FUKIEN SECONDARY SCHOOL

S4 First Term Uniform Test (2021-2022)

Biology

(1 hour)

Date: 10th November 2021 Name:_____

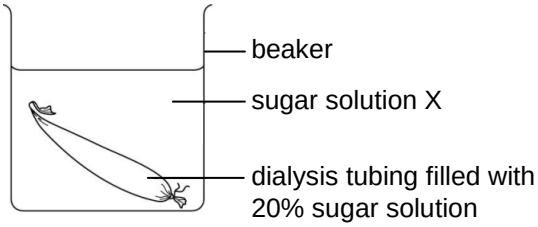
Time: 10:30a.m. - 11:30a.m. Class: _____ No.: _____

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 60.

I. Multiple Choice Questions (20 marks)

1 The diagram below shows a set-up used to study diffusion.



More sugar diffuses out of the tubing than diffuses in. What is the possible concentration of sugar solution X?

A 10%

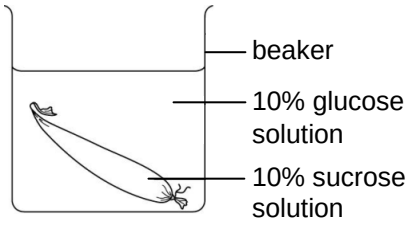
B 20%

C 30%

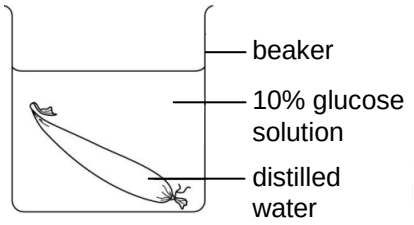
D 40%

2 In which of the following set-ups does the dialysis tubing show the greatest increase in weight after 3 hours?

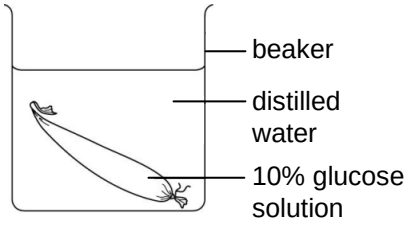
A



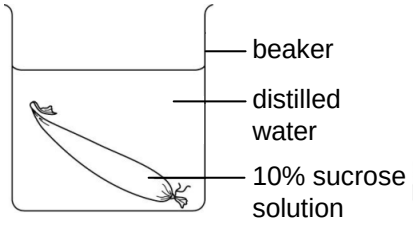
B



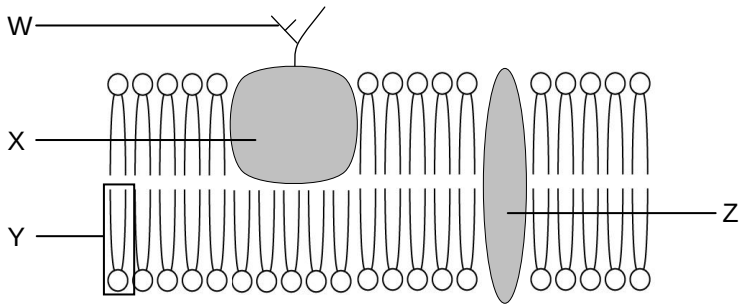
C



D



3 The diagram below shows the structure of the cell membrane.



In people with cystic fibrosis, a structure in the cell membrane is defective. As a result, fewer chloride ions move out of the cells, leading to the production of thick mucus. Which labelled structure in the cell membrane is most probably defective?

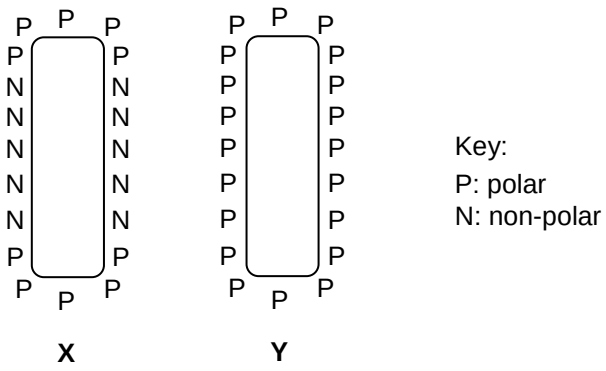
A W

B X

C Y

D Z

4 The diagram below shows the polarity of different parts of two protein molecules found in a cell membrane.



Which of the following shows the arrangement of the two protein molecules in the cell membrane?

