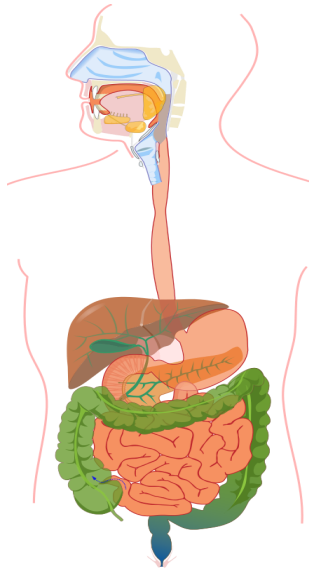


St Ninian's High School

Biology Department



S4 Homework (Multicellular Organisms 3)

Homework	Due date	Grade
1		
2		
3		
4		
5		
6		

Name _____

Teacher _____

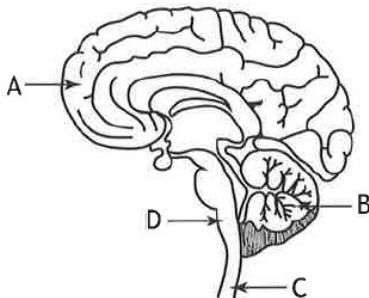
Homework 1

Score _____

1. Which line in the table below identifies correctly the male gametes and their site of production in a flowering plant?

	Male gamete	Site of production
A	sperm	testes
B	pollen nucleus	anther
C	sperm	anther
D	pollen nucleus	testes

2. Which letter on the diagram represents the part of the brain responsible for conscious thought?



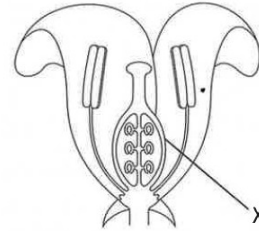
3. Which of the following is an unspecialised cell?

- A plant cell
- B red blood cell
- C sperm cell
- D stem cell

4. Which of the following is an example of continuous variation?

- A height
- B blood group
- C gender
- D tongue rolling

5. The diagram below shows some structures in a flower.



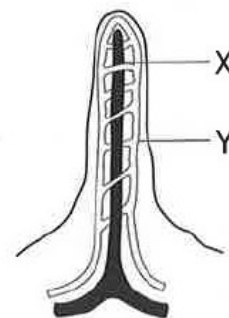
Structure X represents

- A ovary
- B ovules
- C egg
- D anthers

6. Which of the following structures is diploid?

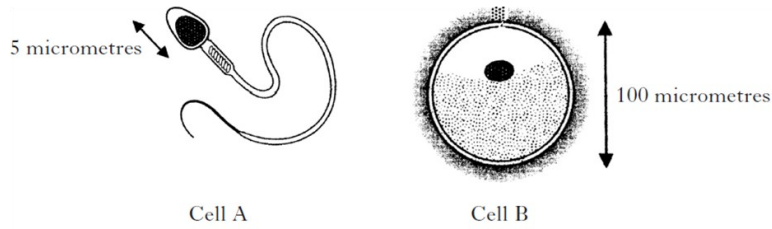
- A pollen
- B sperm
- C testes
- D ovule

7. The diagram below represents a villus found in the small intestine. What would be found in structures X and Y?



- A X = glucose Y = glycerol
- B X = fatty acids Y = glycerol
- C X = glycerol Y = glucose
- D X = amino acids Y = glucose

8. The diagram below shows two types of human sex cells.



a) What is the scientific name for a sex cell?

1

b) Choose one of the cells above (cell A or B) and explain how it is adapted to suit its function.

Cell _____

Adaptation _____

1

c) Complete the table determining whether the following cells are haploid or diploid.

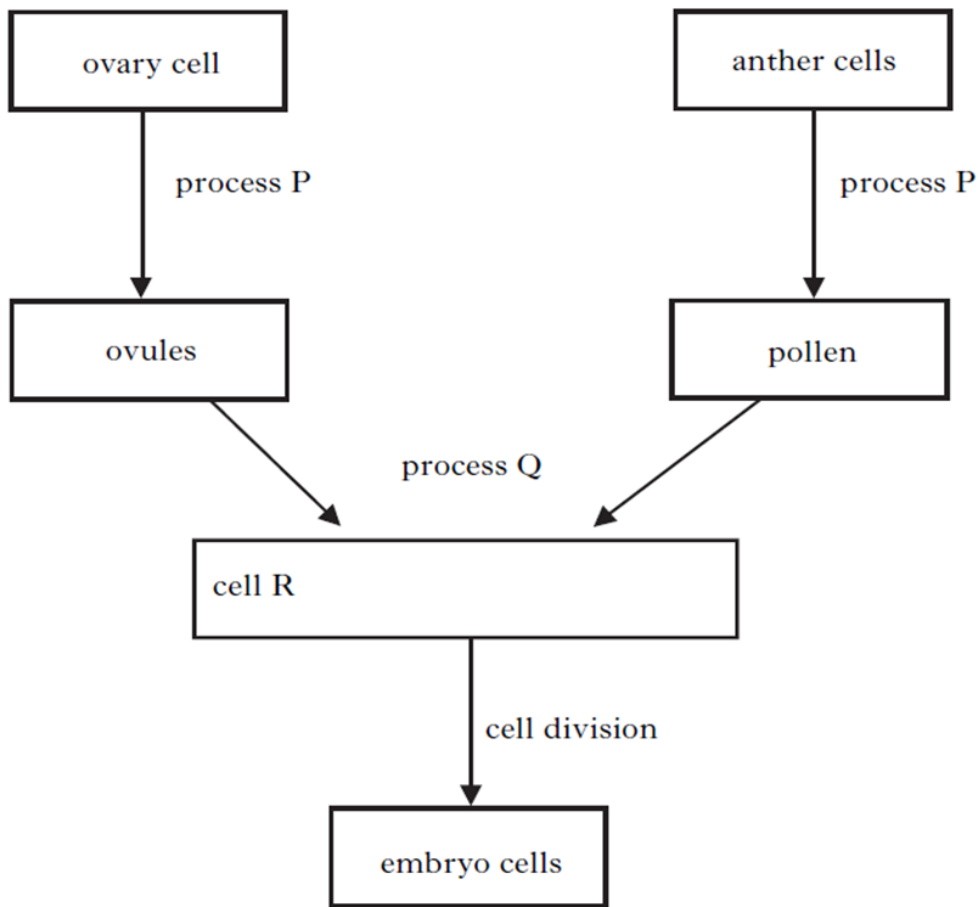
Cell Type	Haploid	Diploid
Sperm		
Liver		
Egg		
Anther		
Ovule		

3

d) Describe what is meant by continuous variation.

1

9. The diagram below shows some of the stages involved in plant reproduction.



a) Complete the diagram by entering the name of cell R. 1

b) Is Cell R haploid or diploid? 1

c) Which process (letter) in the diagram represents fertilisation? 1

d) Explain why gametes must be haploid.

_____ 1

e) Describe the process of fertilisation.

