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## THEORETICAL TEST II

(Write the answers to the following questions on the ANSWER SHEET)

1. **(4 point)** Look at the pictures of Indonesian primates below.



(Orangutan)



(Long-nosed monkey)



(Javan gibbon)



(Siamang)



(Slow loris)



(Lutung)



(Tarsier)

A	B	C	D	E	F	G
—		—		—	—	—
—		—		—	—	
	—			—	—	
	—	—	—			—
—		—	—			
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—	—		—	—	—	—

Notes:

A: Orangutan

B: Long-nosed monkey

C: Javan gibbon

D: Siamang

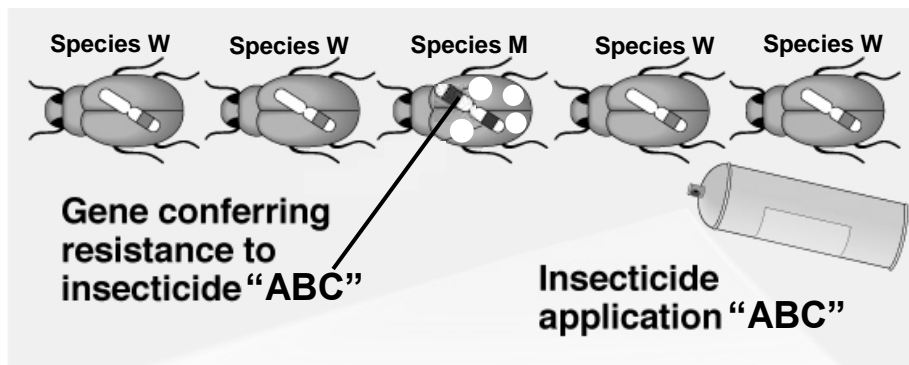
E: Slow loris

F: Lutung

G: Tarsier

From the DNA data above, group the primates into several groups which have closest relation and put the groups to complete the diagram on the answer sheet.

2. Look at the pictures below.

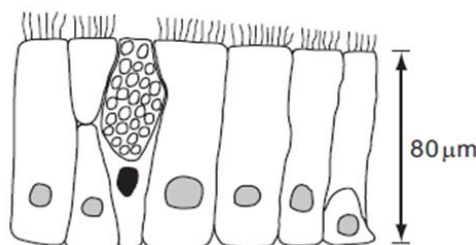


Based on the picture above, there are two species of ladybug. The ratio between species M and species W per  $\text{m}^2$  is 4 to 1. Species W does not have resistance gene on their DNA, while species M has resistance gene on their DNA. These insects typically have a lifecycle of a few days to a few weeks.

