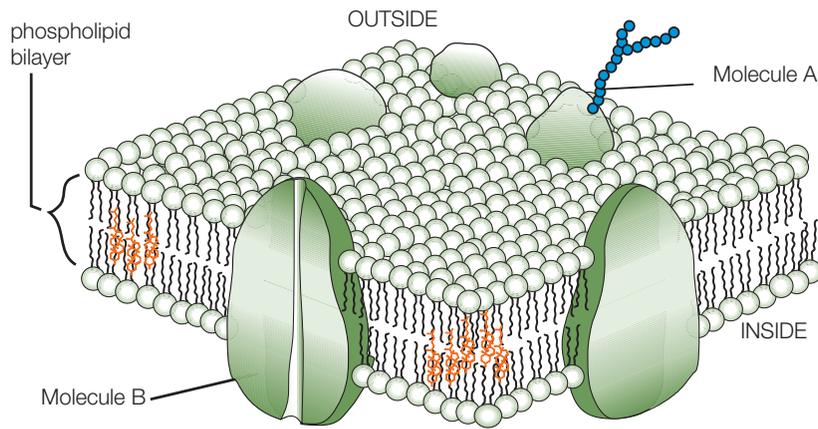


### TOPIC 1 Test Yourself

Allocate 60 minutes to complete this test. Answer all of the questions in the spaces provided. The number of marks for each question is shown in brackets. Answers are suggested for all questions at the end of the test. Note that they are not intended to be the only possible answer. Read these carefully after the test and use them as part of an assessment for learning activity.

1. Refer to the diagram below and answer the questions that follow:



a) Briefly describe the structure of the cell membrane.

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(4 marks)

b) Describe two ways in which this membrane controls the entry and it of materials between the cell and its external environment.

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(4 marks)

c) Name molecule B

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(2 marks)

d) Explain how molecule B could be involved in the process of active transport.

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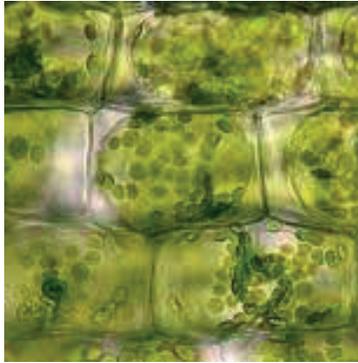
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(4 marks)

2. Refer to the pictures below to answer the questions that follow. (Source: Google images)



Cell A (~5000x)



Cell B (~250x)



Cell C (~500x)

a) Explain the meaning of the phrase ‘ the cell is the unit of structure and function in all organisms

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(4 marks)

b) Name one organelle that you would expect to find in all three types of cells

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(2 marks)

c) State one difference between DNA in cell A compared to cells B and C.

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(2 marks)

d) Explain why cell A cannot be part of a tissue.

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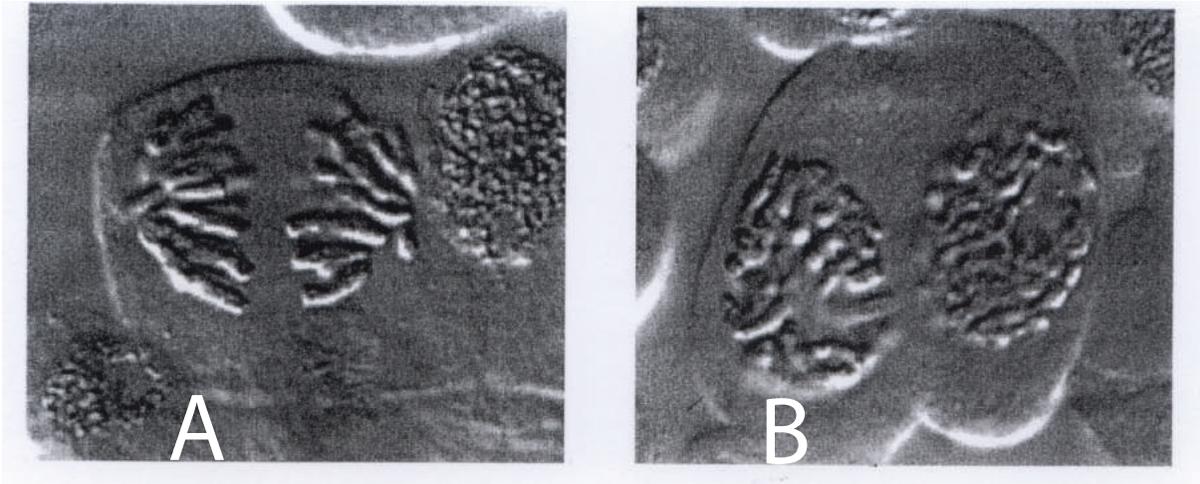


