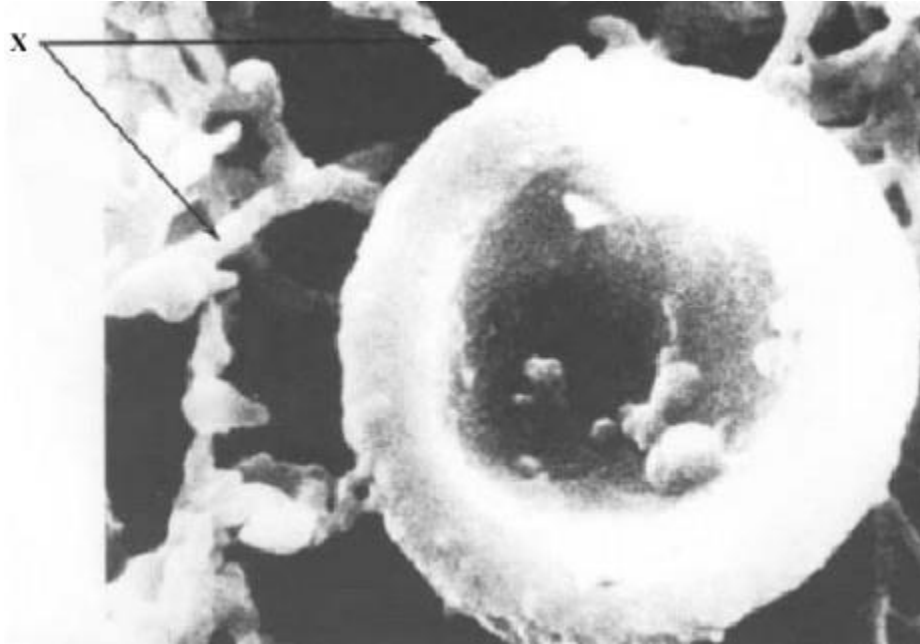**1** The photograph shows a red blood cell in part of a blood clot. The fibres labelled **X** are produced in the early stages of the clotting process.

(a) Suggest how the fibres labelled **X** help in blood clot formation.

_____

(1)

(b) The average diameter of a real red blood cell is 0.008 millimetres.
On the photograph, the diameter of the red blood cell is 100 millimetres.

Use the formula to calculate the magnification of the photograph.

Diameter on photograph = Real diameter × Magnification

_____

_____

_____

Magnification = _____

(2)

(c) Some blood capillaries have an internal diameter of approximately 0.01 millimetres.

(i) Use information given in part (b) to explain why only one red blood cell at a time can pass through a capillary.

_____

(1)

(ii)   Explain the advantages of red blood cells passing through a capillary one at a time.

_____

_____

_____

_____

_____

_____

(3)

(Total 7 marks)

2   (a)   How many pairs of chromosomes are there in a body cell of a human baby?

_____

(1)

(b)   Place the following in order of size, **starting with the smallest,** by writing
numbers **1 – 4** in the boxes underneath the words.

chromosome   nucleus   gene   cell

[ ]   [ ]   [ ]   [ ]

(1)

(c)   For a baby to grow, its cells must develop in a number of ways.

Explain how each of the following is part of the growth process of a baby.

(i)   Cell enlargement

_____

(1)

(ii)   The process of cell division by mitosis

_____

_____

_____

_____

_____

_____

(3)

(d)   Why is cell specialisation (differentiation) important for the development and growth of a
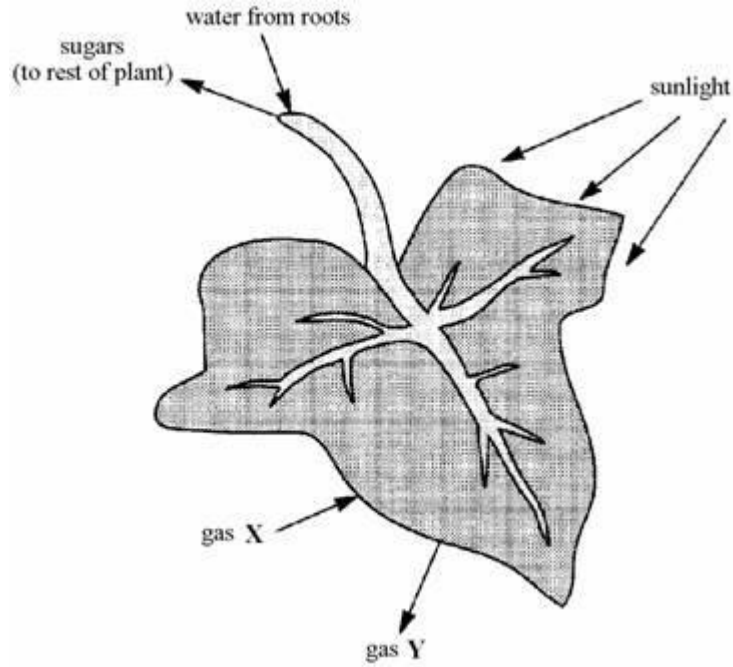   healthy baby from a fertilised egg?

