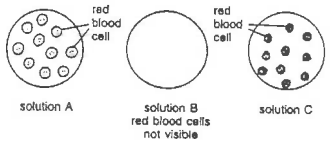
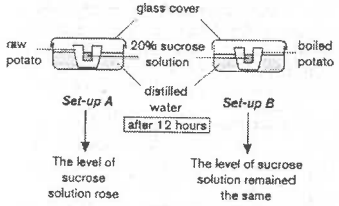
Past HKCEE Questions
Cell Activities
Paper I

1. A sample of human blood was dropped onto 3 clean slides, each containing a salt solution.



(i) Explain why the red blood cells are not visible in solution B.
(ii) Which salt solution has a concentration similar to that of human plasma? Explain your answer.
(iii) Briefly describe the part played by the kidneys in regulating the salt concentration of the plasma in order to avoid shrinkage of the red blood cells.
(iv) A plant cell, whose cell-sap concentration is similar to the concentration of the contents of human red blood cells, is placed in solution B.
Describe and explain its appearance after half an hour. (11 marks)
(HKCEE 1982)

2. In order to study the conditions for osmosis, a student prepared two set-ups as shown in the diagrams below. The skin of each potato was removed and a cavity was made for holding the sucrose solution.



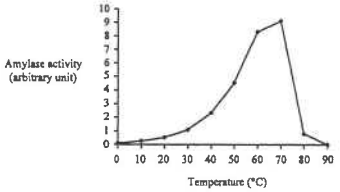
(i) Explain why the level of sucrose solution of set-up A rose after 12 hours. (3 marks)
(ii) What can you conclude from the results of the two set-ups? (2 marks)
(iii) Referring to set-up A, draw a labeled diagram to show the possible appearance of a complete potato cell which is in contact with
(1) the sucrose solution,
(2) the distilled water. (4 marks)
(iv) At the end of the experiment, sucrose was found in the distilled water in set-up B. Explain why this occurred. (2 marks)

3. Jelly contains a kind of protein called gelatin, which causes the jelly solution to solidify after cooling. In order to prepare some jelly for a party, Mary dissolved the jelly powder in different ways as shown in the table below:

Jelly solution	Method of preparation
A	Jelly powder dissolved in water at 40°C
B	Jelly powder dissolved in water at 40°C + fresh pineapple juice
C	Jelly powder dissolved in water at 80°C + fresh pineapple juice

(i) Solution A solidified after cooling while solution B did not. Suggest why solution B failed to solidify. (2 marks)
(ii) Solution C was found to solidify after cooling. How would you explain the difference in the results between solutions B and C? (3 marks)
(iii) It is found that if beef is mixed with small pieces of fresh pineapple and left to stand for about half an hour before cooking, the meat will become tender (less tough). Based on the answer to (ii), explain why this treatment can tenderize the beef. (3 marks)
(HKCEE 1999)

4. In the production of beer, the raw material used is barley grains, which contain a large amount of starch. When barley grains germinate, amylase is produced. The grains are then crushed and mixed with warm water. After several hours, yeast is added to the mixture for fermentation.
(i) What is the action of amylase on the starch in the barley grains? (1 mark)
(ii) After the crushed grains are mixed with warm water, why is it necessary to wait for several hours before adding the yeast? (1 mark)
An investigation was carried out to study the effect of temperature on the activity of barley amylase. For each temperature, the same amount of crushed grains and water were used. The amylase activity was estimated by the rate of disappearance of starch using the iodine test. The results obtained are shown in the graph below:



(iii) What conclusions can be drawn from the graph about the effect of temperature on amylase activity? (3 marks)
(iv) If you want to store the mixture of crushed grains and water with minimal reaction so that it can be used several days later, what temperature would you choose? Why? (3 marks)
(v) Suggest another method to estimate the amylase activity for this investigation. (2 marks)
(HKCEE 2000)

