



LIFE SCIENCES: PAPER III

EXAMINATION NUMBER

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Time: 1½ hours

50 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. Write your examination number in the blocks above.
2. This question paper consists of 10 pages and a yellow Information Sheet of 2 pages (i–ii). Please check that your question paper is complete.
3. You have ten minutes reading time before you begin. You are advised to read the paper carefully and spend time planning your work.
4. Perform the tasks with care. You will be assessed on your ability to follow instructions.
5. Standard time accommodations will apply to this examination.
6. Answer the questions in the spaces provided. Should you need more space for answering, use pages 9 and 10 in this question paper only. **DO NOT** use any additional paper.
7. The Information Sheet is printed on separate yellow paper. Please read it **carefully** before you begin and **refer to it during the course of the examination**.

Invigilators are asked to please complete this after the examination.

CRITERIA		
Following instructions	0	1
Test tube contents	0	1
Manipulation	0	1
TOTAL		3

(3)

For Markers USE ONLY

Procedure							Total

Please read the Information Sheet carefully before you start. There are two parts to this question paper: Part 1 – the investigation and Part 2 – the experimental design.

You are going to be investigating the presence of protein content in various liquids.

Before you begin your investigation, make sure that you have the following equipment at your workstation:

- four identical test tubes in a test tube rack/container
- 100 ml of milk
- sample of an unknown, white nutrient powder clearly labelled X
- empty polystyrene or plastic cup
- 100 ml of tap water
- wooden kebab stick
- permanent marking pen (your own or one supplied)
- two 10 ml syringes
- 5 ml measuring spoon
- access to a dropper bottle of indicator A
- access to a dropper bottle of indicator B
- access to a dropper bottle of indicator C
- a wall clock or timing device is available

PART 1 INVESTIGATION

1. Label the empty test tubes A, B, C and D using the marking pen.
2. Add 30 ml of tap water to test tube A.
3. Add 25 ml of tap water and 5 ml of milk to test tube B.
4. Add 30 ml of milk to test tube C.
5. In the polystyrene/plastic cup, add 5 ml of powder X. To this add 40 ml of water and mix using the kebab stick.
6. Immediately add 30 ml of this solution to test tube D.
7. To **each** test tube add 7 drops of indicator A and 7 drops of indicator B.

CALL THE INVIGILATOR BEFORE PROCEEDING FURTHER

8. Gently tap the test tubes to mix the contents. Observe the colour change in each test tube. Record your observations in a table on the following page.

9. Draw up a suitable table in the space below and record your observations.

(6)

10. Allow the test tubes to stand for 20 minutes and observe any further changes in the test tubes once more. In the space below, describe your observations of the contents of the test tubes.

(3)

11. Write a conclusion for this investigation about the presence of protein in the four different test tubes.

(2)

12. What is the independent variable for this investigation?

(2)

13. What is the dependent variable for this investigation?

(2)

14. Life scientists in a laboratory have determined that the protein concentration of the liquid milk used in this investigation was 30% of its total volume.

Knowing this, complete the following table of information:

Test tube	Protein in the test tube (%)
A	
B	
C	
D	

(3)

15. 15.1 Look at test tubes B and C. In which test tube would you expect to find the higher concentration of protein? Explain.

(2)

15.2 Do your observations support your response in Question 15.1? Explain any differences between observed and expected results.

(2)

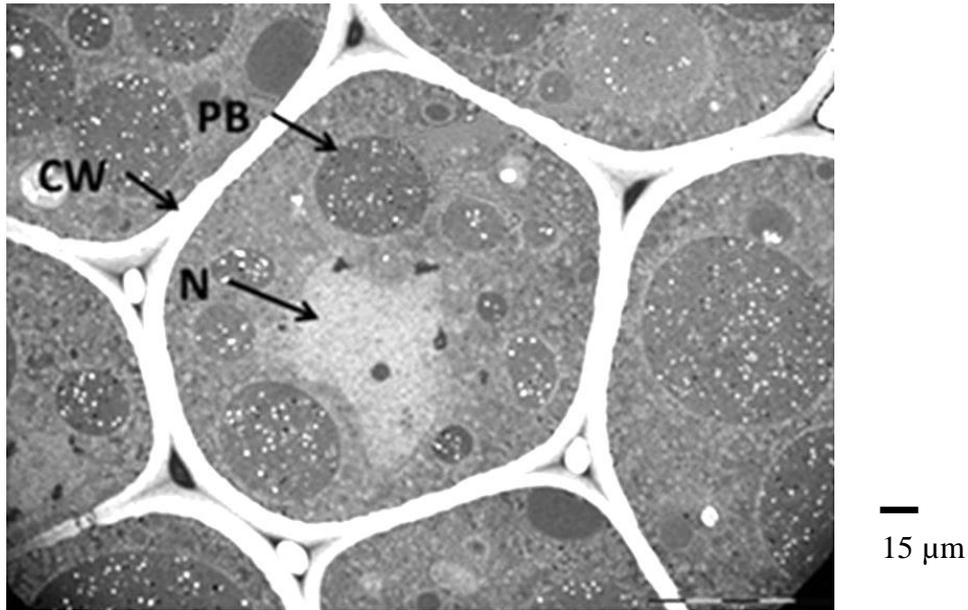
16. If you put 15 ml of milk mixed with 15 ml of water in a test tube and add indicators A and B, what colour do you predict the mixture will be, based on the results you have observed in your investigation?

(2)

17. Read the following extract below and then answer the question that follows.

A rich source of protein that is consumed by millions of individuals worldwide is the soya bean. The soya bean is prepared in numerous ways to provide vegetarians in particular with many different foods to supplement protein provided from animal products.