_____ 1

10. Read the following passage and use the information to answer the questions.

Twins

Multiple births have been on the rise with increasing numbers of twins being born. There are several reasons for this, including the growing use of fertility drugs and the fact that more older women are having babies. Between 1996 and 2006 there was a 182% increase in multiple births in women aged 35 and over. About 1.25% of births from natural conception results in twins, but this increases to 25% if fertility drugs are used.

Twins can be identical or non-identical. An ultrasound scan can help to determine which is the case. If babies develop together in a single sac with no separating membrane, or share one placenta, they are likely to be identical. Identical twins will always be the same sex because they carry the same genetic information. However, the only sure way to tell if twins are identical is to have a DNA test.

The chance of having identical twins is about 1 in 250 births. The chance of having non-identical twins varies according to whether there is a history of non-identical twins in the mother's family. If there is, she is more likely to have them. About 33% of all twins born are identical. They are formed when one egg is fertilised by one sperm and then the zygote divides into two halves which develop separately. Non-identical twins form when two eggs are fertilised by two different sperm.

a) Give **two** reasons for the increase in the number of twins being born. 1

1- _____

2- _____

b) What percentage of all twins are **non-identical**? 1

_____ %

c) What is the only sure way to tell twins are non identical? 1

d) Which parent's family history has more influences on the chance of having non-identical twins? 1

e) In a country where there are 600,000 births from natural conception per year, how many of these births are likely to result in twins being born? 1

_____ births

Total Marks = 23

Homework 2

Score _____

1. Inherited characteristics controlled by alleles of more than one gene are described as

- A homozygous
- B polygenic
- C discrete
- D dominant

2. A homozygous black-coated mouse was crossed with a homozygous brown coated female.

All the F1 mice were black.

The F1 mice were allowed to mate and the F2 generation contained both black and brown mice.

What evidence is there that the allele for black coat is dominant to the allele for brown coat?

- A only one of the original parents were black.
- B the original male parent was black.
- C all of the F1 were black.
- D some of the F2 were black.

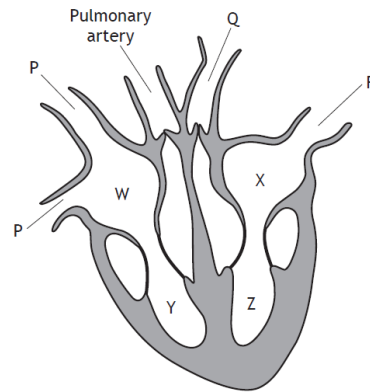
3. What term refers to the description of a characteristic of an organism?

- A allele
- B genotype
- C phenotype
- D polygenic

4. Which part of the brain controls heart rate?

- A cerebrum
- B cerebellum
- C medulla
- D spinal cord

5. The following diagram represents the heart.



What letters contain deoxygenated blood?

- A W and X
- B Z and Q
- C W and Y
- D Y and X

6. In a breeding experiment with *Drosophila*, homozygous normal winged flies were crossed with vestigial winged flies and all of the F1 were normal winged.

If flies from the F1 were crossed, what percentage of their offspring would have **normal wings**?

- A 25%
- B 50%
- C 75%
- D 100%

7. Which of the following cells is haploid?

- A anther
- B pollen
- C testes
- D ovaries

8. Hair type in humans is controlled by a single gene. The dominant form is curly hair (H). The recessive form (h) produces straight hair.



Both parents of this curly haired child have the genotype Hh.

- a) What term is used to describe the **genotype** of both parents? 1

- b) Complete the punnet square to show the possible genotypes of their offspring. 2

		Male gametes	
		H	h
Female gametes	H		
	h		

- c) State the **genotype(s)** of the girl in the picture. 1

- d) Characteristics can show either discrete or continuous variation.

State which type of variation is shown by hair type, and give a description of this variation.

Type of variation _____

Description _____

9. Coat colour in Labrador dogs is an inherited characteristic. Black coat (B) is dominant to chocolate coat colour (b).



a) A homozygous black Labrador was crossed with a Labrador with a chocolate coloured coat. Complete the diagram below to show the genotypes of each of the parents and the F₁ phenotype.

Parents:	black coat	X	chocolate coat	
Genotypes:	<input type="text"/>		<input type="text"/>	2
F ₁ genotype:	All Bb			
F ₁ phenotype:	<input type="text"/>			

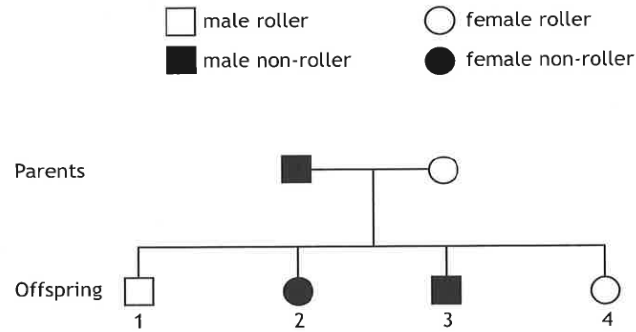
b) (i) Explain what is meant by the term homozygous. 1

(ii) Many characteristics in dogs are examples of polygenic variation. Describe what is meant by the term 'polygenic variation'. 1

(iii) State the term for different forms of a gene. 1

10. Tongue rolling is an inherited characteristic in humans. Tongue rolling is determined by the dominant form of the gene **T** and the non rolling condition is determined by the recessive **t**.

The family tree diagram below shows the pattern of inheritance in one family.



- a) (i) State the genotype of the following individuals.

2

Male 1 _____

Female 2 _____

Female 4 _____

- (ii) Identify which of the parents is **homozygous**.

1

Tick the correct box.

Male parent

Female parent

Both parents

Neither parent

- c) Tongue rolling is an example of discrete variation.

Give an example of *continuous* variation, and describe what is meant by this term.

Example of continuous variation _____

1

Description _____

1

Total Marks = 23

Homework 3

Score _____

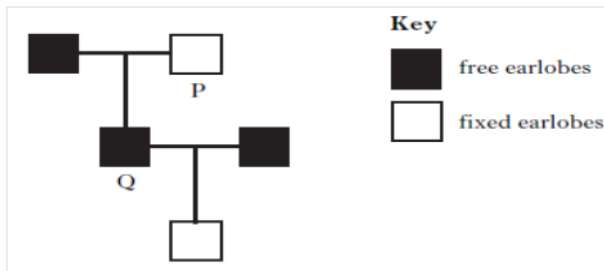
1. In gerbils, brown coat colour is dominant to white. Some heterozygous gerbils were allowed to interbreed and 56 offspring were produced.

What would be the expected number of brown gerbils?

- A 14
- B 28
- C 42
- D 56

2. In humans, the allele for free ear lobes (E) is dominant to the allele for fixed earlobes (e).

The diagram below shows the inheritance of this characteristic.

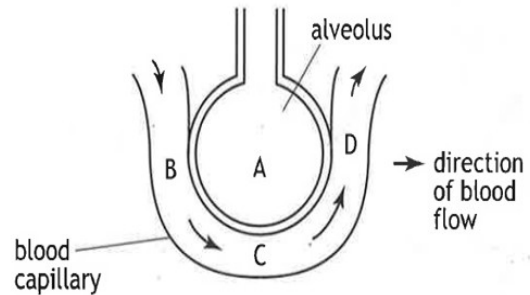


Which line in the table identifies correctly the genotypes of persons P and Q?