**Questions:**

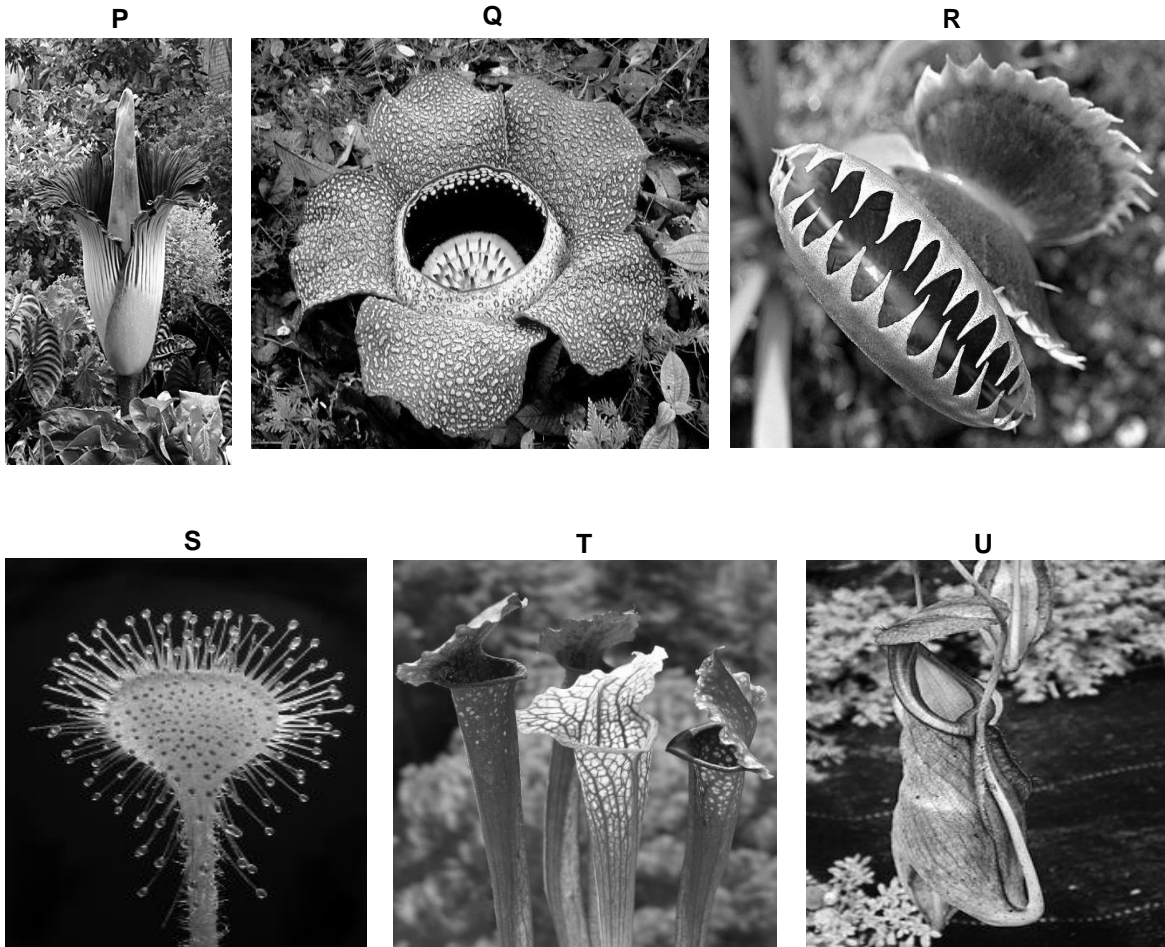
- (1 point)** What will happen if “ABC” insecticide is used in a long period to those insect population?
- (2 point)** How should we use insecticide to prevent the resistance effect?
- (1 point)** After the “ABC” insecticide usage was banned and people never use insecticide, predict the ratio of two ladybug species.
- (3 point)** Draw a pattern of the amount of two species population **before and during the use of insecticide, and also after it was banned** in the diagram on the **ANSWER SHEET**.

3. The picture below shows a section through a type of epithelium in the respiratory system.



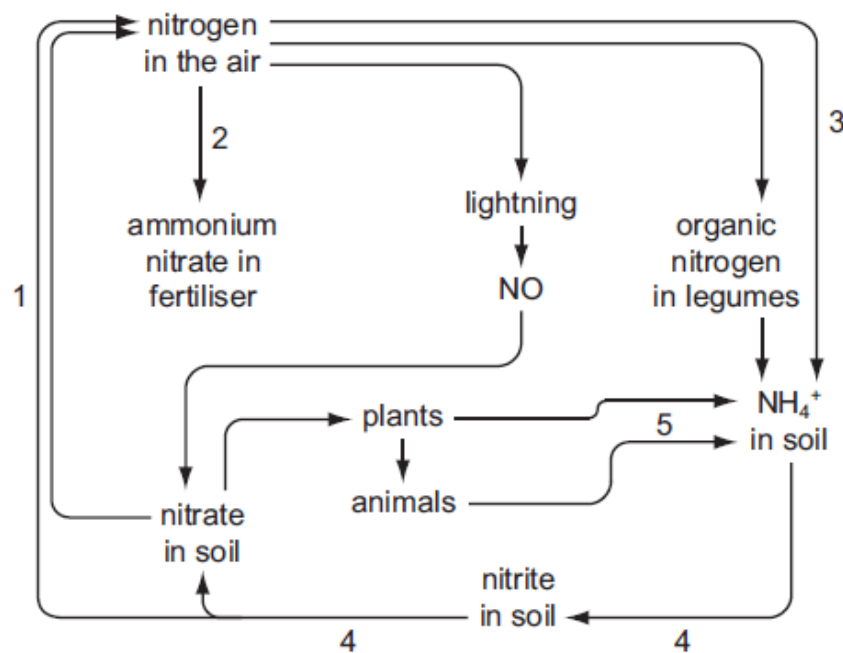
- (2 point)** Where is this type of epithelium found?  
(fill in the box on the ANSWER SHEET)
- (2 point)** What is the function of cilia on the epithelium in the respiratory system?

