

**I. Part 1- Multiple choice questions (7.0 points) Choose the best answer**

**Question 1.** In separate experiments, an actively photosynthesising plant was supplied with one of two labelled reactants: water containing the  $^{18}\text{O}$  isotope of oxygen; carbon dioxide containing the  $^{17}\text{O}$  isotope of oxygen. In which products of photosynthesis would these isotopes be found?

- A.  $^{18}\text{O}$ : carbohydrate produced by the chloroplast stroma,  $^{17}\text{O}$ : oxygen produced by chloroplast grana.
- B.  $^{18}\text{O}$ : oxygen produced by the chloroplast stroma,  $^{17}\text{O}$ : carbohydrate produced by chloroplast grana.
- C.  $^{18}\text{O}$ : oxygen produced by chloroplast grana,  $^{17}\text{O}$ : carbohydrate produced by the chloroplast stroma.
- D.  $^{18}\text{O}$ : carbohydrate produced by chloroplast grana,  $^{17}\text{O}$ : oxygen produced by the chloroplast stroma.

**Question 2.** Root hairs are the most important to a plant because they

- A. anchor a plant in the soil.
- B. store starches.
- C. increase the surface area for absorption.
- D. contain xylem tissue.

**Question 3.** Increases and decreases of the heart rate result from changes in the activity of the

- A. corpus callosum.
- B. medulla oblongata.
- C. thalamus.
- D. cerebellum.

**Question 4.** Most of the mass of organic material of a plant comes from

- A. soil minerals.
- B. carbon dioxide.
- C. water.
- D. nitrogen.

**Question 5.** The sequence of steps by which large food molecules are broken down into their respective building blocks by catalytic enzymes within hydrolysis reactions is called:

- A. propulsion.
- B. chemical digestion.
- C. ingestion.
- D. mechanical digestion.

**Question 6.** Which metabolic pathway is common to both fermentation and cellular respiration of a glucose molecule?

- A. Synthesis of acetyl CoA from pyruvate.
- B. Glycolysis.
- C. The electron transport chain.
- D. The Krebs cycle.

**Question 7.** The following table shows the adaptation of Plant A and Plant B in response to different conditions.

	Plant A	Plant B
Compensation point of $\text{CO}_2$ ( $\mu\text{L CO}_2 \text{ L}^{-1}$ )	20 – 100	0 – 5
Quantum yield as function of temperature	Declining	Steady

Indicate if each of the following statements is true.

- A. If atmospheric  $\text{CO}_2$  concentration doubles, photorespiration in Plant A is likely to be reduced.
- B. If atmospheric  $\text{CO}_2$  concentration doubles, Plant B is likely to be more competitive.
- C. Plant B is  $\text{C}_3$ .
- D. Plant A is more competitive in high water availability and high temperature environment.

**Question 8.** A plant seedling bends toward sunlight because

- A. auxin migrates to the lower part of the stem due to gravity.
- B. there is more auxin on the light side of the stem.
- C. auxin is destroyed more quickly on the dark side of the stem.
- D. auxin is found in greatest abundance on the dark side of the stem.

**Question 9.** What are the products of the light dependent reactions of photosynthesis?

- A. G3P, reduced NADP and ribulose-1,5 diphosphate.
- B. G3P, oxygen and reduced NAD.
- C. ATP, ribulose-1,5 diphosphate and reduced NAD.
- D. ATP, oxygen and reduced NADP.

**Question 10.** Which of the following animals have air sacs attached to their lungs?

- A. reptiles.                      B. amphibians.                      C. mammals.                      D. birds.

**Question 11.** When the blood glucose level drops below the normal range, the secretion of \_\_\_\_\_ promotes the release of \_\_\_\_\_ into the blood from energy stores.

- A. insulin, glucose.              B. glucose, glucagon.              C. insulin, glucagon.              D. glucagon, glucose.

**Question 12.** Cell walls of vessels and tracheids of vascular plants contain a phenolic polymer called “lignin”, which together with cellulose confers mechanical strength to these water-conducting tissues. If vessels/tracheids are deficient in lignin, they:

- A. burst outward when transpiration is very inactive.    B. collapse inward when transpiration is very active.  
C. collapse inward when transpiration is very inactive.    D. burst outward when transpiration is very active.

**Question 13.** Choose the correct arrangement in order of water potential. Use the symbol > to mean ‘greater than’

- A. dry atmospheric air > root hair cell > xylem vessel contents > mesophyll cell > soil solution.  
B. dry atmospheric air > root hair cell > mesophyll cell > xylem vessel contents > soil solution.  
C. soil solution > root hair cell > xylem vessel contents > mesophyll cell > dry atmospheric air.  
D. soil solution > root hair cell > mesophyll cell > xylem vessel contents > dry atmospheric air.

