FUKIEN SECONDARY SCHOOL

S5 First Term Examination (2020-2021)

Biology

(1 hour 30 minutes)

Date: 5th January 2021 Name:_____

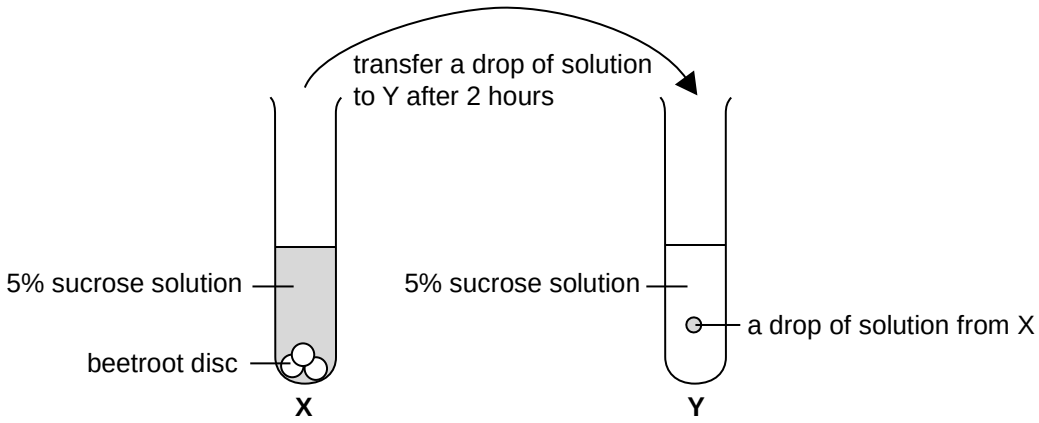
Time: 10:30a.m. - 12:00nn Class: _____ No.: _____

Instructions to students:

1. Write your name, class and class number on both the question paper and the answer sheets.
2. Answer ALL questions.
3. Write down all the answers on the answer sheets.
4. Hand in the question paper and the answer sheets at the end of the examination.
5. The total mark of the paper is 100.

I. Multiple Choice Questions (40 marks)

1. A student carried out an experiment to determine the water potential of beetroot cells. He put some beetroot discs into a test tube containing 5% sucrose solution (X). After 2 hours, he transferred a drop of the solution from X to another test tube containing 5% sucrose solution (Y). The diagram below summarizes the steps of the experiment.



The drop of solution from X moved up in Y. Which of the following statements about the experiment are correct?

(1) The drop of solution had a lower density than the 5% sucrose solution in Y.

(2) There was a net movement of water molecules from the beetroot cells into the 5% sucrose solution in X.

(3) The water potential of beetroot cells was lower than that of 5% sucrose solution.

A (1) and (2) only

B (1) and (3) only

C (2) and (3) only

D (1), (2) and (3)

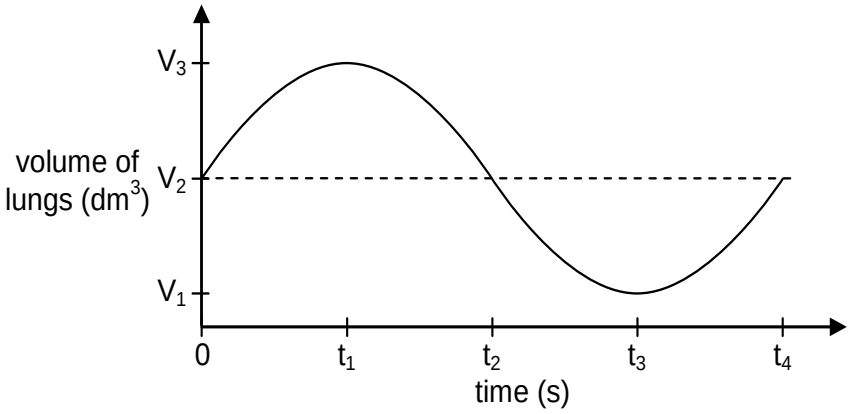
2. Which of the following structures can be observed under a light microscope at 400X magnification?
   (1) cell wall
   (2) chloroplast
   (3) ribosome
   A (1) only
   B (1) and (2) only
   C (2) and (3) only
   D (1), (2) and (3)

3. The photograph below shows a carton of milk fortified with extra vitamin D.

   Which of the following is a possible reason for adding extra vitamin D in the milk?
   A Vitamin D cannot be synthesized by human body cells.
   B Vitamin D promotes the absorption of calcium ions in the small intestine.
   C Vitamin D is an important component of bones.
   D Vitamin D prevents the loss of calcium ions from bones.

4. Which of the following can facilitate the absorption of fatty acids in the small intestine?
   (1) the bile pigment produced by the liver
   (2) the presence of a large number of villi in the small intestine
   (3) the peristalsis of the small intestine
   A (1) and (2) only
   B (1) and (3) only
   C (2) and (3) only
   D (1), (2) and (3)

5. The graph below shows the change in the volume of lungs of a person within a period of time.



Which of the following statements about the breathing of the person is/are correct?

(1) The rate of breathing of the person is $60/t_4$ breaths per minute.

(2) From t_2 to t_4, the pressure inside the lungs is lower than the atmospheric pressure.

(3) The person breathes in $(V_3 - V_2)$ dm^3 of air in each breath.

A (1) only

B (2) only

C (3) only

D (1) and (2) only

6. Under normal conditions, which of the following blood vessels will have the largest drop in blood pressure?

A artery

B arteriole

C capillary

D venule

7. Which of the following may cause the accumulation of tissue fluid in body tissues?

(1) The blood pressure decreases.

(2) The amount of plasma proteins in blood decreases.

(3) The lymph capillaries are blocked.

