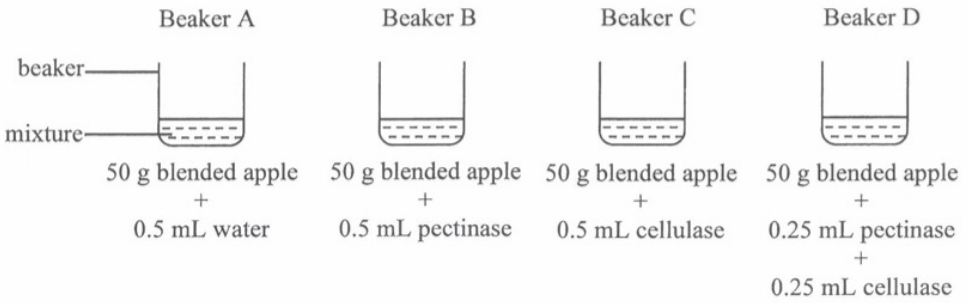
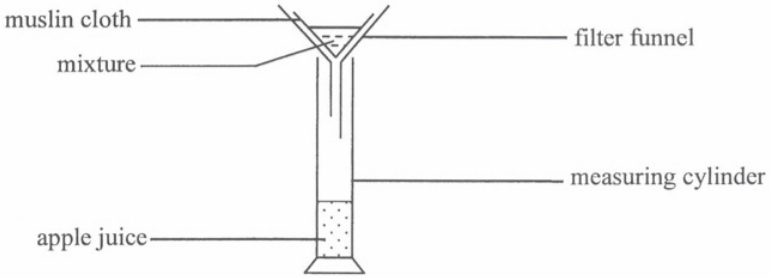
5. Pectinase and cellulase are enzymes that break down the chemical components of plant cell walls. The following experiment investigates the effects of these two enzymes on the production of apple juice:



stir each mixture for 10 minutes and then carry out filtration



The experiment was repeated three times and the results are shown below:

Beaker	Mixture	Volume of apple juice produced (mL)				Cost of enzyme(s) for producing 1 mL apple juice
		Trial 1	Trial 2	Trial 3	Average	
A	0.5 mL water + 50 g blended apple	2.0	1.0	3.0	2.0	---
B	0.5 mL pectinase + 50 g blended apple	33.5	31.0	28.5	31.0	
C	0.5 mL cellulase + 50 g blended apple	4.5	4.0	3.5	4.0	
D	0.25 mL pectinase + 0.25 mL cellulase + 50 g blended apple	34.0	32.0	36.0	34.0	

(a) State the independent variable and dependent variable of this experiment. (2 marks)

.....

.....

(b) Why are three trials better than one trial? (1 mark)

DSE M.C. Questions - Enzymes and metabolism
(sort by difficulty)

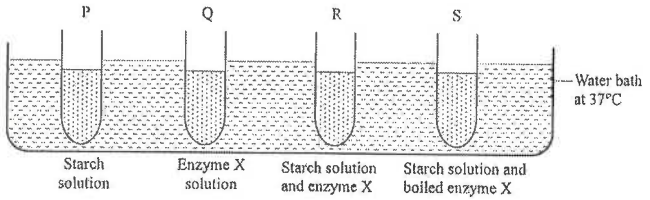
Challenging

2016 Q.27 (18%)

Which of the following statements about enzymes is incorrect?

A. Enzymes are produced by cells.
B. Enzymes are denatured at extreme temperatures.
C. There could be more than one specific enzyme to catalyse the same reaction.
D. When an enzyme encounters the same substrates, it always produces the same products.

Directions: Questions 2 to 4 refer to the diagram below, which shows four test tubes prepared by a student to investigate the action of a starch-digesting enzyme X:



2017 Q.3 (34%)

The student conducted some tests on the content of each test tube at the beginning and after 30 minutes. Which of the following correctly shows the results of the tests for tube R at the beginning?

	Benedict's test	*Iodine test*	*Test for protein*
A.	negative	positive	positive
B.	negative	positive	negative
C.	positive	negative	negative
D.	positive	negative	positive

Challenging

2017 Q.4 (23%)

Which of the following is ***not*** the purpose of the experimental design?

