Cathkin High School

National 5 Biology

Unit 2: Multicellular Organisms Homework Booklet

Cells, Tissues and Organs

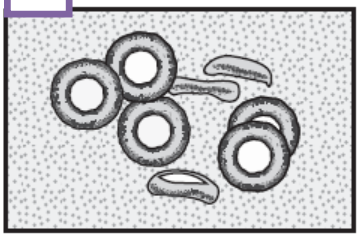
Homework Exercise 1

10

Q.1. Cells within the human body can be described as 'specialised', explain what this term means. (1)

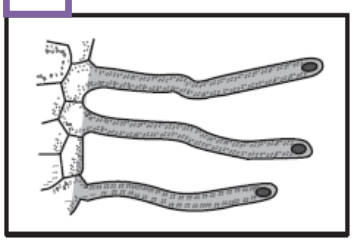
Q.2. The diagrams below contain examples of specialised cells.
Match each of the diagrams to the correct description of their function.

1



2

3



a Contracts to cause movement within animals

b Absorbs water and minerals from soil for the plant

c Carries oxygen around the body of mammals

(3)

Q.3. Explain why the heart is described as an organ and not as a tissue. (1)

Q.4. Organise the list of terms below into the table by placing them under the correct headings.

Sperm Eye Muscular Red Blood Root Nervous Egg Lung Liver

Cell	Tissue	Organ

(3)

Q.5. Give an example of a specialised cell and describe how it is specialised to carry out its function. (2)

Stem cells and Meristems

Homework Exercise 1

10

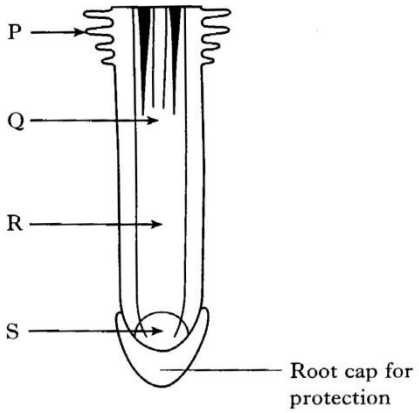
Q1. Which of the following statements correctly describes properties of stem cells?

1.	They are found in animals
2.	They produce non-specialised cells
3.	They are involved in growth and repair
4.	They are found in plants
5.	They produce specialised cells

(2)

Q.2. The diagram to the right shows a root from a plant.

Which letter shows the position of a meristem? (1)



Q.3. Complete the sentences below by underlining the correct word.

Meristems are {specialised/non-specialised} cells found in {animals/plants}.

The cells which are produced can become {one/many} type(s) of cell. (3)

Q.4. Complete the following sentences using words from the word bank. (4)

embryos	**tissues**	**muscles**	**injury**	**stem**
cells	**kidneys**	**many**	**organs**	

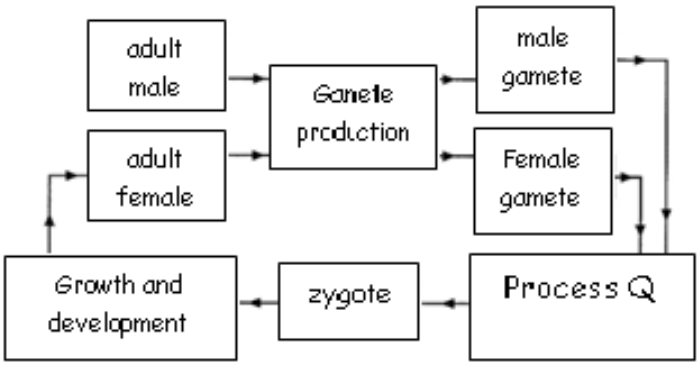
Stem cells are body cells with the ability to develop into _____ types of _____ that can be used in the body to treat disease or _____. Scientists hope that one day _____ cells will be used to grow new _____such as _____or spinal cords, as well as different types of tissues such as nerves and _____. Stem cells can be taken from _____which is very controversial; adult stem cells are a preferred alternative.

Reproduction
Homework Exercise 1

17

Q1 (a) State the name of the gametes produced by mammals and the site of their production. (2)

(b) The diagram below represents events in the human life cycle.

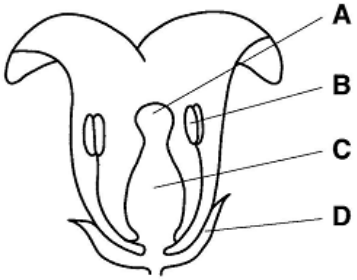


i) Name process Q and state the site of process Q in a mammal's body. (2)

ii) State the chromosome complement of the gametes and the resultant zygote. (2)

iv) If the number of chromosomes in a human cell is 46, how many should be present in a human gamete? (1)

Q2. The diagram below shows a section through a flower with various structures labelled by letters.



a. Copy and complete the table using letters from the diagram to identify the sites of the processes and name each structure.

Process	*Site (letter)*	*Name of Structure*
Production of male gametes		
Production of female gametes		

(2)

(b) Of which sex are the gametes present in a pollen grain? (1)

3. Describe how the male sex cells reach the female sex cells in

(i) Mammals (2)

(ii) Flowering plants (2)

4. Two samples of sperm from a human male were collected. The table gives the volumes of the samples and the number of sperm cells contained within each.

a) Copy and complete the table to show the number of sperm cells per millilitre for each sample.