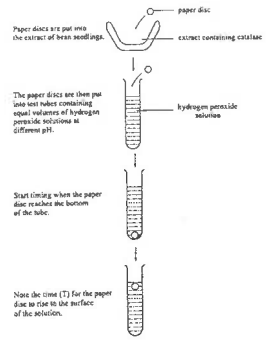
5. A kind of Chinese dessert is made by mixing milk with ginger juice so that the milk becomes coagulated. The coagulation of milk is due to the conversion of a soluble milk protein into an insoluble form. To find out the conditions for milk coagulation, a person mixed milk at different temperatures with some fresh ginger juice. The mixtures were observed for 15 minutes to see if coagulation would occur. The results are shown in the table below:

Temperature of milk (°C)	Result
20	No sign of coagulation after 15 minutes
40	Fully coagulated in 14 minutes
60	Fully coagulated in 1 minute
80	Fully coagulated in 1 minute
100	No sign of coagulation after 15 minutes

Note : The same study was repeated using boiled ginger juice and the milk did not coagulate at any temperature.

(i) Referring to the above results, describe the effect of milk temperature on the rate of milk coagulation by ginger juice. (3 marks)
(ii) How would you explain the action of fresh ginger juice in bringing about the coagulation of milk? Give evidence to support your answer. (2 marks)
(iii) Milk protein also coagulates at low pH. In which part of the alimentary canal does this coagulation occur? Based on your biological knowledge, suggest why the coagulation of milk protein can facilitate its digestion in that part of the alimentary canal. (3 marks)
(HKCEE 2002)

6. The following shows the procedure of an experiment to study the effect of pH on the activity of catalase extracted from bean seedlings:



The results of the experiment are shown below:

pH of hydrogen peroxide solution	T (s)
3	>100
5	50
7	20
9	20
11	27

(i) Explain why the paper discs rose to the surface of the solution in some of the tubes. (2 marks)

(ii)
(1) Work out the rate of reaction from the value of T for each tube. Tabulate your answer. (2 marks)
(2) Using the data obtained in (1), plot a graph on graph paper to show the effect of pH on catalase activity. (3 marks)

(iii)
(1) Based on your graph, estimate the optimum pH of catalase. (1 mark)
(2)In order to get a more accurate estimate of the optimum pH, what further work would you carry out in this experiment? (1mark)

(iv)A sample of bean extract was refrigerated at 4°C and then allowed to warm to room temperature. If the experiment was repeated using this sample, would the catalase activity be different from that of the previous experiment? Explain your answer. (2 marks)
(HKCEE 2003)

7. One day, when Keith and Jane walked past a fresh fruit juice shop, Keith noticed that some pears were cut into pieces and stored in a tank of water before use.
(a) Keith thought that the shopkeeper stored the cut pears in water in order to extract more juice. Explain the

biological principle behind Keith's idea. (3 marks)

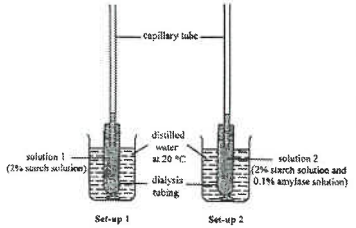
(b) Jane disagreed with Keith because she found that the shopkeeper also stored whole pears in water tanks. Explain why this observation provides Jane with evidence to oppose Keith's idea. (2 marks)

(c) Suggest one possible hygienic problem of storing the cut pears in water tank. (1 mark)

(HKCEE 2007)

Past HKCEE Questions
Cell Activities
Paper II

99.
Directions: Questions 8 and 9 refer to the diagram below, which shows the initial condition of two set-ups:

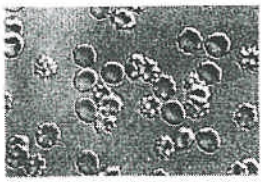


99-8
After 1 hour, the liquid level in the capillary tube of set-up 2 is much higher than that of set-up 1. Which of the following is a probable reason for this result?
A. Solution 1 has a lower water potential than solution 2.
B. The dialysis tubing of set-up 1 is less permeable to water than that of set-up 2.
C. Sugar is produced in solution 2.
D. Less starch is present in solution 2.