	Genotype	
	P	Q
A	ee	EE
B	ee	Ee
C	EE	Ee
D	Ee	Ee

3. The diagram below shows gas exchange in the lungs.

At what position would the lowest concentration of oxygen be found?



4. A pea plant with yellow seeds was crossed with a pea plant with green seeds.

All the F1 generation has yellow seeds.

The genotype of the parent plant with green seeds could be described as

- A heterozygous and recessive
- B heterozygous and dominant
- C homozygous and recessive
- D homozygous and dominant

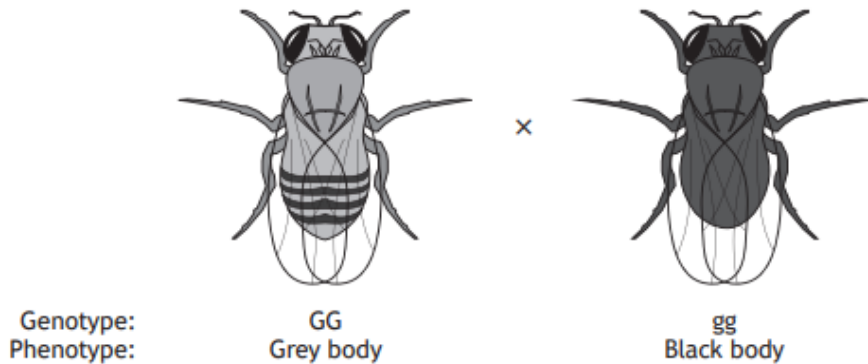
5. If a heterozygous individual was crossed with a recessive individual, what percentage of the F1 generation would show a dominant phenotype?

- A 0%
- B 50%
- C 75%
- D 100%

6. Chromosomes contain the genetic information responsible for variation amongst members of a species.

Fruit flies can have either a grey or black body colour.

The parent flies used in a cross are shown in the diagram below.



- (a) Using the information given, underline one option in each bracket to complete the following sentences.

Body colour in fruit flies is an example of $\left\{ \begin{array}{l} \text{discrete} \\ \text{continuous} \end{array} \right\}$ variation. 2

The F_1 flies produced from this cross will be $\left\{ \begin{array}{l} \text{homozygous} \\ \text{heterozygous} \end{array} \right\}$.

- (b) (i) Two of the F_1 flies were then crossed together.

State the expected ratio of grey to black flies in the F_2 generation. 1

 :
grey *black*

- (ii) There were 150 F_2 flies produced by the F_1 parents.

Using the expected ratio above, calculate how many of the F_2 flies were grey.

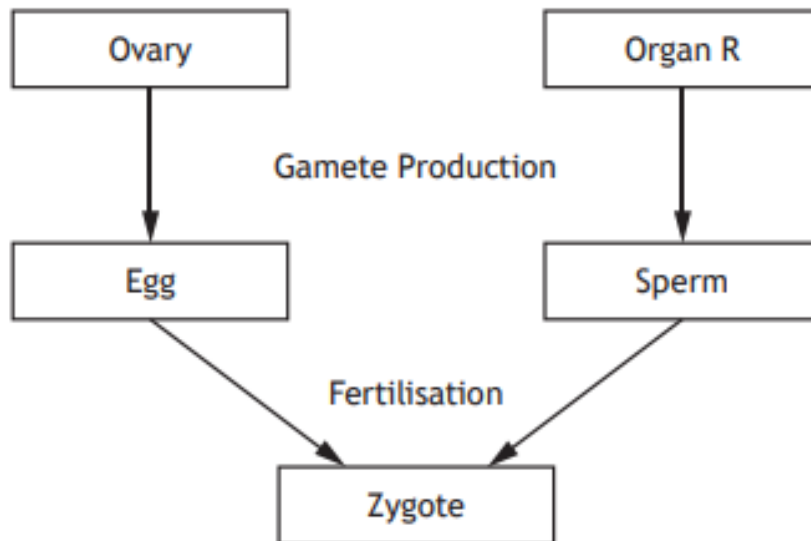
1

- (iii) Two different F_1 flies were then crossed, however they did not produce the same number of black and grey flies as the example above.

Explain why the observed ratio was not the same as the expected ratio in this case.

1

7. The diagram below relates to sexual reproduction in humans.



(a) Name organ R.

1

(b) Describe what happens during fertilisation.

1

(c) An egg cell is haploid but a zygote is diploid.

Explain what this means in terms of the chromosome complement found in each of these cells.

2

(d) The zygote will then start to undergo many rounds of cell division.

State the name given to this structure that develops from the zygote.

1

(e) Most cells are either haploid or diploid in terms of their chromosome complement.

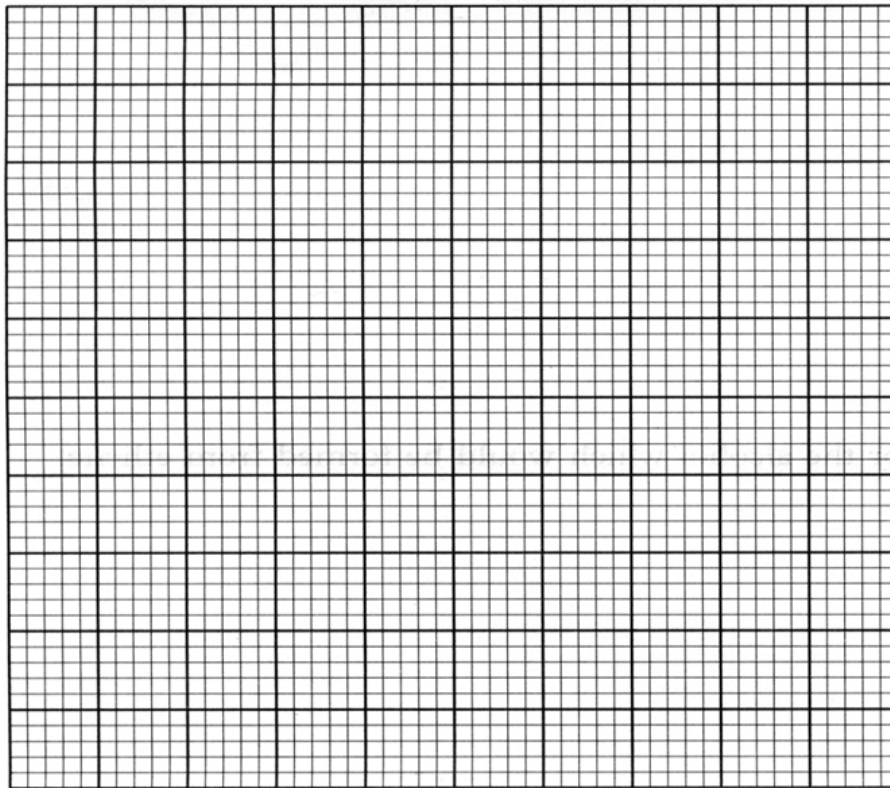
Give one example of a cell that is neither haploid or diploid as it has no chromosomes.