	Design	*Purpose*
A.	setting up tube P	to show the result of iodine test if starch is present
B.	setting up tube Q	to show that enzyme X alone cannot give positive result in Benedict's test
C.	setting up tube S	to show that enzyme X is denatured after boiling
D.	setting up water bath	to simulate the temperature of the human body

2018 Q.5 (37%)

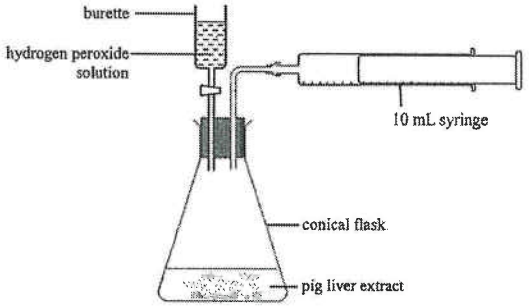
'Lock and Key' is a scientific model which is a selective representation used to explain that enzymes

A. Are biological catalysts
B. Are specific in action
C. Are protein in nature
D. Are required in small amounts

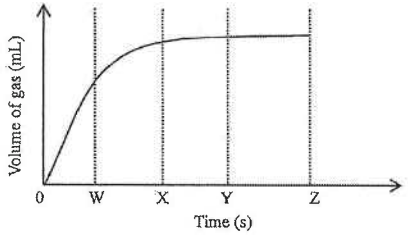
Challenging

2019 Q.10 (22%)

Directions: Question 9 to 10 refer to the diagram below, which shows an experimental set-up prepared by a student to investigate the effect of temperature on catalase activity. Pig liver extract contains catalase which speeds up the breakdown of hydrogen peroxide into oxygen and water. A fixed volume of hydrogen peroxide solution was added to the liver extract and a 10 mL syringe was used to collect the oxygen gas released from the reaction mixture.



After modifying the set-up, the following graph was obtained which shows the volume of gas collected over time at room temperature:

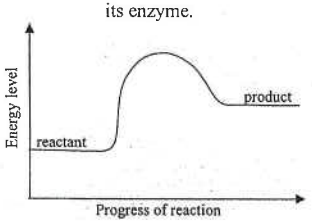


The student planned to use the volume of gas collected over a fixed period of time as the dependent variable to study the effect of different temperatures on catalase activity. Which of the following is the most suitable time period for the measurement?

A. 0-W B. 0-X C. 0-Y D. 0-Z

Average

Directions: Question 6 and 7 refer to the graph below, which shows the energy levels of the reactant and product of a biochemical reaction in the presence of its enzyme.



2013 Q.6 (47%)

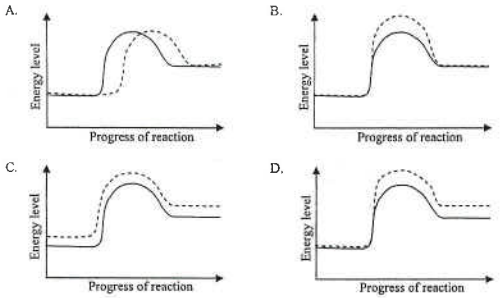
The reaction shown in the graph is

A. an anabolic process because energy is absorbed.
B. an anabolic process because energy is released.
C. a catabolic process because energy is absorbed.
D. a catabolic process because energy is released.

2013 Q.7 (44%)

Which of the following graphs correctly shows the change in the energy level of the reaction if the enzyme involved is absent?

Key: ——— with the enzyme
---------- without the enzyme

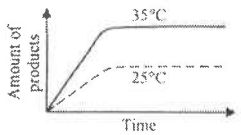


Average

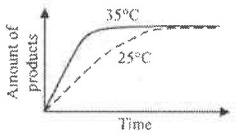
2014 Q.9 (70%)

Which of the following graphs correctly shows the changes in the amount of products in a reaction catalyzed by a human enzyme at different temperatures?

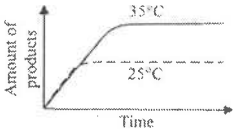
A.



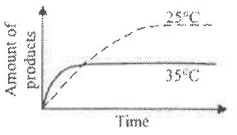
B.



C.

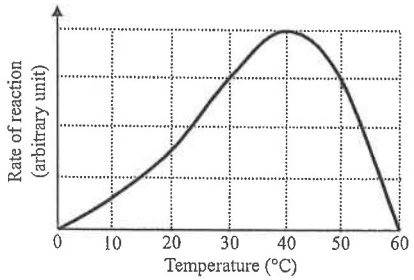


D.



2015 Q.3 (60%)

The graph below shows the effect of temperature on enzyme activity:



Which of the following statements correctly describes the enzyme reaction?

A. The enzyme is denatured at 0°C and 60°C.
B. The reaction taking place at 50°C is faster than that at 20°C.
C. There are more collisions between substrate and enzyme molecules at 40°C than 60°C.
D. The amount of product collected at the end of the reaction is the greatest if the reaction takes place at 40°C

Average

2016 Q.8 (64%)

Which of the following combinations correctly matches the biochemical reaction with the type of metabolism involved?