	X	Y
A	attached to the surface of the phospholipid bilayer	embedded half-way in the phospholipid bilayer
B	embedded half-way in the phospholipid bilayer	spans the entire phospholipid bilayer
C	spans the entire phospholipid bilayer	attached to the surface of the phospholipid bilayer
D	spans the entire phospholipid bilayer	spans the entire phospholipid bilayer

5 A cell that is hypertonic to the surrounding solution

A will experience a net movement of water into the cell from the surrounding solution.

B has a lower concentration of solutes than the surrounding solution.

C has a water potential of zero.

D is in danger of plasmolysis.

6 Which of the following processes does ***not*** require energy?

A White blood cells engulf bacteria.

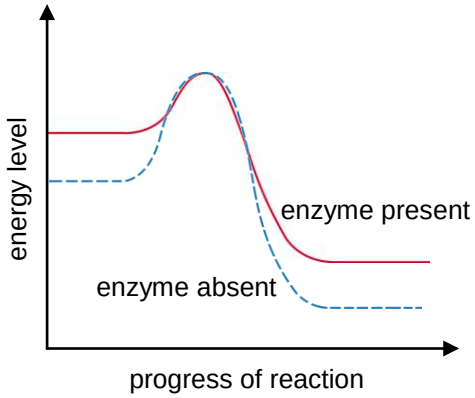
B Glucose is absorbed from the lumen of the small intestine into the villi.

C Nitrate is absorbed from the soil into the roots.

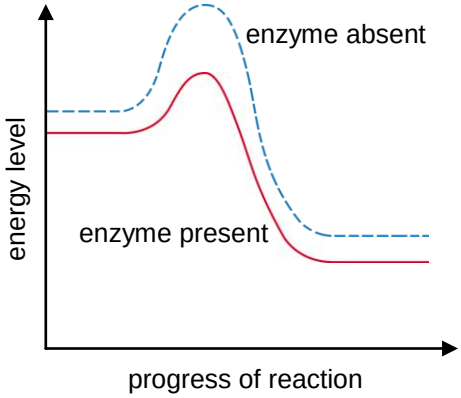
D Oxygen enters red blood cells in the lungs.

7 Which of the following graphs shows the energy profile of the reaction if the enzyme is absent?

A



B



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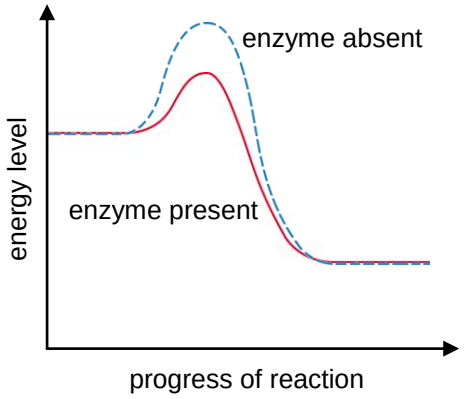
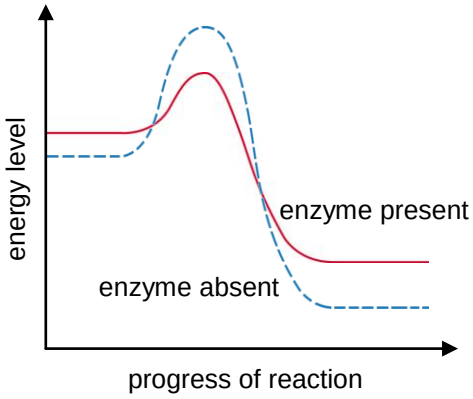
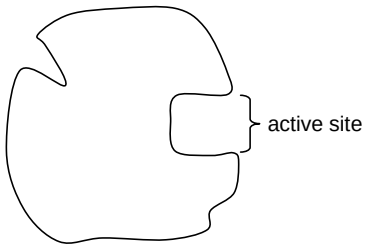


D

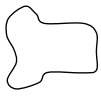


8 The diagram below shows an enzyme molecule.



Which of the following molecules is most probably the substrate for this enzyme?