4. Look at the pictures below.

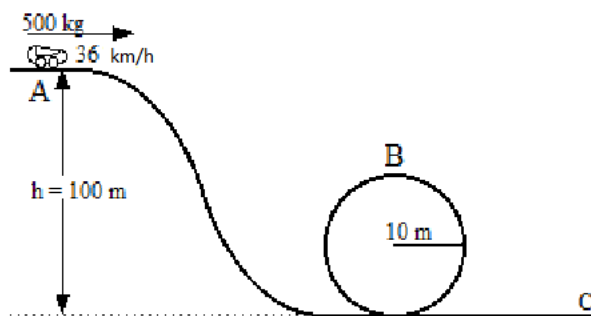


- a. **(1.5 point)** From the pictures above, classify the plants based on the tables on the ANSWER SHEET.
- b. **(0.5 point)** Mention one of the insectivorous plants that can be found in Indonesia.
- c. **(3 point)** What factors have caused insects to be attracted to the trap of insectivorous plants?
- d. **(2 point)** Why does insectivorous plant trap insect and digest it?

5. The diagram below shows the nitrogen cycle in nature. The numbers in the diagram represent each process of the nitrogen cycle.

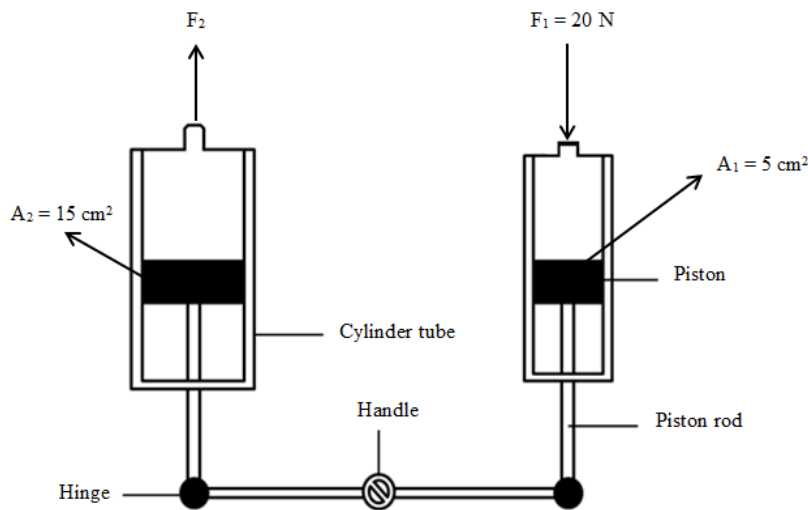


- (1 point)** What number from the diagram above shows a process that gives disadvantages to the plant?
  - (1 point)** Based on the diagram, what will happen if process in number 5 does not occur?
  - (1 point)** What is the name of root modification in legumes plant which bind with nitrogen?
6. The diagram below shows a roller coaster track