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(4 marks)



3. Refer to the following photographs A and B which show two stages in mitosis.



a) State what is happening to the chromosomes in stage A.

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(2 marks)

b) State what is happening to the chromosomes in stage B.

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(2 marks)

c) Explain how it is possible that cells produced from mitosis are clones of the original cell.

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d) Explain one difference between mitotic division and binary fission.

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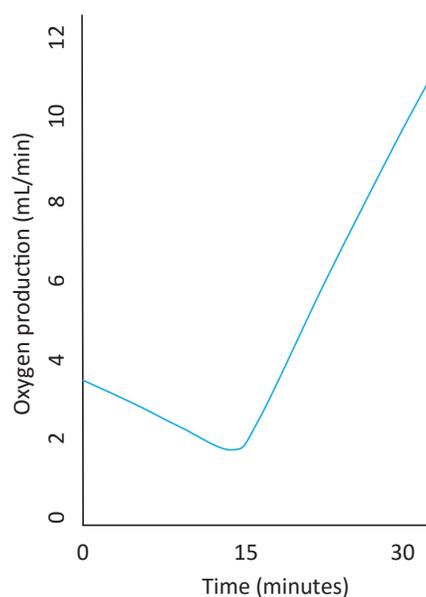
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(4 marks)

4. In an investigation into the effects of light on the rate of photosynthesis, a scientist enclosed a group of plants in the dark for a period of 15 minutes, they were then exposed to light. The researcher continually measured and recorded the volume of oxygen produced in the air surrounding the plants.

Refer to the graph below to answer the following questions.



- a) Write a possible investigable question that the research would have used in this investigation.

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(2 marks)

- b) Write a word equation for the process of photosynthesis.

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- c) Write a possible conclusion based on the data.

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(2 marks)

- d) State the reason that the concentration of oxygen can be used as a measure of the rate of photosynthesis.

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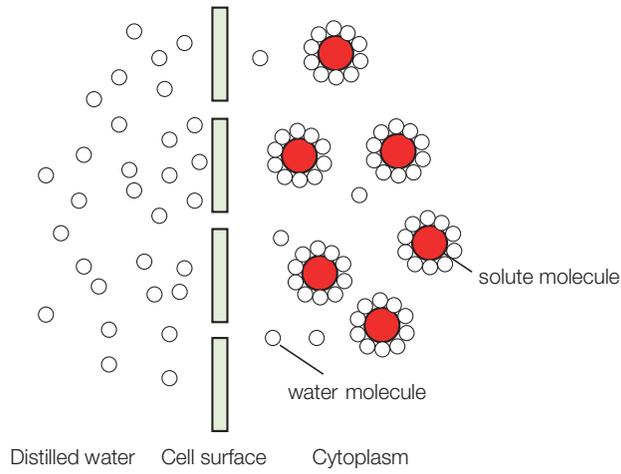


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(2 marks)

App

5. Refer to the diagram below to answer the questions that follow



a) Explain why the nett movement of water molecules would be from left to right, i.e. from the distilled water into the cell.