99-9
Which of the following treatments might increase the rate of rise of the liquid level in set-up 2?
(1) using a narrower dialysis tubing
(2) using a capillary tube with a smaller internal diameter
(3) raising the temperature of the distilled water from 20°C to 30°C
A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

01-4.
Which of the following statements about enzymes is correct?
A. Enzymes are made up of proteins or fats.
B. Enzymes are denatured at 0°C,
C: The optimum temperature of most enzymatic activities is 37°C.
D. The activity of most enzymes is lower than 80°C.

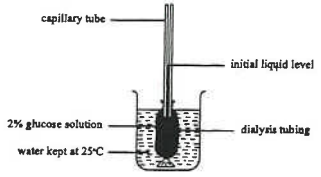
02-35
Which of the following can account for the appearance of the red blood cells shown in the photomicrograph below?



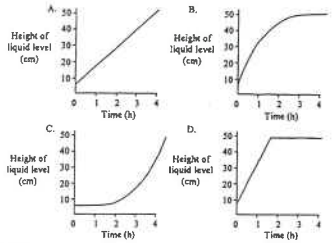
A. The red blood cells are undergoing mitosis.
B. The red blood cells are in the deoxygenated state.
C. The red blood cells are bathed in a concentrated sugar solution.
D. The cell membrane of the red blood cells becomes greatly folded to increase the surface area for oxygen uptake.

04-03
A student defines osmosis as 'the movement of water molecules from a dilute solution to a concentrated solution across a selectively permeable membrane'. This definition is inaccurate because
A. solute molecules can also move along the concentration gradient.
B. water molecules can also move from the concentrated solution to the dilute solution.
C. it should state clearly that the membrane is not permeable to the solute molecules.
D. movement of water molecules can still occur without a selectively permeable membrane.

Directions: Questions 15 and 16 refer to the diagram below, which shows a setup used by Eric to study osmosis:



04-15
If Eric carries out the investigation for four hours, what would be the change in the liquid level in the capillary tube with time?



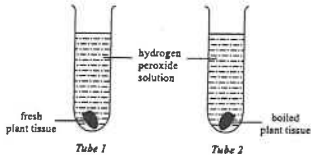
04-16

Which of the following can increase the rate of rise of the liquid level in the capillary tube?

(1) Raise the water temperature to 30°C.
(2) Use a larger beaker with more water inside.
(3) Use a capillary tube with a smaller internal diameter.

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

Directions: Questions 59 and 60 refer to an investigation on the enzyme catalase, which breaks down hydrogen peroxide and releases oxygen. In order to show whether a certain plant tissue contains catalase or not, Joyce set up the following experiment:



04-59

Joyce observed that a lot of gas bubbles were released in tube 1 but not in tube 2. In order to conclude that the plant tissue contains catalase, what ***additional*** steps should be taken by Joyce?

(1) Test whether the gas bubbles contain oxygen.
(2) Set up a tube containing water and the fresh plant tissue.
(3) Set up a tube containing hydrogen peroxide but no plant tissue.

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

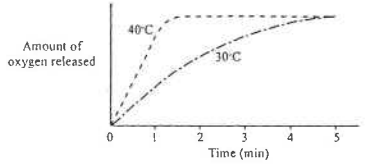
04-60

When gas bubbles stopped coming out from tube 1, Joyce added more hydrogen peroxide into the tube. She observed that gas bubbles were produced again. What can be implied from this observation about the property of enzymes?

A. Enzymes can be reused.
B. Enzymes are specific in action.
C. Enzymes are made up of proteins.
D. Enzymes can speed up chemical reactions.

Directions: Questions 1 to 3 refer to the following experiments:

Two test tubes containing 5 cm^3 of hydrogen peroxide solution and 1 cm^3 of catalase solution respectively were kept at 30°C for 30 minutes. The content of the two tubes were then mixed and maintained at the same temperature, and the amount of oxygen released was recorded for 5 minutes. The same experiment was repeated at 40°C. The results are shown in the graph below:



05-1

The initial rate of oxygen production at 40°C is higher than that at 30°C because

A. catalase is denatured at the lower temperature.
B. oxygen is less soluble at the higher temperature.
C. more active sites are present in the enzyme molecules at the higher temperature.
D. the substrate molecules have more kinetic energy at the higher temperature.