_____

_____

(2)
(Total 8 marks)

3   The diagram shows a plant leaf during photosynthesis.

(a)   Name:

       (i)   gas **X**; _____

       (ii)   gas **Y**. _____

(2)

(b)   Why is sunlight necessary for photosynthesis?

_____

_____

(1)

(c)   Some of the sugars produced by photosynthesis are stored as starch in the roots.
Explain, as fully as you can, why it is an advantage to the plant to store carbohydrate as
starch rather than as sugar.

_____

_____

_____

_____

_____

_____

(3)
(Total 6 marks)

4   Plants need chemical energy for respiration and for active transport.

(i)   Write a balanced chemical equation which represents the process of respiration in plants.

_____

(2)

(ii)   Describe the process of active transport in the root hair cells of plants.

_____

_____

_____

_____

_____

_____

_____

_____

_____

(3)
(Total 5 marks)

5 Plant roots obtain some of their mineral salts from the soil by active transport.

What is involved in *active transport*?
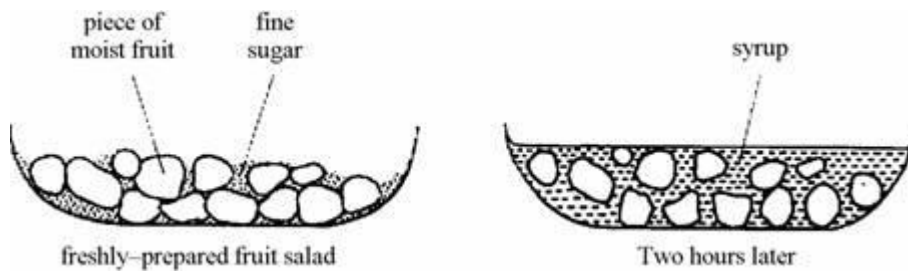
_____

_____

_____

_____

_____

_____

_____

_____

(Total 4 marks)

6 A cook prepares a fresh fruit salad by cutting up a variety of fruits and placing them in a bowl with layers of sugar in between. After two hours the fruit is surrounded by syrup (concentrated sugar solution).

Explain, as fully as you can, why syrup (concentrated sugar solution) was produced after two hours.

_____

_____

_____

_____
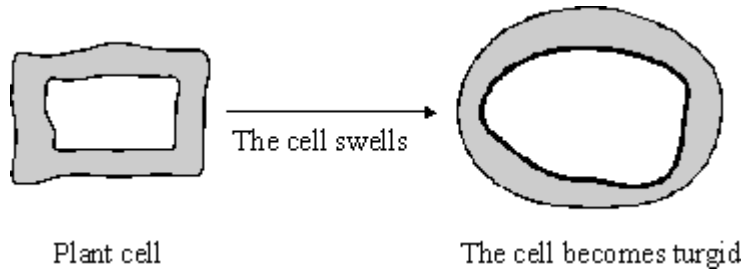
_____

_____

(Total 4 marks)

7　(a)　The diagrams show what happens to the shape of a plant cell placed in distilled water.

The cell swells

Plant cell　　　　The cell becomes turgid

(i)　Explain why the cell swells and becomes turgid. Name the process involved.

_____

_____

_____

(2)

(ii)　Give **one** feature of the cell wall which allows the cell to become turgid.

_____

(1)

(b)　Describe the change which will occur if a piece of peeled potato is placed in a concentrated sugar solution and explain why this change occurs.

_____

_____

_____

_____

_____

_____

(3)
(Total 6 marks)

8 The diagram shows how an immature egg could be used either to produce cells to treat some human diseases or to produce a baby.