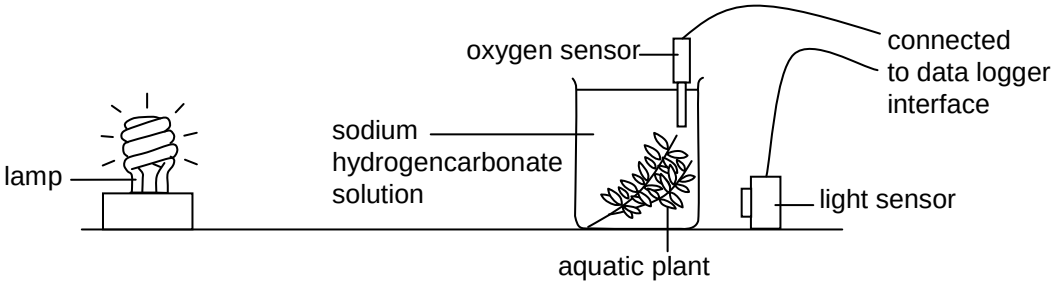
A (1) and (2) only

B (1) and (3) only

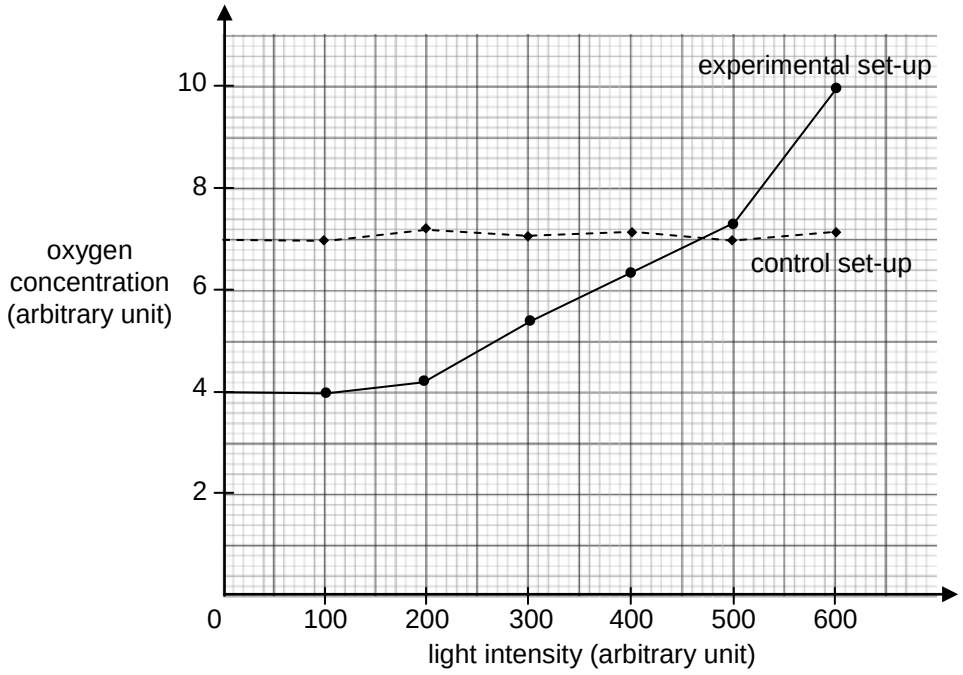
C (2) and (3) only

D (1), (2) and (3)

Directions: Questions 8 and 9 refer to the diagram below, which shows an experimental set-up used to investigate the effect of light intensity on the gas exchange of an aquatic plant.

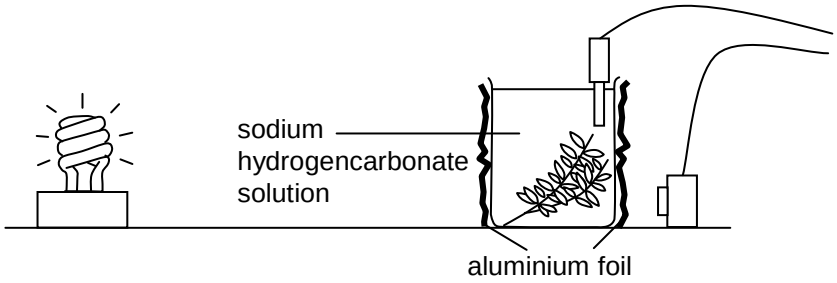


The graph below shows the results obtained from the experimental set-up. The results obtained from a control set-up are also shown.

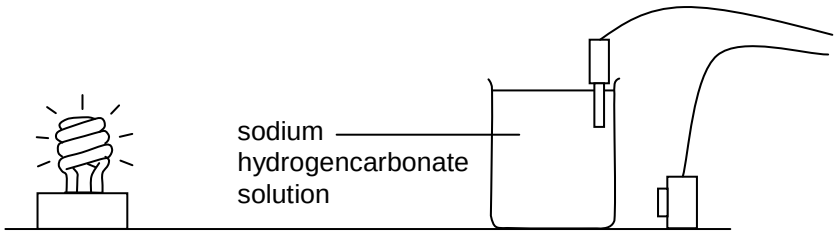


8. Which of the following diagrams shows the control set-up used in the experiment?

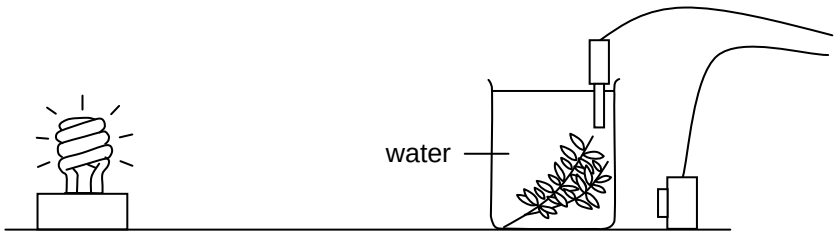
A



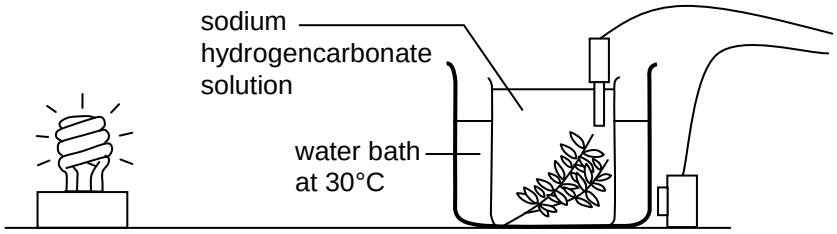
B



C



D



9. Which of the following can be deduced from the results obtained?

(1) The plant reaches the compensation point when light intensity is 470 arbitrary units.

(2) The plant does not carry out photosynthesis when light intensity is lower than 470 arbitrary units.

(3) When light intensity is higher than 100 arbitrary units, there is net production of food by the plant.

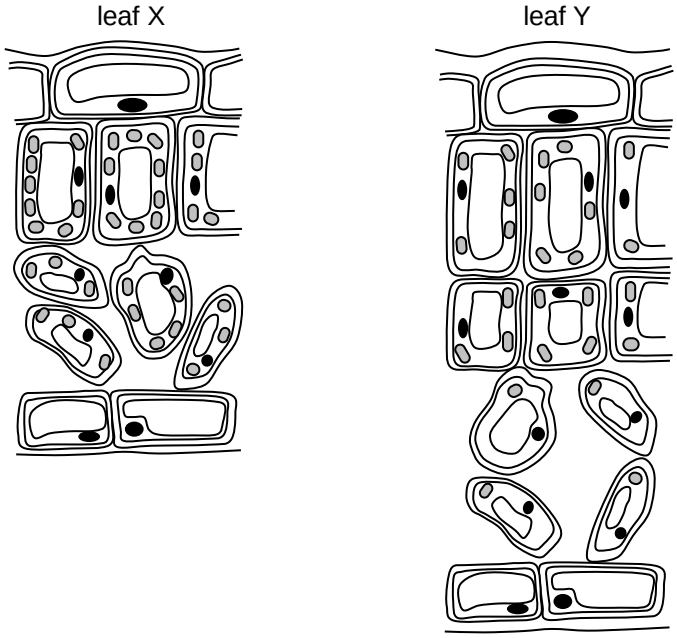
A (1) only

B (2) only

C (1) and (3) only

D (2) and (3) only

10. The diagrams below show the transverse sections of leaves X and Y.



Which of the following statements about leaves X and Y are correct?