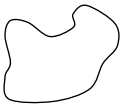
A



B

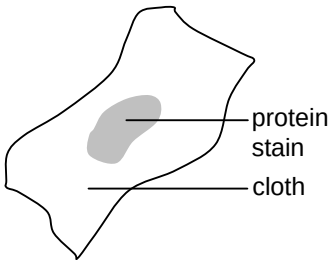
C

D



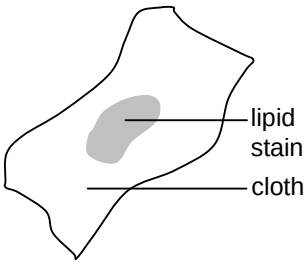
Directions: Questions 9 and 10 refer to the diagrams below, which show the set-ups used for investigating the effectiveness of washing powders in removing stains.

(1)



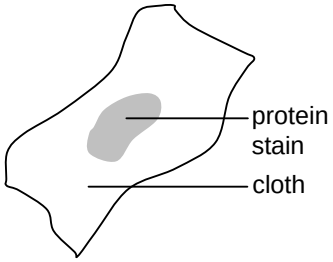
non-biological washing powder,
25 °C

(2)



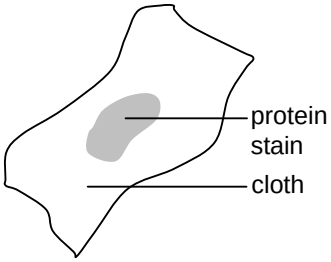
biological washing powder,
25 °C

(3)



biological washing powder,
25 °C

(4)



biological washing powder,
35 °C

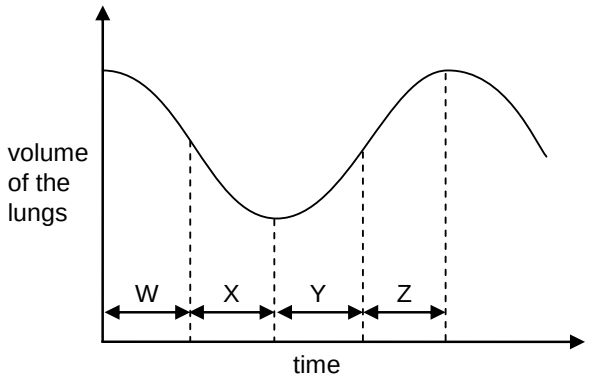
9 To investigate the effectiveness of biological washing powder in removing different stains, we should compare the results of

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

10 Which of the following factors is under investigation when comparing the results of (3) and (4)?

A temperature
B type of washing powder
C type of cloth
D type of stain

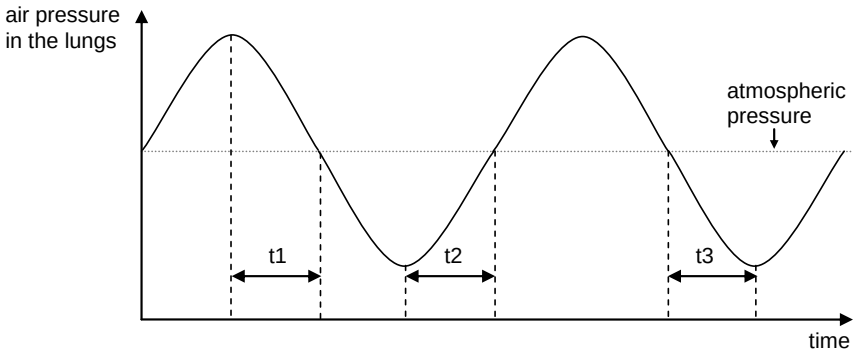
11 The graph below shows the change in volume of the lungs of a person within a period of time.



At which periods of time is the air pressure in the lungs lower than the atmospheric pressure?

