Characteristics of living organisms:

- Movement: CHANGE IN LOCATION - WHOLE ORGANISM/LIMB
- RESPIRATION: Release of energy in organic molecules such as glucose using oxygen.
- Sensitivity: DETECT & RESPOND TO INTERNAL/EXTERNAL CONDITIONS/STIMULI
- GROWTH: An increase in mass due to larger or more numerous cells.
- Reproduction: INCREASE IN ORGANISM NUMBER/PRODUCTION OF OFFSPRING
- Excretion: REMOVAL OF WASTE METABOLIC PRODUCTS
- Nutrition: OBTAINING ORGANIC MATERIAL
- GROWTH: maintaining the bodies internal conditions at a constant and appropriate level.

Classification:

Modern classification classifies organisms depending upon their structure and FUNCTION

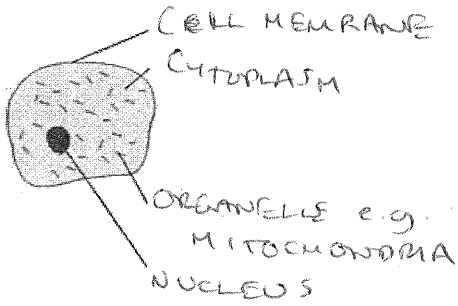
Organisms are classified using the following system (Taxa):-

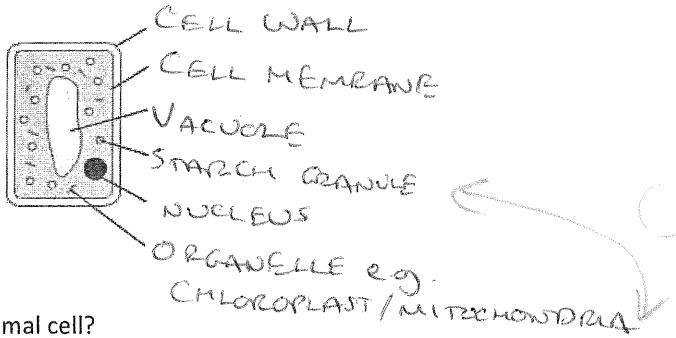
Kingdom, PHYLUM, CLASS, ORDER, Family, GENUS, SPECIES. The following: **panthera leo** is the incorrect way of representing the Latin name of a lion:

The correct way is: Panthera leo

Variety of living organisms:

Label the diagram of the animal and plant cells below:

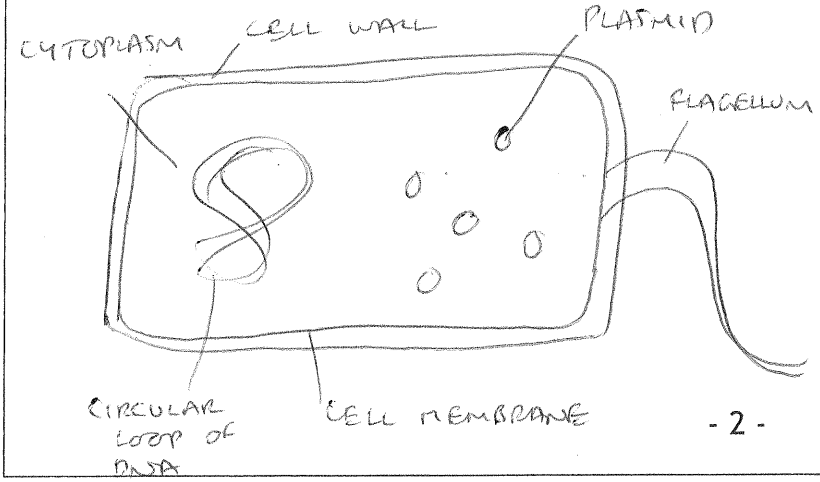


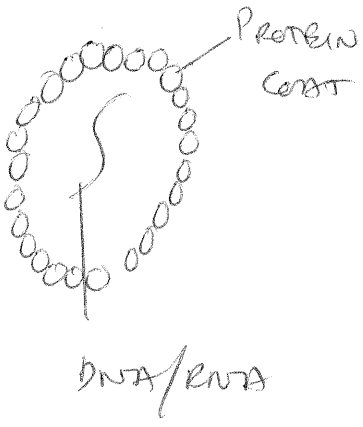


How might a cell of a fungus differ from that of an animal cell?