	Biochemical reaction	*Type of metabolism*
A.	Conversion of glucose to pyruvate	Anabolism
B.	Conversion of protein to amino acid	Anabolism
C.	Conversion of amino acid to urea	Catabolism
D.	Conversion of glucose to glycogen	Catabolism

2017 Q.1 (67%)

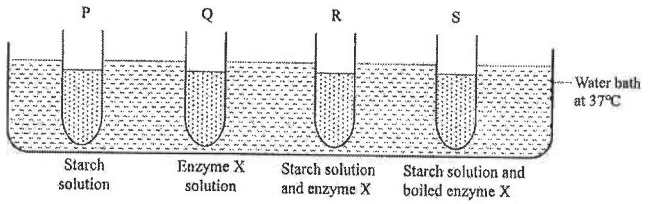
Which of the following combinations correctly matches the process with the type of metabolism involved?

	Process	*Type of metabolism*
A.	digestion of lipids in the small intestine	anabolism
B.	storage of excess energy in the form of glycogen	catabolism
C.	assimilation of amino acids to form muscle fibres	anabolism
D.	absorption of digested food in the small intestine	catabolism

Average

2017 Q.2 (67%)

Directions: Questions 2 to 4 refer to the diagram below, which shows four test tubes prepared by a student to investigate the action of a starch-digesting enzyme X:



In which of the following regions of the human alimentary canal can enzyme X be found?

(1) mouth cavity
(2) stomach
(3) small intestine

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

2017 Q.5 (60%)

Different animals produce different maltases to digest maltose. The maltases produced have different molecular sizes. Which of the following description of these maltases is correct?

A. Their active sites have similar shape.
B. Their amino acid sequences are the same.
C. They have the same optimum temperature.
D. They have the same three-dimensional structure.

Average

2018 Q.1 (71%)

Which of the following processes involves enzymes on cell membranes?

A. Excretion of carbon dioxide by the lungs
B. Transport of water along the xylem vessel
C. Calvin cycle in the chloroplast of plant cells
D. Digestion of carbohydrates in the small intestine

Directions: Question 2 to 4 refer to an experiment on the enzyme catalase, which speeds up the breakdown of hydrogen peroxide to release oxygen. John added a 1 cm^3 cube of pig liver to boiling tube containing 5 mL hydrogen peroxide solution. Gas bubbles were released and he used a glowing splint to test the gas. He repeated the experiment with beef, potato and apple. The results are shown below:

Tissue	*Rate of bubbles released*	*Glowing splint re-lit*
Pig liver	Moderate	Yes
Beef	Moderate	Yes
Potato	Slow	Yes
Apple	Slow	Yes

2018 Q.2 (54%)

Which of the following statements is an observation of the experiment?

A. These tissues contained catalase
B. Oxygen gas was released in the reaction
C. The gas released re-lit the glowing splint
D. Animal tissues had more catalase than plant tissues

2018 Q.4 (69%)

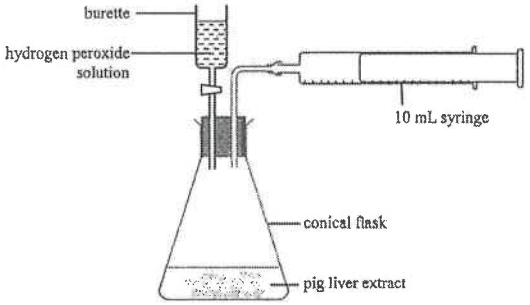
In order to prove that hydrogen peroxide is the substrate of this enzymatic reaction, which of the following steps should be used as a control?

A. Repeat the experiment using water and the tissues
B. Repeat the experiment using water and boiled tissues
C. Repeat the experiment using hydrogen peroxide but no tissues
D. Repeat the experiment using hydrogen peroxide and boiled tissues

Average

2019 Q.9 (72%)

Directions: Question 9 to 10 refer to the diagram below, which shows an experimental set-up prepared by a student to investigate the effect of temperature on catalase activity. Pig liver extract contains catalase which speeds up the breakdown of hydrogen peroxide into oxygen and water. A fixed volume of hydrogen peroxide solution was added to the liver extract and a 10 mL syringe was used to collect the oxygen gas released from the reaction mixture.



In the trial run conducted at room temperature, the students found that the volume of oxygen released was greater than the maximum collection volume of the syringe. How should he modify the set-up in order to collect valid data when repeating the experiment at different temperatures?