Immature egg extracted from ovary

Egg treated chemically so that it starts to divide

Blastocyst – a group of about 100 cells

Cells used to treat some human diseases

Blastocyst could be implanted into the mother's womb. She would later give birth

Scientists may be allowed to use this technique to produce cells to treat some human diseases, but not to produce babies.

Using information from the diagram, suggest an explanation for this.

_____
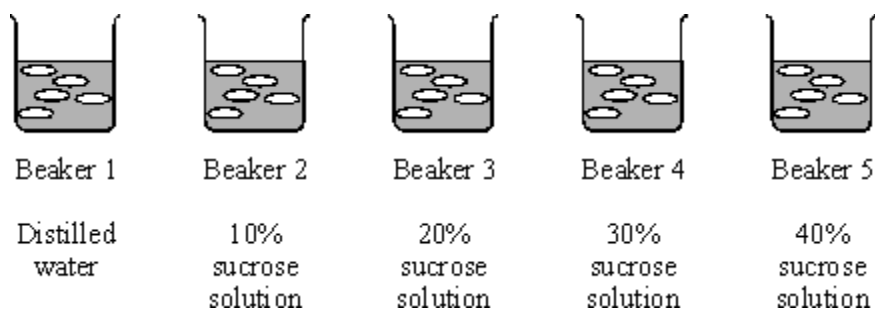
_____

_____

_____

_____

_____

_____

_____

_____

(Total 4 marks)

9 Some students set up an experiment using osmosis to find the concentration of sucrose solution in potato cell sap. They used discs of potato cut to the same size and weighing approximately 10 gms. The discs were put into each of five beakers.

Beaker 1	Beaker 2	Beaker 3	Beaker 4	Beaker 5
Distilled water	10% sucrose solution	20% sucrose solution	30% sucrose solution	40% sucrose solution

(a) (i) After two hours they reweighed the discs after carefully blotting them first. Why did the students blot the potato before weighing it?

_____

_____

(1)

(ii) Their results are shown in the table below.

|	**Beaker 1**	**Beaker 2**	**Beaker 3**	**Beaker 4**	**Beaker 5**
Final mass in g	13.0	12.2	9.0	7.9	7.3
Initial mass in g	10.0	10.6	10.0	10.1	10.4

The students calculated the % gain or loss in mass of potato. Complete this table of results for Beakers 2, 4 and 5.

Beaker 1	**Beaker 2**	**Beaker 3**	**Beaker 4**	**Beaker 5**
$13 - 10.0 = 3.0$ $\frac{3.0}{10.0} \times 100\% = 30\%$		$9.0 - 10.0 = -1.0$ $\frac{-1.0}{10.0} \times 100\% = -10\%$		
Gain in mass = 30%		Loss in mass = 10%		

(3)

(b)　(i)　Draw a graph of % Gain or Loss in mass against sucrose concentration.
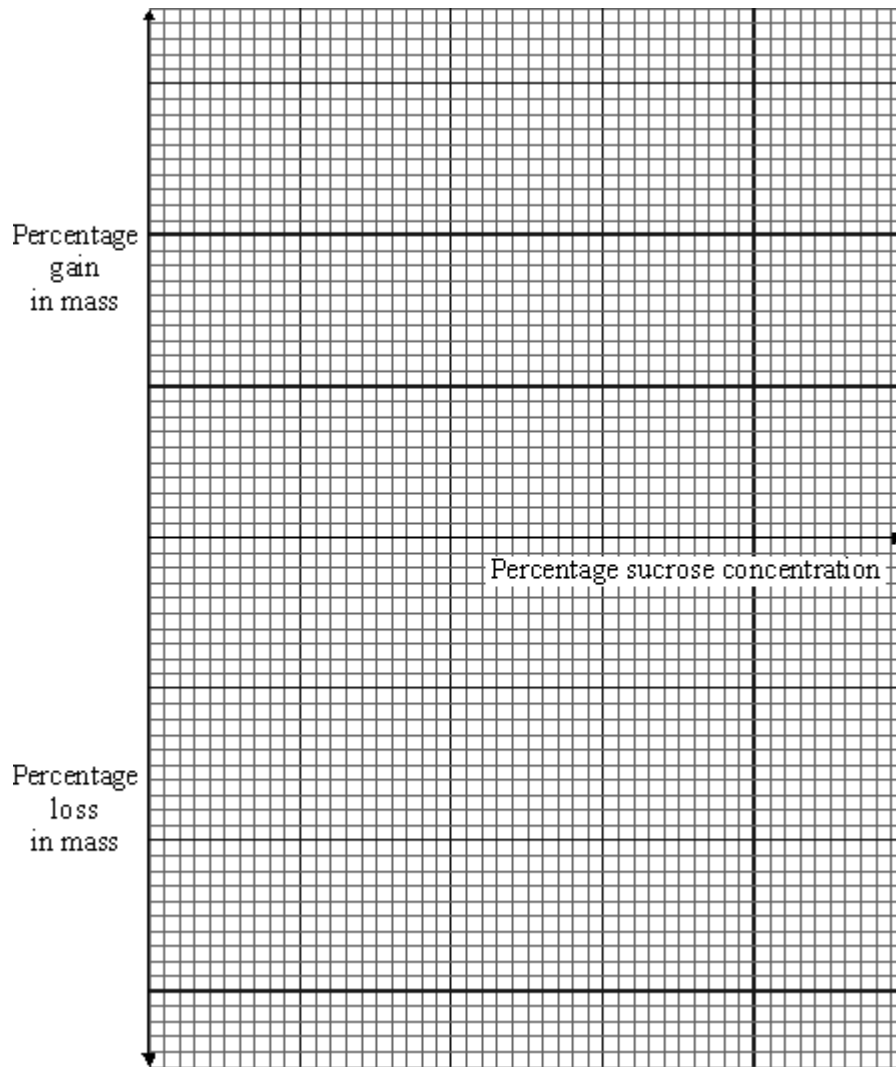
(3)