Cell wall (fungus)

Draw and label a diagram of a typical virus and bacterium:





Plants: These are multicellular organisms; they contain chloroplasts and are able to carry out Photosynthesis; they have cellulose cell walls; they store carbohydrates as Starch or sucrose. Examples include Flowering plants, such as a cereal (e.g. maize) and herbaceous legumes (e.g. peas or beans).

Animals: These are Multicellular organisms; they do not contain chloroplasts and are not able to carry out photosynthesis; they have no cell walls; they usually have Nerves coordination and are able to move from one place to another; they often store carbohydrate as Glycogen Examples include mammals (e.g. humans) and Insects (e.g. housefly).

Fungi: These are organisms that are Not able to carry out photosynthesis; their body is usually organised into a Mycelium made from thread like structures called Hyphae, which contain many nuclei. Some examples are single-celled; they have cell walls made of Chitin; they feed by extracellular secretion of digestive enzymes onto food material and absorption of the organic products; this is known as Saprotrophic nutrition; they may store carbohydrate as glycogen. Examples include *Mucor*, which has the typical fungal hyphal structure, and Yeast which is single-celled.

Bacteria: These are microscopic single celled organisms; they have a simple cell structure that lacks a Nucleus, but contains a circular chromosome of DNA; some bacteria can carry out photosynthesis but most feed off other living or dead organisms. Examples include *Lactobacillus bulgaricus*, a rod shaped bacterium used in the production of Yoghurt from milk, and *Pneumococcus*, a spherical bacterium that acts as the pathogen causing pneumonia.

Protoctists: These are microscopic Single-celled organisms. Some, like *Amoeba,* that live in pond water, have features like an animal cell, while others, like *Chlorella,* have Chloroplasts and are more like plants. A pathogenic example is Plasmodium, responsible for causing malaria.

Viruses: These are small particles, smaller than bacteria; they are parasitic and can only Reproduce inside living cells; they infect every type of living organism. They have a wide variety of shapes and sizes; they have no cellular structure but have a protein coat and contain one type of nucleic acid, either DNA or RNA. Examples include the Tobacco Mosaic Virus that causes discolouring of the leaves of tobacco plants by preventing the formation of chloroplasts, and the influenza virus that causes Flu in humans.

A Pathogen is a disease causing organism; such organisms may be: bacteria, Fungi, Viruses or protoctists

Cell structures

- NUCLEUS: Contains chromosomes which carry the genetic information to control the activity of the cell
- Cytoplasm: SITE OF MANY CELLULAR REACTIONS
- MEMBRANE: Selectively permeable layer controlling the entry and exit of substances in to/out of the cell
- Cell wall: Freely permeable layer that enables the vacuole to push outward upon it to give the cell structure.
- Chloroplast: SITE OF PHOTOSYNTHESIS
- VACUOLE: Contains cell sap, a store of dissolved sugars and solutes.

Levels of organisation:

- Cells e.g. ERYTHROCYTE, SPERM, PALISADE MESOPHYLL
- Tissue e.g. GLANDS (PLANTS), MUSCLE
- ORGAN e.g. heart, lung
- Organ system e.g. REPRODUCTIVE; CIRCULATORY
- Organism

Movement into and out of a cell:

Give a simple definition of the following:

Diffusion:

PASSIVE. PARTICLES MOVE FROM HIGH → LOW CONCENTRATION

Osmosis:

MOVEMENT (NET) OF WATER MOLECULES FROM A DILUTE (HIGH WATER POTENTIAL) TO CONCENTRATED (LOW WATER POTENTIAL) SOLUTION THROUGH PARTIALLY PERMEABLE MEMBRANE. PASSIVE

Active transport:

REQUIRES ENERGY AGAINST CONCENTRATION GRADIENT THROUGH MEMBRANE PROTEINS

An e.g. of diffusion is the net movement of CO_2 OUT of a cell down the CONCENTRATION gradient. Diffusion is a slow process and is sped up by increasing the SURFACE AREA of the structure, e.g. alveoli in the lungs. By increasing the CONCENTRATION gradient, diffusion is also quicker. Higher temperatures also increase the rate of diffusion, this is because diffusion, relies on the KINETIC energy of the particles, which causes them to move. A higher temperature will INCREASE this energy causing more rapid diffusion.