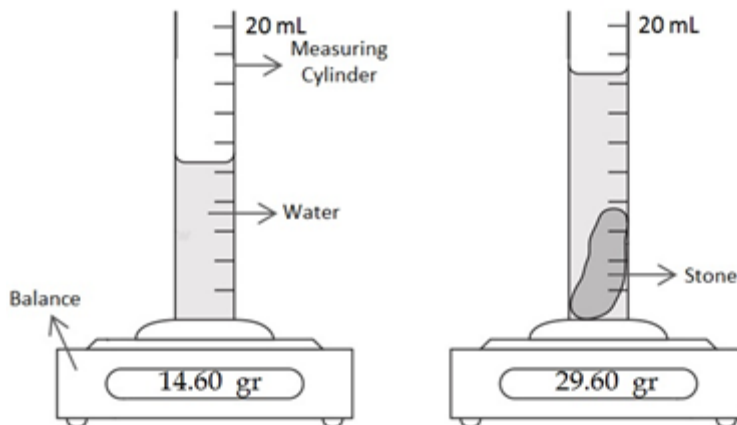


- (1 point)** How much is the potential energy of the lorry at point B ?
- (1 point)** How much is the speed of lorry at point C?
- (2 point)** Draw a graph of potential energy related to distance from A to C on the answer sheet?

7. The diagram below shows a hydraulic pump

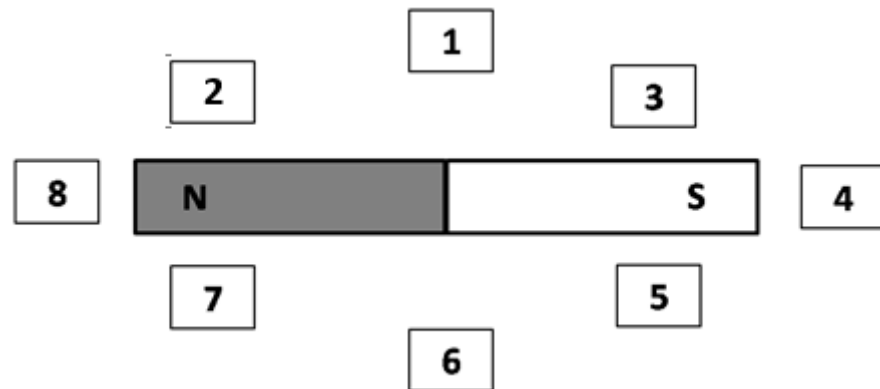


- (1 point)** How much is pressure on the right piston?
  - (1 point)** How much is the force ( $F_2$ ) resulted on the left side?
  - (1 point)** How many centimeters does the left piston move if the right piston is pushed 30 cm downward?
8. The diagram below presents an experiment conducted by a student to measure density of a stone



- (1 point)** How much is the volume of the stone?
- (1 point)** How is the density of the stone?
- (2 point)** How much is the mass of the measuring cylinder if the mass of stone is  $\frac{3}{2}$  of water mass?

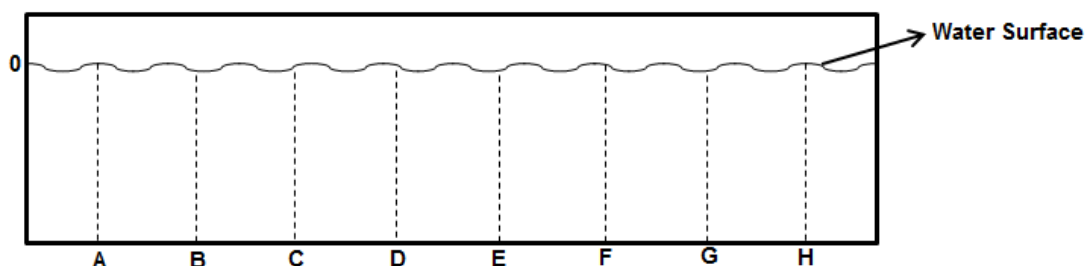
9. The figure shows a bar magnet surrounded by compass needles which are located in the following numbers.



