MODULE: *Cells*

Intervention Session
Teaching Guide

This session has been designed to help your student to practice answering PISA questions, both paper and computer based assessments about Energy. The computer based assessment item is the interactive that goes with this module. This intervention also helps your students to practice reading and interpreting text; analysing and interpreting data; evaluating scientific enquiries; and explaining key concepts and applying their understanding.

It must be emphasised that PISA assessment items are not designed to test knowledge in the approach of TIMSS assessment items. PISA assessment items are designed to test students' ability to read and interpret text, analyse and interpret data, evaluate scientific enquiries; explain the outcomes of enquiries using their scientific understanding; and apply their understanding of how the world of science works. These assessment items have been designed to help students practice those skills.

1. (15 minutes)

   Carry out the Cancer Research computer based assessment question on the computer. Read the information, instructions and questions carefully before selecting or typing in your answers.

   Remember that you can navigate backwards and forwards to check and change your answers.

   When you have finished print your answers by clicking on the print icon.

   Q1 *Yeast*
   it can be grown easily and quickly in a laboratory.
   Q2 *Healthy human cells behave in a very controlled way. They grow, divide, stop dividing and eventually die. In cancer, this process goes wrong. A cancer cell divides and grows into a tumour. A tumour is a swelling or growth that can occur almost anywhere in the body.*
   Q3 *Scientists compare the outcomes of their research with the outcomes of research of other scientists*
   Q4 *Nucleus*
   DNA
   The scientists added a substance to the yeast cells to damage the DNA inside the nucleus.
   Q5 *one cell*
   Cell grows
   cell's nucleus (control centre) starts to divide
   cell narrows in the middle
   cell splits in two.(the new cells are exactly the same as the old one)
   Q6 *A gene controls how a cell divides.*

2. (5 minutes)

Read the information below and then answer the questions.

The structure of living things

Theodor Schwann **Matthias Schleiden**

In 1838 two scientists were eating dinner and discussing the latest observations of living things made with a light microscope.

Suddenly they realised something. The structures they had observed inside living things were the same. A nerve cell from an animal contained many of the same parts as a leaf cell from a plant!

a. What two things had they discovered?

all living things are made of cells

an animal cell contains many of the same parts as a plant cell

b. What structures do animal and plant cells have in common?

Nucleus, Cytoplasm, Cell membrane, Mitochondria

c. How do plant and animal cells differ?

In addition to the nucleus, cytoplasm, and cell membrane the plant cells have chloroplasts, cell wall and large vacuole

d. Explain why they differ.

Plants make their own food through the process of photosynthesis. This process takes place in the chloroplasts. The cell wall and large vacuole are important in supporting the cell and plant.

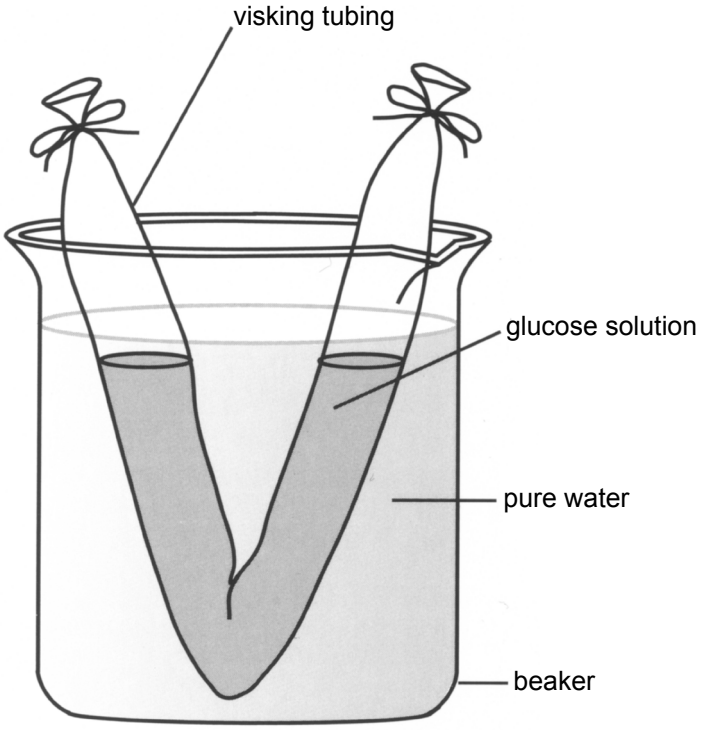
3. (20 minutes)

Read the information below and then answer the questions.

Pocket water purifier

Nanotechnologists are developing a membrane that behaves like a cell membrane. They hope the membrane will be used to purify dirty water in areas where there is a water shortage, and people do not have easy access to clean water.

