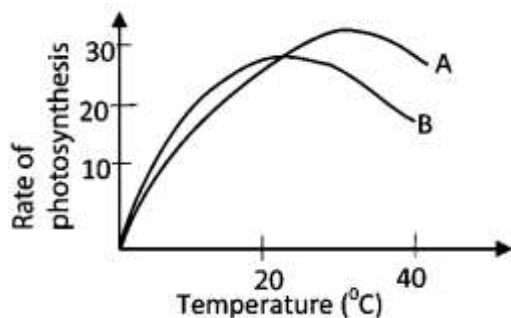
- A Potassium and sulphur
 B Nitrogen and magnesium
 C Calcium and phosphorus
 D Zinc and copper
16. Photosynthetic bacteria differ from plants in their nutrition in that the bacteria
 A Derive their energy from oxidation of ammonia
 B Obtain hydrogen for reduction of carbon dioxide from hydrogen sulphide
 C Possess chlorophyll b to trap sunlight
 D Oxidize hydrogen sulphide to obtain energy
17. Which one of the following is the role of reduced NADP in the dark stage of photosynthesis?
 A Combines with carbon dioxide
 B Provide energy
 C Provides hydrogen
 D Acts as an electron acceptor
18. Which one of the following colours of light are most effective in photosynthesis?
 A Green and red
 B Blue and red
 C Blue and yellow
 D Blue and green
19. Which wavelength from light spectrum is mostly absorbed by green plants?
 A Red
 B Green
 C Blue
 D Yellow
20. Where in the cell does the reduction of carbon dioxide occurs during photosynthesis?
 A Lamella
 B Stroma
 C Quatasome
 D Grana membrane
21. During what stage of the dark reaction is NADPH₂ used?
 Conversion of
 A Ribulose diphosphate to phosphoglyceric acid
 B Phosphoglyceraldehyde to hexose sugar
 C Hexose sugar to starch
 D. Phosphoglyceric acid to Phosphoglyceraldehyde
22. The figure blow illustrates the phenomenon of limiting factors.



What, in this case, is the limiting factor for photosynthesis?

- A Chlorophyll content
 B Temperature

- C Carbon dioxide
D light
23. Which of the following occurs during the light dependent stage of photosynthesis?
A Formation of ADP
B Formation of NADPH₂
C Formation PGAL
D Production of NAGP+
24. Which of the following pairs of reactants is not required for the lightindependent reaction of photosynthesis?
A NADPH and ATP
B ATP and carotenoid
C RuBP and free oxygen
D Carbon dioxide and enzymes
25. The first carbohydrate made in photosynthesis is
A Ribose sugar
B Ribulose
C Phosphoglyceric acid
D Phosphoglyceraldehyde
26. In photosynthesis, the major advantage of the C4 pathway is to
A Fix carbon dioxide in the Calvin cycle
B Concentrate carbon dioxide in the cell of leaves
C Fix carbon dioxide from atmosphere into the leaves
D Store carbon dioxide in form of organic acid
27. During the light stage of photosynthesis, water is an important raw material in that it
A gives off oxygen
B Provide hydrogen that reduces NAD
C Reduce carbon dioxide to carbohydrate
D Provides electron
28. During water stress, photosynthesis reduces in plant mainly due to shortage of
A carbon dioxide
B mineral salts
C Water
D Sunlight
29. A close relationship between the action spectrum for photosynthesis and absorption spectrum of the chlorophylls indicate that
A All the light absorbed by the chlorophylls is used in photosynthesis
B Chlorophylls are responsible for absorption of light in photosynthesis
C Photosynthesis proceeds after light absorption
D Light energy is trapped in chlorophylls.
30. The products of light reaction in photosynthesis are
A NADH₂, ATP and O₂
B NADP, ATP and O₂
C NADPH₂, ADP and O₂
D NADPH₂, ATP and O₂
31. Which one of the following stages of photosynthesis uses light energy directly?
A Regeneration of ribulose diphosphate
B Production of energy in the form ATP
C Reduction of carbon dioxide
D Formation of phosphoglyceric acid
32. Which one of the following is the main form of photosynthetic product transported by the phloem?
A Starch
B Amino acids
C Sucrose
D Glucose
33. The difference between a green plant and the iron bacteria in synthesis of organic compound is that
A Bacteria derive their energy for synthesis from oxidation of inorganic compounds
B Source of hydrogen for the bacteria is not water
C Bacterial have a different kind of chlorophyll
D Bacteria lack enzymes for fixing of carbon dioxide
34. Which of the following stages of photosynthesis use light energy?
A Regeneration of ribulose diphosphate
B Production of energy in form of ATP
C Reduction of carbon dioxide
D Formation of phosphoglyceric acid
35. The organism that require only inorganic raw materials from the environment is
A Virus
B Amoeba
C Euglena
D Plasma
36. If carbon containing radioactive carbon was added to a suspension of photosynthesizing algae, in which one of the following compound would the radioactive carbon show first?
A Glucose
B Phosphoglyceric acid
C Ribulose biphosphate
D Triose phosphate
37. The table shows the effect of temperature on the rate of apparent photosynthesis and respiration in plants.
- | Temperature (°C) | 7 | 10 | 15 | 19 | 22 | 28 |
|--|-----|-----|-----|-----|-----|-----|
| Rate of apparent photosynthesis (mgCO ₂ g ⁻¹ h ⁻¹) | 1.3 | 2.3 | 2.8 | 3.1 | 2.8 | 2.5 |
| Rate of respiration (mgCO ₂ g ⁻¹ h ⁻¹) | 0.3 | 0.6 | 0.7 | 1.2 | 1.8 | 2.1 |
- The temperature in °C, at which the plant is least efficient photosynthetically is
A 7
B 10
C 22
D 28
38. The figure below shows the relationship between temperature and the rate of photosynthesis in two plant species A and B.