The pumps for active transport are made of protein and are located in the cells membrane. An example of this is the absorption of glucose in the small intestine and the uptake of some ions by plant roots.

Osmosis is important in moving water from cell to cell across the cortex of a plant Roots. If plant loses too much water by osmosis, the cell vacuole will shrink and cause the cell membrane to pull away from the cell wall. Water is therefore needed to provide a turgor pressure to support the plant. If this is reduced the cell is said to be flaccid or plasmolysed

If a piece of visking tubing (which is partially permeable), containing a strong sucrose solution, were placed in some distilled water, the net movement of water would be into the visking tubing causing the volume of liquid in the tubing to go up.

Biological Molecules:

There are five main biological molecules:

- Carbohydrates
- Proteins
- Lipids (Fats & Oils)
- Nucleic acids (DNA &RNA)
- Water (N.B. Not organic does not contain carbon atoms)

The following elements are commonly found in biological molecules:

- Carbon – found in: carbohydrates, proteins, lipids and nucleic acids.
- Hydrogen – found in: all 4 above
- Oxygen – found in: all 4 above
- Nitrogen – found in: proteins & nucleic acids

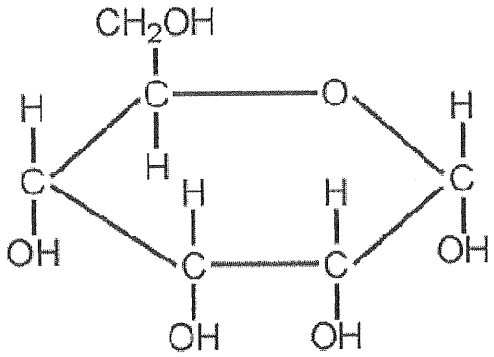
In addition biological molecules contain small amounts of other elements such as: iron, sulphur and phosphorous.

Most biological molecules are complex and are known as **polymers** i.e. they are made up of repeated subunits called monomers. The following section deals with the structure of these polymers:

<u>Carbohydrate:</u>

The monomer subunits of carbohydrates are known as monosaccharides, such as Glucose, fructose and ribose

The structure of glucose is shown below (you do not need to known this):



Glucose molecules can join together to form a polysaccharide such as STARCH in plants and GLYCOGEN in animals. These molecules can be stored. Carbohydrates act as an important energy source.

Protein:

Protein molecules are made up of AMINO ACIDS, of which there are 20 different types. Again these join together to form a structure known as a polypeptide. This 'folds' into a 3D shape, known as a protein. Many important structures are made of protein, such as enzymes, HORMONES and ANTIBODIES.

Fats:

There are two important subunits in fats: GLYCERIN and FATTY ACIDS

In most fats, three fatty acids join (bond) to one glycerol molecule to form a TRIGLYCERIDE. Fats have many functions such as:

1. ENERGY STORAGE
2. INSULATION
3. ORGAN PROTECTION
4. BUOYANCY

Testing for these molecules:

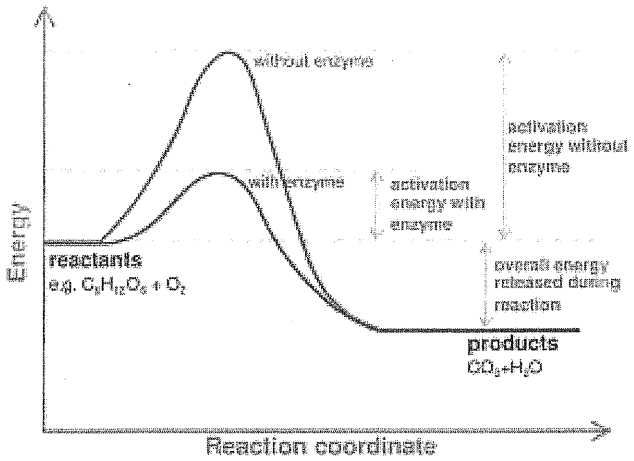
You will need to know how to test for these molecules.