(1) The diffusion of gases in leaf X is more effective than that in leaf Y.

(2) If the rates of respiration of the two leaves are similar, the compensation point of leaf X is lower than that of leaf Y.

(3) More water is lost through the cuticle of leaf X than through the cuticle of leaf Y.

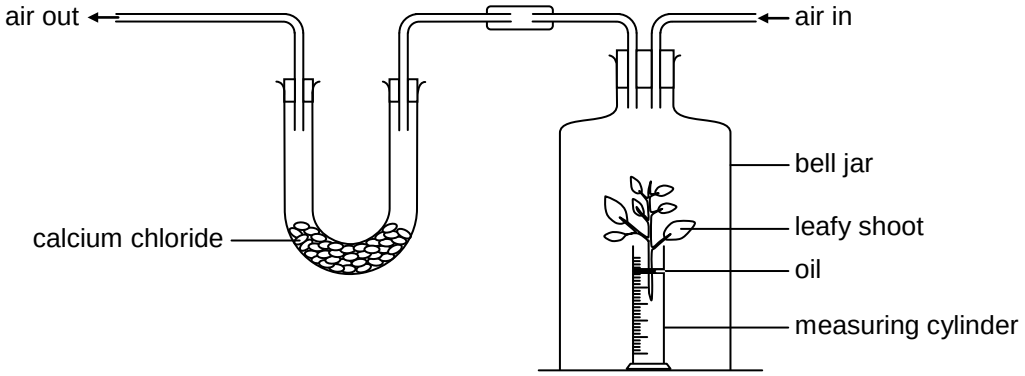
A (1) and (2) only

B (1) and (3) only

C (2) and (3) only

D (1), (2) and (3)

11. The diagram below shows a set-up used to measure the amounts of water absorbed and water lost by a leafy shoot on a sunny day. Calcium chloride increases in mass after it absorbs water vapour from the air.



The table below shows the results.

Time (h)		0	1	2	3
Without the leafy shoot in the bell jar	**Mass of calcium chloride** (g)	150	155	161	165
With the leafy shoot in the bell jar	**Mass of calcium chloride** (g)	150	173	200	225
	Water level in the measuring cylinder (cm^3)	100	85	68	49

The mass of 1 cm^3 of water is 1 g. Which of the following correctly describes the changes of the leafy shoot during the experiment?

A The leafy shoot lost 75 g of water.

B The leafy shoot lost 60 g of water.

C The leafy shoot absorbed 15 g of water.

D The leafy shoot retained 9 g of water.

12. A student observed two pieces of tissues (X and Y) taken from different parts of an onion root tip under a microscope. He counted the numbers of cells in each stage of the cell cycle. The table below shows the results.

	Number of cells				
	Interphase	**Prophase**	**Metaphase**	**Anaphase**	**Telophase**
X	85	0	0	0	0
Y	80	8	5	2	3

Which of the following statements about X and Y is correct?

A X is taken from the apical meristem of the root tip.

B Chromosomes can be seen in the cells in X.

C The cells in Y spend most of the time in anaphase in a cell cycle.

D No vacuoles can be seen in the cells in Y.

13. Which of the following processes can lead to genetic variations in offspring?

(1) crossing over during first meiotic division

(2) crossing over during second meiotic division

(3) independent assortment of chromosomes

A (1) and (2) only

B (1) and (3) only

C (2) and (3) only

D (1), (2) and (3)

14. The photograph below shows a daffodil plant. Both structures X and Y are involved in the reproduction of the plant.

Which of the following statements about the reproduction carried out by X and Y is correct?

A Reproduction carried out by both X and Y produces offspring that are genetically identical to the parent plant.

B Reproduction carried out by both X and Y does not rely on external agents.

C Reproduction carried out by X helps the species to adapt to changes in the environment while that by Y does not.

D Reproduction carried out by X involves mitosis while that by Y does not involve mitosis.

15. Which of the following statements about the uterus is ***incorrect***?

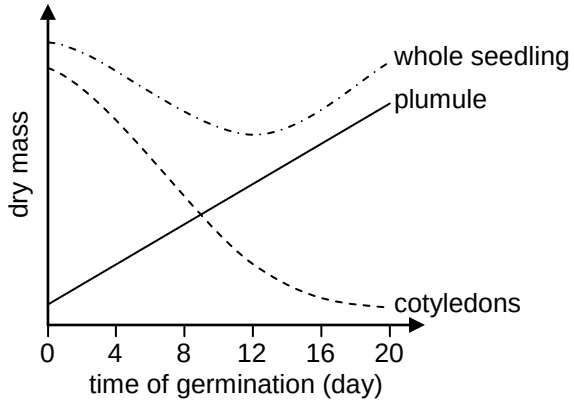
A The uterus is the place where the embryo develops.

B The muscle layer of the uterus contracts to push the foetus out of the uterus during labour.

C The uterus can secrete female hormones.

D The thickness of the uterine lining changes periodically.

16. The graph below shows the changes in the dry mass of a soya bean seedling, the cotyledons and the plumule of the same seedling during the first 20 days of germination.



Which of the following correctly explains the increase in dry mass of the soya bean seedling after day 12?

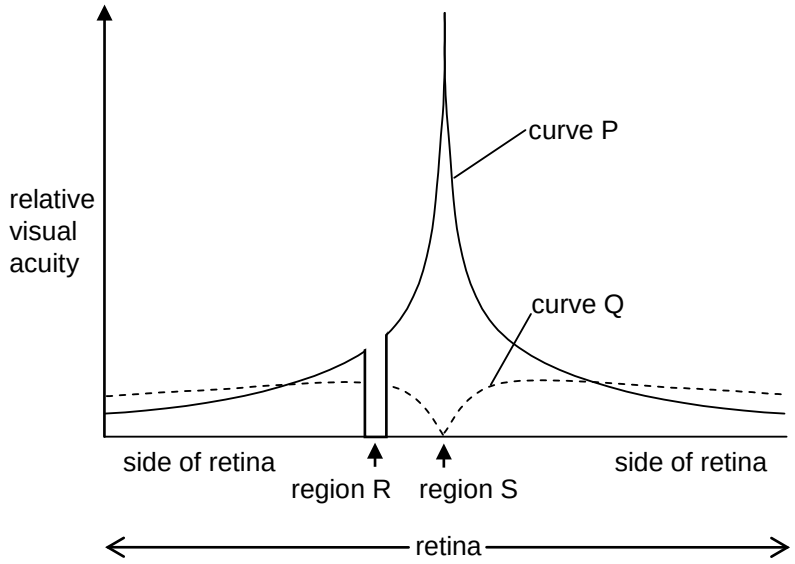
A The seedling carried out photosynthesis after day 12.