Which one of the following is the correct conclusion from the result?

- A B is a shade plant while A is a sun plant
- B A has a lower compensation point than B
- C A has a higher optimum temperature for photosynthesis than A
- D Photorespiration does not occur in A but occurs in B

39. The figure below shows the variation of rate of photosynthesis with light intensity.

The factor limiting the rate of photosynthesis in region A is

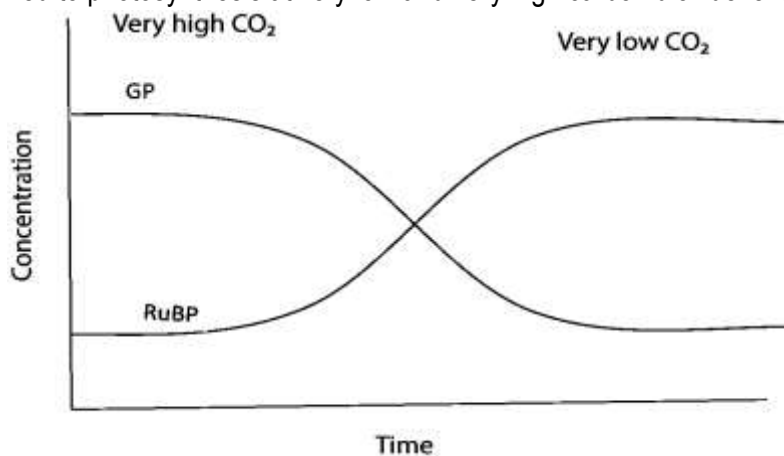
- A Light intensity
- B Carbon dioxide concentration
- C Water
- D Temperature

40. Which of the following action is most affected by low temperature?

- A Absorption of light
- B Splitting of water
- C Fixation of carbon dioxide
- D Formation of ATP

SECTION B. (60MARKS)

41. Figure 7 show the concentration-3 phosphate (GP) and ribulose biphosphate (RuBP) during an investigation in which a sample of chlorella was allowed to photosynthesis at very low and very high carbon dioxide levels.



(a) Explain the change in concentration of RuBP at:

(i) High carbon dioxide levels.

(2marks)

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(ii) Very low carbon dioxide levels.

(2marks)

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(b) Suggest why the concentration of GP falls when the levels of carbon dioxide is reduced. (1mark)

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(c) Name two factors which must have been kept constant in the investigation. (1mark)

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(d) Give four difference between cyclic and noncyclic photophosphorylation. (4marks)

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42. (a) (i) What is chemosynthesis? (1mark)

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(ii) Outline three ways in which photosynthesis in purple sulphur bacteria differs from that of higher plants. (3marks)

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(b) Explain why it is possible for photosynthetic and chemosynthetic bacteria to co-exist in an oxygen free environment? (3marks)

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(c) State the importance of chemosynthetic bacteria in nature. (3marks)

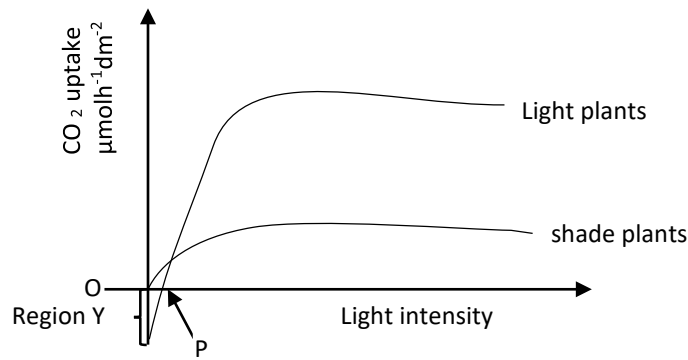
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43. The figure below shows light saturation curves of photosynthesis for plants of the same species growing under different light intensities.