Starch: To test for starch add a small amount of IODINE SOLUTION to the substance in question. If a BLUE/BLACK colour appears, starch is present. This test will only tell you if starch is PRESENT not the AMOUNT of starch.

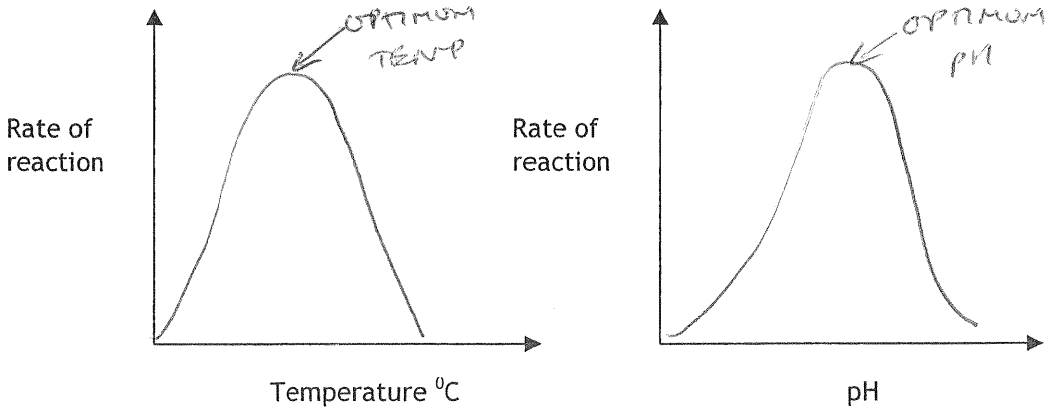
Glucose: The test for glucose is slightly more complicated. To test you must add BENEDICT'S reagent to your sample and then HEAT it. If glucose is present it will convert the Cu^{2+} ions in the reagent to Cu^{+}, as glucose and all other monosaccharides are reducing sugars. This causes a colour change from blue to BRICK RED. This test is QUANTITATIVE and so can give an indication of the amount of glucose (sugar) present.

Enzymes:

Enzymes are known as Biological catalysts as they speed up chemical reactions. They do this by reducing the energy needed for the reaction to proceed. This is known as the Activation energy. The following graph shows this:



Enzymes have a specific 3D protein structure. The molecule involved in the reaction (known as the substrate) binds to the enzyme at a special region known as the Active Site. Many factors affect the ability of enzymes such as pH and Temperature.
High temperature and extremes of pH disrupt the shape of the molecule so that the substrate can no longer bind to the enzyme. This is known as Denaturation. Use the following axes to draw a graph to show the effect of temperature and pH on the activity of enzymes:



An enzyme example:

The enzyme Catalase is found in almost all biological tissue, e.g. spinach, potato, yeasts and liver. It is very important as it helps to break down Hydrogen Peroxide (H_2O_2) into water and oxygen gas. Hydrogen peroxide is produced in small quantities during respiration and is toxic.

Use this information (plus a little research) to plan an investigation into the effect of temperature on the activity of Catalase enzyme. **(N.B. C O R M S)**

C - COMPARE THE DECOMPOSITION OF H_2O_2 BY CATALASE AT 0, 10, 20, 30, 40, 50, 60 °C

O - LIVER IS SOURCE OF CATALASE

R - REPEAT AT LEAST 3 TIMES

M - MEASURE THE AMOUNT OF O_2 GIVEN OFF, OVER 2 MINUTES

S - KEEP VOLUMES, PH, TIMINGS SAME FOR EACH TEST

Respiration

This process transfers chemical energy in food into a usable chemical form as ATP, in all cells. There are two main types of respiration:-

- ✓ AEROBIC (With oxygen). Under the word equation below, write the balanced chemical equation:

Glucose + oxygen → Carbon dioxide + water + 'ENERGY'

$C_6H_{12}O_6$ + $6O_2$ → $6CO_2$ + $6H_2O$ + 'ENERGY'

This form of respiration is used most of the time when oxygen is readily available, for example when you are sleeping or doing a long run.