B The food stored in the cotyledons was broken down to provide energy for growth.

C There was a net production of food in the seedling after day 12.

D The rate of respiration of the plumule decreased after day 12.

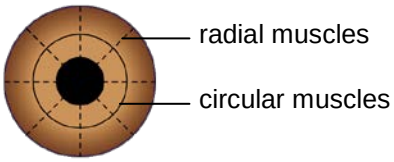
17. Visual acuity is the degree of sharpness of details seen by an eye. Curves P and Q below show the relative visual acuity of the eye under different light intensities.



What do curves P and Q represent? What are regions R and S on the retina?

	Curve P	Curve Q	Region R	Region S
A	high light intensity	low light intensity	blind spot	yellow spot
B	high light intensity	low light intensity	yellow spot	blind spot
C	low light intensity	high light intensity	blind spot	yellow spot
D	low light intensity	high light intensity	yellow spot	blind spot

18. The diagram below shows the front view of the iris in a human eye.



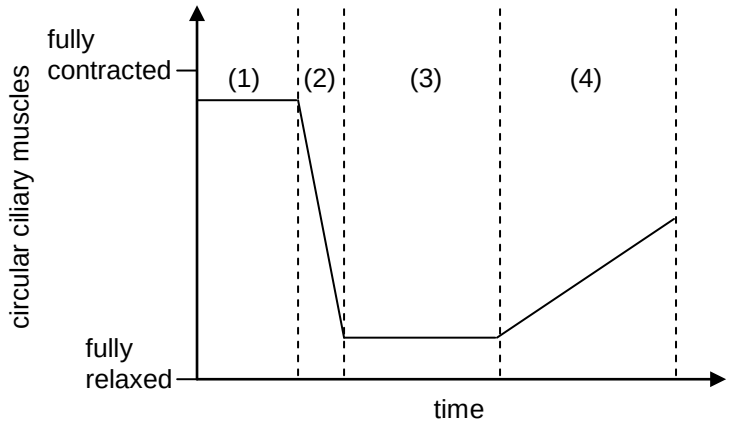
Which of the following about the eye is correct?

	Condition	Radial muscles	Circular muscles
A	high light intensity	relax	contract
B	high light intensity	relax	relax
C	low light intensity	contract	contract
D	low light intensity	relax	contract

19. Which of the following structures of a human eye does ***not*** contain pigments?

A choroid
B retina
C cornea
D iris

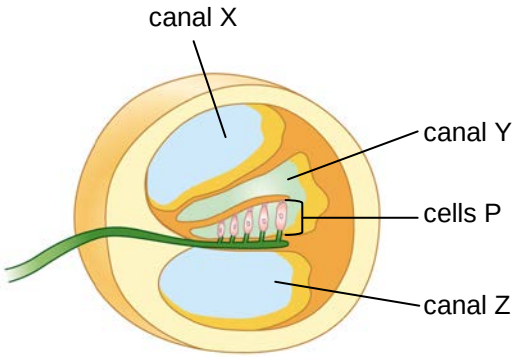
20. The graph below shows the changes in the conditions of the circular ciliary muscles of the eyes of a woman as she is looking at a butterfly moving from a flower to another.



During which time period is the butterfly moving towards the woman?

A (1)
B (2)
C (3)
D (4)

Directions: Questions 21 and 22 refer to the diagram below, which shows the cross section of the tube of the cochlea.



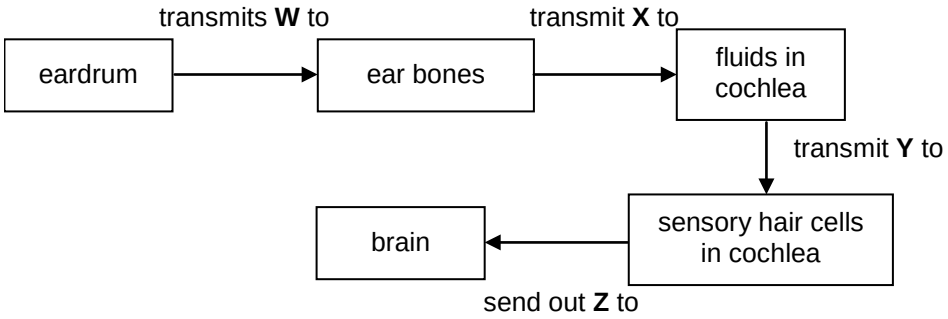
21. Which of the following statements about canals X, Y and Z is ***not*** correct?

A Canal X is connected to the round window while canal Y is connected to the oval window.
B Canals X, Y and Z are filled with fluid.
C The fluid in canal X is continuous with that in canal Z.
D Canal Y contains receptors for hearing.

22. A baby was born without any cells P in the cochlea. What will happen to the baby?

A The sound that the baby hears will have a lower volume than usual.
B The baby cannot detect the directions of its head movements.
C The baby cannot maintain body balance.
D The baby cannot hear any sound.

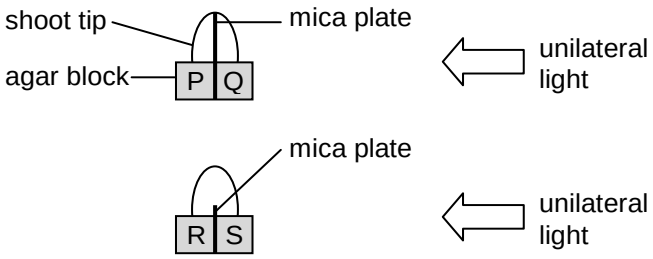
23. Sound collected by the ear is converted to different forms in the ear before reaching the brain.



What are W, X, Y and Z?

	W	**X**	**Y**	**Z**
A	sound waves	vibrations	vibrations	vibrations
B	sound waves	vibrations	electrical signals	electrical signals
C	vibrations	vibrations	vibrations	electrical signals
D	vibrations	sound waves	electrical signals	electrical signals

24. A student performed an experiment to study the movement of auxins in shoots. The diagram below shows the set-ups of the experiment.