1

8. The table below shows the results from an investigation into the effect of volume of milk in an infant cow's diet every day on their weight when they reach 5 years old.

Volume of milk per day (ml)	Weight at 5 years old (kg)
200	250
400	290
600	360
800	420
1000	480

- (a) Convert the results table into a line graph using the graph paper below.



3

- (b) Draw a conclusion about the effect of volume of milk consumed and the weight of cows.

1

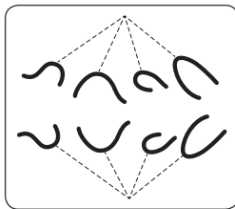
Homework 4

Score _____

1. Which of the following does not involve mitosis?
- A synthesis of proteins
 - B growth of tissue
 - C maintenance of the diploid chromosome complement
 - D repair of tissue

2. The diagram below shows one of the stages of mitosis in the root tip of a plant.

Which of the following statements describes the stage shown?

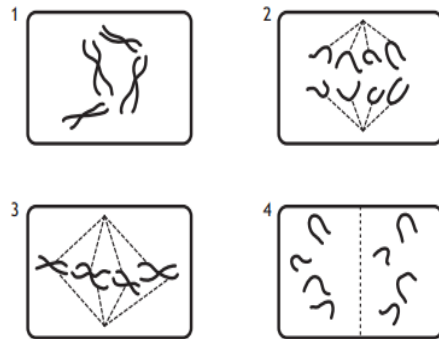


- A Chromosomes line up at the equator of the cell
 - B Daughter chromosomes gather at the ends of the cell
 - C Chromosomes become visible as pairs of identical chromatids
 - D Spindle fibres pull chromatids to opposite poles of the cell
3. A cell has a diploid chromosome number of 12. After the cell undergoes mitosis, how many chromosomes should each of the daughter cells have?
- A 6
 - B 12
 - C 18
 - D 24

4. Which of the following structures would be described as being diploid?

- A sperm
- B ovule
- C pollen
- D testes

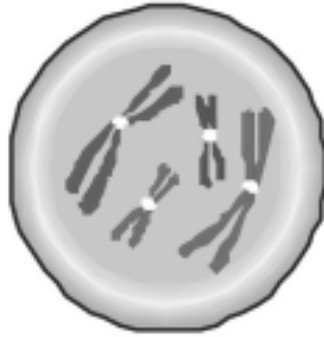
5. The following diagrams show a cell at four different stages of mitosis.



The correct order of the stages of mitosis is

- A 1,3,2,4
- B 2,3,4,1
- C 3,2,1,4
- D 4,1,2,3.

6. The diagram below represents a cell in an early stage of cell division



a) What name is given to this process of cell division?

1

(ii) Using the diagram above, describe what is happening during this stage of mitosis.

1

(iii) State the number of chromosomes present in this cell.

_____ chromosomes

1

(ii) State how many chromosomes will be present in each of the two cells produced by the process of cell division.

_____ chromosomes

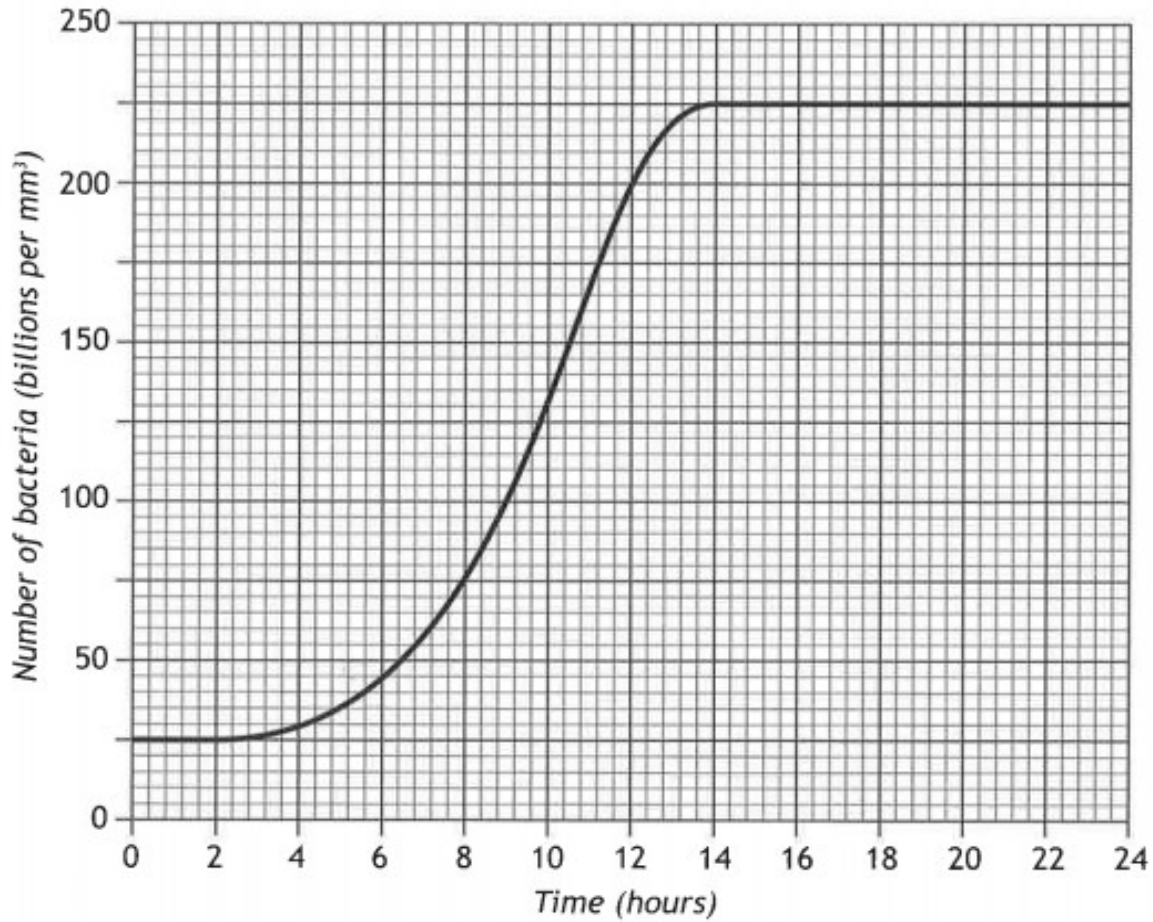
1

b) Draw a diagram of the next stage of cell division following the diagram above.



1

7. The graph below shows the growth curve of a population of bacterial cells at 30°C over a 24-hour period.



- a) Describe the relationship between the number of bacteria in the population and time.

2

- b) During which two-hour period was there the greatest increase in the number of bacteria?

Tick (✓) the correct box

6 - 8 hours

8 - 10 hours

10 - 12 hours

12 - 14 hours

1

c) Calculate the percentage increase in the number of bacteria over the first 8 hours.