- ✓ ANAEROBIC (Without oxygen). This process can differ between organisms:
  - Animals: GLUCOSE → LACTIC ACID + 'ENERGY'
  - Plants: GLUCOSE → ETHANOL + CARBON DIOXIDE + 'ENERGY'

This is used when oxygen is not readily available, for example when you are SPRINTING

The products of this process eventually build up to a level which forces you to stop exercising so intensely. After this, you must repay the oxygen DEBT, to do this you continue to breathe deeply and rapidly after the end of exercise.

Testing for products of respiration:

Hydrogen Carbonate Indicator is usually red but turns YELLOW in acidic conditions and PURPLE in more alkaline solutions. If CO_2 gas were being produced by respiration, it should turn YELLOW, as it produces an ACID . N.B. Carbon dioxide is a non-metal oxide which dissolves in water to produce acidic solutions e.g. SO_2, NO_2.

Limewater is also used to test for the presence of the CO2, as the solution turns CLOUDY

Therefore by passing the gases released from respiring organisms into a solution of hydrogen carbonate indicator we can test for the release of CO_2.

How could you test to determine if respiration also produces heat?

RESPIRING SEEDS (GERMINATING) - IN THERMOS FLASK; RECORD TEMPERATURE OVER 4 DAYS. COMPARE TO BOILED (DEAD) SEEDS & BOILED/STERILISED SEEDS.

IGCSE questions.

May 2006

1. The following terms are used to describe how substances move into or out of cells.

- Active transport
- Diffusion
- Osmosis

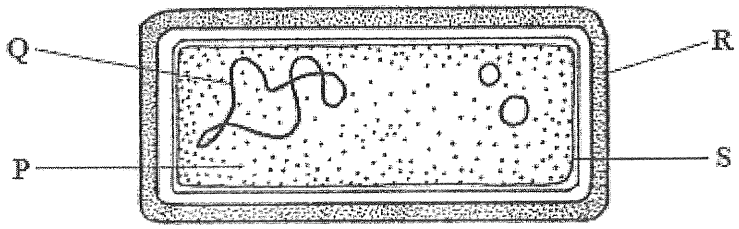
Choose the correct term to complete each sentence below.

Gas exchange in the lungs occurs by: .....

Water absorption by root hair cells occurs by: .....

The absorption of mineral ions from the soil, using energy, occurs by: .....

2. (a) The diagram shows a typical bacterium. Name the parts labelled **P**, **Q**, **R** and **S**.



P.....

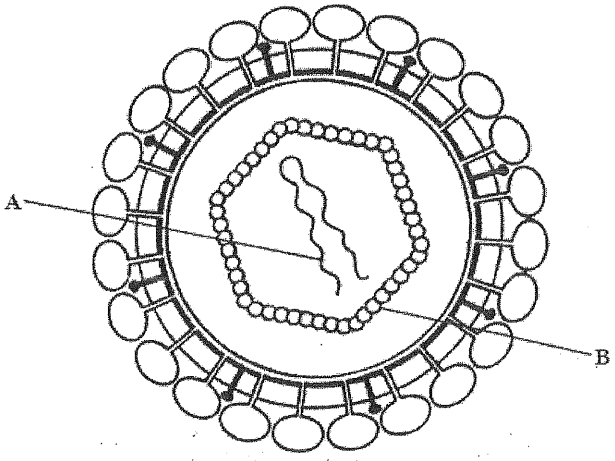
Q.....

R.....

S.....

(4)

3. The diagram shows a virus.



(a) Name the parts labelled **A** and **B**.

A: .....

B: ..... **(2)**

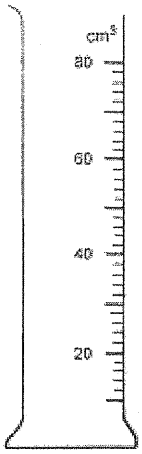
(b) Where do viruses reproduce?