A W and X
B W and Z
C X and Y
D Y and Z

12 The graph below shows the change in air pressure in the lungs of a person within a period of time.

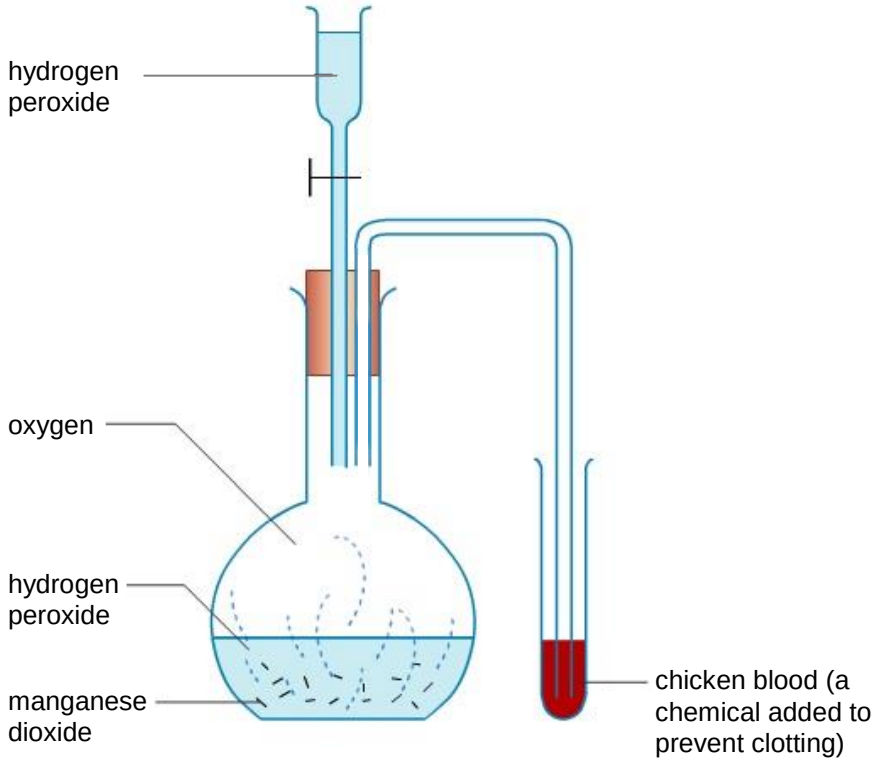


Which of the following statements about the events that happen in different periods of time are correct?

(1) During t1, the volume of the lungs is increasing.
(2) During t2, the intercostal muscles contract.
(3) During t3, the diaphragm is becoming flattened.

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

Directions: Questions 13 and 14 refer to the diagram below, which shows an experimental set-up used for studying the effect of oxygen on chicken blood. Manganese dioxide catalyses the breakdown of hydrogen peroxide into oxygen and water. Chicken blood contains haemoglobin which is similar to that in human blood.



13 What will be the colour change of the blood?

A from bright red to purplish red

B from purplish red to bright red

C from bright red to blue

D no colour change

14 Which of the following statements are correct?

(1) The colour change is reversible if carbon dioxide is bubbled into the blood.

(2) Haemoglobin becomes bright red in colour when combined with oxygen.

(3) At high carbon dioxide concentration, oxyhaemoglobin forms.

A (1) and (2) only

B (1) and (3) only

C (2) and (3) only

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

Directions: Questions 15 and 16 refer to the nutrition label below, which shows the nutritional information of a food.

Nutrition Facts			
Serving size: 258 g			
Serving per container: 1			
Amount per serving			
Energy 1134 kJ		From fat 294 kJ	
		% Daily value	
Total fat 8 g			**12**%
Saturated fat 3.5 g			**15**%
Cholesterol 30 mg			**9**%
Sodium 500 mg			**20**%
Total carbohydrates 28 mg			**9**%
Dietary fibre 3 g			**13**%
Sugars 5 g			
Proteins 21 g			
Vitamin A 8%	·	Vitamin C 0%	
Calcium 35%	·	Iron 6%	