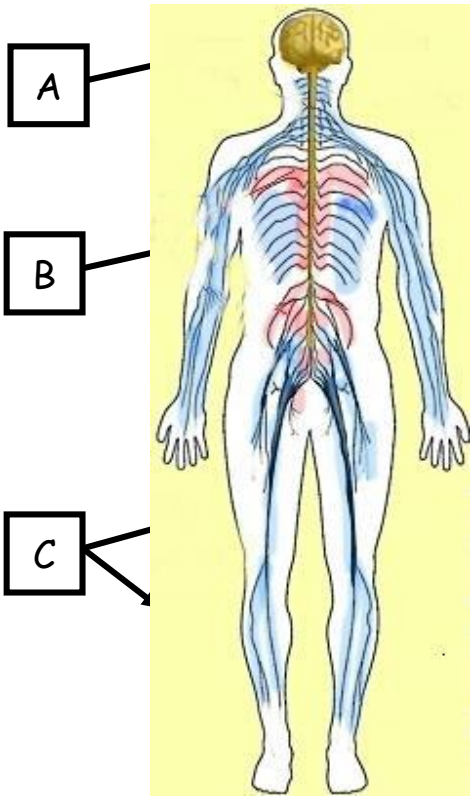
Volume of sample (ml)	Number of sperm cells (millions)	Number of sperm cells per ml (millions)
10	56	
13	89	

(2)

b) Calculate the average number of sperm cells produced per millilitre. (1)

Control and Communication
Homework Exercise 1

20



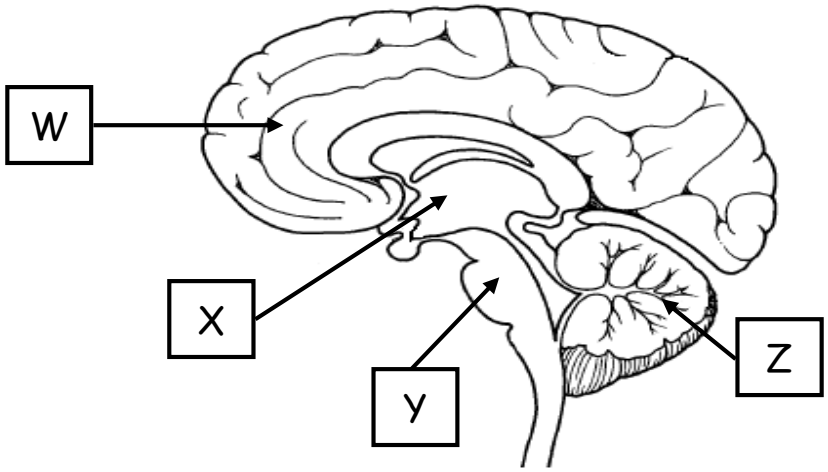
Q1. The diagram shows the human nervous system.

a. Name the parts labelled A, B and C on the diagram. (3)

b. Name the parts which make up the Central Nervous System. (1)

c. What is the function of the nerves? (1)

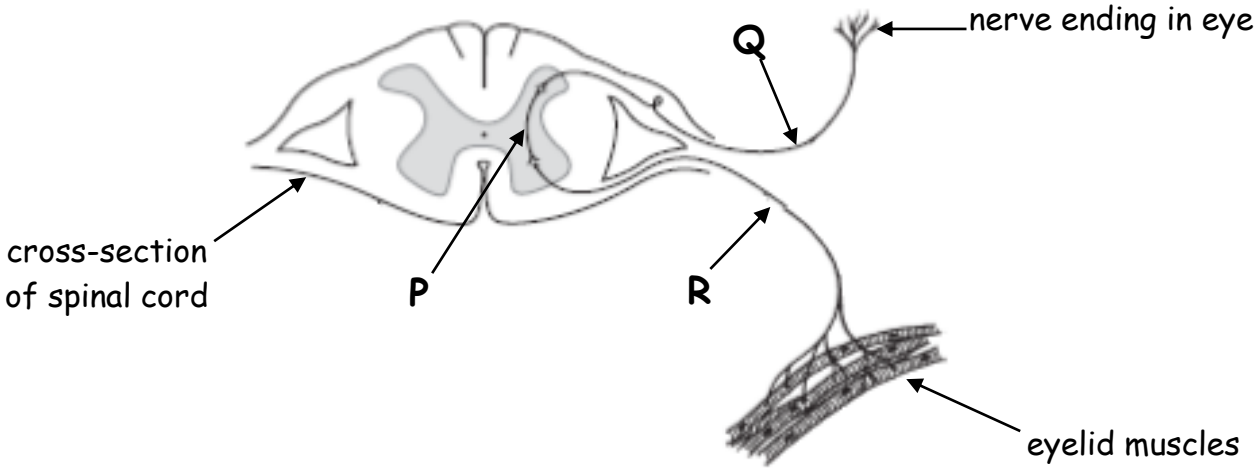
Q.2. The diagram below shows the structures within the human brain. Copy and complete the table to describe the correct labels, structures and functions.



