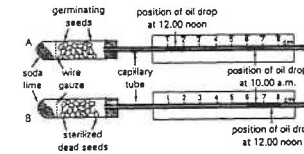


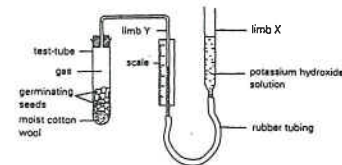
Past HKCEE Questions
Respiration
Paper I

1. A student used the following apparatus to measure the rate of respiration of some seeds. The positions of the oil drop in each capillary tube are shown in the diagrams below:

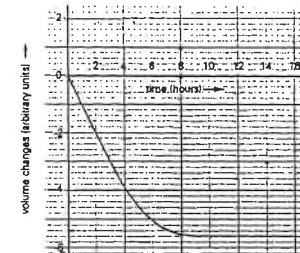


- What is the distance travelled by the oil drop
(1) in A, and
(2) in B?
- Calculate the rate of respiration of the germinating seeds in A.
- Fully explain the results shown in A and B.
(HKCEE 1982)

2.

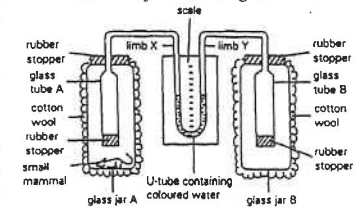


The diagram above shows an experimental set-up used to measure the changes in the volume of gas enclosed in the apparatus during the germination of seeds. At fixed time intervals the volume of the gas was measured on the scale after adjusting the liquid in limbs X and Y to the same level. The volume changes with time are shown in the graph below:



- State the purpose of adjusting the liquid levels before each measurement.
- Name one external factor that would affect the accuracy of the measurements.
- Name the process carried out by the seeds that brought about the changes in gas volume.
- State and explain the changes in gas volume during the first 4 hours.
- Explain why the curve levelled off after the 10th hour, even though the seeds remained alive.
- Suggest a control for this experiment.
- Why is it necessary to cover the test-tube with a dark cloth if leafy seedlings are used instead of germinating seeds?
(HKCEE 1986)

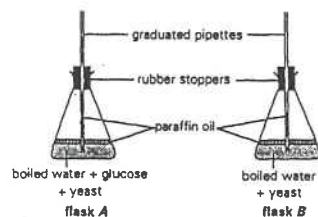
3. The diagram below shows an experimental set-up to investigate the respiration of a small mammal. All the joints are airtight.



At the start of the experiment

- What will be the change in the level of the coloured water in the U-tube at the end of the experiment? Explain your answer.
(3 marks)
- What is the purpose of surrounding the glass jars with cotton wool? (1 mark)
- State the function of glass jar B.
(1 mark)
- If you were provided with a beaker of potassium hydroxide solution, describe and explain how you would modify this experimental set-up, without using additional apparatus, to indicate the uptake of oxygen by the small mammal.
(6 marks)
(HKCEE 1987)

4. The following experiment was set up to study the anaerobic respiration of yeast cells. The air temperature was maintained at 27°C throughout the experiment.



After 40 minutes, the rates of respiration in the two flasks were compared by measuring the change in liquid levels in the graduated pipettes.

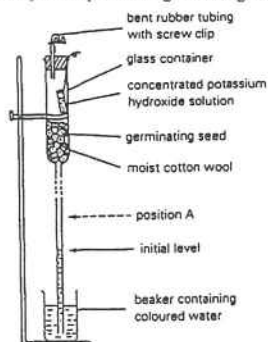
The results are shown below:

	Flask A	Flask B
Rise in liquid level (cm)	3.1	-0.5

- State and explain TWO precautions used in this experiment to ensure that the yeast cells were under anaerobic conditions. (4 marks)
- Explain why the liquid level of the pipette in flask A rose at the end of the experiment. (2 marks)
- Suggest a reason for the drop in the liquid level of the pipette in flask B. (1 mark)
- By comparing the results observed in flasks A and B, what conclusion can be drawn about the condition for anaerobic respiration? (1 mark)

(HKCEE 1988)