- (0.8 point)** Draw a sketch indicating the direction of the needles at each location.
  - (1.2 point)** Why does it happen?
  - (1 point)** What will happen when the bar magnet is removed? Explain your answer.
10. Ultrasonic wave propagates at 1480 m/s. One of the benefits from ultrasonic waves is to measure the depth of the sea by using the reflectance properties.
- (1 point)** What is the frequency of the wave if the ultrasonic wavelength is 0.04m?
  - (1 point)** How much time does ultrasonic wave take to measure ocean depth 3330 m?
  - (2 point)** The table below records time required by ultrasonic wave to propagate from transmitter to the sea floor and back again to the transmitter.

Location	A	B	C	D	E	F	G	H
Time (s)	1	2	2,5	5	3	6	4	2

Draw an underwater surface based on the data



11.

**ANGKLUNG: A MUSICAL INSTRUMENT MADE OF BAMBOO**

Bamboo is a monocot plants in the grass family Poaceae (Figure 1). Bamboo species are found in diverse climates, from cold mountains to hot tropical regions. They distribute across Asia, Africa, Australia and America.

Bamboos are of notable economic and cultural significance in South Asia, Southeast Asia and East Asia, being used for building materials, as a food source, as a versatile raw product and also music instrument. Angklung is a musical instrument from the West Java, Indonesia made of two to four bamboo tubes attached to a bamboo frame (Figure 2, 3 and 4). The tubes are carved to have a resonant pitch when struck and are tuned to octaves. The sound of angklung is produced from collision of the base tubes. The sound is amplified by resonator on each tube.