**Question 14.** Two groups of tomatoes were grown under laboratory conditions, one with humus added to the soil and one a control without humus. The leaves of the plants grown without humus were yellowish (less green) compared with those of the plants grown in humus-enriched soil. The best explanation for this difference is that

- A. the humus made the soil more loosely packed, so water penetrated more easily to the roots.  
B. the healthy plants absorbed chlorophyll from the humus.  
C. the healthy plants used the food in the decomposing leaves of the humus for energy to make chlorophyll.  
D. the humus contained minerals such as magnesium and iron, needed for the synthesis of chlorophyll.

**Question 15.** The NPK percentages on a package of fertilizer refer to the

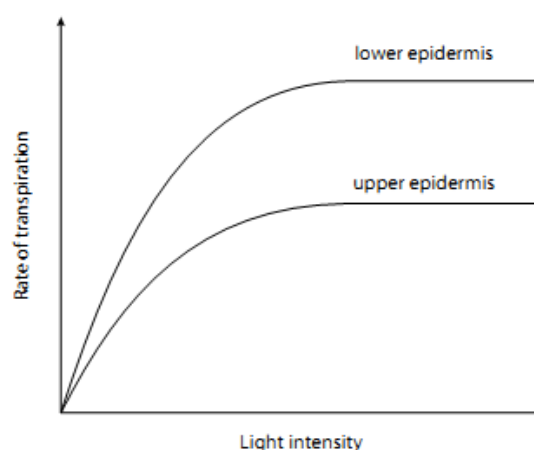
- A. total protein content of the three major ingredients of the fertilizer.  
B. percentages of manure collected from different types of animals.  
C. relative percentages of organic and inorganic nutrients in the fertilizer.  
D. percentages of three important mineral nutrients.

**Question 16.** Which of the followings does not occur during the Calvin cycle?

- A. Release of oxygen.                      B. Regeneration of the CO<sub>2</sub> acceptor.  
C. Carbon fixation.                      D. Consumption of ATP.

**Question 17.** The diagram shows the effect of light intensity on the rate of transpiration from the upper and lower epidermis of a leaf. Other environmental factors were kept constant. What could explain the differences in transpiration rates from the two surfaces?

- A. The upper epidermis is more exposed to light.  
B. The palisade mesophyll cells have fewer air spaces than the spongy mesophyll cells.  
C. Higher light intensities are associated with higher temperatures.  
D. The upper epidermis has fewer stomata.



**Question 18.** In a double circulatory system, which of the following vessels would blood contain the highest concentration of carbon dioxide?

- A. Carotid artery.                      B. Pulmonary vein.                      C. Aorta.                      D. Pulmonary artery.

**Question 19.** What does not occur in the conversion of glucose to two molecules of pyruvate?

- A. Phosphorylation of triose (3C) sugar.                      B. Phosphorylation of ATP.  
C. Reduction of NAD.                      D. Hydrolysis of ATP.