(a) Compare the effect of intensity on the carbon dioxide uptake in the two types of plants. (4marks)

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(b) Describe the state of the light plants at point P. (2marks)

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(c) Explain what happens to the plant biomass in region Y. (2marks)

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(d) State an environmental factor that affects the shape of the graph other than carbon dioxide. (2marks)

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44. (a) How does the synthesis of organic compounds in photosynthetic bacterial differ from that in:

(i) Green plants (2marks)

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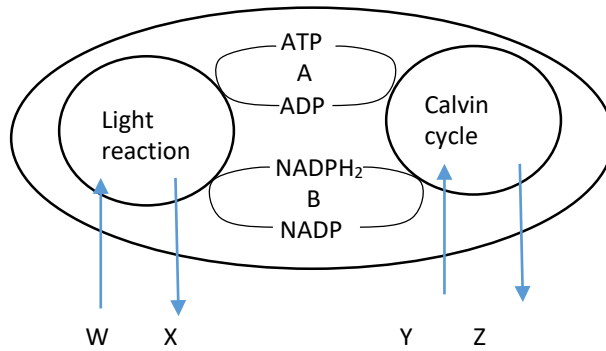
(ii) Chemosynthetic bacterial? (2marks)

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(b) The figure below shows a scheme of reactions occurring in a chloroplast during photosynthesis.



(i) Name the chemical substances represented by letters W, X, Y and Z (2marks)

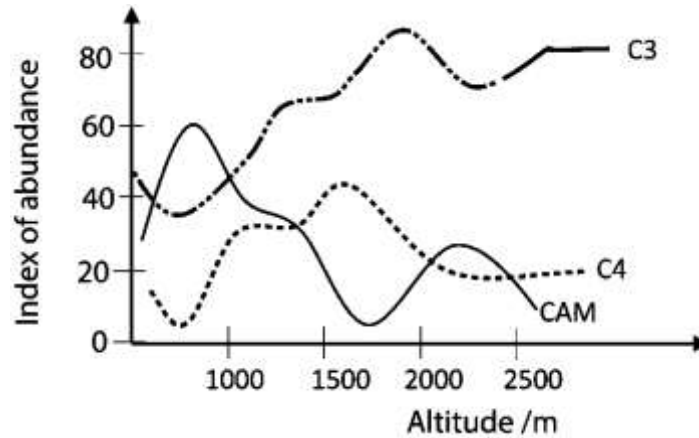
W.....
X.....
Y.....
Z.....

(ii) Indicate by means of arrows on the diagram, the direction of transfer of substances occurring in cycles A and B (1mark)

(c) State three adaptations of a chloroplast for photosynthesis. (3marks)

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45. Figure below shows the distribution of C3, C4 and CAM plants at altitudes.



(a) Suggest reasons for the trends in the distribution of each of the plants

(i) C3 plants (2marks)

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(ii) C4 plants (2marks)

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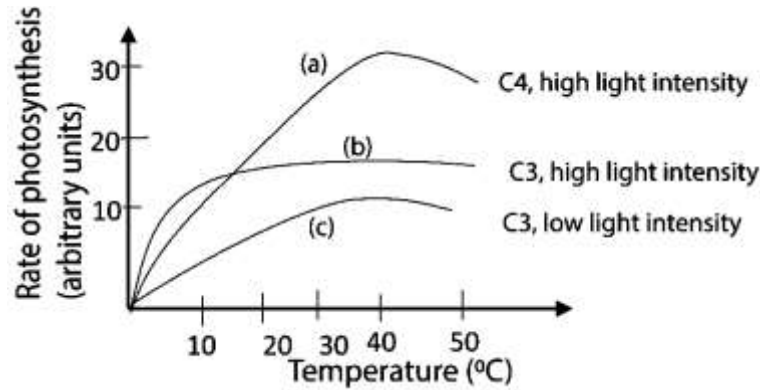
(iii) CAM plants. (2marks)

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(b) State four physiologic differences between C3 and C4 plants. (4marks)

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46. The figure below shows the variation of the rate of photosynthesis with temperature in C3 and C4 plants, at different light intensities.



(a) Using the figure, state how different temperatures affect the rate of photosynthesis in C3 plants from C4 plants at high light intensity. (3marks)

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(b) Explain the differences in the effect of temperature on the rate of photosynthesis in C3 and C4 plants at high light intensities stated in (a). (3marks)

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(c) Explain the pattern of curve C in the figure above. (4marks)

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