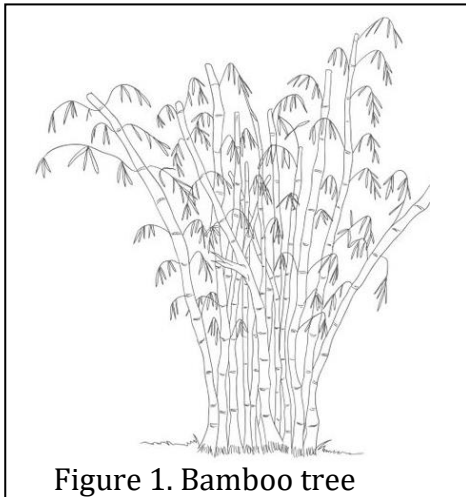


Figure 1. Bamboo tree

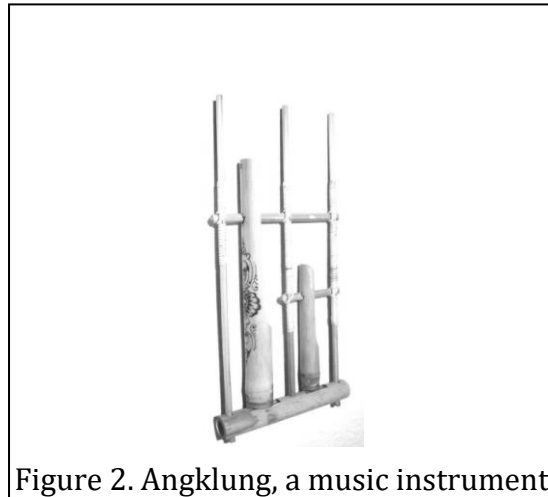


Figure 2. Angklung, a music instrument

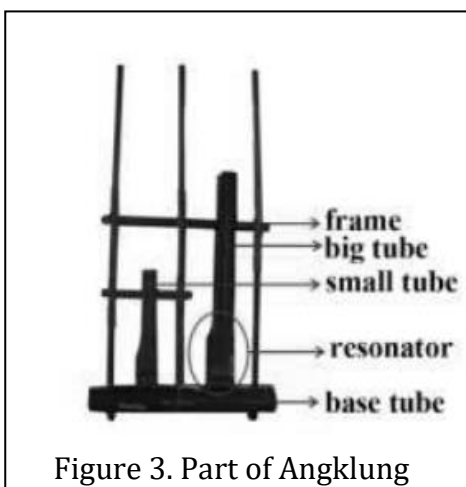


Figure 3. Part of Angklung

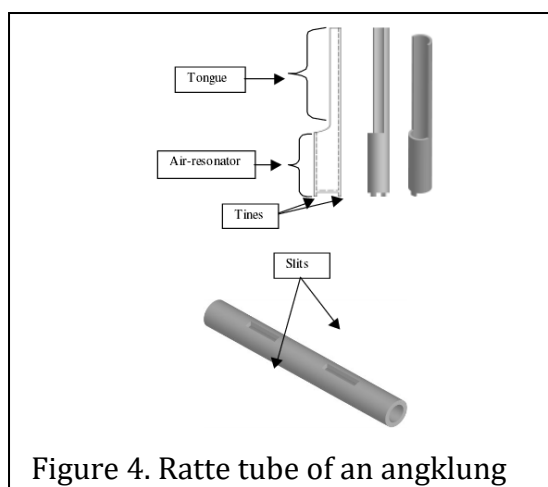


Figure 4. Ratte tube of an angklung



Playing angklung as an orchestra requires cooperation and coordination, and is believed promotes the values of teamwork, mutual respect and social harmony (Figure 5).

On November 18, 2010, UNESCO officially recognized Indonesian "angklung" as a Masterpiece of Oral and Intangible Heritage of Humanity. (Source: [www.wikipedia.org](http://www.wikipedia.org))



Figure 5. Angklung orchestra

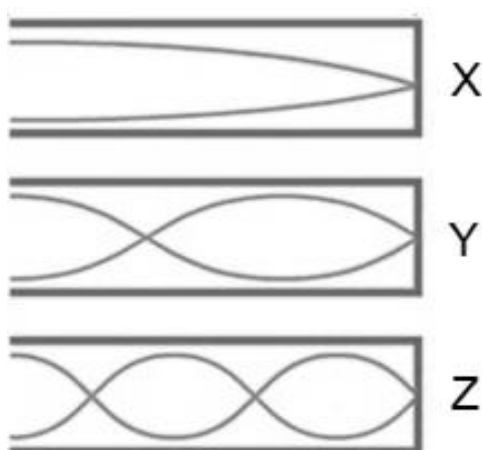
#### QUESTIONS:

- a. **(2.5 points)** State whether the statements below is TRUE or FALSE.

Statements	TRUE or FALSE
Bamboo can reproduce through vegetative	
Bamboo is classified as non-flowering plant	
Bamboo has no branches	
<b>Figure 1</b> shows the population of bamboo trees	
Bamboo can be cultivated from seed	

- b. **(1 point)** What is resonance?
- c. **(1 point)** What is the type of wave produced by angklung sound?
- d. **(1 point)** A kind of angklung can produce 660 Hz sound. What is the wavelength if it travels 330 m/s?