The idea came from observations made while using the equipment below.



They firstly filled the Visking tubing with glucose and found that after 15 minutes there was glucose in the pure water. Next they tried sucrose instead of glucose. This time there was no sucrose in the water. However what they did notice was that the volume of liquid inside the Visking tubing had increased. This was their eureka moment!

a. What conclusion could they make from their first experiment?

Glucose had past out of the Visking tubing and into the water

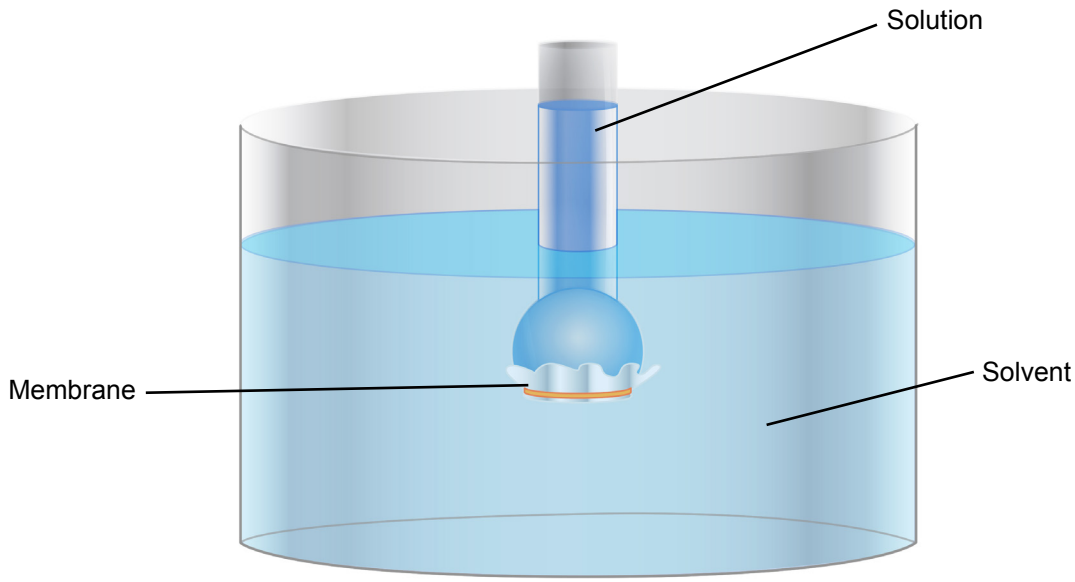
b. Explain what had happened?

The glusose molecules are small enough to pass through the tiny holes in the Visking tubing.

c. Explain what had happened in the second experiment?

The sucrose molecules are too large to pass through the pores. However the water molecules are sufficiently small, and as there is a lower concentration of water molecules in the sucrose solution the water passes through the pores in the membrane by a special form of diffusion called osmosis.

d. They thought they would carry out an enquiry to find out what would happen if they changed the concentration of sugar. They changed their apparatus. This is a drawing from the research log of one of the researchers.



i. What would be the independent variable?

Concentration of sucrose solution

ii. How would they change it to see a pattern in their results?

Produce a range of concentrations at regular intervals such as 10%, 20% and 30%

iii. What would they measure?

The increase in the height of the water in the tube

iv. How would they ensure their measurements are precise?

They could use callipers or certainly measure using a rule with millimetres

v. What variables would they control?

The size of the Visking tubing

The volume of solution in the Visking tubing

The volume of water in the beaker

The type of water

The time they ran the test or frequency of measurements

vi. What would you predict will happen?

The greater the concentration of sucrose the higher the solution would move up the tube (the greater the volume of water entering the Visking tubing)

vii. Explain your prediction

The higher concentration of sucrose would contain fewer molecules of water and so more water molecules would move from the beaker into the Visking by osmosis.

4. (20 minutes)

Read the information below and then answer the questions.

MRSA

MRSA bacteria are harmless on your skin. But if they get in through a cut they may cause a fatal infection. Doctors fight most infections with antibiotics. Different antibiotics target different bacteria. But antibiotics cannot kill every type of bacteria that make us ill. These bacteria are resistant. Over the years, more and more types of bacteria – like MRSA – have become resistant to antibiotics. Sometimes, the genes in bacteria change, or mutate. This happens naturally. Most mutations are not useful to bacteria, but occasionally they make bacteria resist antibiotics.

Sam has a throat infection. He takes antibiotic tablets. The antibiotic kills nearly all the bacteria. But a few bacteria – the resistant ones – survive. These bacteria reproduce rapidly. This is natural selection.

Bacteria are more likely to become resistant if:

- lots of people take antibiotics for minor illnesses
- if people don't finish all the tablets
- if doctors prescribe the wrong antibiotics.