Letter	*Structure*	*Function*
	Cerebrum	
X	Hypothalamus	
Y		Controls breathing and heart rate
Z		Controls balance and co-ordination of movement

(4)

Q.3. The diagram below represents a reflex arc.



a. Name neurones P, Q and R. (3)

b. Which labelled structure is the effector in this response? (1)

c. What is the function of a reflex action? (1)

d. Give an example of a reflex action. (1)

Q.4. A motor cyclist is put on a driving simulator and his reaction time is measured.
He has to apply the brakes on the simulator whenever he sees a red light.
His reaction time is measured as the thinking distance before he applies the brakes.
The table shows the results of his test over a period of time.

Trial Number	1	2	3	4	5	6	7	8	9	10
Thinking distance (m)	13.4	12.9	12.5	12.1	11.8	11.3	10.8	10.4	9.7	9.3

a. On a piece of graph paper, plot these results as a line graph. (2)

b. What conclusion can be drawn about the effect of practise on reaction time? (1)

c. Calculate the average reaction time (in metres) for this test. (1)

d. Which area of the brain is responsible for thinking about this question? (1)

Control and Communication
Homework Exercise 2

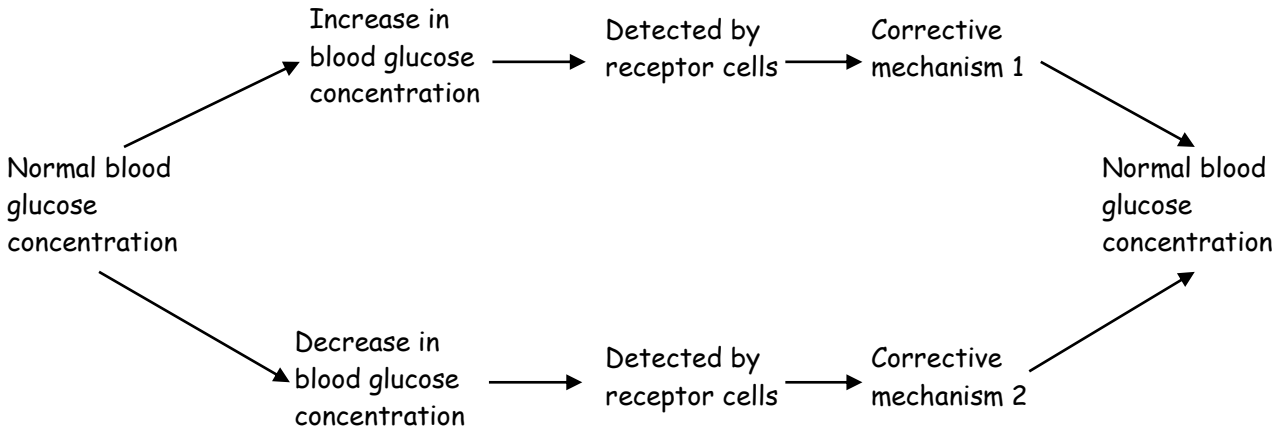
14

Q1. Name the type of gland which releases hormones into the bloodstream. (1)

Q.2. a. What is a hormone? (1)
b. What is the function of the receptors on the target tissues of a hormone? (1)

Q.3. a. What is diabetes and what are the causes of diabetes? (2)
b. Diabetes results in the reduction of fat stores in the body. Describe two effects this would have on the body. (2)
c. How can diabetes be treated? (1)

Q.4. The diagram below shows the responses of the body to differing blood glucose concentrations.



a. State where the receptors cells are found (1)
b. Copy and complete the table by inserting the words **increases** or **decreases** to describe the levels of hormones during each corrective mechanism.

	Insulin concentration	*Glucagon concentration*
During corrective mechanism 1		
During corrective mechanism 2		

(2)

(1)

c. Name the organ which produces the hormones insulin and glucagon.

d. During corrective mechanism 1, glucose is removed from the blood and converted into a storage carbohydrate.
Name this storage carbohydrate and state where it is found. (2)

Variation and Inheritance

Homework Exercise 1

20

Q.1. a. What is meant by an 'inherited characteristic'? (1)

b. Give 2 examples of inherited characteristics in
i) plants ii) animals and iii) humans. (3)

Q.2. What is meant by the term 'phenotype'? (1)

Q.3. What is meant by the term 'genotype'? (1)

Q.4. Give examples of the different phenotypes which exist for the each of the following characteristics in humans:

a) eye colour b) tongue rolling (1)

Q.5. From the list below, write down the letters which identify examples of continuous variation.

List

A human blood group
B mass of new born rats
C height of thistles
D sex of Highland cattle
E diameter of limpet shells

(1)

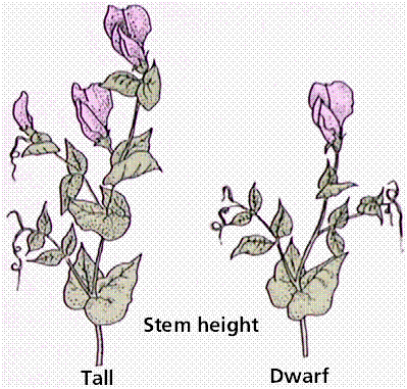
Q.6. Using hair colour as an example, explain the meaning of the term '*discrete variation*'. (1)

Q.7. The eye colours of 160 school pupils are shown in the table below.