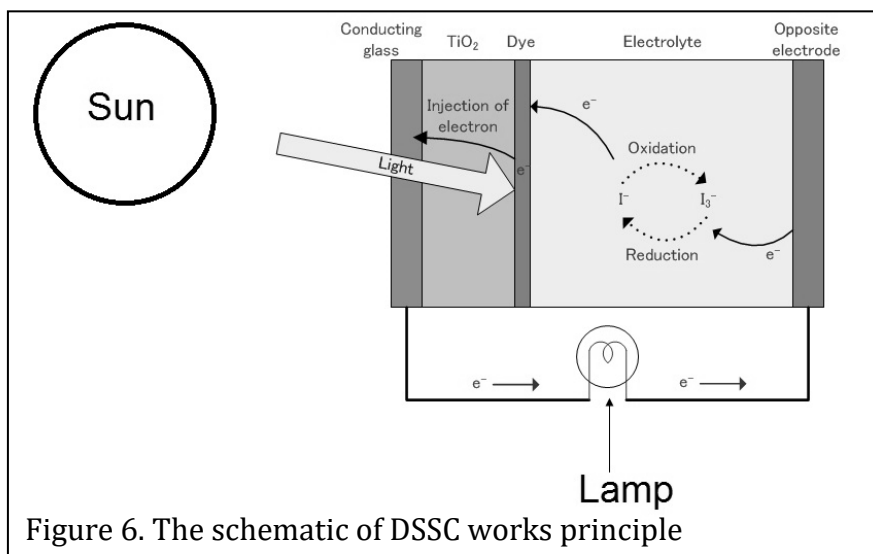
e. **(1 point)** Three angklungs produce different sound waves as shown below.



Rank the angklung produced from the lowest frequency to the highest?

f. **(2 points)** Explain the relation between wavelength and frequency?

12. The dye-sensitized solar cell (DSSC) is a new type of solar cell which converts the visible light into electricity based on photosynthesis principle.

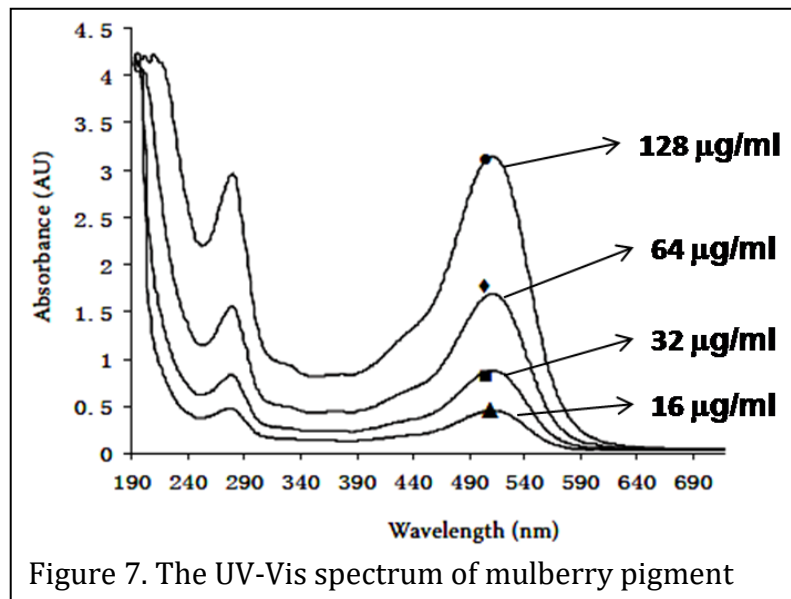


The figure illustrates the DSSC work principles. The DSSC uses dyes or natural pigments to capture light energy. This energy excites electrons which can then flow toward the electrode.

Scientists use synthetic dyes and natural pigments like anthocyanins. Anthocyanins are a class of pigments found in many berries and other plants. Comparing with chlorophyll, anthocyanins have higher efficiency.

**QUESTIONS:**

- a. **(1 point)** How is the working principle of dye sensitized solar cell?
- b. **(1.5 point)** Write down the steps of energy conversion from the sun light-DSSC-lamp.
- c. **(2 point)** Figure 7 shows the ultraviolet-visible (UV-Vis) spectrum of mulberry pigment with different concentrations. What can be concluded from the UV-Vis spectrum of mulberry pigment with different concentrations.



- d. **(2.5 points)** State whether the statement is TRUE or FALSE.

Statements	TRUE or FALSE
Anthocyanin is one of photosynthetic pigments	
Anthocyanin can express more than one color	
Chlorophyll can be used as insect attractant in pollination	
Anthocyanin can be found in plastids	
Chlorophyll can help plant to produce organic molecule	