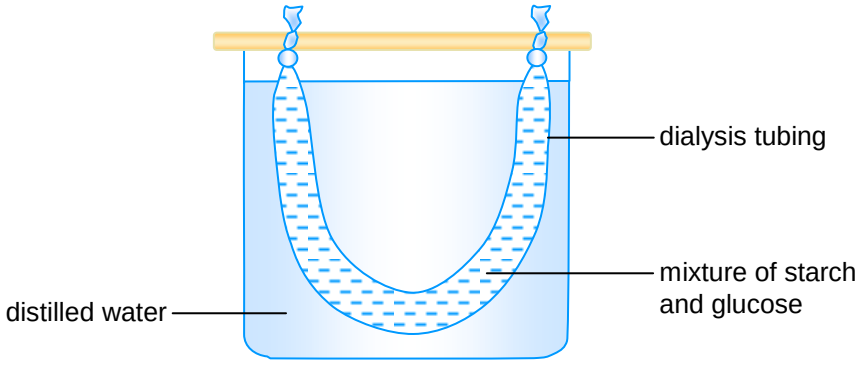
15 The recommended daily intake of energy of a 5-year-old girl is 6500 kJ. If she eats only this food, how many grams of this food does she need to eat in order to obtain the amount of energy she needs per day?

A 5.7 g
B 25.2 g
C 1478.8 g
D 5704.1 g

16 In which of the following food tests will the above food give a negative result?

A Benedict's test
B mixing it with DCPIP solution
C iodine test
D grease spot test

Directions: Questions 17 and 18 refer to the diagram below, which shows a model used for demonstrating a process that occurs in a part of the human alimentary canal.



17 The distilled water outside the dialysis tubing represents

A the water in the saliva.
B the water surrounding the villi.
C the blood supplied to the small intestine.
D the blood supplied to the oesophagus.

18 After 1 hour, the distilled water outside the dialysis tubing would contain

A glucose only.
B starch only.
C both glucose and starch.
D neither glucose nor starch.

19 Which of the following is ***not*** a function of the liver?

A regulation of blood glucose level
B storage of glycogen
C storage of calcium
D breakdown of excess amino acids

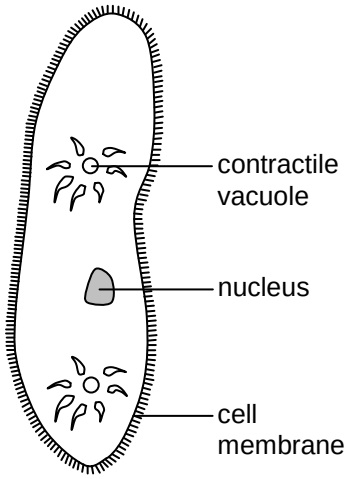
20 Glucose absorbed in the small intestine is transported to the liver via

A the hepatic vein.
B the hepatic artery.
C the hepatic portal vein.
D the hepatic portal artery.

End of Section I

II. Structured Questions (40 marks)

1 The diagram below shows a unicellular organism *Paramecium*.



Paramecium lives in freshwater environment. Due to the difference in water potentials between the cytoplasm of *Paramecium* and the surrounding environment, water continuously enters *Paramecium.*

A special structure called contractile vacuole is present in *Paramecium* to regulate its water content. Solutes are first actively transported into the contractile vacuole from the cytoplasm. This causes water to move into the contractile vacuole. The contractile vacuole then contracts to expel the solution out of the cell.

a Compare the water potentials of the cytoplasm of *Paramecium* and the surrounding environment. (1 mark)

b Describe the route by which water molecules enter *Paramecium* through its cell membrane. (1 mark)

c What is the consequence if excess water is not removed from *Paramecium* by the contractile vacuole? (1 mark)

d Explain why the transport of solutes into the contractile vacuole causes water to move into it. (3 marks)

e Unicellular organisms with a cell wall usually do not have contractile vacuoles. Explain why. (2 marks)

2 The breakdown of hydrogen peroxide into water and oxygen can be catalysed by an enzyme found in various tissues. In an experiment, samples of liver tissues or blood, either fresh or boiled, are added to test tubes containing hydrogen peroxide solution. A chemical, manganese dioxide, is added to a test tube of hydrogen peroxide solution.