Eye colour	*Number of school pupils*
brown	80
green	24
blue	48
grey	8

a. Construct a bar chart to show this information. (2)
b. What type of variation is shown by eye colour? (1)
c. What percentage of the school pupils have green eyes? (1)

Q.8. A plant breeding experiment was carried out over a period of three years using two varieties of garden pea. One variety produced tall plants and the other dwarf plants.
In the first year, the two varieties were grown and were cross-pollinated; the seeds were collected from the plants.
The seeds were sown the following spring and all the plants were tall. The plants were allowed to self-pollinate and again the seeds were collected. These seeds were sown in the spring of the third year and the numbers of tall and dwarf plants noted.



a. In an experimental cross like the one described above, the parental plants must be selected carefully.

Select the correct statement to complete the following sentence:
The parental plants in the experimental cross should…
A …have the same phenotype
B …have the same genotype
C …be true-breeding (1)

b. The offspring collected from the final self-pollination were found to consist of 128 tall plants and 32 dwarf plants. Write this result as a simple, whole number ratio. (1)

Q.9. In mice, coat colour is controlled by two forms of a single gene.
B represents the gene for black coat colour and **b** represents the gene for brown coat colour. The genotypes of the parents in an experimental cross are:

BB x bb

a. State the genotype of the F_1 offspring of this cross. (1)
b. Two mice from the F_1 generation were allowed to breed. What is the expected ratio of black mice to brown mice in the resulting offspring? (1)
c. Decide if each of the following statements about the experimental cross are **TRUE** or **FALSE**. Copy and complete the table by ticking the appropriate box.
If the statement is **FALSE**, write the correct word or phrase in the *Correction* box to replace the word or phrase <u>underlined</u> in the statement. (3)

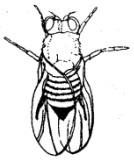
Statement	*True*	*False*	*Correction*
The parents in the cross have <u>the same genotype</u>.			
The <u>parents</u> in this cross are true breeding.			
The F_1 mice all have <u>brown</u> coats.			

Variation and Inheritance
Homework Exercise 2

21

Q.1. Variety A is true-breeding and normal winged fruit fly. Variety B is true-breeding and vestigial (dumpy) winged. The normal winged form of the gene is dominant to the vestigial winged form. The diagram below shows the results of crossing females of type A with males of type B, and then self crossing the F1 offspring.
Choose suitable symbols and copy and complete the diagrams and the punnet squares to fill the blanks.

Parental generation



X

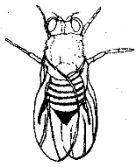
F1		

phenotypes — normal wing — vestigial wing

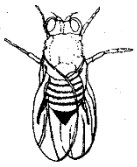
genotypes …… ……

gametes …… …… (2)

First generation (F1)



X



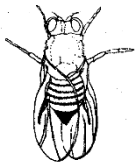
F2		

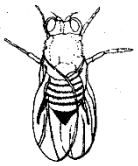
phenotypes …… ……

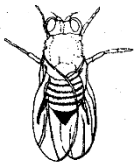
genotypes …… ……

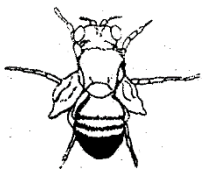
gametes …… …… (3)

Second generation (F2)









phenotypes …… …… …… ……

genotypes …… …… …… …… (2)

Q.2. A cross was carried out between a brown mouse and a white mouse.
Their genotypes are shown below.

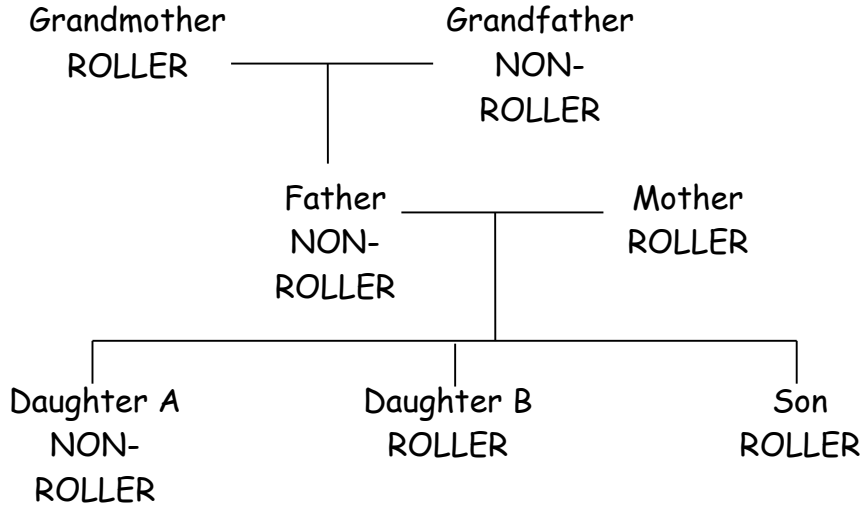
Bb **x** **bb**

Brown male White female

a. Draw a punnet square to show the genotypes of the offspring of this cross. (1)

b. Give the ratios of the (i) F1 genotypes and (ii) F1 phenotypes. (2)

Q.3. The ability to tongue roll is an inherited characteristic controlled by a dominant gene '**R**'.
The recessive gene is represented by '**r**'.
The diagram below represents part of a family tree. Some members of the family can roll their tongue (Rollers) and some cannot (Non-rollers).