(ii)　Use the graph to find the concentration of potato cell sap.

Concentration of cell sap =_____% sucrose solution

(1)

(iii)　Explain in terms of osmosis how you chose this value.

_____

_____

_____

(2)
(Total 10 marks)

10 The table shows the concentrations of some mineral ions in the cells of a pond plant and in the surrounding pond water.

	Concentration in mmol per dm³		
	Potassium	**Calcium**	**Sulphate**
Plant cells	49.0	7.0	7.0
Pond water	0.5	0.7	0.4

(i) The plant cells would not have been able to absorb these mineral ions from the pond water by diffusion. Explain why not.

_____

_____

(2)

(ii) Suggest a process which would allow these ions to be absorbed from the pond water by the plant cells.

_____

(1)
(Total 3 marks)

Mark schemes

1   (a)   hold <u>cells</u> together **or** prevent flow of <u>cells</u> **or** trap <u>cells</u>

1

     (b)   12500

             if correct answer, ignore working / lack of working

$$\frac{100}{0.008}$$ *for **1** mark*

             ignore any units

2

     (c)   (i)   size RBC approximately same size capillary **or**
                 no room for more than one cell **or**
                 <u>only</u> one can fit **or**
                 RBC is <u>too</u> big

                    allow use of numbers
                    *do **not** accept capillaries are narrow*

1

          (ii)   more oxygen released (to tissues) **or**
                more oxygen taken up (from lungs)

1

              and any **two** from:

- slows flow **or** more time available

- shorter distance (for exchange) **or** close to cells / capillary wall

- more surface area exposed

2

[7]

2   (a)   23

1

     (b)   chromosome   nucleus   gene   cell
                2   3   1   4

1

     (c)   (i)   any **one** from

                 (cells which are bigger) take up more space

                 (cells) have to get bigger **or** mature to divide

1

(ii) chromosomes duplicate **or**
make exact copies of self

accept forms pairs of chromatids

1

nuclei divide

*accept chromatids **or**
chromosomes separate*

1

identical (daughter) cells formed

*accept for example, skin cells make
more skin cells **or** cells are clones*

1

(d) any **two** from

Differentiation mark
babies need **or** are made of different types of cells **or** cells that have
different functions

*accept different cells are needed
for different organs*

Division or specialisation mark
as fertilised egg starts to divide each cell specialises to form a part of the body

*accept specialised cells make
different parts of the body*

Growth mark
specialised cells undergo mitosis to grow further cells

*accept cells divide **or** reproduce
to form identical cells*

2

[8]

3 (a) (i) carbon dioxide / CO_2 (*reject* CO)