Test Tube	Content	Results
P	Hydrogen peroxide solution	No oxygen evolved
Q	Hydrogen peroxide solution + manganese dioxide	Oxygen evolved
R	Hydrogen peroxide solution + fresh liver tissue	Oxygen evolved
S	Hydrogen peroxide solution + boiled liver tissue	No oxygen evolved
T	Hydrogen peroxide solution + fresh blood	Oxygen evolved
U	Hydrogen peroxide solution + boiled blood	No oxygen evolved

a How can we test for oxygen in the gas evolved? (2 marks)

b What is the purpose of setting up test tube P? (1 mark)

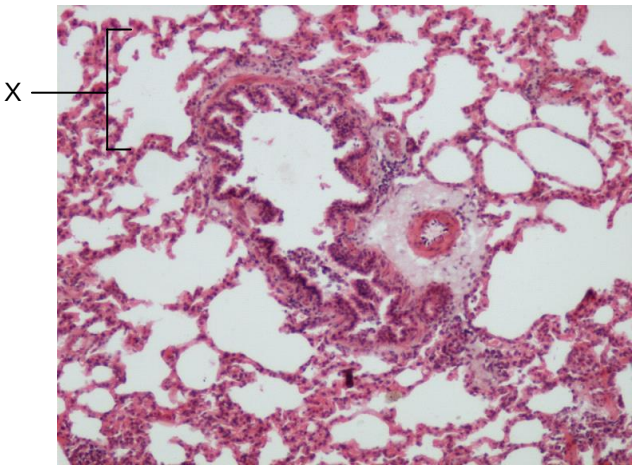
c Explain the results of test tube Q. (1 mark)

d Explain the results of test tubes R and T. (1 mark)

e Explain the results of test tubes S and U. (2 marks)

f State ***two*** controlled variables of this experiment. (2 marks)

3 The photomicrograph below shows a section of human lung tissue.



a Name structure X. (1 mark)

b With reference to the photomicrograph, describe ***two*** adaptive features of structure X for gas exchange. (2 marks)

c Describe the mechanism by which the air in structure X goes to the atmosphere. (4 marks)

4 The table below shows the amounts of food substances in 100 g of three brands of cornflakes.

	Brand X	**Brand Y**	**Brand Z**
Carbohydrates (g)	65	70	60
Lipids (g)	10	2	5
Proteins (g)	10	15	10
Dietary fibre (g)	5	15	15

a Which brand of cornflakes provides the largest amount of energy per 100 g? Show your workings. (Given that 1 g of carbohydrate, lipid and protein provide 17.1 kJ, 38.9 kJ and 18.2 kJ of energy respectively) (4 marks)

b Cornflake manufacturers often claim that their products are good for health. According to the information above, which brand of cornflakes is the healthiest? Explain your answer. (2 marks)

5 A student carried out the following experiment to simulate the process of digestion of steamed rice in the human body.

(1) Chew 20 g of steamed rice for one minute in the mouth cavity.

(2) Mix the rice with water, hydrochloric acid and pepsin in a test tube and leave the mixture at 37 ℃ for 30 minutes.

(3) Adjust the pH of the mixture to 8 and add amylase to it. Leave the mixture at 37 ℃ for 120 minutes.

(4) Draw samples from the mixture at 15-minute intervals for measurement of the amount of reducing sugar.

(5) Repeat steps (2) to (4) with steamed rice that has been chopped up in a blender for one minute.

The table below shows her results.

Time (minute)	**Amount of reducing sugar** (arbitrary unit)	
	Chewed rice	**Chopped rice**
0	14	0
15	49	30
30	66	46
45	75	56
60	78	62
75	80	68
90	80	74
105	80	80
120	80	80

a What was the purpose of mixing the rice with water, hydrochloric acid and pepsin in step (2)? (1 mark)

b Suggest ***one*** way to adjust the pH of the mixture in step (3). (1 mark)

c Using the graph paper provided, plot a graph to show the results. (5 marks)

d Why was reducing sugar present in chewed rice but not in chopped rice at the beginning of the 120-minute? (3 marks)

End of Paper