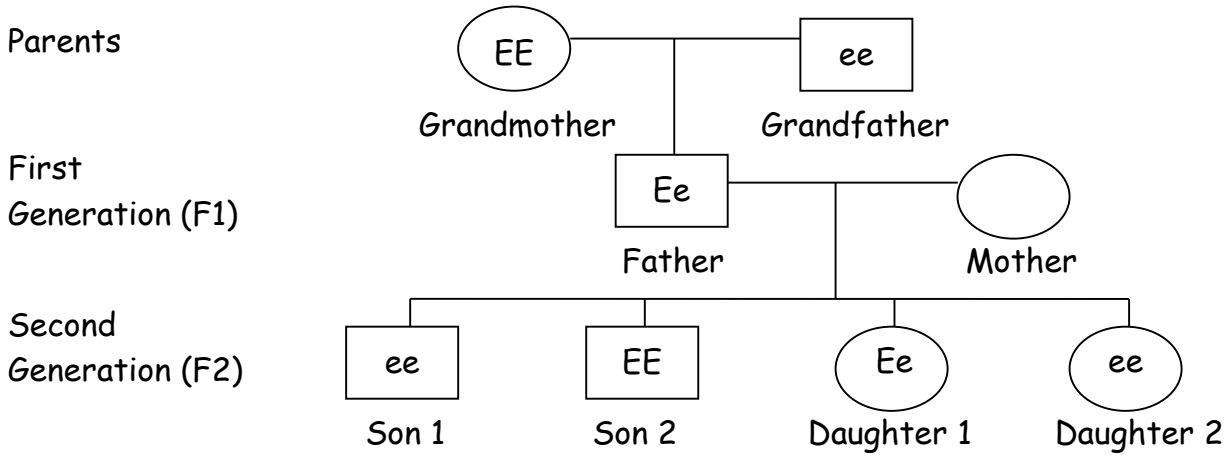
a. What are the genotypes of (i) daughter A, (ii) mother and (iii) grandmother? (3)

b. Daughter B marries a man who is homozygous for the tongue-rolling characteristic. Copy and complete the table below to work out the possible phenotypes of their children (F1 generation).

Parents	Daughter B	X	Husband
Genotypes	……		……
F1 phenotypes	……		
F1 genotypes	……		

(3)

Q.4. In humans, the gene for fixed ear lobes (e) is recessive to the gene for free ear lobes (E).
The diagram below represents part of a family tree in which some members have fixed ear lobes.



a. Using the gene symbols 'E' and 'e' state the genotype of the mother. (1)

b. What is the phenotype of the grandfather? (1)

c. i. What is the ACTUAL ratio of individuals with fixed ear lobes to those with free ear lobes in the F2 generation? Write this ratio as *fixed ear lobes: free ear lobes*. (1)
ii. What is the predicted ratio? (1)

d. Daughter 1 married a man with free ear lobes. Is it possible to predict whether any of their children will have fixed or free ear lobes? Explain your answer. (1)

Variation and Inheritance

Homework Exercise 3

13

Q.1. Albinism is a condition in which the skin, hair and eyes lack pigment. In humans, albinism is controlled by a recessive gene. A wife, with normal colouring, whose father was an albino, has an albino husband. They have two children both of whom have normal colouring.

a. Using the gene symbol '**A**' for normal colouring and '**a**' for the gene for albinism, give the genotypes of the following:
(i) wife (ii) husband (iii) children (3)
b. If these parents have a third child, what are the chances that it will be an albino? (1)
c. What term is used to describe the genotype of the mother? (1)

Q.2. Below are the genotypes of two brown mice which were crossed. In this cross **B** represents the gene for brown coat colour and **b** represents the gene for white coat colour.

Bb x Bb

a. Are the parent mice homozygous or heterozygous for coat colour? (1)
b. Draw a punnet square to show the resulting F1 offspring. (1)
c. How many of the F1 mice are (i) homozygous and (ii) heterozygous? (2)
d. What is the ratio of the F1 genotypes? (1)
e. What is the ratio of F1 phenotypes? (1)

Q.3. In cucumber plants, the presence of a chemical giving a bitter taste to the cucumber is under genetic control. The bitter taste (B) is dominant to the non-bitter taste (b).
A plant breeder wanted to obtain a supply of plants which produced cucumbers which did not taste bitter. She carried out the crosses shown in the table below.

		Phenotype of F1 offspring	
Cross	*Genotypes of parents*	*Bitter tasting*	*Non-bitter tasting*
1	**BB x BB**		
2	**BB x bb**		
3	**Bb x bb**		
4			

a. Copy and complete the table by ticking the boxes to indicate the phenotype(s) found in the F1 offspring for crosses 1, 2 and 3. (1)
b. Identify the parental genotypes which would have been used in cross 4 to obtain only plants producing cucumbers with no bitter taste. Write the genotypes in your table. (1)