(1) use a larger syringe
(2) use a larger conical flask
(3) reduce the volume of the hydrogen peroxide solution added

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

Easy

2018 Q.3 (76%)

Directions: Question 2 to 4 refer to an experiment on the enzyme catalase, which speeds up the breakdown of hydrogen peroxide to release oxygen. John added a 1 cm^3 cube of pig liver to boiling tube containing 5 mL hydrogen peroxide solution. Gas bubbles were released and he used a glowing splint to test the gas. He repeated the experiment with beef, potato and apple. The results are shown below:

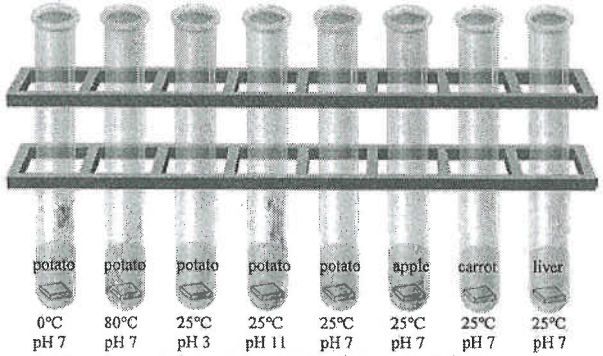
Tissue	*Rate of bubbles released*	*Glowing splint re-lit*
Pig liver	Moderate	Yes
Beef	Moderate	Yes
Potato	Slow	Yes
Apple	Slow	Yes

When the release of gas bubbles had stopped, John added more hydrogen peroxide solution to the boiling tubes. Which of the following combinations correctly shows the expected result and the explanation of this additional experiment?

	Expected result	*Explanation*
A.	Gas bubbles released	Catalase is specific in its action
B.	Gas bubbles released	Catalase is reusable
C.	No gas bubbles	Catalase has been used up
D.	No gas bubbles	Catalase is denatured

2020 Q.6

Directions: Questions 6 and 7 refer to the diagram below, which shows a set-up for investigating the activity of catalase in living tissues. Catalase is an enzyme which can break down hydrogen peroxide. Each test tube contains the same amount of hydrogen peroxide solution at the same concentration. A piece of living tissue is added into each tube as indicated below:



6. How many independent variables are being studied in this investigation?

A. 2
B. 3
C. 4
D. 8

2020 Q.7

7. Which of the following control variables is most important for a fair comparison in the above investigation?

A. mass of living tissues
B. shape of living tissues
C. volume of living tissues
D. surface area of living tissues

2020 Q.8

8. Which of the following descriptions of the active site of an enzyme is correct?

(1) It can be used again.
(2) It is the part of the enzyme on which its substrate can fit.
(3) Its shape is determined by the amino acid sequence of the enzyme.

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

Answers

Challenging

2016	2017	2018	2019
27 [B]	3 [A] 4 [C]	5 [B]	10 [A]

Average

2013	2014	2015	2016	2017	2018	2019
6 [A] 7 [B]	9 [B]	3 [B]	8 [C]	1 [C] 2 [B] 5 [A]	1 [D] 2 [C] 4 [A]	9 [B]

Easy

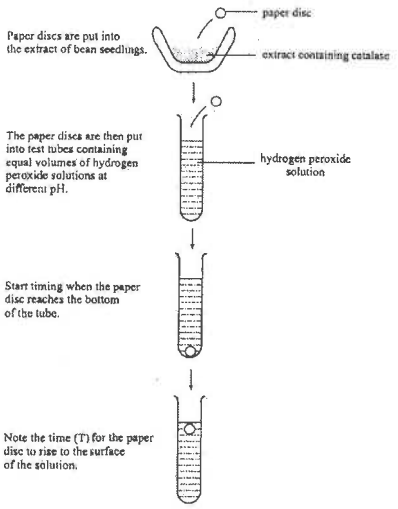
2018
3 [B]

2020
6[B]
7[D]
8[D]

Past Questions – Enzyme

CE – 2003

3. (b) The following shows the procedure of an experiment to study the effect of pH on the activity of catalase extracted from bean seedling :



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)

(ii) (1) Work out the rate of reaction from the value of T for each tube. Tabulate your answer. (2)

(2) Using the data obtained in (1), plot a graph on graph paper to show the effect of pH on catalase activity. (3)

(iii) (1) Based on your graph, estimate the optimum pH of catalase. (1)

(2) In order to get a more accurate estimate of the optimum pH, what further work would you carry out in this experiment? (1)

(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 pervious experiment? Explain your answer. (2)

CE – 2008

6. Ginger milk curd (薑汁撞奶) is a Chinese dessert. Below is a recipe of this dessert.

Recipe:
1. Grind the ginger to obtain some ginger juice.
2. Boil the milk.
3. Wait until the temperature of the milk drops to around 65°C.
4. Pour 220 mL of milk into 15 mL of ginger juice.
5. Ginger milk curd is made as the milk coagulates.