**Question 20.** Which of the followings is correct for a blood pressure reading of 130/80?

I. The systolic pressure is 130.

II. The diastolic pressure is 80.

III. The blood pressure during heart contraction is 80.

A. I only.

B. III only.

C. I and II only.

D. I and III only.

**Question 21.** All of the following respiratory surfaces are associated with capillary beds except the

A. alveoli of lungs.

B. gills of fishes.

C. tracheae of insects.

D. skin of earthworms.

**Question 22.** Which cellular organelle in C<sub>3</sub> plant cells does not have photorespiration?

A. Peroxisome.

B. Ribosome.

C. Mitochondrion.

D. Chloroplast.

**Question 23.** In horses, rodents, and koalas which organ is the main site of cellulose digestion?

A. Cecum.

B. Rumen.

C. Large intestine.

D. Appendix.

**Question 24.** Which is a correct statement concerning the insect circulatory system?

A. There is no heart, or pump.

B. Blood transports oxygen and nutrients to all the tissues.

C. Blood is always contained in a system of tubes called tracheae.

D. The circulating fluid bathes tissues directly.

**Question 25.** If the ambient temperature rises by 5°C, photorespiration will

A. increase in rice, little effects on maize.

B. increase in rice, decrease in maize.

C. increase in maize, little effects on rice.

D. increase in maize, decrease in rice.

**Question 26.** Where in the chloroplast are the products of the light reactions used?

A. Granum.

B. Stroma.

C. Envelope.

D. Thylakoid

**Question 27.** A micronutrient is

A. potassium.

B. nitrogen.

C. magnesium.

D. iron.

**Question 28.** Where does each stage of aerobic respiration occur in a eukaryotic cell?

A. Glycolysis: cytoplasm; Krebs cycle: mitochondrial matrix; The electron transport chain: inner mitochondrial membrane.

B. Glycolysis: mitochondrial matrix; Krebs cycle: inner mitochondrial membrane; The electron transport chain: cytoplasm.

C. Glycolysis: cytoplasm; Krebs cycle: inner mitochondrial membrane; The electron transport chain: mitochondrial matrix.

D. Glycolysis: mitochondrial matrix; Krebs cycle: Cytoplasm; The electron transport chain: inner mitochondrial membrane.

**Question 29.** Experiments on the positive phototropic response of plants indicate that

A. light destroys auxin.

B. auxin moves down the plant apoplastically.

C. auxin is synthesized in the area where the stem bends.

D. auxin can move to the shady side of the stem.

**Question 30.** In legumes, it has been shown that "sleep" (nastic) movements are correlated with

A. positive thigmotropisms.

B. rhythmic opening and closing of K<sup>+</sup> channels in motor cell membranes.

C. senescence (the aging process in plants).

D. flowering and fruit development.

**Question 31.** The light reactions of photosynthesis supply the Calvin cycle with

A. ATP and NADPH.

B. sugar and O<sub>2</sub>.

C. CO<sub>2</sub> and ATP.

D. light energy.

**Question 32.** Tuan has been having trouble digesting lean steaks and other protein-rich foods, and these foods seem to stay in his stomach longer than usual. Tuan is likely to lack the enzyme

A. amylase.

B. lipase.

C. pepsin.

D. cellulase.

**Question 33.** A mineral is involved in the activation of enzyme and serves as a part of the structure of chlorophyll. What is mineral?

A. Calcium.

B. Sodium.

C. Chloride.

D. Magnesium.

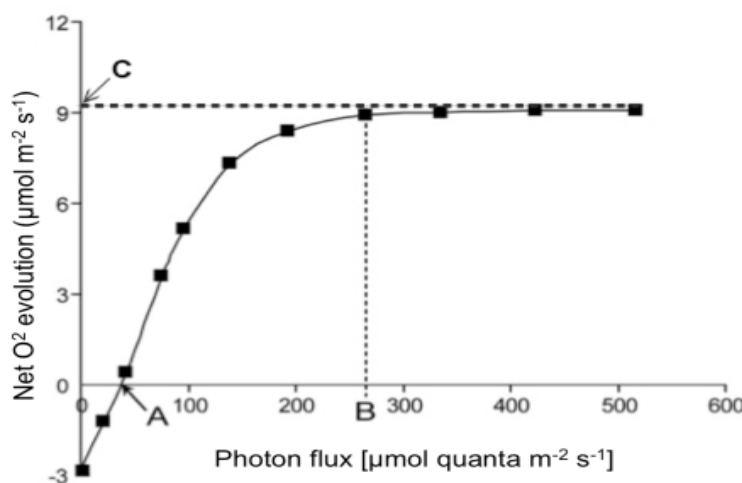
**Question 34.** The following photo shows a strawberry leaf displaying guttation. Answer the following question regarding guttation.



What is the main cause of guttation in plants?

- A. root pressure
- B. transpiration
- C. pressure flow in phloem
- D. plant injury

**Question 35.** Study the graph below and determine which of the statements (A to D) is correct.



- A. Plants stop growth when they grow under the irradiance greater than the value shown at point B.
- B. C is the maximal photosynthetic rate.
- C. Point A is light saturation point.
- D. Point B is light compensation point.

## II. Part 2- Problem solving (3.0 points)

**Exercise 1 (2,0 point).** When growing 3 different plant species A, B and C in greenhouse with the same low level of light, it is noticed that the amount of  $\text{CO}_2$

- + absorbed by plant A is equal to emitted
- + absorbed by plant B is higher than emitted
- + absorbed by plant C is lower than emitted

**Question 1.** What physiological criteria related to light can be used to classify plant A, B and C into different groups? Explain.

**Question 2.** To obtain highest photosynthesis capacity, what light condition does plant A, B and C need?

**Exercise 2 (1,0 point)** Read the passage and choose the best answer or answer the questions

“The World Health Organization (WHO) has declared a global health emergency over a new coronavirus that has killed so many people worldwide following an outbreak in the central Chinese city of Wuhan. According to the WHO, coronaviruses are a family of viruses that cause illnesses ranging from the common cold to more severe diseases such as severe acute respiratory syndrome (SARS). These viruses were originally transmitted between animals and people. Signs of infection include fever, cough, and shortness of breath and breathing difficulties. In more severe cases, it can lead to pneumonia, multiple organ failure and even death. Current estimates of the incubation period range from one to 14 days. While we work towards rolling out a safe and effective vaccine fairly, we must continue the essential public health actions to suppress transmission and reduce mortality” (*Adapted from <https://oureverydaylife.com>*)

**Question 1.** What are the symptoms of coronavirus?

**Question 2.** What is the origin of coronaviruses?

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Student's full name: ..... Student's ID: .....

First observer's name and signature: ..... Second observer's name and signature: .....