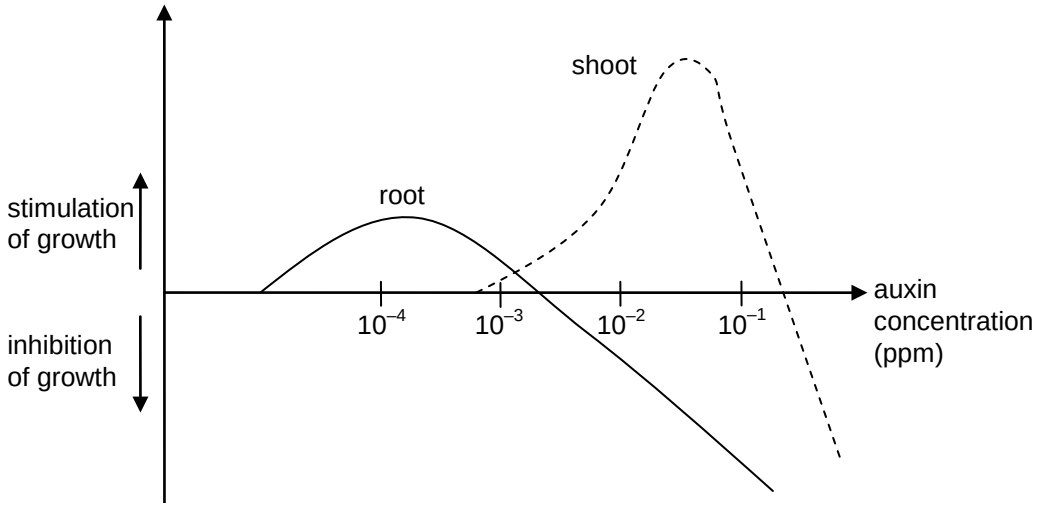


After 48 hours, the student measured the amounts of auxins in agar blocks P, Q, R and S. Which of the following statements about the results is/are correct?

(1) The amount of auxins in P was similar to that in Q.
(2) Q contained more auxins than R.
(3) R contained more auxins than S.

A (1) only
B (2) only
C (1) and (3) only
D (2) and (3) only

25. The graph below shows the results of an experiment designed to investigate the relationship between auxin concentration and the growth of a shoot and a root.



Auxins may be used commercially as a growth promoter in cutting. The cut end of a leaf can be placed in a culture solution containing auxins, so that the leaf can develop into a plant. Which concentration of auxins should be used? Why?

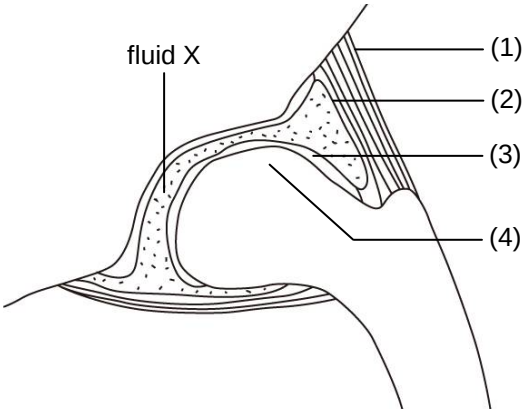
A about 10^{-1} ppm to stimulate the growth of the shoot but inhibit the growth of the root

B about 10^{-2} ppm to inhibit the growth of the shoot

C about 10^{-3} ppm to stimulate the growth of the shoot and the root

D about 10^{-4} ppm to stimulate the growth of the root

26. The diagram below shows the structure of a movable joint.



Which of the labelled structures secretes fluid X?

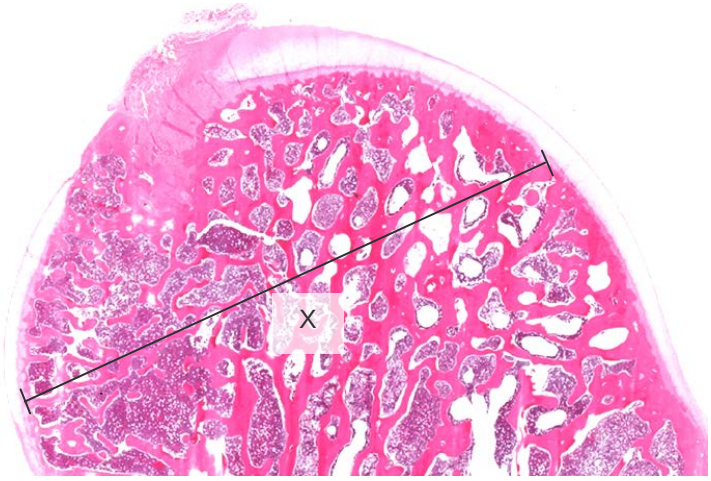
A (1)

B (2)

C (3)

D (4)

27. The photomicrograph below shows a section of the head of a long bone in the human leg.



Which of the following statements about structure X is ***incorrect***?

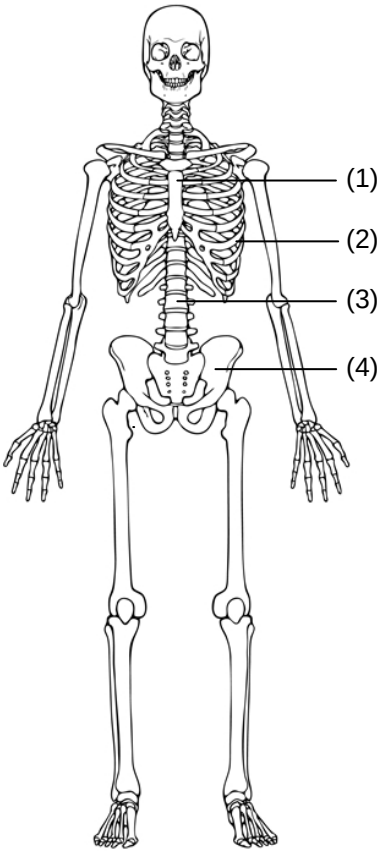
A It contains living cells.

B It contains minerals.

C Its cavity is filled with fatty tissue.

D It helps absorb shock.

28. The diagram below shows the human skeleton.



Which of the labelled parts does ***not*** belong to the axial skeleton?

A (1)

B (2)

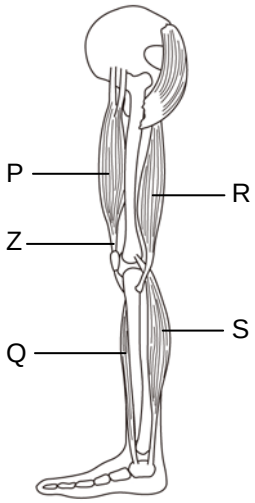
C (3)

D (4)

Directions: Questions 29 to 31 refer to the diagrams below. Diagram I shows the posture of a dancer and diagram II shows some of the muscles associated with her right leg.