Resistant strains of bacteria spread quickly from person to person. This is because no one is immune to the bacteria, and there is no treatment that works. Therefore scientists are trying to find and develop new antibiotics and antiseptics.

One possibility is Cockroach brain juice. These are two investigations that have been carried out.

Hypothesis: Cockroach brain juice could cut MRSA infections in humans because it contains substances that kill bacteria.

Investigation 1

- grow two types of bacteria on agar plates
- add cockroach brain juice and leave for two hours at 37 ºC.

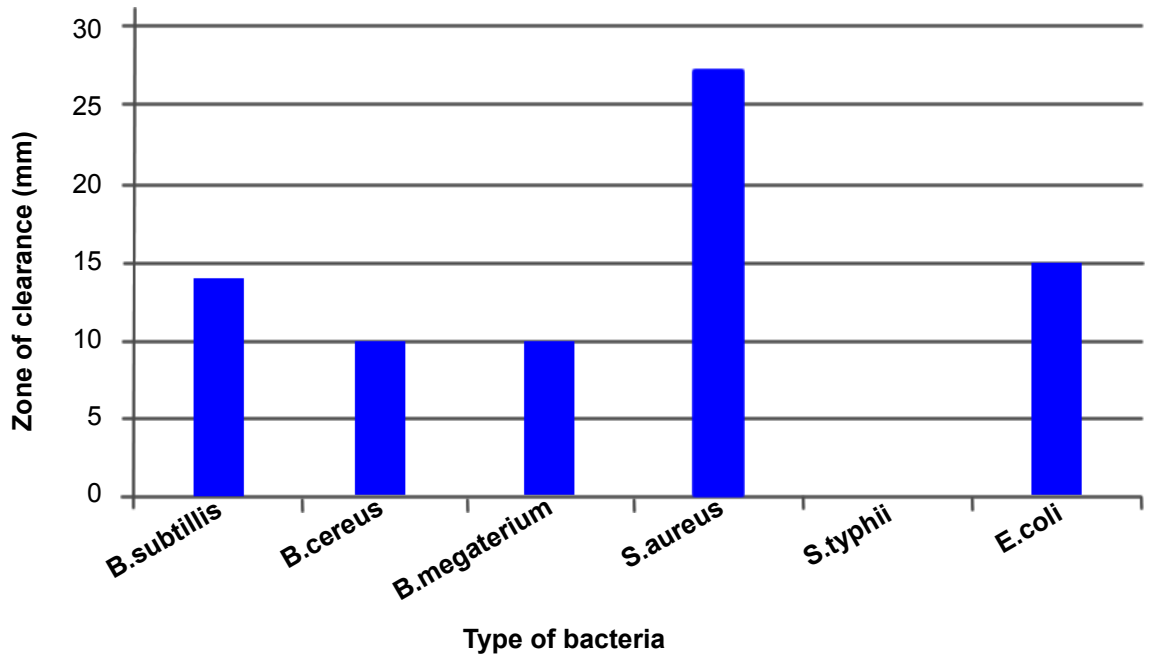
Type of bacteria	Percentage of bacteria killed
MRSA	More than 90
Escherichia coli	More than 90

If an antibiotic kills 90% of the bacteria, your body's immune system can kill the rest.

Investigation 2

- grow different types of bacteria on agar plates
- add cockroach juice and leave overnight at 37 ºC.

Results



The bigger the zone of clearance, the more bacteria are killed

a. What type of microorganism is MRSA?

- Virus
- Protozoan
- Bacterium ✓
- Yeast

b. What do doctors normally use to treat MRSA?

Antibiotics

c. What natural process causes resistance?

Mutation

d. How have they become resistant?

People take antibiotics for minor illnesses; if people don't finish all the tablets; if doctors prescribe the wrong antibiotics

e. Why do resistant strains of bacteria spread so quickly?

Because no one has immunity to the bacteria

f. Do the results of investigation 1 support the hypothesis? Explain your answer.

To a certain extent. It has shown that it killed the bacteria in an agar plate, but it would also have to be trialled in clinical conditions

g. Which bacteria does cockroach brain juice kill most?

S. aureus

h. Which bacteria are resistant to cockroach brain juice?

S. typhil

i. Do the results of investigation support the results of hypothesis? Explain your answer.

The juice has killed bacteria to a greater or lesser extent, although it did not test the effects on MRSA and the E.coli result was not the most successful. It did not kill any of the S.typhil

j. What do the researchers need to do to ensure the reliability of their results?

They need to repeat the investigations. They could check each other research by carrying out each others investigation using the same methodology to see if they get the same results

k. What would you need to know to be able to carry out the investigations?

You would need to know the complete methodology