Space for working.

_____ %

1

d) Express the number of bacteria at the start to the number at 24 hours as a simple whole number ration.

Space for working.

_____ : _____
At the start At 24 hours

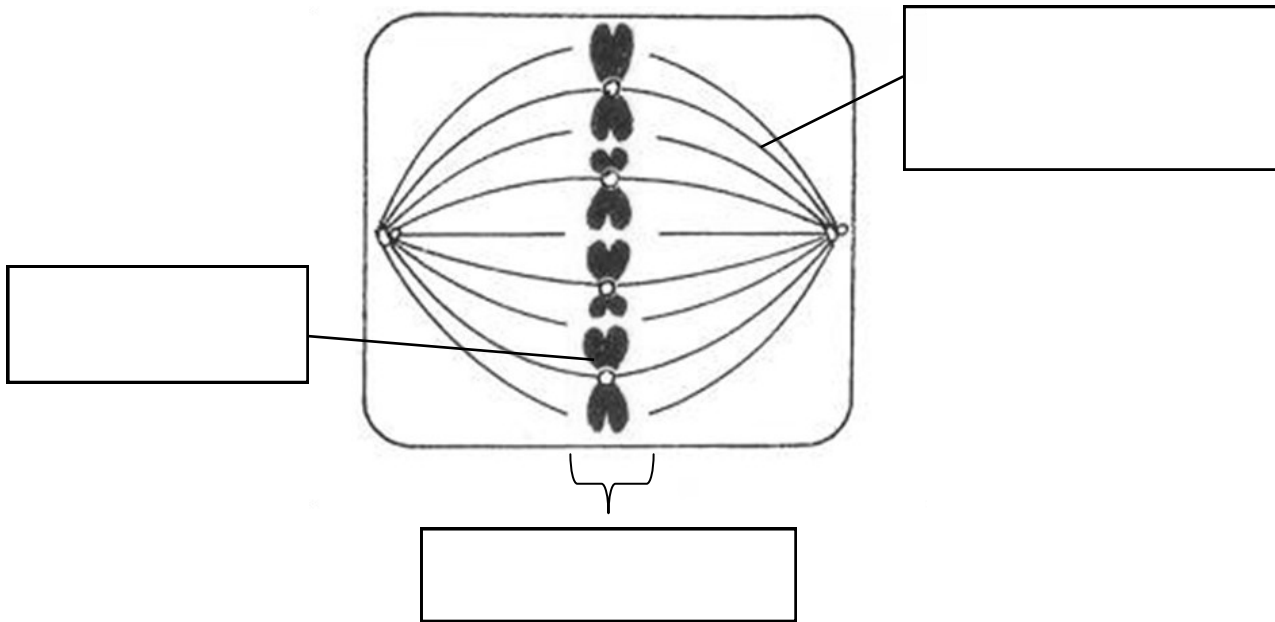
1

e) Explain why it is important to maintain the chromosome number during mitosis.

1

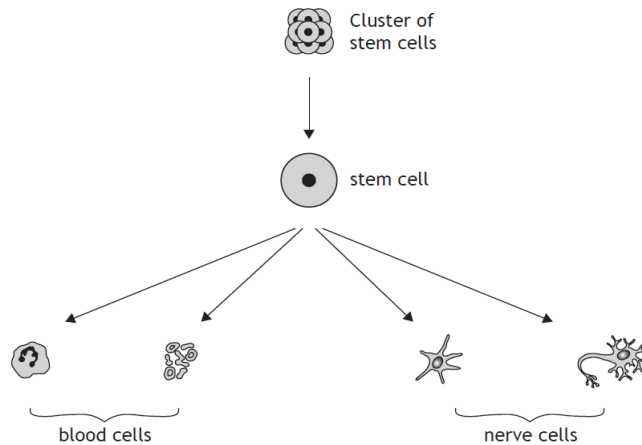
8. The following diagram shows a stage during the process of mitosis.

Complete the diagram by filling in the boxes to label the: **equator**, **chromatid** and **spindle fibres**.



3

9. The diagram below shows some stages in the development of blood cells and nerve cells.



a) Name two places in the body where stem cells can be found.

1 _____

2 _____

2

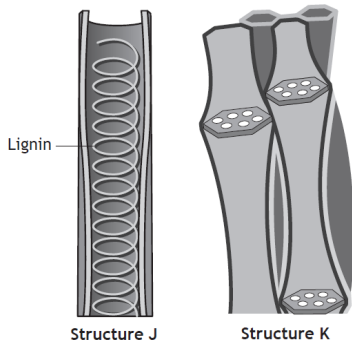
b) Describe the feature of stem cells which gives them the potential to develop into many different types of cells such as blood and nerve cells.

1

Homework 5

Score _____

1. The diagram below shows some of the structures involved in transport of materials in plants.



Which line in the table below correctly identifies structures J and K and the substances transported by them?

	Structure J		Structure K	
	Name	Substance transported	Name	Substance transported
A	Xylem	Water	Phloem	Sugar
B	Xylem	Sugar	Phloem	Water
C	Phloem	Water	Xylem	Sugar
D	Phloem	Sugar	Xylem	Water

2. Transpiration is the

- A evaporation of water through stomata
- B uptake of water by root hair cells
- C transport of water through xylem
- D transport of sugars through phloem

3. Transpiration occurs from the leaves of a plant.

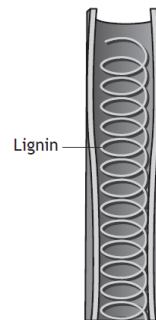
Which environmental conditions would produce the **greatest** transpiration rate?

- A warm and still air
- B cold and still air
- C warm and windy
- D cold and windy

4. Which of the following is the site of photosynthesis in a plant cell?

- A cytoplasm
- B chloroplasts
- C vacuole
- D cell wall

5. Apart from water, what else does this structure transport?



- A sugar
- B carbon dioxide
- C oxygen
- D minerals

6. Which of the following statements about plant transport is *false*?

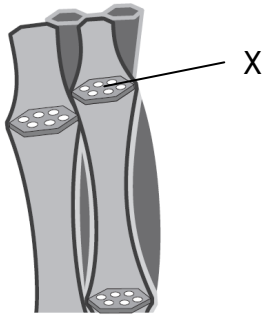
- 1 Plant organs include the roots, stems and leaves.
- 2 Xylem vessels have companion cells.
- 3 Stomata are found in the upper epidermis of a leaf.
- 4 Root hair cells have a small surface area to absorb water.

- A 1 only
- B 2 and 3
- C 3 and 4
- D 2, 3, and 4

7. In which structure of a leaf would a large number of chloroplasts be found?

- A upper epidermis
- B lower epidermis
- C palisade mesophyll
- D spongy mesophyll

8. The following diagram shows a phloem vessel in a plant.



Which structure is labeled X?