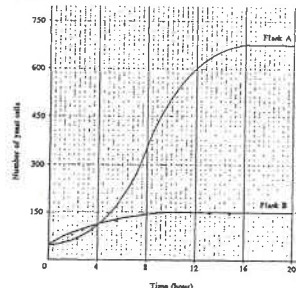
5. The diagram below shows an apparatus used to study the respiration of germinating seeds:



- At the beginning of the experiment, it is better to set the initial water level near the middle of the glass tubing. (1 mark)
- Suggest a reason for this. (1 mark)
- Suggest a method of doing this. (2 marks)
- After one hour the water level rose to position A. Explain this phenomenon. (5 marks)
- In another experiment, the concentrated potassium hydroxide solution was replaced by water. After one hour, the water level remained unchanged. Explain this observation in terms of gaseous exchange. (1 mark)

(HKCEE 1991)

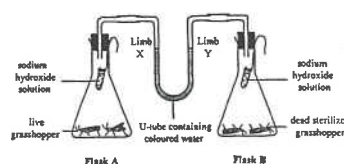
6. Two flasks contained yeast cells growing in equal volumes of a sugar solution. Flask A received a constant air supply whereas flask B did not have any air supply at all. The graph below shows the changes in the number of yeast cells with time:



- Calculate the difference in the number of yeast cells at hour 20 between the two flasks. Give a reason to explain why there is such a difference. (5 marks)
- Suggest two reasons for the different rates of reproduction of yeast in flask A at hour 8 and hour 16. (3 marks)
- Draw and label a simple experimental set-up to show whether heat is released by the yeast cells in flask A. (4 marks)

(HKCEE 1994)

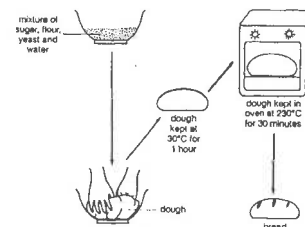
7. The diagram below shows a set-up used to measure the rate of respiration of grasshoppers:



- Write a simple word equation of aerobic respiration. (1 mark)
- The set-up measures the change in the amount of a substance in the word equation. What is this substance? (1 mark)
- What change will occur to the water level in the U-tube after 15 minutes? Explain your answer. (4 marks)
- What is the use of flask B? (1 mark)
- How will the result be different if the experiment is repeated at a higher room temperature? Explain your answer. (2 marks)

(HKCEE 1996)

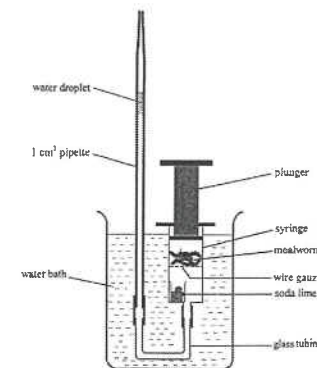
8. Yeast is commonly used in the making of bread. The diagrams below show the steps in bread-making:



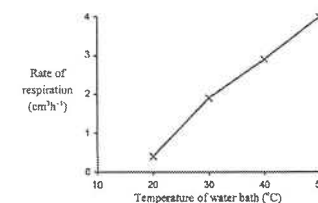
- Explain what happens to the volume of the dough after keeping it at 30°C for 1 hour. (3 marks)
- Give a reason why the volume of the dough will not change any more after it has been kept in the oven for 10 minutes. (1 mark)
- Suggest another industrial application of yeast. (1 mark)
- If the bread is left in a warm and humid place for several days, black dots will be found on the bread surface. Make a labelled drawing to show some of these black dots and their associated structures when observed under a microscope. (3 marks)

(HKCEE 1997)

9. The diagram below shows an experimental set-up used by John to study the changes in the rate of respiration of mealworms at different temperatures. During the experiment, the position of the plunger remained unchanged.