Having studied the recipe, a science student, Kelvin, conducted an investigation on the making of ginger milk curd. He followed the steps in the recipe with the use of raw ginger juice for one setup and boiled ginger juice for another setup. The results are shown below:

	Result
Boiled ginger juice	No coagulation
Raw ginger juice	Coagulation occurred

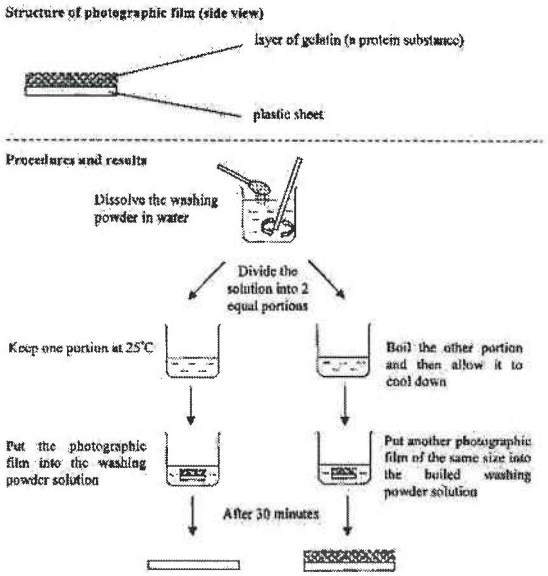
(a) With reference to the treatment used by Kelvin, what do you think is his hypothesis about the coagulation of milk in making ginger milk curd? (1)

(b) What is the principle behind the design of this investigation? (3)

(c) Kelvin then carried out another investigation on the effect of temperature on milk coagulation by cooling the boiled milk to different temperatures before mixing it with ginger juice. He found that milk coagulation only occurs at around 65°C. After that, he would like to test if boiling of milk is necessary. Suggest the procedures he would have to carry out in this test. (2)

CE - 2010

1. A certain brand of washing powder claims to contain protease that can remove egg stains on clothes. To find out if protease was present in the washing powder, a student carried out an investigation using photographic film. The procedures and results of his investigation are shown in the diagram below.



(a) (i) To make the investigation a fair test, the boiled washing powder solution should be cooled down to_____before the photographic film is put into it. (1 mark)

(ii) Explain why cooling the boiled washing powder solution to the temperature you stated in (i) would make the investigation fair. (1 mark)

(b) How can the results of the investigation support the claim that the washing powder contains protease? Explain your answer. (4 marks)

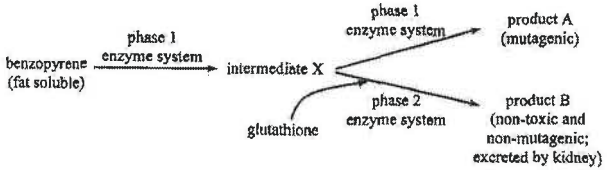
(c) Explain why egg stains on clothes can be removed by using this washing powder. (2 marks)

AL - 2000 1A

6. Yeast produces an extracellular invertase to breakdown sucrose into glucose and fructose. Design an experiment to show the presence of extracellular invertase activities in a yeast culture and state *two* appropriate controls. (7)

AL - 2007 2A

1. Benzopyrene is a harmful compound commonly found in coal tar, automobile exhaust fumes, tobacco smoke, burnt toast, and the crust of barbecued meat. When taken into the body, benzopyrene can be metabolized in the liver by two enzyme systems, known as phase 1 and phase 2, as shown in the pathway below:



(b) In order to protect the body against the mutagenic consequence of benzopyrene metabolism, which enzyme system (phase 1 or phase 2) should be more active? Explain your answer. (4)

(c) Glutathione is manufactured in the mitochondria. However, the number of mitochondria in the liver decreases when one ages. Explain the effect of this phenomenon on the detoxification of benzopyrene in the liver. (3)

(e) Phase 1 reactions occur on the smooth endoplasmic reticulum. Suggest how the structural features of the smooth endoplasmic reticulum facilitate the phase 1 reactions. (3)

HKDSE - 2014 1B

6. It is generally believed that domestic dogs evolved from ancient wolves. A recent study comparing the genomes of wolves and dogs suggests that genes with key roles in starch digestion were selected during the domestication of wolves into dogs. One of these genes was gene A, which codes for amylase.