- A lignin
- B companion cell
- C sieve tube
- D sieve plate

9. Which of the following shows the correct organisation in multi cellular organisms?

- A tissues → cells → organs
- B cells → organs → tissues
- C cells → tissues → organs
- D organs → tissues → cells

10. What is the function of the cell wall in plant cells?

- A controls substances that enter and exit the cell
- B supports the cell
- C site of chemical reactions
- D contains cell sap

11. Which of the following environmental conditions would *decrease* the rate of transpiration?

- A low temperatures
- B high temperatures
- C low humidity
- D high wind speed

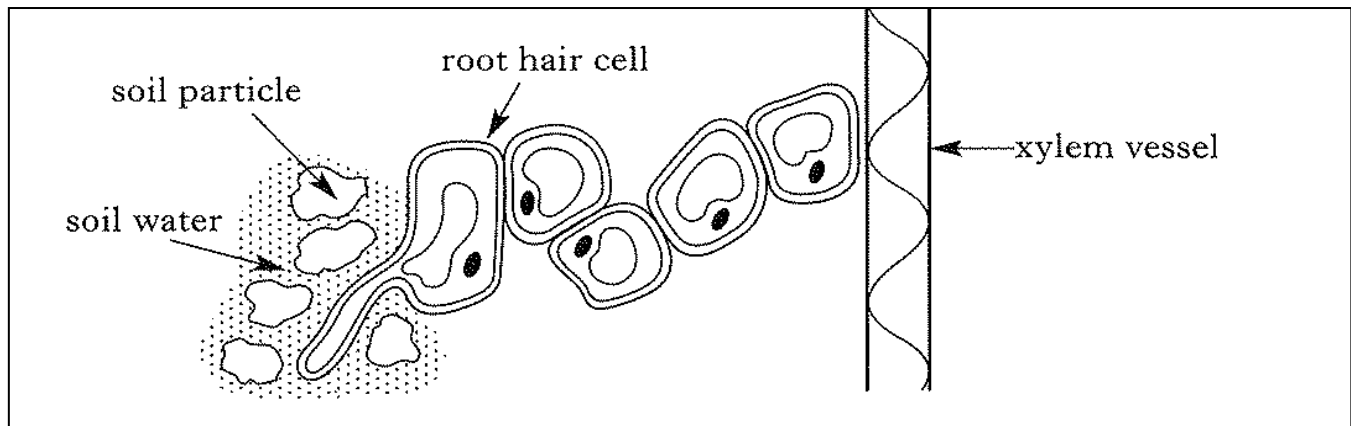
12. Which of the following characteristics would be an example of discrete variation?

- A plant height
- B root length
- C petal colour
- D plant mass

13. What term describes the physical characteristics of an organism?

- A phenotype
- B genotype
- C allele
- D polygenic

14 a) Describe the processes and structures involved in the uptake of water by plant roots and the loss of water through their leaves.



3

b) Root hair cells are specialised cells.

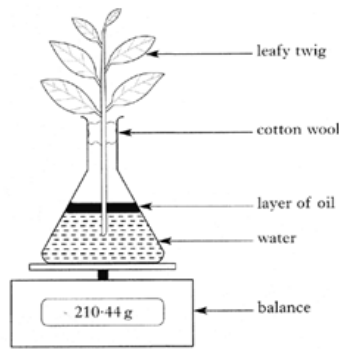
Explain how the root hair cells are adapted to suit their function.

2

c) Give one reason for the importance of the transpiration stream.

1

15. The apparatus below was used to show the transpiration stream of a leafy twig at different temperatures.



a) The twig was left for 10 minutes at each temperature before a reading was taken.

Explain why this is good experimental procedure.

1

b) The results of the experiment are shown in the table below.

Temperature (°C)	Change in mass per 10 minutes (g)
5	1.5
10	3.0
15	4.5
20	5.5
25	6.0

Predict what change in mass would occur after 10 minutes at 30°C.

_____ g

1

c) Stomata play a very important role in transpiration.

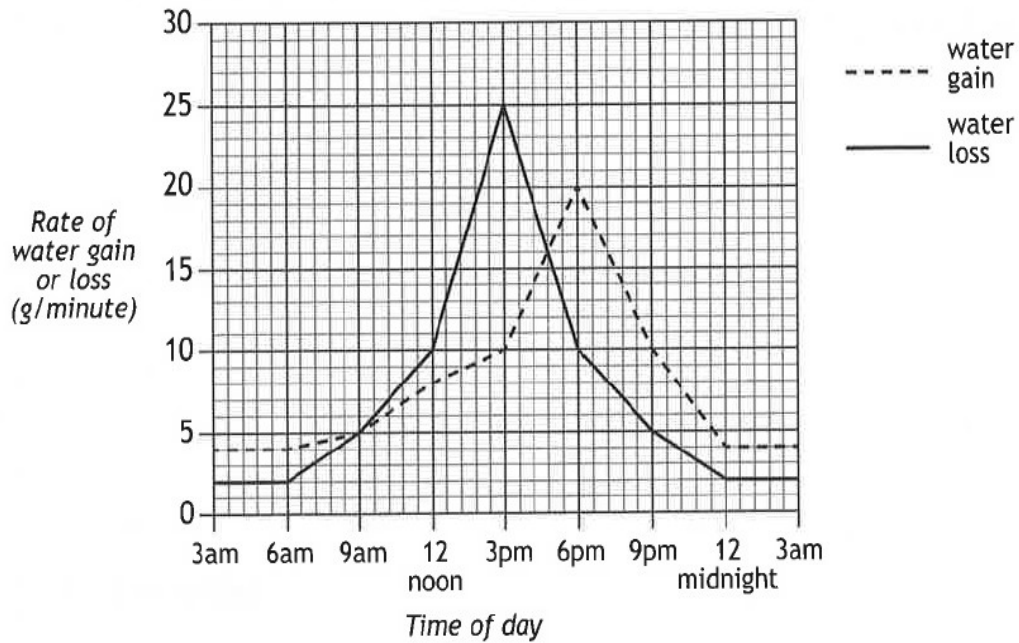
(i) When would stomata be **open**?

1

(ii) What **state** are the guard cells when the stomata are open?

1

16. The graph below shows the rate of water gain and water loss by a plant during a 24-hour period.



a) Calculate the **number of hours** during which the **water loss** was greater than 5g per minute.

Space for Calculation

1

_____ hours

b) Identify the **three hour period** during which the greatest increase in the rate of water gain took place.

Between _____ and _____

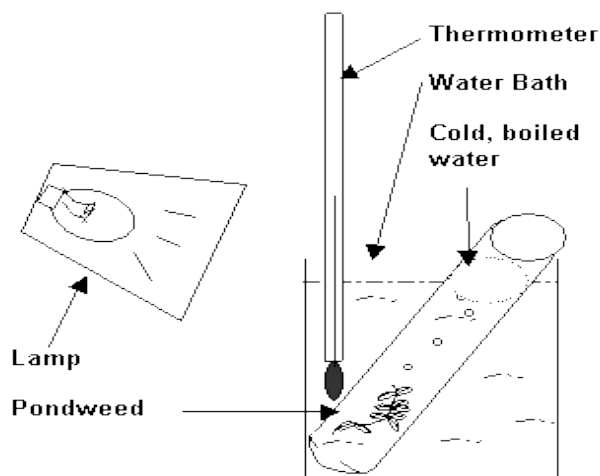
1

c) Identify the time in the **morning** that the rate of water gain equals the rate of water loss.