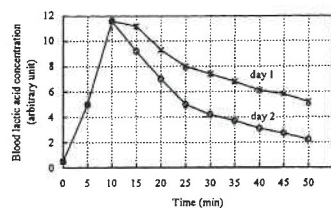
- Explain why this set-up can be used to measure the rate of respiration of the mealworms. (4 marks)
- Using the data obtained from this set-up, John worked out the rate of respiration of the mealworms at different temperatures and the results are shown in the graph below:



- What conclusion can be drawn from the results of the experiment? (2 marks)
- Based on biological principles, explain the conclusion obtained in (1). (3 marks)
- Whenever the water bath was changed to a new temperature, John waited for 10 minutes before he started to take any reading. Explain why this is necessary. (2 marks)

(HKCEE 1999)

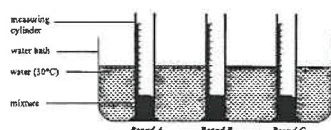
10. An experiment was carried out to study the changes in blood lactic acid concentration of an athlete during and after exercise. On day 1, the athlete ran for 10 minutes and then sat down to rest for 40 minutes. On day 2, she performed the same exercise, followed by slow jogging for 40 minutes. The results of the experiment are shown in the graph



- (i) Account for the increase in blood lactic acid concentration in the first 10 minutes. (3 mark)
- (ii) The rate of carbon dioxide production also increased in the first 10 minutes. Write a word equation to show how carbon dioxide is produced. (2 marks)
- (iii) Why is it harmful to the body cells if the blood contains a high level of lactic acid? (1 mark)
- (iv) Referring to the graph, which method, sitting down or slow jogging, is more effective in removing lactic acid from the blood after exercise? Based on your biological knowledge, explain why this method is more effective. (4 marks)

(HKCEE 2004)

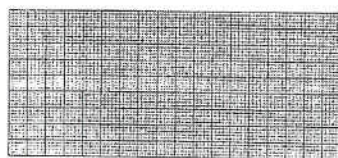
11. A student carried out an investigation to compare the activity of three brands of yeast. He added a mixture of fixed amounts of dough and yeast into a measuring cylinder and recorded the volume of the mixture. After putting the measuring cylinder in a water bath at 30°C for one hour, the volume of the mixture was recorded again. The diagram below shows his set-up:



- (a) The results of the investigation are shown in the table below. Complete the table by finding out the percentage change in the volume of mixture for brand C. (1 mark)

Brand of yeast	Initial volume of mixture (cm ³)	Volume of mixture after 1 hour (cm ³)	Percentage change in the volume of mixture (%)
A	20	25	25
B	20	49	145
C	20	46	

- (b) Draw a bar chart to show the activity of the three brands of yeast in terms of the percentage change in the volume of mixture. (3 marks)



- (c) Explain why the yeast can make the mixture rise. (3 marks)
- (d) The student wants to make a cake that is the spongy. Based on the above results, which brand of yeast should be used? (1 mark)
- (e) Why should the set-up be kept in a water bath? (1 mark)
- (f) If the student wanted to study the effect of temperature on the activity of yeast, suggest two changes that should be made in his experimental design. (2 marks)

(HKCEE 2007)

Past HKCEE Questions

Respiration

Paper II

90-45

Which of the following shows the correct end product of the corresponding metabolic process occurring in a mammal?

	metabolic process	end product
A.	breakdown of amino acids	nitrogen
B.	breakdown of red blood cells	bile salts
C.	breakdown of glucose aerobically	Water
D.	breakdown of glucose anaerobically	alcohol

91-19

The following table shows two types of cells P and Q and the product(s) of anaerobic respiration in these cells:

Cell	Product(s)
P	lactic acid
Q	alcohol and carbon dioxide

Cells P and Q most likely to be

	cell P	cell Q
A.	muscle	yeast
B.	guard cells	liver
C.	liver	muscle
D.	yeast	guard cells

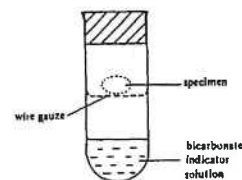
92-10

When compared with aerobic respiration, anaerobic respiration

- A. releases more energy.
B. oxidises food incompletely.
C. produces no carbon dioxide.
D. occurs in microorganisms only.

92-11

The experimental set-up shown below was placed in a well-illuminated area. After 24 hours the bicarbonate indicator solution changed from red to purple.