(c) Describe an experiment which can compare the different amylase activities of wolves and dogs. (4 marks)

HKDSE – 2015 1B

7. Hydrogen peroxide is by-product of some metabolic reactions inside our body. If it were allowed to accumulate, it would kill our cells. Fortunately, we have an enzyme called catalase which speeds up the breakdown of hydrogen peroxide into water and oxygen. A student planned to investigate the effect of temperature on the activity of catalase. Below are the steps the student has drafted for his investigation:
   (1) Extract catalase from an animal organ.
   (2) Mix 5 mL 0.1% hydrogen peroxide solution with 1 mL catalase extract.
   (3) Place the mixture in a water bath set at 0℃
   (4) Measure and record the volume of oxygen gas release in the first 5 minutes.
   (5) Repeat steps (2) to (4) with the water bath set at 20℃, 40℃ and 60℃.

   (a) Suggest an animal organ in which catalase is present in great abundance and from which the enzyme can be obtained. Explain why this organ has so much catalase. (2 marks)

   (b) The student has missed out an important step in his drafted procedure. What is it? Explain the importance of this step. (2 marks)

   (c) You are provided with the following apparatus and materials:

   measuring cylinder, boiling tube, one-hole stopper, glass tubing, rubber tubing, pipette, ink, water trough, clip

   Choose the appropriate apparatus and materials to assemble a set-up for measuring the rate of oxygen production. Draw the set-up in the space below. (3 marks)

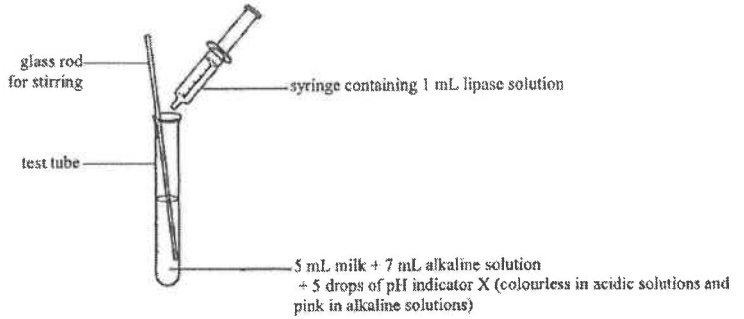
   Set-up for measuring the rate of oxygen production

HKDSE - 2017 1B

2. Denise ate a piece of pineapple preserved in a sugar solution and noticed that it was softer than fresh pineapple. Explain this phenomenon. (3 marks)

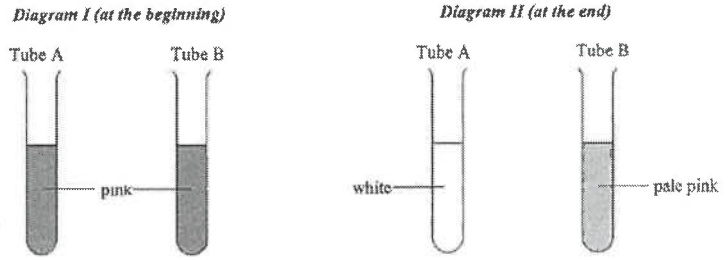
HKDSE - 2018 1B

8. A student used the following set-up to compare the fat digestion of full fat fresh milk and half fat fresh milk:



   (a) Write a simple word equation of fat digestion. (2 marks)

   (b) Two test tube, each with a different type of milk, were prepared. The colour of each mixture was recorded immediately after the addition of lipase solution, and then monitored until there was no more change in colour. The colours of the mixtures at the beginning and the end are shown in Diagram I and Diagram II respectively:



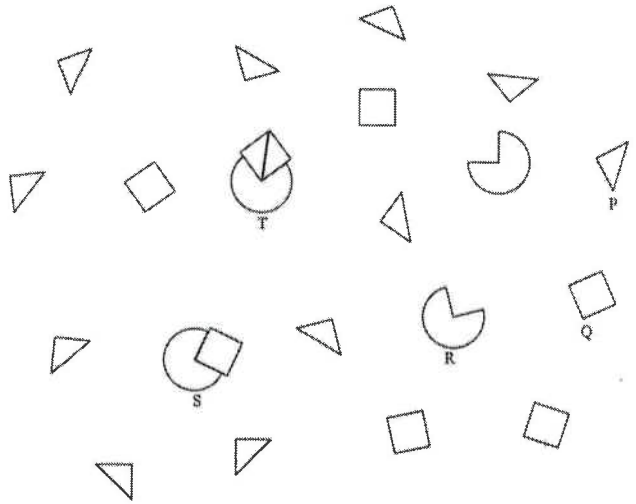
   (i) What is the independent variable in this investigation? (1 mark)

   (ii) Describe the results of this investigation. (2 marks)

   (iii) Which test tube(A or B) was the one with full fat fresh milk? Explain your answer. (4 marks)