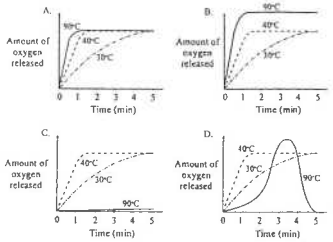
05-2

Which of the following is a correct interpretation of the graph?

A. At 30°C, the rate of reaction was highest at the 5th minute.
B. At both temperatures, the amount of oxygen released in 5 minutes was the same.
C. At both temperatures, the time for the decomposition of all hydrogen peroxide was the same.
D. All active sites of the enzymes were occupied at the end of the experiment.

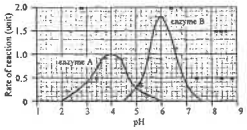
05-3

Which of the follow graphs is correct?



06.

Directions: Questions 23 to 25 refer to the graph below, which shows the rates of reactions catalysed by two enzymes A and B over a range of pH values:



06-23

The rates of the reactions catalysed by enzymes A and B are equal at

A. pH 4.
B. pH 5.
C. pH 6.
D. pH 7.5.

06-24

Which of the following is a correct interpretation of the graph?

A. Enzyme A is found in gastric juice.
B. Enzyme B is more active than enzyme A.
C. The optimum pH value for enzyme B is 1.8.
D. Enzyme A is more active than enzyme B at pH 4.

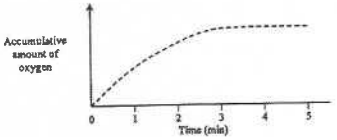
06-25

In the above study, it is important to keep the temperature at which the reactions occur constant because

A. temperature affects enzyme activity.
B. the enzyme becomes inactive at low temperatures.
C. the enzyme becomes denatured at low temperatures.
D. temperature should be the same for control experiments.

07

Directions: Questions 7 and 8 refer to the following experiment: Two boiling tubes containing 5 cm^3 of hydrogen peroxide solution and 1 cm^3 of catalase solution respectively were kept at 25°C for 10 minutes. The contents of the two tubes were then mixed and maintained at the same temperature, and the amount of oxygen released was recorded for 5 minutes. The results are shown in the graph below:



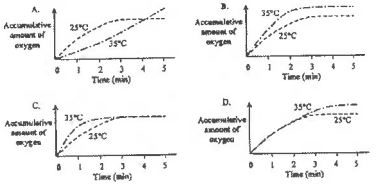
07-07

The line levels off at the 3rd minute. Which of the following is a correct explanation for this?

A. The reaction stops at the 3rd minute because catalase has been used up.
B. The reaction stops at the 3rd minute because hydrogen peroxide has been used up.
C. The reaction rate reaches the maximum at t he 3rd minute because the amount of oxygen released is highest.
D. The reaction rate reaches the maximum at the 3rd minute because there is no more increase in the amount of oxygen released.

07-08

The same experiment was repeated but the contents were kept at 35°C. Which of the following would best indicate the results of this experiment?

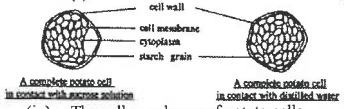


Past HKCEE Questions
Cell Activities
Suggested Answers

Paper I

1. (i) All RBC bursted 1
because water enters by osmosis / as solution B is hypotonic 1
(ii) Solution A 1
No change in shape of RBC 1
Water gain = water loss (*NOT* isotonic) 1
(iii) Increased reabsorption of water from kidney tubules 1
excrete excess salt / decrease reabsorption of salt 1
(iv) becomes turgid 1
because water enters 1
cellulose cell wall can resist the water pressure / prevent bursting 1