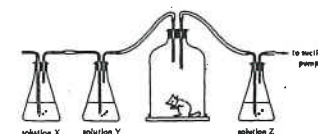


The specimen placed inside the tube would probably be

- A. a green leaf.
B. a grasshopper.
C. a germinating seed.
D. a sterilized boiled seed.

92.

Directions: Questions 23 and 24 refer to the experimental set-up below which shows the release of carbon dioxide from a small mammal:



92-23

Which of the following are the correct solutions for X, Y and Z?

	Solution X	Solution Y	Solution Z
A.	potassium hydroxide solution	lime water	lime water
B.	lime water	potassium hydroxide solution	potassium hydroxide solution
C.	lime water	potassium hydroxide solution	lime water
D.	potassium hydroxide solution	lime water	potassium hydroxide solution

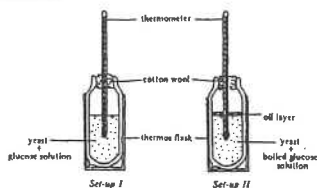
92-24

Which of the following would be the probable results of the experiment?

	Solution X	Solution Y	Solution Z
A.	milky	clear	clear
B.	clear	clear	milky
C.	clear	milky	milky
D.	milky	milky	clear

93.

Directions: Questions 24 and 25 refer to the diagram below which shows two set-up used to investigate respiration of yeast under different conditions:



93-24

Which of the following substances will be produced?

	Set-up I	Set-up II
A.	carbon dioxide	carbon dioxide and ethanol
B.	carbon dioxide	carbon dioxide and lactic acid
C.	carbon dioxide and lactic acid	carbon dioxide
D.	carbon dioxide and ethanol	carbon dioxide

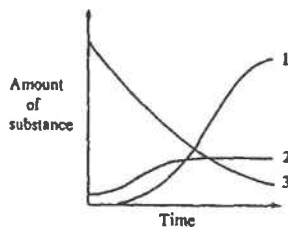
93-25

If the experiment is conducted at a room temperature of 25°C, what will be the probable thermometer readings after one hour?

	Set-up I	Set-up II
A.	24°C	27°C
B.	27°C	24°C
C.	27°C	25°C
D.	28°C	27°C

96.

Directions: Questions 22 and 23 refer to the information below:
In a set-up, some living yeast cells were added to a 10% glucose solution under anaerobic conditions. The graph below shows the changes in the amount of three substances in the set-up



96-22

Which curves represent yeast and glucose respectively?

	Yeast	Glucose
A.	1	2
B.	1	3
C.	2	3
D.	3	1

96-23

What products are formed in the set-up?

- ethanol and lactic acid
- ethanol and carbon dioxide
- lactic acid and carbon dioxide
- ethanol, lactic acid and carbon dioxide

00-4

Which of the following reactions occurs in the skeletal muscle when a person is performing vigorous exercise?

- glucose \rightarrow lactic acid
- glucose \rightarrow lactic acid + carbon dioxide
- glucose + oxygen \rightarrow carbon dioxide + water

- (1) only
- (2) only
- (1) and (3) only
- (2) and (3) only

00-5

What is the significance of anaerobic respiration to yeast?

- It produces a large amount of ethanol.
- It provides energy to yeast when there is a lack of oxygen.
- Yeast can only use anaerobic respiration to release energy from food.
- It provides additional energy to yeast when it is undergoing budding.

00-12

Which of the following processes requires energy from respiration?

- movement of water in xylem vessels caused by transpiration pull
- absorption of water by mesophyll cells from xylem vessels
- absorption of mineral salts by root hair cells
- water loss through the stomata of the leaf

01-6

During a 100 m race, the lactic acid concentration in the blood of an athlete increases rapidly. Which of the following word equations represents the process that leads to the formation of lactic acid?

- glucose \rightarrow lactic acid
- glucose \rightarrow lactic acid + carbon dioxide
- glucose + oxygen \rightarrow lactic acid + water
- glucose + oxygen \rightarrow lactic acid + water + carbon dioxide

02-7.

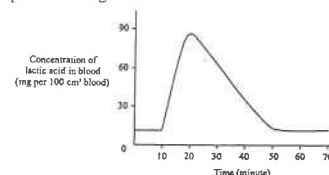
Which of the following can carry out anaerobic respiration?