_____ am

1

17. A pupil set up an experiment to measure the effect of temperature on the rate of photosynthesis in a plant. She set up 5 water baths at varying temperatures, and measured the rate of photosynthesis by measuring the number of bubbles of oxygen that was produced every minute. The set up is shown below.



Her results are shown in the table below.

Temperature (°C)	Number of bubbles produced/min
10	4
20	10
30	26
40	48
50	14

a) Calculate the average number of bubbles produced per minute.

Space for working

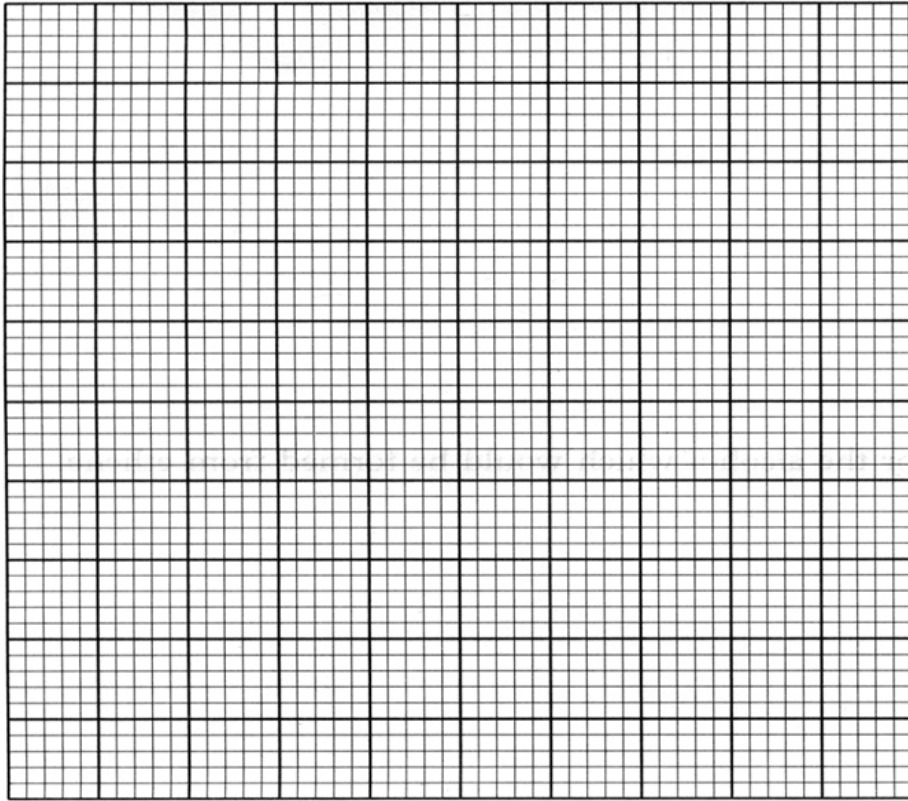
_____ bubbles per minute

1

b) How could the pupil have increased the reliability of her results?

1

c) Use the results table to complete a line graph of the results.

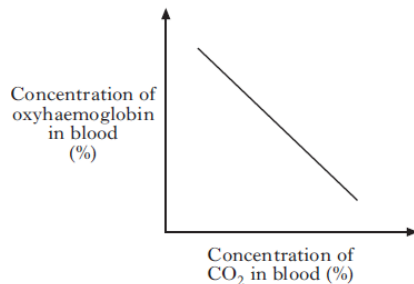


3

Homework 6

Score _____

1. The graph below shows the relationship between the concentration of carbon dioxide and oxyhaemoglobin in the blood.



Which of the following describes this relationship?

- A As the carbon dioxide concentration decreases, the concentration of oxyhaemoglobin decreases.
- B As the carbon dioxide concentration increases, the concentration of oxyhaemoglobin decreases.
- C As the carbon dioxide concentration increases, the concentration of oxyhaemoglobin increases.
- D As the carbon dioxide concentration increases, it has no effect upon the concentration of oxyhaemoglobin.

2. 100g of baked beans contain 4.5g of protein.

How many grams of beans would provide a daily protein requirement of 81g?

- A 5.5g
- B 18g
- C 364.5g
- D 1800g

3. The table below shows the changes in the rate of blood circulating in parts of an athlete's body before and during exercise.

Part of body	Rate of blood circulating (cm ³ / minute)	
	before exercise	during exercise
Heart muscle	300	900
Skeletal muscles	1200	12000
Skin	600	1900
Muscles of the gut	1500	600

For heart muscle, how many times greater is the rate of blood circulating during exercise compared with before exercise.

- A 3 times
- B 4 times
- C 10 times
- D 30 times

4. Which of the following correctly describes the pathway of air out of the lungs?

- A trachea → bronchi → bronchioles → alveoli
- B alveoli → bronchioles → bronchi → trachea
- C trachea → bronchioles → bronchi → alveoli
- D alveoli → bronchi → bronchioles → trachea

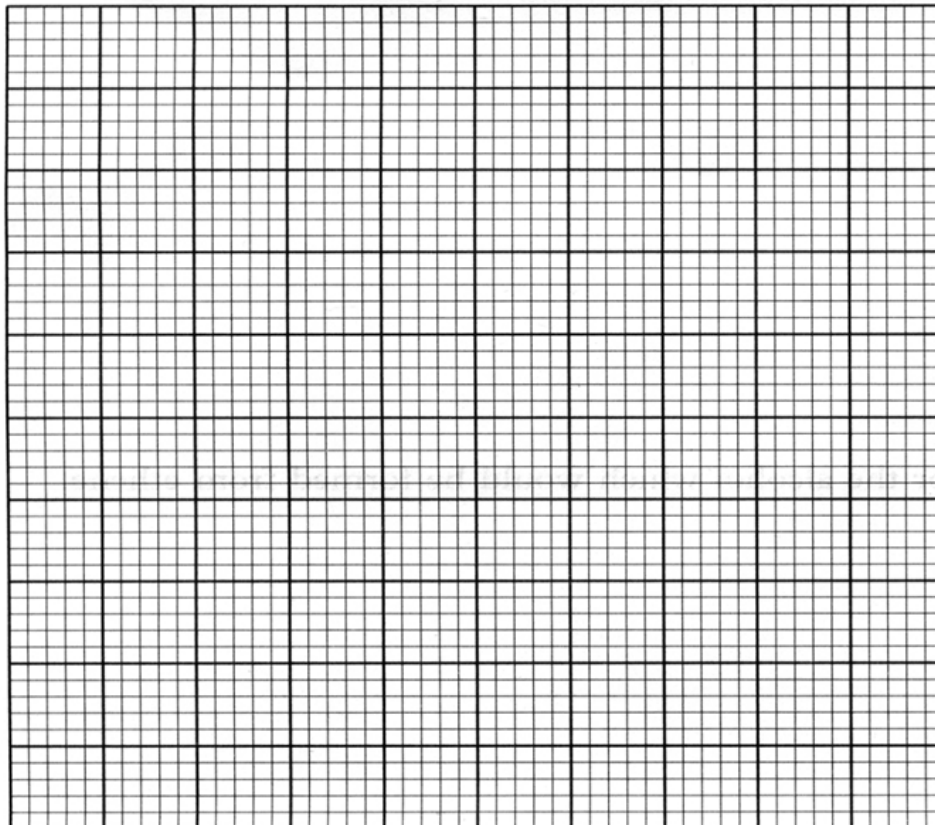
5. What nerve is found only in the CNS?