.....**(1)**

(c) Give **one** example of a virus.

.....**(1)**

4. A student wanted to find out how change in temperature affected the rate of carbon dioxide production by yeast during anaerobic respiration. He used the apparatus below to measure 30 cm^3 of a glucose solution.



(a)

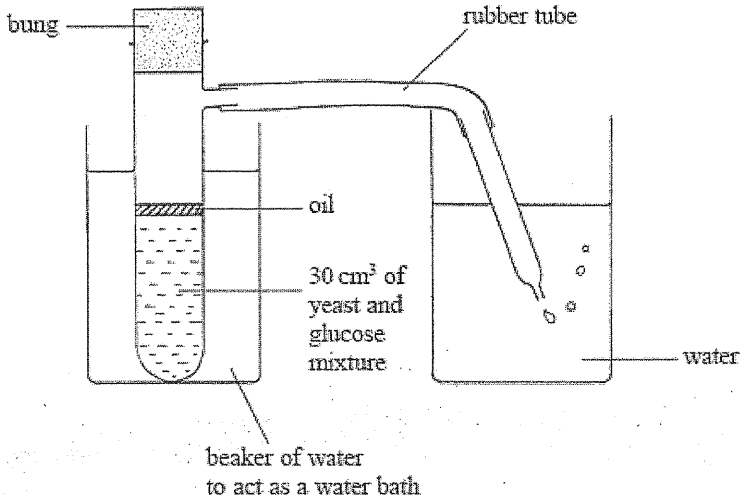
(i) What is the name of the piece of apparatus?

.....**(1)**

(ii) Draw a line on the apparatus to show a volume of 30 cm^3.

..... **(1)**

(b) Yeast was added to the 30 cm^3 of glucose solution. The apparatus below was then set up to measure the carbon dioxide production.



(i) Suggest why a layer of oil was put on the top of the yeast and glucose mixture.

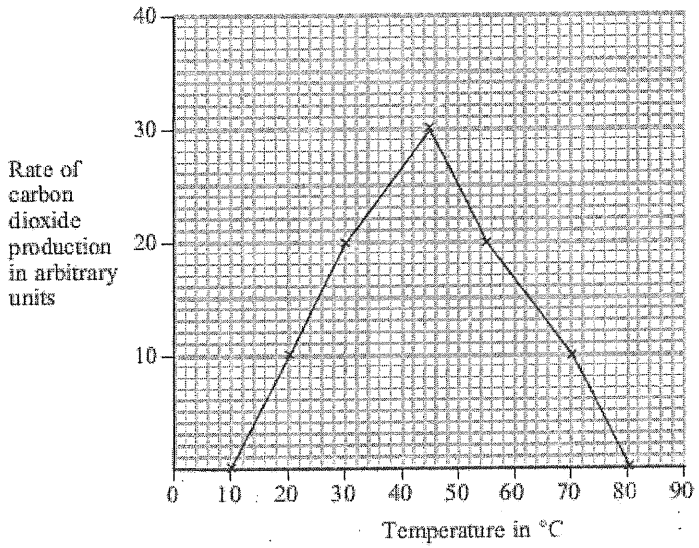
.....**(1)**

(ii) Describe how this apparatus could be used to measure the rate of carbon dioxide production at any temperature.

.....

..... **(2)**

(c) To measure the rate of carbon dioxide production at different temperatures, the apparatus was put into a water bath that could be set up at different temperatures. The results are shown on the graph.



c (i) Describe how the rate of carbon dioxide production changed with temperature, as shown by the graph.

.....

.....

.....

.....

..... **(3)**

c(ii) It is known that enzymes in yeast break down glucose and release carbon dioxide during anaerobic respiration. Use your biological knowledge to explain the results shown on the graph.

.....

.....

.....

.....

..... **(3)**

(d) Suggest how the students could extend and improve this investigation to obtain a more accurate idea of the temperature, that produces the most carbon dioxide gas.

.....

.....

..... **(2)**

Nov. 05

5. Living organisms can be put into major groups based on common features that they share. The table below shows some main groups of organisms, some of their features and some examples of each. Complete the table to show the correct groups, **two** features of each group and **one** example of an organism in each group.