HKDSE – 2019 1B

2. The schematic diagram below shows a reaction mixture of an anabolic reaction catalysed by an enzyme. Drawings P, Q, R, S, and T represent different components of the mixture:



(a) Which drawing represents the substrate in this anabolic reaction? Explain your answer. (2 marks)

(b) Which drawing represents the enzyme? Explain the answer. (2 marks)

HKDSE – 2021 1B

4. Glycogen and a disaccharide named trehalose are two common types of energy reserve found in insect species A. An experiment was conducted to study the energy reserve used for flying in this insect species. Three groups of insect species A were respectively injected with equal volumes of physiological saline, an inhibitor of trehalose-digesting enzyme and an inhibitor of glycogen-digesting enzyme. The insects were then stimulated to fly until they were exhausted. The flight time of each individual was recorded in the following table:

Solution injected	Samples of insect species A	Flight time (s)	Mean flight time (s)
physiological saline	1	150	165.6
	2	138	
	3	168	
	4	210	
	5	162	
inhibitor of trehalose-digesting enzyme	6	42	
	7	78	
	8	114	
	9	90	
	10	102	
inhibitor of glycogen-digesting enzyme	11	132	
	12	192	
	13	174	
	14	162	
	15	156	

(a) Complete the above table by calculating the mean flight time (to the nearest 1 decimal place) for the groups injected with the respective inhibitors. (1 mark)

(b) With reference to the aim of the experiment, what conclusions can you draw from the data? Explain your answer. (4 marks)

(c) Among individual insects, suggest ***one*** difference which led to different flight times within each group. (1 mark)

10. In humans, breast milk provides not only nutrients but also protective effects to infants. Recently, scientists discovered a new constituent of breast milk: short RNA fragments enclosed in vesicles. Scientists have very diverse views about the roles of these short RNA fragments. The following are two of the hypotheses:

Hypothesis 1: the short RNA fragments serve as food particles
Hypothesis 2: the short RNA fragments regulate gene expression in infants

(a) To test Hypothesis 1, scientists performed an experiment of *in vitro* digestion of breast milk. The method is shown below:

Method of *in vitro* digestion with 20 mL of fresh breast milk

Step 1	Addition of hydrochloric acid solution
Step 2	Addition of enzyme mixture 1
Step 3	Incubation at 37°C for 20 minutes
Step 4	Addition of sodium hydrogen carbonate solution
Step 5	Addition of enzyme mixture 2
Step 6	Incubation at 37°C for 30 minutes
Step 7	Incubation at 85°C for 3 minutes
Step 8	Measurement of the level of short RNA fragments and nucleotides

(ii) What is the purpose of Step 7?

Past Papers Marking Scheme – Enzyme

CE - 2003 Q.3 (b)

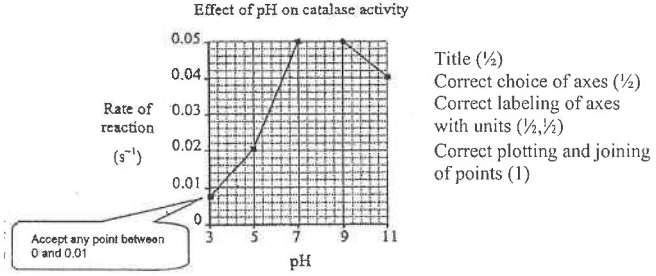
(i) The catalase in the paper disc broke down hydrogen peroxide, releasing oxygen 1
When the amount of oxygen evolved reached a certain level, the oxygen bubbles buoyed up the disc to the surface of the hydrogen peroxide solution 1

(ii) (1)

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

½
½
1 0r 0

(2)



Title (½)
Correct choice of axes (½)
Correct labeling of axes with units (½,½)
Correct plotting and joining of points (1)

(iii) (1) any value between 1 and 9 / any value read from the graph drawn 1
(2) Repeat the experiment using hydrogen peroxide 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

CE - 2008 Q.6

(a) Ginger juice contains an enzyme that causes the coagulation of milk 1

(b) Enzyme is protein in nature 1
which is denatured by high temperature 1
Therefore, if enzyme is involved, the action of enzyme will be lost after boiling 1

(c) Follow the steps in the recipe for one set-up 1
and heat the milk to 65 °C instead of steps 2 and 3 in another setup 1

Other ways of expression:
Boil the milk, cool down to 65 °C and mix with ginger juice
Heat the milk to 65°C and mix with ginger juice
OR
Heat the milk to 65 °C and mix with ginger juice
Compare with the results of the experiment of cooling down boiled milk to 65 °C

CE - 2010 Q.1

1. (a) (i) 25 (1)
(ii) To make the results of the set-ups comparable/ to eliminate the effect of temperature difference on the results (1)