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(4 marks)

b) Explain why the impact of this movement is usually more significant for animal cells when compared to plant cells.

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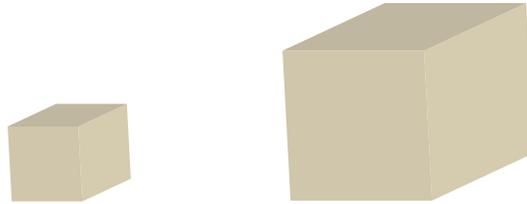


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(4 marks)

6. Refer to the diagram below of two potato cubes that were placed in 5% solution of glucose; the smaller cube measures 1x1x1 cm and the larger is 2x2x2 cm.

It was noted that both cubes shrunk and became soft when left in the solution for one hour. Use this information to help you answer the questions that follow.



a) State the reason the cubes became soft.

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(2 marks)

b) Calculate the surface area to volume ratio for each cube.

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(4 marks)

c) The student who conducted this investigation predicted that the 1 cm cube would lose a greater percentage of its mass when compared to the 2 cm cube. Explain the likely reason that they made this prediction.

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(4 marks)

d) Explain the significance of the surface area to volume ratio for the size of a cell.

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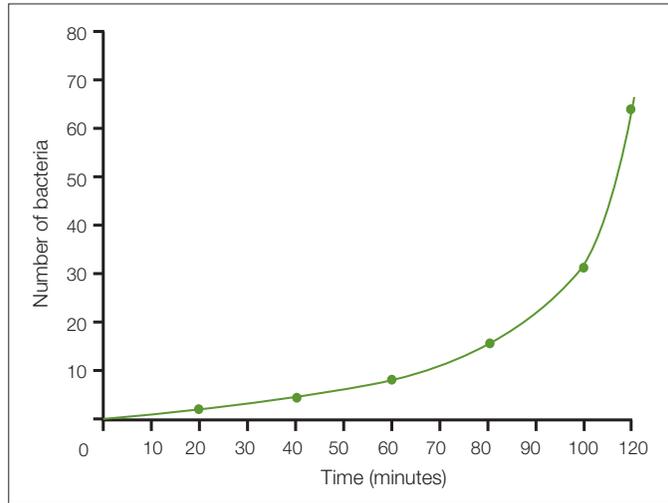


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(4 marks)



7. Refer to the graph of exponential bacterial growth under ideal conditions. Fortunately this rarely occurs as resources become a limiting factor.



- a) Name two such resources required by bacteria that could become limiting factors and outline the importance of each for bacterial growth.

Resource 1

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(4 marks)

Resource 2

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4 marks

- b) Briefly name and describe the process that enables the bacteria to divide so rapidly.

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(4 marks)

- c) Bacteria are one useful group of microbes for humans. Name one other group of microbes that are also useful and outline how this group is important.

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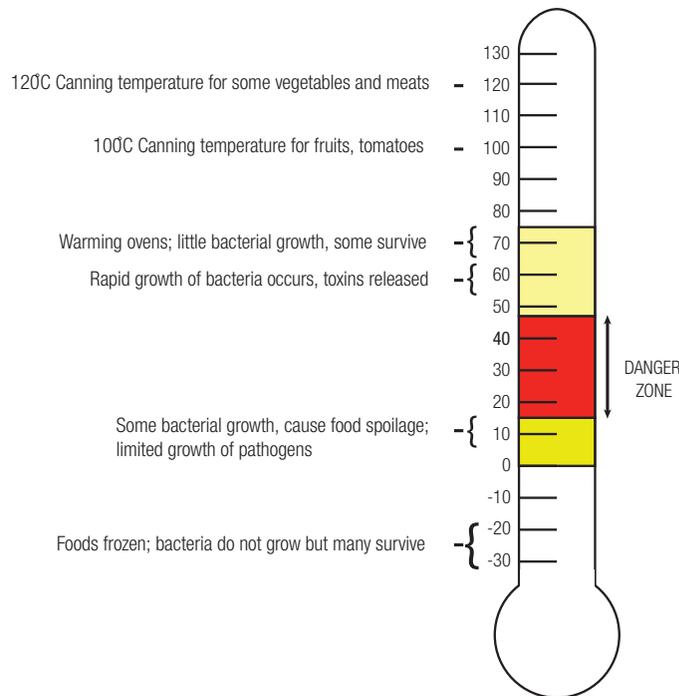
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(4 marks)