(ii) oxygen / O_2 / O (water vapour neutral)

for 1 mark each

2

(b) (provides) energy

for one mark

1

(c) starch insoluble therefore water not taken in by osmosis
or
sugar is soluble / has small molecules may diffuse out therefore lost
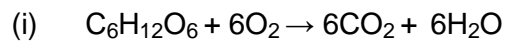
*(*ignore *ref. to cells bursting)*

or
starch has large molecules
cannot diffuse therefore retained

for 1 mark each

3

[6]

4 (i) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

energy is neutral

1

formulae all correct

with no omissions / deletions

correctly balanced

credit 1 mark if the answer is the exact
reverse of an incorrect answer for (a)

1

(ii) and **three** from

take up of (soluble) substances / ions against the concentration gradient

***or** when the concentration (of the*
substance / ions) is greater inside the
cell / cytoplasm than outside it

through the (semi-permeable) (cell) membrane energy from mitochondria

***or** energy from respiration*
not just energy

3

[5]

5 any **four** from

molecules / ions

do not credit mineral salts

move(d) through / across the cell

wall / membrane

against (a / the) concentration

gradient

by a series of chemical

reactions

(because) diffusion cannot occur

energy (required)

(supplied by) respiration

oxygen required for respiration (to occur)

[4]

6 *ideas that*
sugar has dissolved in moisture (on surface of fruit)
this solution more concentrated than solution inside fruit
osmosis / diffusion movement of water out of fruit
through partially permeable membrane (of fruit cells)

any four for 1 mark each

allow explanations in terms of concentrations of water molecules for full marks

[4]

7 (a) (i) water (molecules) enter(s) (the cell)

or water (molecules) pass(es) through the (semi-permeable) cell membrane

1

by osmosis

or because the concentration of water is
greater outside (the cell than inside it
the vacuole)
accept because of the concentration
gradient provided there is no contradiction

1

(ii) any **one** from

(it is) elastic

(it is) strong

(it is fully) permeable (to water)
or water can pass through it
do not credit semi-permeable
do not credit cell membrane is semi-permeable

1

(b) (the piece of) potato shrinks
or loses its turgor
or becomes flabby
or becomes flaccid
or plasmolysis occur
or cytoplasm pulls away from the cell wall

(because) concentration of sugar
or because concentration of water

1

(solution) is greater than concentration inside the cell / vacuole
inside the cell / vacuole is greater than concentration (of water)
outside

1

water is drawn out of the cell

1

[6]

8   any **four** from:

- cells used to treat diseases do not go on to produce a baby

- produces identical cells for research

- cells would not be rejected

- allow cells can form different types of cells

- (immature) egg contains only genetic information / DNA /
genes / chromosomes from mother **or** there is only one parent

- asexual / no mixing of genetic material / no sperm involved /
no fertilisation **or** chemical causes development

- baby is a clone

- reference to ethical / moral / religious issues
  > *allow ethically wrong*
  > **NB** <u>cloning</u> *is illegal gains* **2** *marks*
  > *ignore unnatural*

- risk of damage to the baby
  > *in correct context*

[4]

9   (a)   (i)   change in weight was due to changes <u>in</u> potato
or osmosis **or** not due to outside liquid
> *ignore 'to make fair test'*

1

(ii)   beaker 2 = 15.1(%) gain
> *allow 15%*

1

beaker 4 = 21.8(5) loss
> **not** *21.7*
> *allow –22%*
> *if no minus or no 'loss' check graph*

1

beaker 5 = 29.8(%) loss
> *allow –30%*

1

(b) (i) both axes correct values
and scales > ½ of each axis

ignore lack of minus signs on vertical axis

1

points correct
< ± ½ square

allow answers in (a)(ii)

1

line correct

allow curve of best fit which can miss 10, 15
***or** straight lines between points*
*do **not** allow <u>one</u> straight line or sketched line*
bar graph zero marks

1

(ii) point where line crosses axis (eg 15-16% sucrose)

allow point from candidate's graph (± 0.5%)

1

(iii) any **two** from:

looking for understanding that water in equilibrium

no change in mass

not **net** movement of water
or water entry and exit are equal

because sucrose solution same
concentration as cell sap **or** sucrose has
same water potential as cell contents

allow because the concentrations are the same (inside and out)

2

[10]

10 (i) in diffusion: material moves high to low concentration

1

here: concentration in cells > concentration in water **or**
uptake is against the concentration gradient **or** by diffusion ions would move out

1

(ii) active transport / active uptake

1

[3]