(b) The gelatin layer of the photographic film is removed by the unboiled washing powder solution (1)
This shows that the washing powder contains protein-digesting substance (1)
However, the ability to remove the gelatin layer is lost when the washing powder solution is boiled. (1)
This shows that the protein-digesting substance in the washing powder is heat sensitive/ is denatured/ inactivated at high temperature (1)
This substance is probably protease

(c) Egg stains contain proteins (1)
Protease digests the insoluble protein into peptides which are soluble, so it can be removed by water easily (1)

AL - 2000 1A

6. incubate yeast culture with sucrose solution for some time (1), centrifuge / dialyse / filter to separate cell from supernatant (1), test supernatant (1) with Benedict's solution (1), red ppt indicates presence of invertase activity (1) (Accept correct alternatives) 5

Controls:
- yeast without sucrose (1),
- sucrose without yeast (1),
- boiled yeast with sucrose (1), (any 2) 2

(Accept correct alternatives) (7)

AL - 2007 2A

1. (b)
- phase 2 enzyme system should work faster than phase 1 enzyme system (1)
- so that intermediate X could be quickly transformed to product B (1) for fast elimination from the body (1)
- and less product A would be formed (1) to produce mutagenic effect (4)

(c)

Concept for mark award: (3)
- effect of decline in mitochondria number on glutathione production (1) and phase 2 enzyme activity (1) / the relative production of product A and product B
- implication on benzopyrene metabolism (1)

e.g.
- the production of glutathione in the liver would drop (1) due to a reduction in the number of mitochondria
- activity of the phase 2 enzyme system / reaction would decrease (1) / product A would accumulate and less product B would be formed
- detoxification of benzopyrene in the liver would be impaired (1) / danger of mutagenesis would increase (3)

(e)
- the SER is a network of folded / stacked membranes (1)
- it provides a large surface area for various enzymes to align for carrying out the biochemical process in sequence (1)
- the SER network also helps to transport the metabolites from one area to another for further processing (1) (3)

HKDSE- 2014 1B

6. (c)
- obtain digestive juice from the digestive tract (mouth / stomach? / intestine/ pancreas) of a wolf & a dog (1)
- mix 1 mL of digestive juice with 5 mL of starch solution (1)
- at regular time intervals, remove a fixed amount of the mixture for iodine test (1)
- record the time taken for the tested mixture to remain brown in colour /the blue colour no longer appears (1)
- the one that takes a shorter time to remain brown in colour has a higher amylase activity (1) (4)

HKDSE – 2015 1B

7. (a) liver (1)
it is the organ where many metabolic reactions take place / it is the organ for detoxification (1) 2

(b) the hydrogen peroxide and catalase solution should be incubated at the set temperature for 10 minutes before mixing (1)
such that the mixture has reached the set temperature at the beginning of the reaction (1) 2

(c) the set-up could collect gas (1)
the set-up could measure the volume of the gas (1)
labels (1) 3

HKDSE – 2017 1B

2.
- sugar solution has a lower water potential / higher osmotic (solute) potential or pressure (do NOT accept: water concentration) than the cell content (of fresh pineapple) / cytoplasm or vacuole of fresh pineapple cells (1)
- as a result, pineapple cells lose water (do NOT accept: solution) to the sugar solution by osmosis (accept: water diffuses out by osmosis but do NOT accept: diffuse only) (1)
- pineapple cells become flaccid / lose their turgor pressure / pressure potential / less turgid to press against one another (1)
hence, the texture of pineapple preserved in sugar solution is softer than that of fresh pineapple (3)

3 marks

HKDSE – 2018 1B

8. (a)
- Triglyceride / fat $\xrightarrow{\text{lipase}}$ glycerol + fatty acids (2)

(b) (i)
- Type of milk (1) (1)

(ii)
- colour of the mixture in Tube A turned from pink to white (1)
- colour of the mixture in Tube B turned from pink to pale pink / became pale (1) (2)

(iii)
- Tube A (1)
- Tube A turned white, showing that the mixture in Tube A was acidic (1)
- Tube B remained pale pink, showing that the mixture in Tube B was alkaline (1)
- full fat fresh milk release more fatty acid than half fat fresh milk after fat digestion (1), eventually resulting in to the acidic condition of the mixture in Tube A (4)

9 marks

HKDSE – 2019 1B

2. (a)
- P (1)
- because two molecules of P are joined together / Ps are joined together to form one molecules of Q (1) (not acceptable: product / enzyme-substrate complex) (2)

(b)
- R (1)
- it has (a specific site / active site for) binding with P or Q / it remains unchanged or is regenerated after the reaction (1) (2)

4 marks