The micrograph below is of cells from the soya bean. The structure labelled PB is one of many 'protein bodies' found within the cell that are packed with protein molecules.



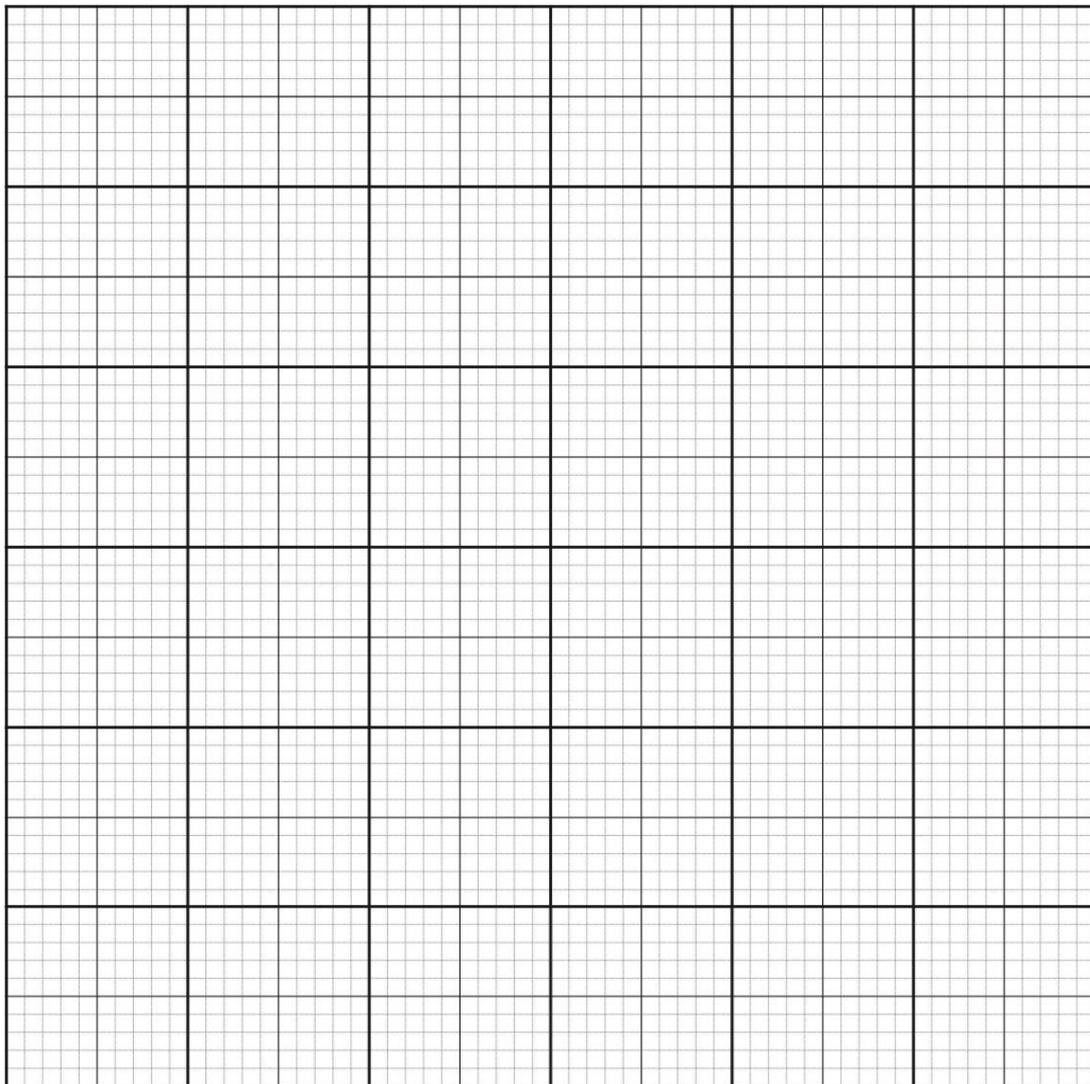
[Source: <pubs.rsc.org/en/content/2014/ra/c4ra 0093g>]

Using the scale line provided, calculate the actual or real size of the labelled protein body.

Express your answer in μm . It is necessary to show all working below. Show each step clearly.

(4)

18. Draw a suitable graph on the grid below to indicate the protein content in gram/100 cal of the following foods: tofu, cooked soybeans, quinoa and lentils.



(6)

PART 2 EXPERIMENTAL DESIGN

RENNIN IS AN ENZYME FOUND IN MAMMALS

When babies are born and their diet consists of milk alone, the body produces rennin from the stomach wall to cause the milk to be changed from its liquid form into a semi-solid. This allows the milk to stay in the stomach for longer and slows down the digestion process. By doing this the baby can be satisfied longer on its very limited diet of milk in the early months of life.

When milk turns sour in the container if it is left out of the refrigerator for too long, it goes lumpy and we see this as we pour it into a glass. The lumps that are observed in souring milk are very similar to the effect we see when adding rennin to milk.

Rennin, in the form of 'Rennet', is used in the cheese-making process to coagulate (solidify) milk and make cheese. Commercial rennin or 'Rennet' can be bought in liquid form from cheese-making suppliers and used in the laboratory to show its effect on coagulating milk. Rennet works best if it is at a temperature in the 60 °C to 70 °C range and at a slightly acidic pH. Adding a drop of lemon juice to a solution can lower pH.

Using equipment that you would normally find in a school laboratory, Rennet obtained from chemical suppliers and any other materials you may need, design a simple experiment to show that when added to milk, Rennet will cause the milk to coagulate and form lumps. *In your investigation you will need to have both an experiment and a control.*

(Do not actually perform your experiment)

19.1 Formulate a hypothesis for this experiment that you are designing.

(3)

19.2 State the aim of the experiment.

(2)