- biceps
- yeasts
- xylem vessels

- (1) only
- (2) only
- (1) and (2) only
- (1), (2) and (3)

02.

Directions: Questions 32 and 33 refer to the graph below, which shows the change in lactic acid concentration in the blood of a person when he performed vigorous exercise:



02-32

The person stopped doing exercise at

- the 10th minute.
- the 20th minute.
- the 50th minute.
- the 70th minute.

02-33

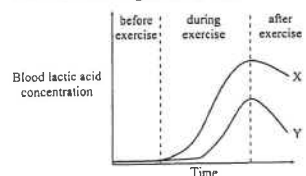
Which of the following lead to the change in lactic acid concentration in the blood during the 10th to 20th minute?

- an increase in the breakdown of glucose
- a reduction in oxygen supply to the muscles
- an increase in energy demand of the muscles

- (1) and (2) only
- (1) and (3) only
- (2) and (3) only
- (1), (2) and (3)

03.

Directions: Questions 9 and 10 refer to the graph below, which shows the change in lactic acid concentration in the blood of a trained athlete and an untrained person when they performed the same amount of vigorous exercise



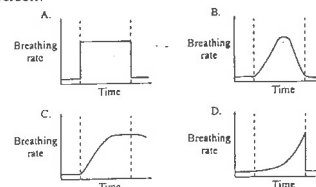
03-09

The athlete is

- X because more lactic acid is produced.
- X because anaerobic respiration starts earlier.
- Y because less lactic acid is produced.
- Y because aerobic respiration stops at a later time.

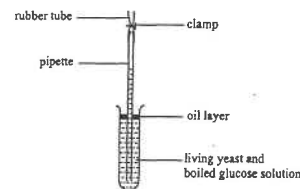
03-10

Which of the following is the correct sketch of the change in breathing rate of the untrained person?



03.

Directions: Questions 24 and 25 refer to the diagram below, which shows an experimental set-up used to study the action of yeast on glucose:



03-24

Which of the following correctly states and explains the change in liquid level in the pipette after 30 minutes?

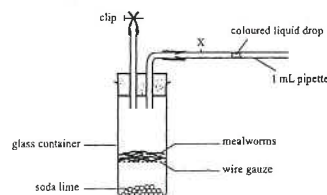
	Change in liquid level	Cause for the change
A.	rises	ethanol is produced
B.	rises	oxygen is consumed
C.	drops	glucose is consumed
D.	drops	carbon dioxide is produced

03-25

To show that living yeast is essential for bringing about the change in liquid level in the pipette, the control set-up should contain

- boiled glucose solution only.
- living yeast and boiled water.
- dead yeast and boiled water.
- dead yeast and boiled glucose solution.

Directions: Questions 6 and 7 refer to the set-up below, which is used to estimate the rate of respiration of mealworms:



05-6

At the end of the experiment, the liquid drop was found to be at position X. The movement of the liquid drop indicated

- the amount of oxygen used by the mealworms.
- the amount of carbon dioxide produced by the mealworms.
- the amount of heat released by the mealworms.
- the change in atmospheric pressure.

05-7

What modification should be made in the above set-up in order to prepare a control for this investigation?

- replacing soda lime with distilled water
- removing the mealworms from the set-up
- putting the set-up in a refrigerator set at 5°C
- covering the glass container with black paper

05-15

Which of the following cells probably have the lowest rate of respiration?

- liver cells
- muscle cells
- cells of the wall of kidney tubules
- epithelial cells of air sacs of the lungs

05-40

Why is anaerobic respiration important to skeletal muscles during exercise?

- The muscle cells cannot carry out aerobic respiration due to a lack of oxygen.
- The muscle cells can oxidize the lactic acid formed in anaerobic respiration.
- Anaerobic respiration provides additional energy for muscle contraction.
- More energy is released from a glucose molecule in anaerobic respiration than in aerobic respiration.

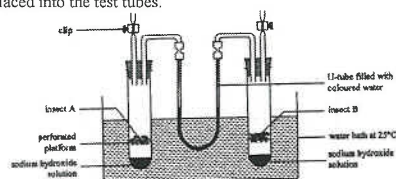
06-9

Which of the following correctly compares alcoholic fermentation and lactic acid fermentation?