- A motor
- B sensory
- C inter
- D central

6. An experiment was carried out to determine the effect of increased workload on heart rate. The work rate of one athlete was increased, and their heart rate was recorded in the results table below.

<i>Work rate</i> (watts)	<i>Heart rate</i> (beats per minute)
0 (at rest)	80
60	104
80	110
120	128
140	140
160	158
200	180

- a) Use the table above to **complete a line graph** of the pupil's heart rate over the range of work rates.



2

- b) From your graph **predict** the athlete's heart rate at a work rate of 100 watts.

_____ beats per minute

1

c) Identify the independent and dependent variable in the investigation on the previous page.

Independent _____

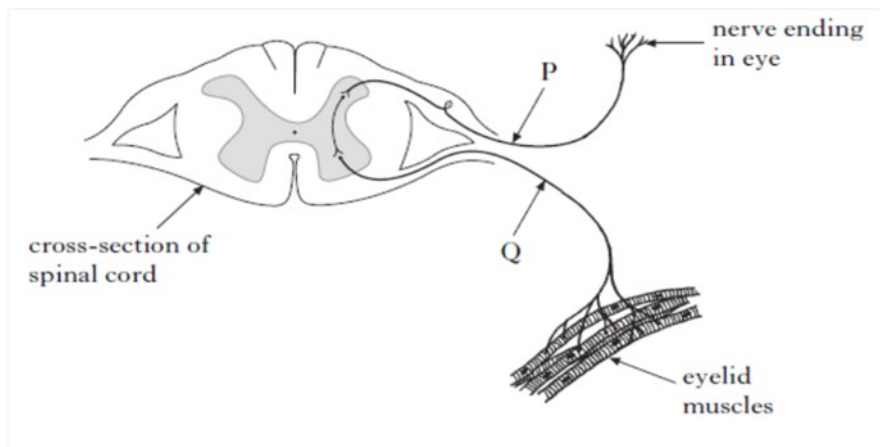
Dependent _____

2

d) Describe how this investigation could have been made more reliable.

1

7. The three types of neuron involved in the reflex arc for blinking are shown in the diagram below.



a) State the name and function of nerve P.

2

Name _____

Function _____

b) Which labelled structure in the diagram above shows the effector?

1

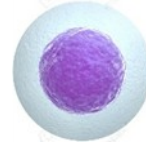
c) What is the function of the reflex arc?

1

d) Describe what happens at a synapse.

1

8. Nerve cells are an example of specialised cells. Pick one other specialised cell from the options below, state its name and describe how its specialisation is related to its function.

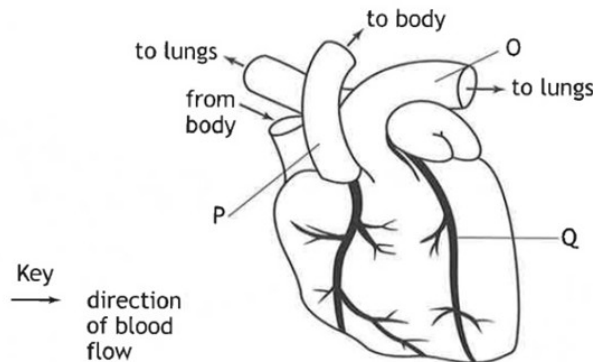


Name _____

2

Function _____

9. The diagram below shows an external surface view of a human heart.



- a) Name artery P.

1

- b) What type of blood will artery O carry?

1

- c) Blood vessel Q can be seen in the diagram above. State its name and describe the effect of a blockage in this blood vessel.

2

Name _____

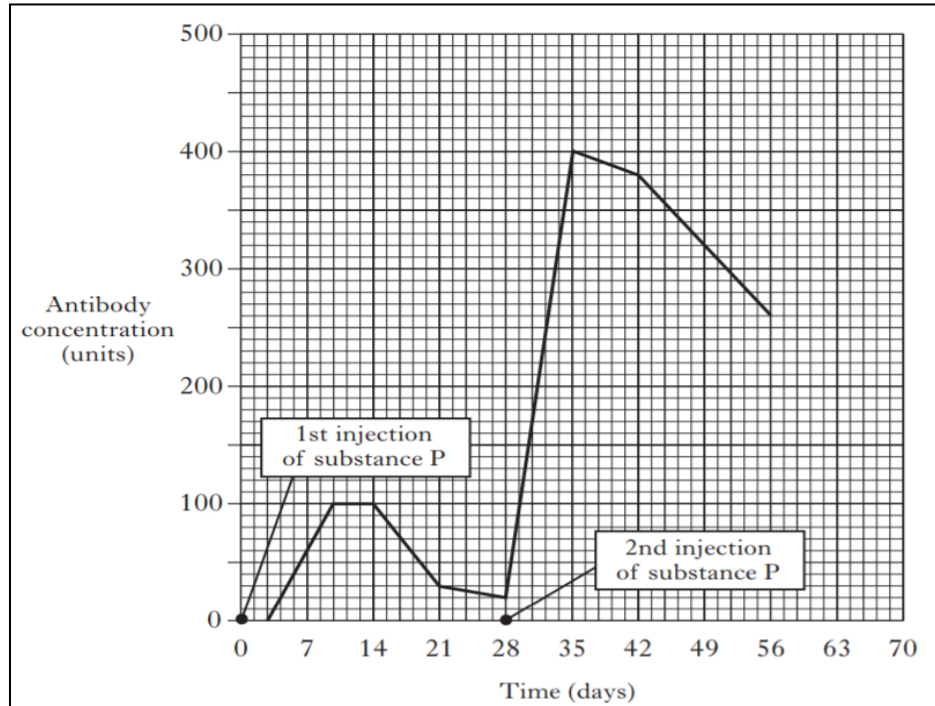
Effect of blockage _____

- d) Describe one structural difference between an artery and a vein.

1

9. Antibodies are produced as a defence against disease-causing organisms. In an experiment, a volunteer was injected with substance P at the start (day 0) and again on day 28. The substance caused the production of antibodies.

The graph below shows antibody concentration in the blood in response to the two injections.



- a) Predict the antibody concentration on day 70.

_____ units

1

- b) The antibody concentration was higher in response to the second injection. From the graph, state one other difference in response to the second injection.

1

- c) Substance P caused the production of antibodies.

Name the type of white blood cell that produces antibodies.

1

- d) A second method of defence against disease-causing organisms is phagocytosis.

Describe the process of phagocytosis.

1

Total Marks = 27