2. (i) As the water potential of the sucrose solution is lower than that of the distilled water, 1
water passes through the potato into the sucrose solution, 1
causing the level to rise. 1
Effective communication (C) 1
(ii) Osmosis occurs when two solutions of different concentrations are separated by living tissue 1
Which serves as a selectively permeable membrane 1
(iii) Large, clear drawing with smooth lines (D) 1
*Labels (any three 0.5 x 3): cell wall, cell membrane, cytoplasm (optional: starch grains, nucleus, vacuole) 1.5
Title 0.5
Signs of plasmolysis and turgidity (s) 1



(iv) The cell membrane of potato cells became freely permeable / was destroyed after boiling 1
So sucrose can diffuse out to the distilled water 1

3. (i) Gelatin in jelly solution B was digested / disappeared / lost its effect 1
due to the presence of fresh pineapple juice 1
(ii) Gelatin was present in solution C, but not in solution B 1
This suggests that the pineapple juice contains protease / enzyme that digests protein or gelatin 1
The enzyme is denatured / activated at high temperature 1
Effective communication (c) 1
(accept alternative answers suggesting that pineapple juice contains a heat-sensitive substance that acts on gelatin)
(iii) Beef contains protein 1
which is digested by the protease in the pineapple juice 1
Allowing the beef and pineapple mixture to stand for half an hour will give enough time for the enzyme to work 1

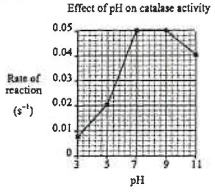
4. (i) The amylase converts starch into maltose 1
(ii) To ensure that sufficient amount of maltose is produced 1
(iii) When the temperature increases from 0-70°C, the amylase activity increases 1
When the temperatures increases from 70-90°C, the amylase activity decreases. 1
The optimum temperature for the activity of barley amylase is 70°C 1
(iv) Keep the mixture at very low temperature (below 10°C) 1
The amylase is inactive at this temperature 1
but it is not denatured / destroyed 1
(v) After incubating the mixture at a given temperature for a fixed period of time, perform the Benedict's test 1
Measure the amount of red precipitate / reducing sugar formed 1

5. (i) From 20°C to 60°C, the rate of coagulation of milk by ginger juice increases with increasing temperature From 80°C to 100°C, the rate of coagulation decreases as temperature increases 1
The rate of coagulation is highest at 60°C – 80°C / is very low at 20°C and 100°C 1
Deduct 1 mark if answer with time of coagulation, instead of rate of coagulation.
Effective communication (C) 1
(ii) Fresh ginger juice contains an enzyme / a heat-sensitive substance that converts soluble milk protein into the insoluble form 1
as the coagulating effect of fresh ginger juice is lost upon boiling / decreases when the temperature of milk increases beyond 80°C 1
(iii) In the stomach 1
Coagulated milk protein, being in semi-solid form, can be retained in the stomach for a longer period of time 1
for the protease to digest it 1

6. (i) The catalase in the paper disc broke down hydrogen peroxide, releasing oxygen. 1
When the amount of oxygen evolved reached a certain level, the oxygen bubbles buoyed up the disc to the surface of the hydrogen peroxide solution. 1
(ii) (1)

pH	Rate of reaction (s^{-1})
3	<0.01
5	0.02
7	0.05
9	0.05
11	0.04

2
(2)



3
(iii) (1) any value between 7 and 9 (or any value read from the graph drawn) 1
(2) Repeat the experiment using hydrogen peroxide solutions with smaller pH intervals between 7 and 9. 1
(iv) The catalase activity would be similar to that of the previous investigation 1
because catalase is not denatured at 4°C and it can become active again at room temperature. 1

7. (a) The water outside has a higher water potential than the cells of pears 1
water moves into the cells 1
increasing the volume of the cell content / water content of the cell 1
As a result, more fruit juice can be extracted
(b) The skin of the fruit acts as a barrier to water 1
Little / no water movement will occur 1
(c) The water / pear may be contaminated with pathogens / lead to food poisoning 1

Paper II

99-8	C
99-9	C
01-4	D
02-35	C
04-03	B
04-15	B
04-16	B
04-59	A
04-60	A
05-1	D
05-2	B
05-3	C
06-23	B
06-24	D
06-25	A
07-07	B
07-08	C