Diagram I

Diagram II



29. Which of the following pairs of muscles are opposing muscles?

(1) P and Q
(2) P and R
(3) Q and R

A (1) only
B (2) only
C (3) only
D (1), (2) and (3)

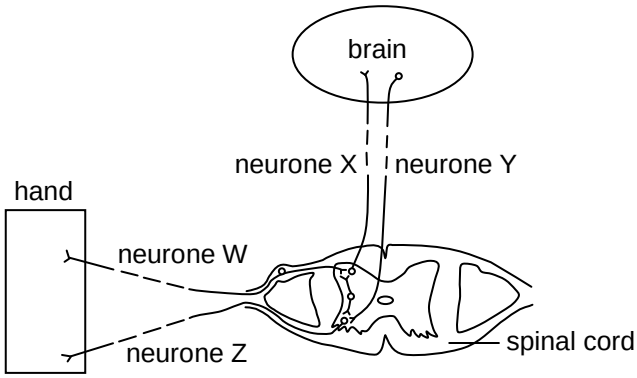
30. Which muscles of the right leg of the dancer are contracting when she maintains the posture in diagram I?

A P and Q
B P and S
C Q and R
D R and S

31. Which of the following will occur if structure Z of the dancer is broken?

A Her knee jerk reflex will be affected.
B Her upper leg will not be able to move.
C Muscle P will not be able to contract.
D Muscle P will not be able to relax.

32. The diagram below shows the arrangement of some neurones in the nervous system of a person.



Which of the following statements is correct?

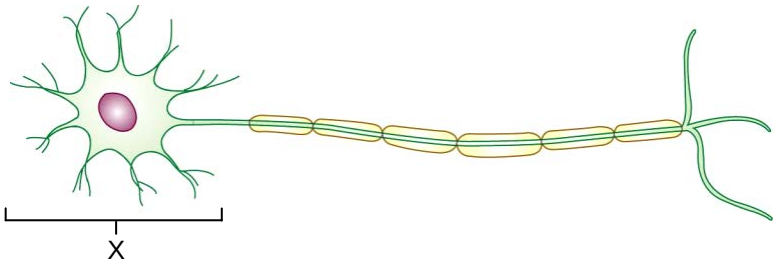
A If neurone W is damaged, the person cannot feel any pain but can still withdraw his hand involuntarily when he touches a sharp object.

B If neurone X is damaged, the person cannot feel any pain but can still withdraw his hand involuntarily when he touches a sharp object.

C If neurone Y is damaged, the person can still feel pain but cannot withdraw his hand involuntarily when he touches a sharp object.

D If neurone Z is damaged, the person cannot feel any pain but can still withdraw his hand involuntarily when he touches a sharp object.

33. The diagram below shows the structure of a neurone.



X can be found in

A the outer layer of the medulla oblongata.

B the cerebral cortex of the cerebrum.

C the white matter of the cerebellum.

D the white matter of the spinal cord.

34. Compared with nervous coordination,

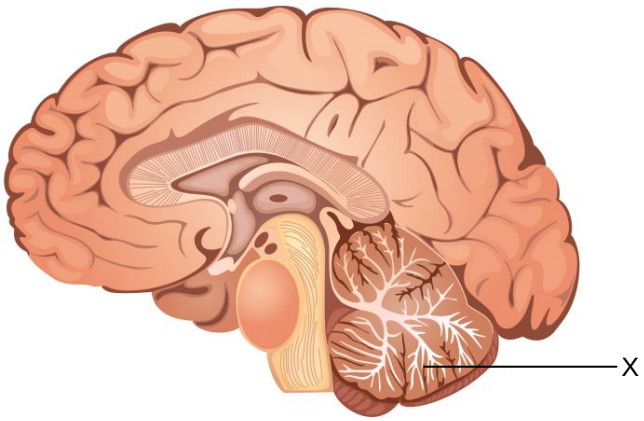
A the duration of the effect of hormonal coordination is short-term.

B hormonal coordination is faster in action.

C the response of hormonal coordination is more widespread.

D hormonal coordination is more important.

35. The diagram below shows a section of the human brain.



Which of the following is a possible consequence if X is damaged?

A The person will have problems in making decision.
B The person cannot walk properly.
C The person will have illusions.
D The person may have problem with his heart rate.

36. Which of the following statements about the human nervous system is/are correct?

(1) The nervous system consists of the central nervous system and the peripheral nervous system.
(2) The peripheral nervous system can generate sensations.
(3) The central nervous system consists of cranial nerves and spinal nerves.

A (1) only
B (1) and (2) only
C (2) and (3) only
D (1), (2) and (3)

37. Which of the following must be involved in a negative feedback mechanism?

(1) receptors
(2) the nervous system
(3) effectors

A (1) only
B (1) and (3) only
C (2) and (3) only
D (1), (2) and (3)

38. The chemoreceptors responsible for detecting changes in blood glucose level in our body are present in

A the brain.
B the liver.
C the hepatic portal vein.
D the pancreas.

39. Which of the following is/are the homeostatic response(s) of a non-diabetic person when his/her body detects a rise in the blood glucose level above the normal level?

(1) excretes glucose in urine
(2) stops eating sugary food
(3) produces more insulin

A (3) only
B (1) and (2) only
C (1) and (3) only
D (2) and (3) only

40. Which of the following comparisons between amylase and glucagon is ***incorrect***?

	Amylase	***Glucagon***
A	produced by exocrine glands	produced by endocrine glands
B	released through ducts	diffuses directly into blood after release
C	catalyses the conversion of starch into maltose	catalyses the conversion of glycogen into glucose
D	protein in nature	protein in nature

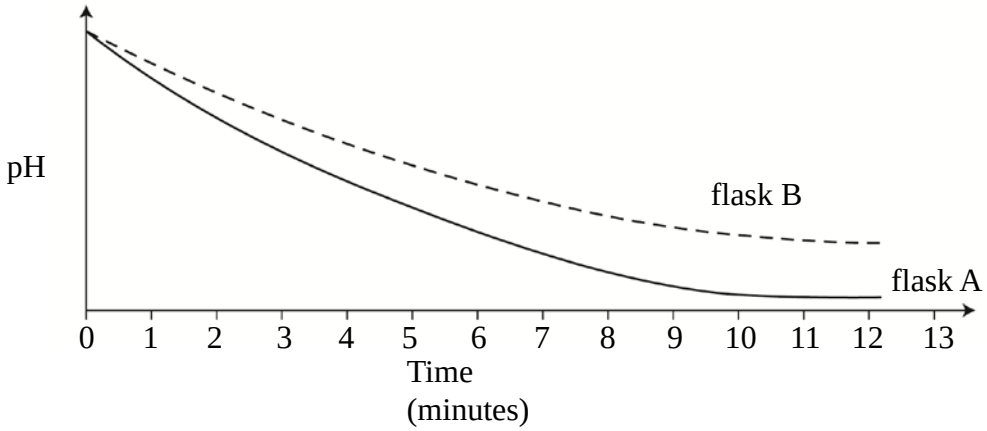
End of Section I

II. Structured Questions (60 marks)

1. An investigation was carried out to study the effect of bile salts on the digestion of lipids. Two flasks were set up as shown in the table below:

Contents	**Flask A** (cm^3)	**Flask B** (cm^3)
Milk (full cream)	10	10
Dilute sodium carbonate solution	10	10
Lipase solution	2	2
Bile salt solution	2	0
Water	0	2

The pH of each mixture was recorded using a pH meter connected to a data logger. The computer printout was shown below:



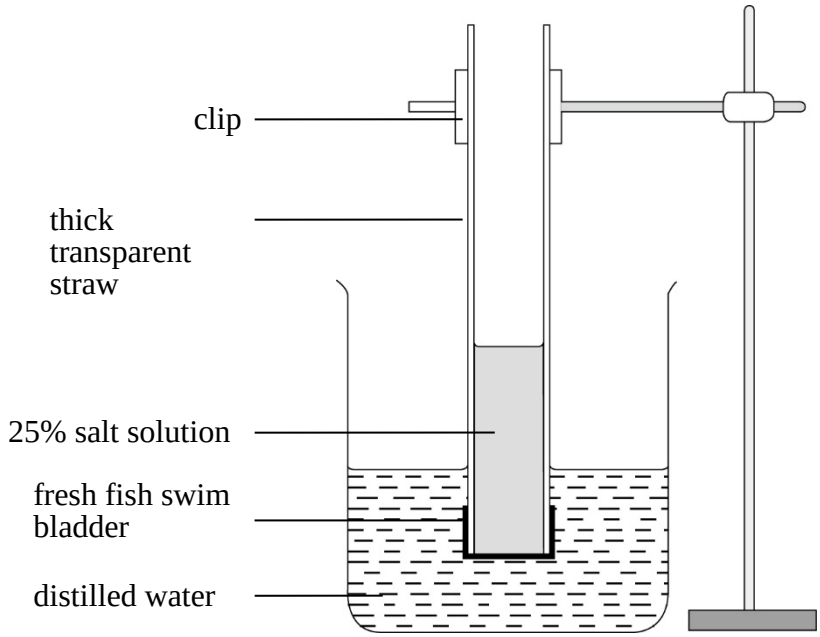
a What is the purpose of adding dilute sodium carbonate solution? (2 marks)

b Why did the pH drop during the experiment? (1 mark)

c With reference to the graph, explain whether bile salts help in lipid digestion. (2 marks)

d Explain why the rate of fall in pH in flask A slowed down after about 12 minutes. (2 marks)

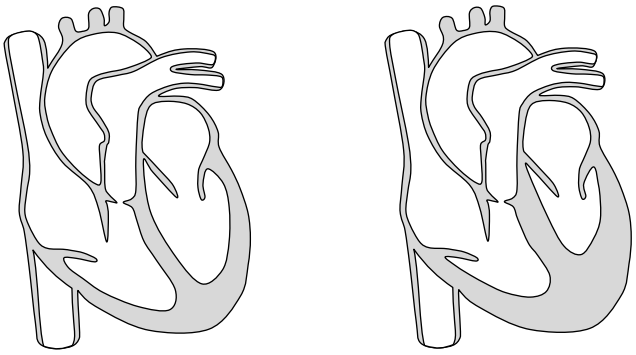
2. A student fixed a fresh fish swim bladder to the end of a thick transparent straw, and the end of the straw is fixed in a beaker containing distilled water. Then he filled the thick straw with 25% salt solution. The experimental set-up is shown below.



a What is the possible change in the level of salt solution in the straw? Explain your answer. (4 marks)

b Would the level of salt solution change if the fresh fish swim bladder was replaced by a boiled fish swim bladder? Explain your answer. (3 marks)

3. The diagrams below show the sections of a normal heart and the heart of a patient. The patient suffers from a disease which causes him to feel tired easily.

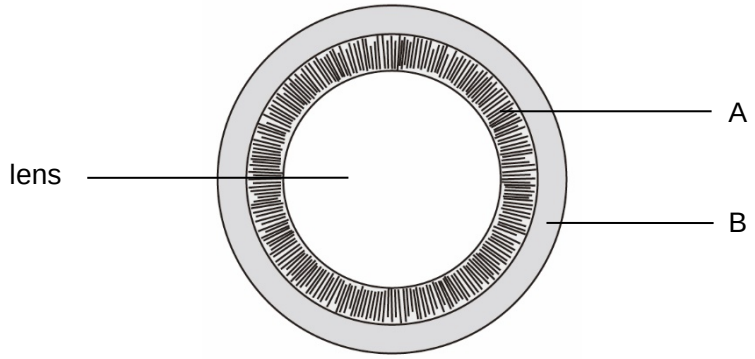


normal heart heart of the patient

a With reference to the above diagrams, state ***one*** difference between the walls of the heart chambers in the normal heart and the heart of the patient. (1 mark)

b According to the answer in part **a**, suggest why the patient feels tired easily. (3 marks)

4. The diagram below shows the structures in the human eye involved in focusing.



a The lens has no blood vessels.

i What is the significance of the absence of blood vessels to the function of the lens. (1 mark)

ii From where do the cells of the lens obtain oxygen and nutrients? (1 mark)

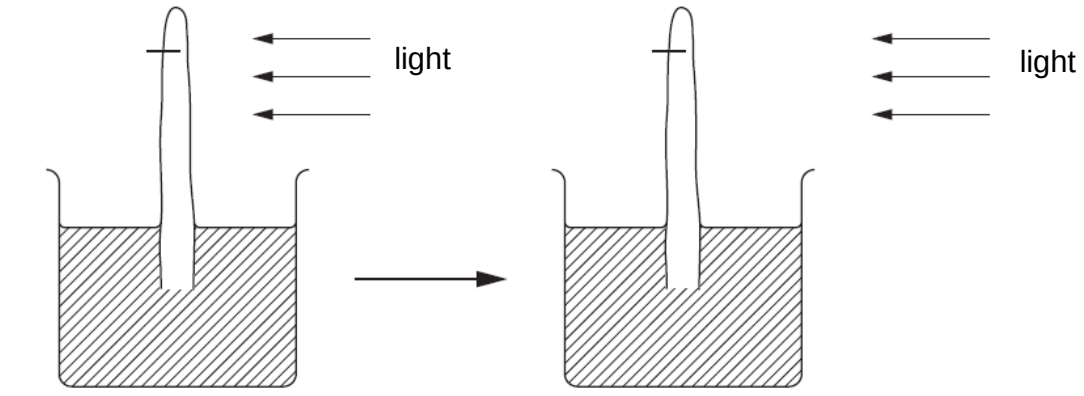
b A person looked at the map on the smartphone he is holding.

i Describe how the image of the map on his retina generated vision in the brain. (4 marks)