8. Refer to the figure below regarding food temperature and storage to answer the questions that follow:



a) Outline reasons for the red or danger zone being labelled as such.

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(4 marks)

b) Describe a possible reason that some fruits and tomatoes may not require such a high Canning temperature as vegetables and meats.

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(2 marks)

c) Imagine you are a visiting Health Inspector giving advice to a bakery about storing hot pastries before sale. What advice would you suggest to help ensure the safety of customers regarding bacterial growth?

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(4 marks)



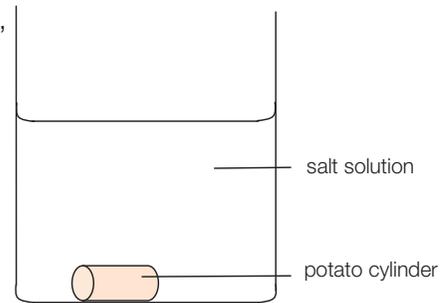
**Inquiry Skills Question**

9. Potato cylinders of equal mass were placed in 5 separate beakers, one of which is shown below:

The 5 beakers contained salt solutions of 0.2%, 0.7%, 1.2%, 1.7%, 2.2%

After 3 hours the change of mass of each cylinder was measured.

Refer to the table below to answer the questions that follow.



Beaker	Salt solution (%)	Change in mass (g)
A	0.2	+ 0.3
B	0.7	+ 0.1
C	1.2	- 0.1
D	1.7	- 0.4
E	2.2	- 0.5

a) Describe the pattern of results as shown in the table

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(4 marks)

b) Predict 2 variables that would have been controlled in the experiment to ensure that this was a 'fair test'.

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(4 marks)

c) Explain the change in mass observed in the potato cylinder in Beaker A

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(4 marks)

d) Predict the salt concentration at which there would be no change in the mass of the potato cylinder.

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(2 marks)

e) Describe how a scientist might have tried to ensure that these results were valid and reliable.

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(4 marks)

## Human Endeavour Question

10. *The following is adapted from an article in the Advertiser August 8, 2016. Read it carefully and then answer the questions that follow to show your understanding of various aspects of Science as a Human Endeavour:*

### Medical triumph in war on cancer

*Written by reporter Rose Brennan*

Australian scientists have achieved a world-first breakthrough in the battle against the deadliest cancer. Nano-medicine technology can now deliver 'gene silencing' drugs to pancreatic cancer tumours that are notoriously difficult to treat. Pancreatic cancer is the most chemotherapy resistant and therefore deadly cancer in Australia, claiming five lives a day. Most people diagnosed with pancreatic cancer are dead within six months.

Scar tissue, which can make up to 90% of a tumour, poses the greatest challenge for doctors as it blocks drugs from reaching the tumour, while also increasing its resistance to chemotherapy. New South Wales University pancreatic cancer translational research group head Dr Phoebe Phillips said her team developed a powerful new drug and an effective way of delivering it to tumours.

"We chemically engineered tiny particles that can get past that scar tissue barrier and actually reach the tumour cell, so that to me is a fairly significant breakthrough" Dr Phillips said.

The particles are used as a vessel to deliver the drug to the tumours. "It can make the development of a tumour and its ability to metastasise and spread throughout the body switch off" Dr Phillips said. The results were achieved in mice which had extensive scar tissue that mimicked human tumours.