- | | <u>Alcoholic fermentation</u> | <u>Lactic acid fermentation</u> |
|----|---|---|
| A. | produces carbon dioxide | does not produce carbon dioxide |
| B. | uses alcohol as the substrate | uses lactic acid as the substrate |
| C. | by-products will be further metabolized | by-products will not be further metabolized |
| D. | occurs in plants only | occurs in animals only |

07

Directions: Questions 29 and 30 refer to the experimental set-up below, which was used to compare the rate of respiration of two different types of insects. Insects of the same mass were placed into the test tubes.



07-29

The movement of coloured water in the U-tube is caused by the

- heat released.
- food consumed.
- oxygen absorbed.
- carbon dioxide released.

07-30

Which of the following modifications can shorten the time for the experiment?

- use a larger test tube
- use a larger water bath
- use a U-tube with a larger internal diameter
- use a water bath set at a higher temperature

07-42

When a person is running an 800m race, which of the following changes will happen in this body?

- The blood volume returning to the heart increases.
- The rate of anaerobic respiration in the exercising muscles increases.
- The rate of aerobic respiration in the exercising muscles remains unchanged.

- (1) and (2) only
- (1) and (3) only
- (2) and (3) only
- (1), (2) and (3)

Past HKCEE Questions

Respiration

Suggested Answers

Paper I

- (1) 5 cm
(2) 1 cm
 - (5+1) / 2 or 3 cm per hour
 - A:
O₂ is used up in seed by respiration
CO₂ produced is absorbed by soda lime
B:
O₂ is not used up by dead seeds / no respiration in dead seeds
volume increase is due to gas expansion caused by increase in room temperature (OR decrease in atm. pressure)
- to take all readings at the same (atmospheric) pressure
 - atmospheric pressure / temperature
 - respiration / oxidation of food
 - decrease
O₂ absorbed / consumed by seeds
CO₂ liberated from seeds
potassium hydroxide solution absorbed the CO₂ liberated
 - O₂ has been completely used up only anaerobic respiration takes place
potassium hydroxide solution absorbed the CO₂ produced
 - use sterilized dead seeds / dry seeds / boiled seeds / no seeds in similar apparatus
 - to prevent photosynthesis
- coloured water in limb Y will rise / in limb X will drop
the heat liberated by respiration will cause the air in glass tube A to expand
reduce heat loss / for insulation
for comparison with glass jar A / as a control

Modification (in words or by drawing)	Explanation
Remove the rubber stopper of the glass tube A.	To enable a continuous air flow between the glass jars and glass tubes

Replace the coloured water with potassium hydroxide solution / Place the beaker of KOH in jar A.	To absorb CO ₂ released by the mammal.
Remove cotton wool from both glass jars.	To eliminate the effect of heat on gas volume

- use boiled water to ensure the water does not contain dissolved O₂
Use an oil layer to prevent O₂ from dissolving into the solution
 - CO₂ / a gas produced the pressure / volume of gas inside the flask increased, therefore the liquid rose up the pipette
 - a rise in atmospheric pressure
 - glucose is necessary for anaerobic respiration in yeast cells (if "glucose + any other substance" are mentioned – no marks)
- It would be easier to observe any changes in the water level in the glass tubing
 - to suck up the water column through the rubber tubing and then close the rubber tubing with the screw clip
 - germinating seeds used up O₂ in the glass container for respiration and released CO₂ which was absorbed by conc. KOH
As the gas in the glass container became less / the gas pressure reduced, the higher atmospheric pressure would force the water level up to position A.
 - the volume of O₂ used up in respiration was equal to the volume of CO₂ released