The Need for Transport
Homework Exercise 1

11

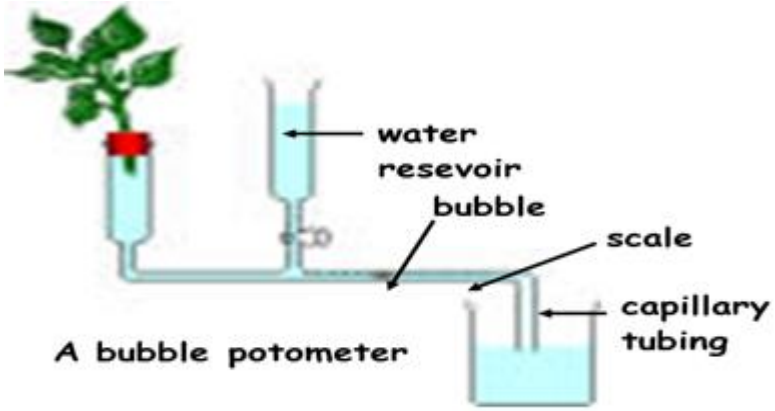
Q.1. Why do plants need a transport system? (1)

Q.2. Why do plants need water? (1)

Q.3. Describe the route of water from the root hairs to being lost at the leaves. (2)

Q.4.What term describes water being lost through the leaves? (1)

Q.5. A bubble potometer is used to measure the rate of transpiration by a leafy shoot. The plant will take up water from the vessel and the rate of transpiration can be calculated.



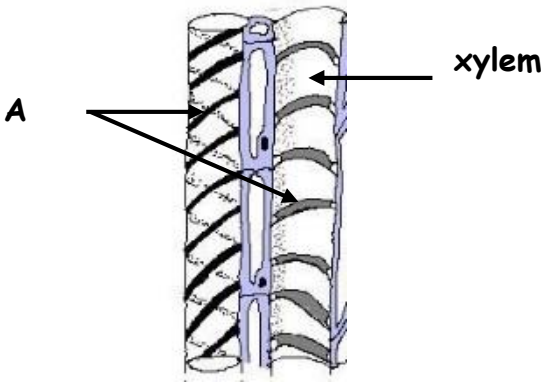
A bubble potometer

a) In which direction will the air bubble move as the plant starts to take up water? (1)

b) Which part of the apparatus will measure the distance moved by the water? (1)

c) Why is this not an exact measurement of transpiration? (1)

Q.6. The diagram shows xylem vessels.



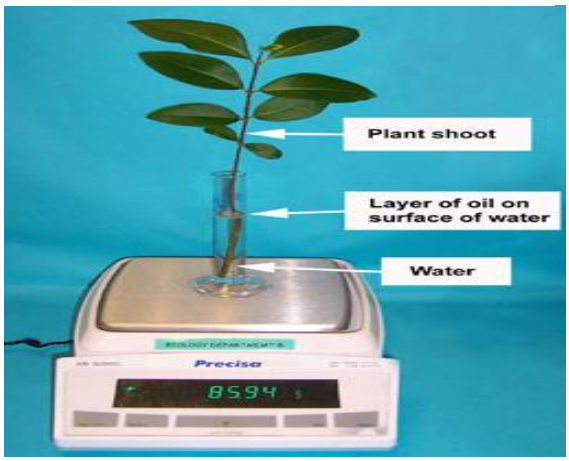
a) Name the structure labelled A. (1)

b) What is the function of xylem vessels? (1)

c) What is the function of structure A? (1)

The Need for Transport
Homework Exercise 2

17



Q.1. The experiment below can be used to investigate the effect of different factors on the rate of transpiration. The equipment is weighed, left for **24hours** and then re-weighed. The more water which is lost, the greater the transpiration rate.

a) What is the function of the layer of oil over the surface of the water? (1)

b) Describe how you would use the above equipment to investigate the effect of light intensity on transpiration rate. Think about variables you would need to keep constant. (1)

c) An experiment was set up to investigate the effect of temperature on transpiration. The following results were obtained:

Temperature (°C)	Water Loss (g)
5	0.45
20	2.25
30	3.30
40	5.40

On a piece of graph paper draw a line graph to display the results. (2)

d) From your graph predict the water loss that may occur at 35°C. (1)

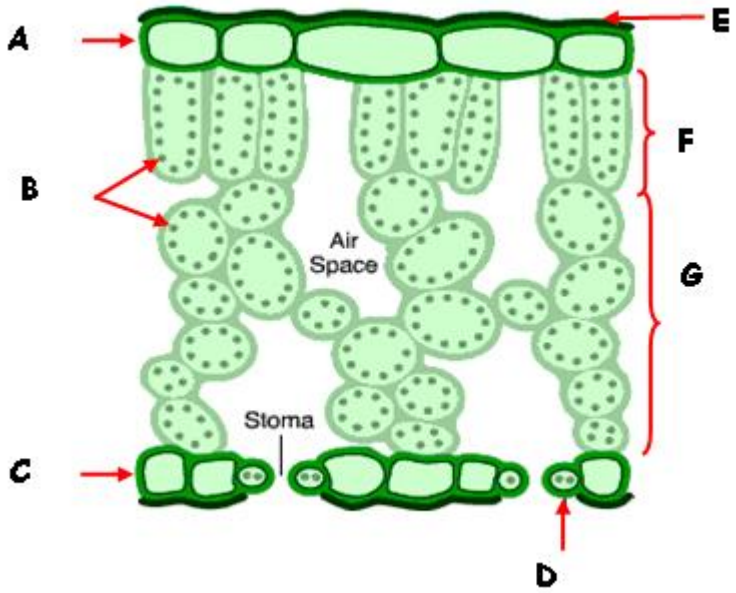
e) Copy and complete the table using information from part (c) and the introductory information about the experiment.