Obesity is a risk factor for pancreatic cancer, which Dr Phillips said by 2030 was expected to be the second biggest killer of all cancers. As obesity and diabetes are on the rise because of the way we live, more and more we are seeing younger patients with pancreatic cancer" Dr Phillips said..

- a) Identify and discuss two examples to show how this report supports the idea that: '*Advances in scientific understanding in one field can influence and/or be influenced by other areas of science...*'

Example 1

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(4 marks)

Example 2

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(4 marks)

- b) Provide an example from this report of how '*Science informs public debate and is in turn influenced by public debate...*'

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(4 marks)



**Assessment Key**

<b>Assessment Design Criteria</b>	<b>Questions where this could be assessed</b>
<b>IAE1</b>	4.a, 9.b;
<b>IAE2</b>	
<b>IAE3</b>	4.c; 9.a, c, d;
<b>IAE4</b>	9.e.
<b>KA1</b>	1.a, b; 2.a; 4.b; 6.d; 7.b;
<b>KA2</b>	1.c; 2.b, c, d; 3.b, c; 4.d; 6.a, b, c; 7.a, c; 8.a, b, c
<b>KA3</b>	8.c, 10.a, b.
<b>KA4</b>	

## Topic 1 Test Yourself - Suggested answers

*The answers for each part of each question provided here are suggestions. They are not intended to be the only answer. Read and use them carefully to self-assess your performance in the test. Consider asking someone in your class to peer-assess them as well, then discuss. Make notes of errors for future reference and seek the assistance of your teacher as required.*

1. Regarding the membrane:
  - a) The cell membrane is a phospholipid bilayer surrounding all cells. The membrane has protein molecules embedded in it, some act as receptor proteins involved in cellular communication, others act as transport channels to move molecules in and out of cells.
  - b) It is lipid in nature and therefore tends to repel a range of molecules that are not lipid soluble. Also it is semi-permeable and restricts the movement of larger molecules. Proteins-both pumps and channels facilitate movement of particular molecules.
  - c) A protein channel or pump
  - d) Active transport involves the movement of molecules against the concentration gradient. A protein pump can use energy to pump or move molecules from a low concentration to a high concentration.
2. With reference to the photographs:
  - a) All organisms are made up of cells or the products of cells. The cell is the basic unit of life, it is the smallest unit that is considered to be alive. As such, it is the building block of all life and the unit of function in carrying out life's processes.
  - b) e.g. ribosome
  - c) A being a prokaryotic cell has DNA in the cytoplasm. B and C are eukaryotic cells with the DNA contained in a nucleus.
  - d) Cell A is a prokaryotic, unicellular organism consisting of a single cell. Tissues consist of many cells combined that have similar structures and functions.
3. With reference to the photographs:
  - a) Each chromosome consists of two chromatids which are being pulled towards the poles of the cell.
  - b) In stage B, the chromosomes are condensing-pulling together.
  - c) Prior to mitosis, the DNA in the cell replicates i.e. DNA is doubled making two identical copies. In mitosis, the DNA separates so that each new cell contains the same DNA and genes as the original cell.
  - d) Mitotic division occurs in eukaryotic cells, it is a division of the nucleus. Binary fission occurs in prokaryotic cells, as no nuclei are present the circular chromosome replicates and then divides into two.
4. With regard to this investigation:
  - a) Is light necessary for the process of photosynthesis to occur?
  - b) Water + carbon dioxide → oxygen + glucose
  - c) Light is required for photosynthesis to occur in plants producing oxygen gas.
  - d) Oxygen is a by-product of photosynthesis, the greater the rate of photosynthesis, the more oxygen is produced.
5. With regard to the diagram:
  - a) Osmosis is the movement of water molecules from low solute concentration to high solute concentration. This is a naturally occurring process and as the left side has a low solute concentration and the right side has a high solute concentration water will move from left through the cell surface to the cytoplasm on the right.
  - b) Plant cells have a cell wall which can resist movement of water into the cell and out of the cell enabling the cell to maintain its structure and shape. Animal cells only have a cell membrane which is more flexible and can breach or break with too much water moving into the cell.