6. (i) The difference in no. of yeast cells between flasks A and B at hour 20 = 675 - 150 = 525
Either
 In flask A, the yeast cells undergo aerobic respiration whereas in flask B, the yeast cells undergo anaerobic respiration
 Anaerobic respiration releases less energy for cell division / growth of the yeast
Or
 In flask A, the yeast cells under aerobic respiration whereas in flask B, the yeast cells undergo anaerobic respiration
 Anaerobic respiration produces ethanol / alcohol which inhibits the cell division / growth of the yeast
- (ii) any 1 set (1+1+1)
 The rate of reproduction of the yeast at hour 8 is much faster than that at hour 16
 Reasons:
 at hour 16, nutrients in the solution may become exhausted
 at hour 16, there may be accumulation of toxic wastes
 Both cause a decline in the reproductive rate of yeast
- (iii) No marks for the whole set-up if it is not workable (e.g. using dry yeast, with an oil layer).
 Insulating layer and stopper thermometer (the bulb must be immersed in the mixture)
 correct connection of tubes
 clear, well-labelled and accurate diagram (D)
-
7. (i) (1) food + oxygen → carbon dioxide + water (+energy)
 (2) Oxygen
- (ii) The water level in limb X would rise

- Reasons:
 The live grasshoppers take up oxygen during respiration and give out carbon dioxide which is absorbed by the sodium hydroxide solution
 As a result, the air pressure inside flask A becomes lower than that in flask B
 Communication skill (C)
 To eliminate the error caused by changes in environmental temperature / pressure
- (iii) The rise in the water level is faster / the water level rises higher because the rate of respiration of grasshoppers is faster at a higher temperature
8. (i) The volume of the dough increases because the yeast carries out anaerobic respiration / alcoholic fermentation which produces carbon dioxide that raises the dough
 Communication skill (C)
- (ii) The yeast are killed/enzymes are denatured under high temperature, thus no more carbon dioxide is produced
 brewing of beer / wine
- (iii) Large, accurate drawing (D)
 Labels and title (any 4): (4 x 0.5)
 *sporangium, *sporangiophore, *spore, *hypha, *rhizoid, *columella (optional)
-
- Diagram of bread mould observed under the microscope**
9. (i) The mealworms take in oxygen during respiration
 Any carbon dioxide produced by the mealworms is absorbed by the soda lime
 This leads to a drop in air pressure inside the syringe and the water droplet will be drawn downwards. Thus the rate of movement, of the water droplet indicates the rate of respiration
 Effective communication (C)

- (ii) (1) The rate of respiration of mealworms increases with an increase in temperature from 20°C to 50°C
 (2) With an increase in the external temperature, the body temperature of mealworms rises
 Thus the enzymatic activity of the worms increases
 This leads to an increase in the metabolic rate / body activities / energy demand thus the respiration rate of the mealworms rises
- (iii) To allow time for the air temperature inside the syringe to become equal to the temperature of the water bath and the respiratory rate of the mealworms to become adjusted to the new temperature
10. (i) The muscles carry out anaerobic respiration to release additional energy for muscle contraction.
 As anaerobic respiration produces lactic acid, it will lead to an increase in blood lactic acid concentration.
 glucose + oxygen → carbon dioxide + water
- (ii) Because it lowers the pH of the blood / tissue fluid which adversely affects cellular activities / it inactivates enzymes.
- (iv) Slow jogging
 This is because slow jogging can maintain a relatively high rate of heart beat / blood flow / breathing, which increases the rate of oxygen supply to the body, thus enhances the breakdown of lactic acid / conversion of lactic acid to glycogen.
11. (a) 130
 (b) correct title
 correct labelling of axes
 correct drawing and labelling of bars
-
- Rate of Anaerobic Respiration of Yeast**
- (c) Anaerobic respiration of yeast

- produce carbon dioxide which is trapped inside the dough making it rises
 Effective Communication
 Brand B
 To ensure the temperature of the three mixtures are the same / maintain the temperature at 30°C throughout the investigation
 Use only one brand of yeast
 Put the measuring cylinder in water baths at different temperatures

Paper II

90-45	C
91-19	A
92-10	B
92-11	A
92-23	A
92-24	B
93-24	A
93-25	D
96-22	C
96-23	B
00-4	C
00-5	B
00-12	C
01-6	A
02-7	C
02-32	B
02-33	B
03-09	C
03-10	C
03-24	D
03-25	D
05-6	A
05-7	B
05-15	D
05-40	C
06-9	A
07-29	C
07-30	D
07-42	A