Temperature (°C)	Rate of Transpiration (g per hour)
5	
20	
30	
40	

(2)

f) What conclusion can you make from these results? (1)

Q.2. The diagram shows a cross section of a leaf.

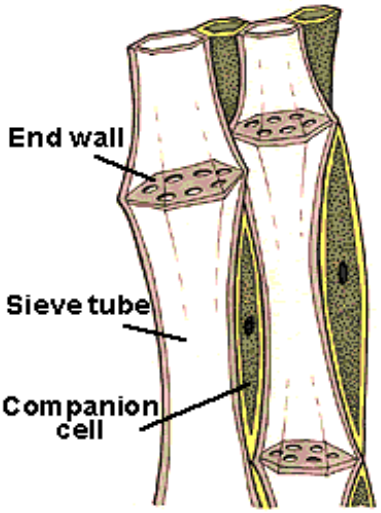


a) Name structures A - G. (3)

b) What are stomata? (1)

c) Which structures control the opening and closing of the stomata? (1)

d) Which type of cells are the main sites of photosynthesis? (1)



Q.3. The diagram shows phloem cells.

a) Which feature in the diagram would allow movement of sugar from one cell to another? (1)

b) Copy and complete the table

Cell	**Materials transported**	**Composition**	**Direction of transport**	**Special features**
Xylem	Water and minerals		Transport water and minerals upwards only	Contains lignin
Phloem		Made up of living cells		

(2)

The Need for Transport
Homework Exercise 3 - Animals

11

Q.1. Name 3 substances which are transported in the blood. (1)

Q.2. What is function of red blood cells? (1)

Q.3. Copy and complete the following equation:

h_____ + oxygen ⟷ o_____ (1)

Q.4. It is known that the number of red blood cells changes if an individual moves from low altitude to high altitude. At high altitude there is a lower concentration of oxygen.
The table below shows changes in the number of red blood cells in a group of mice after they were moved from low altitude to high altitude.

Time at high altitude (days)	**Average number of red blood cells per mm^3 blood (millions)**
0	7.5
5	9.5
10	10.5
15	11.0
20	11.0

a) On a piece of graph paper, draw a line graph to show the results of the experiment. (2)

b) What has happened to the number of red blood cells in the mice? (1)

c) Why would this be an advantage to the mice? (1)

d) Some athletes train at high altitude. Why might this give them an advantage over the competition? (1)

Q5. Copy and complete the table below:

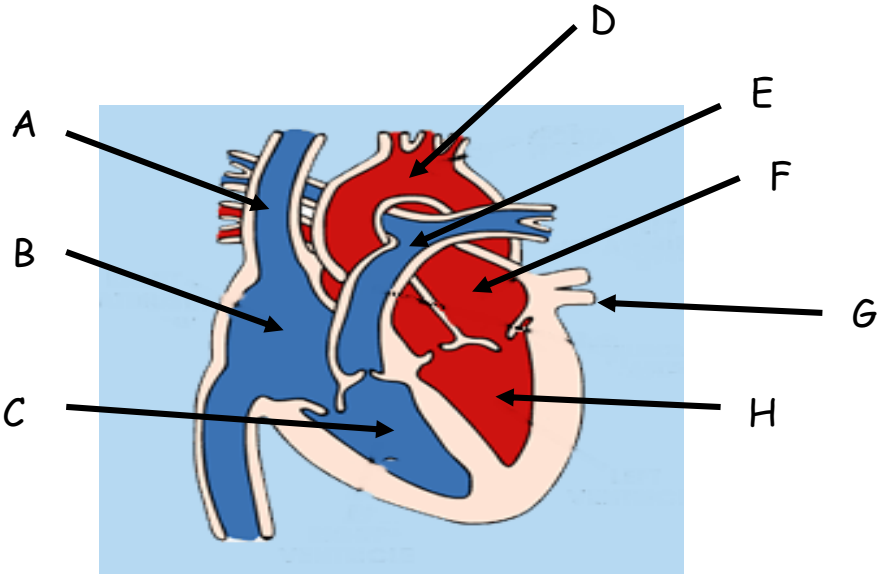
Blood vessel	**Blood Flow**	**Structure**
Artery		
	From arteries to veins	
		Thin walls. Contain valves.

(3)

The Need for Transport
Homework Exercise 4 - Animals

13

Q.1. Name the structures labelled A-H



(4)

Q. 2. Copy and complete the sentence by choosing the correct word.

Oxygenated blood is found in the *left/right* side of the heart
and deoxygenated blood is found in the *left/right* side of the heart. (1)

Q. 3. What is the function of the following blood vessels:

a) aorta
b) vena cava
c) pulmonary artery
d) coronary artery (4)