6. With reference to the potato cubes:
- The cubes become soft as water moves out of the cell by osmosis.
  - For 1 cm<sup>3</sup> cube:  $SA = (1 \times 1) \times 6 = 6 \text{ cm}^2$      $V = 1 \times 1 \times 1 = 1 \text{ cm}^3$      $SA:V = 6:1$   
For 2 cm<sup>3</sup> cube:  $SA = (2 \times 2) \times 6 = 24 \text{ cm}^2$      $V = 2 \times 2 \times 2 = 8 \text{ cm}^3$      $SA:V = 3:1$
  - The 1 cm cube has an SA:V of 6:1 compared to the 2 cm<sup>3</sup> with a SA:V of 3:1. The cube with the greater SA:V will exchange materials faster because there is a greater rate of diffusion and therefore it will lose a greater percentage of its mass as water moves out by osmosis.
  - Cells that are smaller have a higher SA:V ratio and are therefore more efficient at exchanging materials. Cells therefore do not usually grow too large as they will not be able to obtain their requirements as efficiently.
7. With reference to the graph:
- Two such resources include:  
Water; all organisms need water to survive. It maintains the structure and integrity of cells and it is the solvent for the chemicals of life. If water is in short supply, bacterial growth will be limited.  
A source of energy e.g. glucose. All organisms including bacteria, require energy for synthesis reactions and a range of other processes. Breaking down glucose releases energy for cellular activities.
  - Binary fission. The bacterial cells replicate their DNA and then divide forming two new, identical cells.
  - Yeast; yeasts are used in the production of a range of household foods and beverages including bread, wine and beer making.
8. With reference to the diagram:
- The red zone from around 15°C-47°C is an ideal temperature for the rapid growth of bacteria. If allowed to grow unchecked at these temperatures, bacteria will multiply rapidly in food causing spoilage.
  - Fruits, including tomatoes often have higher concentrations of sugars and acids which also inhibit bacterial growth.
  - From the data above, it would appear that the pastries need to be kept in the temperature range 65°C-75°C. At these temperatures, many bacteria die, there is little growth and the food is able to be kept for a reasonably long time.
9. With regards to this data:
- When the cylinder is placed in salt solutions from 0.2%-0.7%, there is a nett gain in mass. At concentrations greater than 1-2% there is a nett loss of water.
  - The temperature of the solution is another important variable, temperature influences the rate of diffusion and osmosis. The SA:V ratios of the potato cylinders is another variable, they should be the same size, mass and SA:V ratio.
  - The cylinder in beaker A has increased in mass due to the gain of water. Water has moved into the cylinder by osmosis; from a low solute concentration (0.2%) to a higher solute concentration inside the potato.
  - Approximately 0.9%; about halfway between 0.7% and 1.2%.
  - The scientist would need to ensure that a reasonable sample size was included. Repeating the experiment with fresh solutions and new equipment enables the scientist to identify any systematic errors and be more confident about the validity of the experiment.
10. With reference to the newspaper article:
- Two examples include:  
Nanotechnology is a branch of science involved in the manipulation of tiny atomic and molecular matter. This technology is at the heart of the breakthrough in getting the drugs past the scar tissue and into the tumour.  
Engineering principles related to chemical engineering in particular, enable the manufacture of specific drugs that penetrate the scar tissue and have potent effects on the cancer cells.
  - Science is providing data, indicating that lifestyle choices e.g. overeating and eating the wrong foods leading to obesity, can be a risk factor for pancreatic cancer. This encourages public debate about how we raise our children and in turn sparks new interest in further research trying to establish the links.