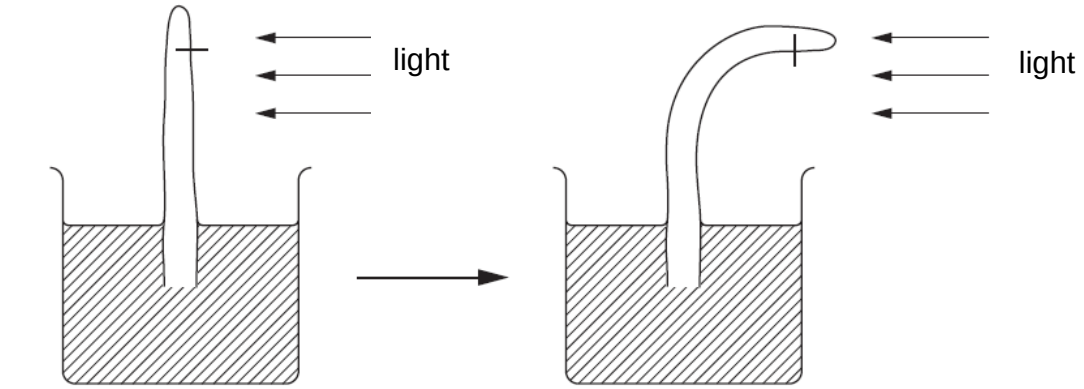
ii After looking at the map, the person tried to locate a building in the distance. Describe how the eye structures shown in the diagram would change when he tried to focus on the building. (3 marks)

iii Although the person could clearly see the map, he could not see the building clearly. Draw a ray diagram to show the path of the light rays when he was focusing on the building. (3 marks)

5. An experiment was carried out to investigate the effect of light shining from one side on a plant shoot.



experiment X



experiment Y

a A plant hormone (auxin) causes the bending response. Auxin is produced in the tip and travels downwards to cause the cells to elongate. Use the results to explain which side of the shoot the auxin travels downwards in. (2 marks)

b **i** Name the response shown by the shoot in experiment Y. (1 mark)

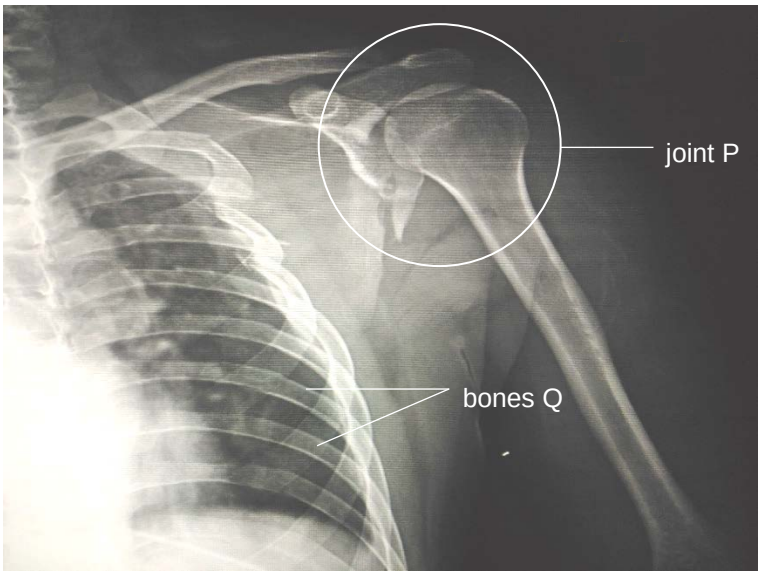
ii What is the significance of this response to the plant? (2 marks)

6. In September 2019, an elevator installed in a skyscraper in Guangzhou broke the record of the world's fastest elevator. Its maximum speed reaches 75.6 km h^{-1}. When travelling upward on such a high speed elevator, passengers are likely to feel pain in their ears.

a With reference to the diagram, explain why passengers are likely to feel pain in their ears when travelling on a high speed elevator. (3 marks)

b With reference to the diagram, explain why this kind of ear pain can be relieved simply by swallowing. (3 marks)

7. The X-ray photograph below shows part of the human skeleton.



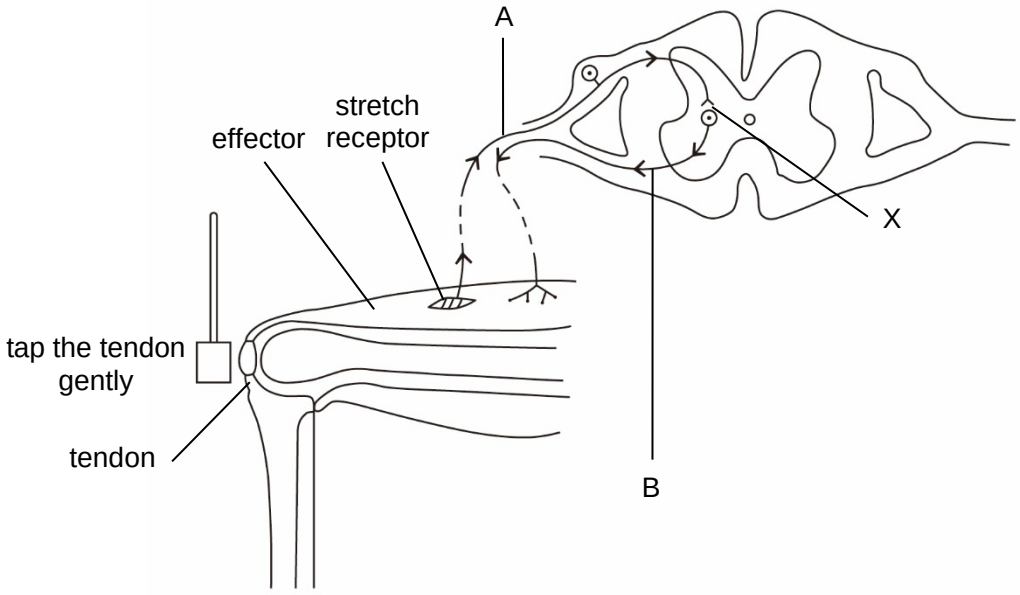
a **i** Name the type of joint P belongs to. Support your answer with ***one*** piece of evidence observed in the X-ray photograph. (2 marks)

ii Compare the degree of movement between joint P and a human knee joint. (2 marks)

b **i** With reference to the X-ray photograph, name the muscle found between bones Q. (1 mark)

ii Describe how the muscle mentioned in your answer to **i** and bones Q work together to bring about inhalation. (3 marks)

8. The diagram below shows the reflex arc of the knee jerk reflex.



a State whether the effector in the reflex arc is a flexor or an extensor. Explain your answer. (2 marks)

b **i** Name gap X. (1 mark)

ii Describe what happens at gap X during the knee jerk reflex. (4 marks)

c The axon of neurone B is covered by a myelin sheath. State ***one*** function of the myelin sheath in neural transmission. (1 mark)

d Give another reflex action which occurs in the human body and state its purpose. (2 marks)

e Apart from being fast, state ***one*** other feature of all reflex actions. (1 mark)

End of Paper