Q. 4. Which type of blood vessel has valves? Why are theses structures necessary? (2)

Q. 5. Copy and complete the paragraph below to show the flow of blood.

right a_____ → right _____ → p_____ a_____ →

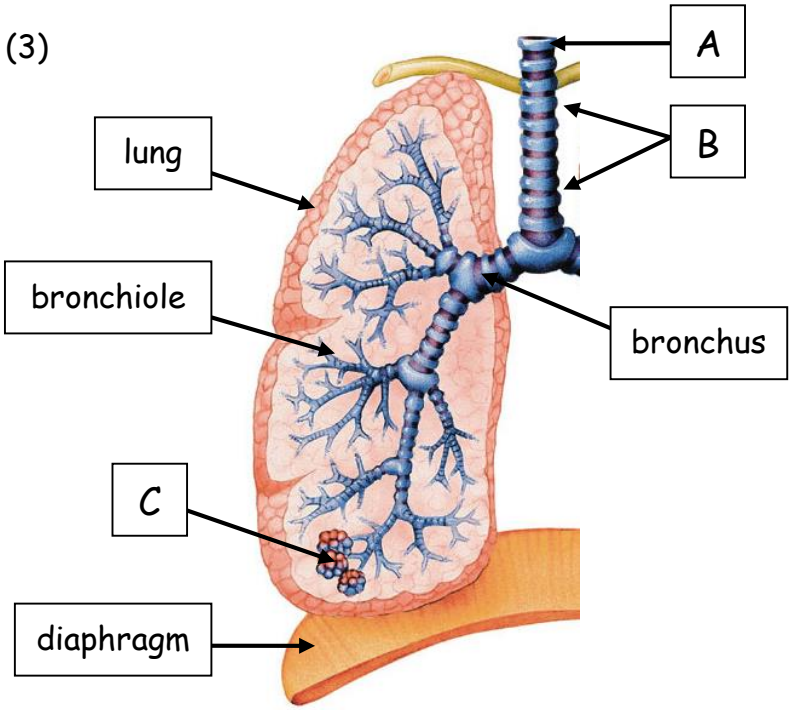
lungs → p_____ _____ → left _____ → left _____ →

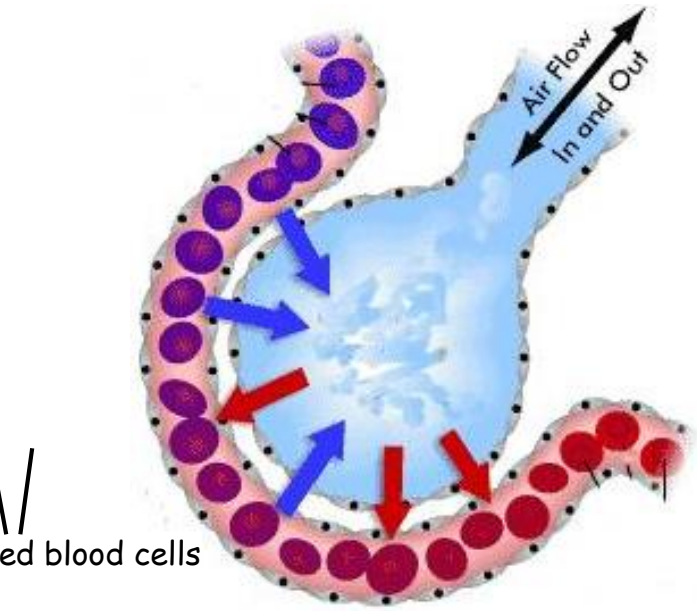
body → v_____ c_____ → right _____ (2)

The Need for Transport
Homework Exercise 5 - Animals

12

Q.1. Name the structures labelled A – C. (3)





Q.2. The diagram to the left represents an alveolus. Name the gases A and B. (2)

ed blood cells

(3)

Q.3. Describe 3 features of alveoli that allow them to be efficient at gas exchange. (3)

Q.4. Starting with the trachea, describe the passage a molecule of oxygen must pass through to reach the blood. (2)

Q.5. What is the function of:

a) mucus

b) cilia in the airways. (2)

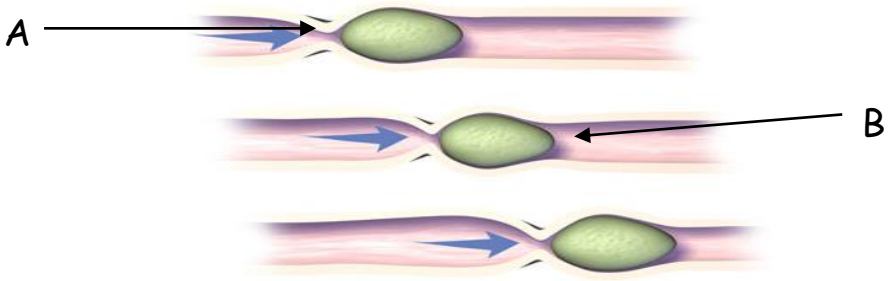
The Need for Transport
Homework Exercise 6 - Animals

10

Q.1. Why must food be digested (broken down)? (1)

Q.2. Describe how food is moved through the gut. (1)

Q.3. Below is a diagram to show how food is moved through the gut, state which muscles are relaxed and which are contracting. (1)



Q.4. Describe the path that food takes from the mouth to the anus. (2)

Q.5. Copy and complete the table below to explain the importance of the adaptations of the small intestine

Adaptation of the small intestine lining	**Importance in allowing absorption**
Millions of villi	
Villi walls are very thin	
Villi have a good blood supply and a lacteal	

(3)

Q.6. Below is a diagram of a villus. Name parts A and B. (2)