Group	Features	Example
animals	1 multicellular 2 do not contain chloroplasts	
bacteria	1 2	
	1 parasitic 2 only reproduce inside living cells	tobacco mosaic

6. Asha wanted to test some foods.

Her teacher told her the following reagents were available.

Biuret	Benedict's	ethanol	iodine

(a) Choose the reagent Asha should use, to test foods for starch.

.....**(1)**

(b) Asha used the table below to show her results. Complete the table by writing the colour change she obtained for each food.**(2)**

Food	Colour obtained	Starch present
bread		yes
milk		no

(c) Asha decided to test her foods for glucose.

(i) Describe the test she would do.

.....

.....

..... **(2)**

(ii) What result would she see if glucose was present?

..... **(1)**

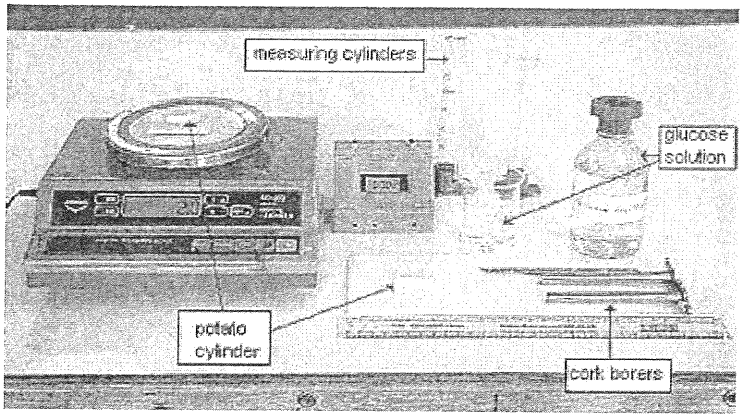
(iii) Suggest how she might use the results to say how much glucose was present.

.....

..... **(1)**

7. Water can move into or out of potato tissue by osmosis.

The photograph shows some apparatus that could be used to investigate how the concentration of glucose solution affects this movement of water.



Plan an experiment which could investigate how the concentration of glucose solution affects this movement of water. **(N.B. C O R M S).**

.....

.....

.....

.....

.....

.....

.....

.....

..... **(6)**

Revision booklet 1 answers

1. diffusion;
osmosis;
active transport; 3

Total 3 marks

2.
P - cytoplasm;
Q - nucleoid / DNA / chromosome / genetic material;
R - cell wall / (slime) capsule / slime layer;
S - (cell) membrane;

3. (a) A - DNA / RNA / genetic material / gene;
B - protein (coat) / capsid; 2

(b) inside cells / host / organisms / bacteria; 1

(c) influenza / HIV / measles / other correct virus; 1

Total 4 marks

4. (a) (i) measuring cylinder; 1
(ii) correct line; 1

(b) (i) stop oxygen or air (**NOT** gas) getting in / keeps anaerobic; 1
(ii) count bubbles / amount of bubbles / volume of gas;
reference to time; → needed to calc rate. max
method for changing temperature of water bath; 2

(c) (i) increases;
peak / optimum / 45°C;
decreases; 3
(ii) molecules move slower at low temps / low kinetic energy / few collisions;
optimum temperature /eq;
enzymes denatured / destroyed by high temperatures; 3

(d) smaller range / more readings; **NOT** repeats
above and below or around 45°C / optimum temperature; 2

Total 13 marks

5.

		human / eq;
	single celled; lack nucleus;	Lactobacillus / eq;
virus;		

(5)

Total 5 marks

6.

(a) iodine; (1)

(b) blue black;
brown / yellow / eq; (2)

(c) (i) Benedict's;
heat; (2)
(ii) brick red / eq; (1)
(iii) time taken to go red / degree of redness; (1)

Total 7 marks

7.

C + and - glucose / range of glucose solutions;
use of measuring cylinder to obtain range;
O same size potato used / same cork borer;
R several pieces used in each solution;
M mass;
before and after;
S same time in solutions;
dried before measuring;
max (6)

Total 6 marks