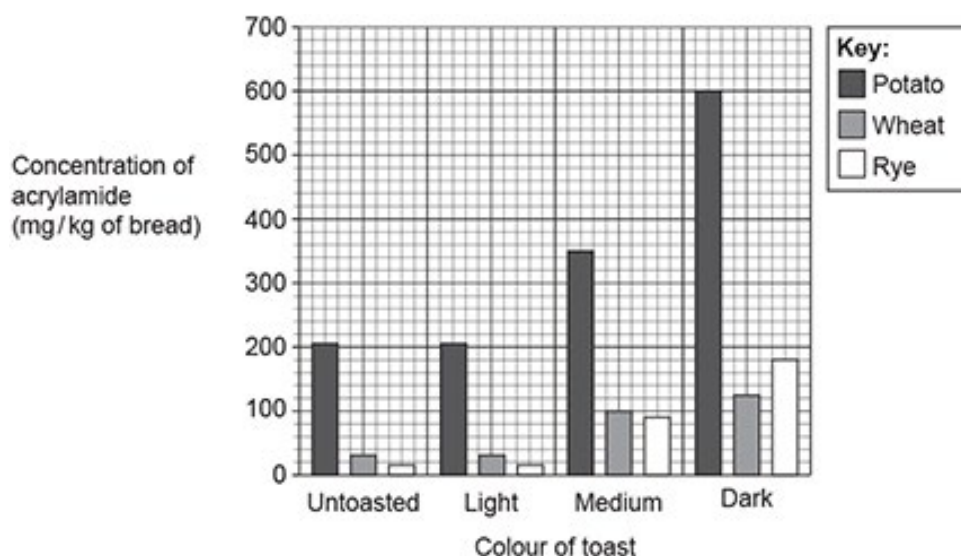


1. Acrylamide is a chemical that is formed when bread is toasted.

Scientists measured the concentration of acrylamide in toast made from three different types of bread: potato, wheat and rye.

They heated the bread for different lengths of time to get different colours of toast.



i. Give **two** conclusions that the scientists could make from their investigation.

1 _____

2 _____

[2]

ii. The daily recommended maximum intake for acrylamide is 195 mg.

A slice of toast has a mass of 50 g.

A person eats toast that is dark and made from potato bread.

Calculate the maximum number of **whole** slices of toast the person can eat without exceeding the recommended maximum intake.

Use the graph.

Number of whole slices = [3]

- [1]**

Disease	Cause	Number of UK cases	Effect
Huntington's	a dominant allele	12 in 100 000 people	The mutation produces a protein that stops the cerebrum communicating with the spinal cord.
Muscular dystrophy (MD)	a recessive allele	1 in 4 000 males	The mutation prevents a muscle protein being made.
Spinal muscular atrophy (SMA)	a recessive allele	1 in 10 000 people	The mutation prevents a protein being made that is needed for motor neurones to work.

Calculate the number of cases of Huntington's disease in the UK.

Number of cases = [2]

Describe **two** risks of using stem cells to treat patients.

[2]

3. Acrylamide is a chemical that is formed when bread is toasted.

Experiments have shown that significant doses of acrylamide can cause cancer in animals.

- i. Describe the effects of cancer on cells.

[2]

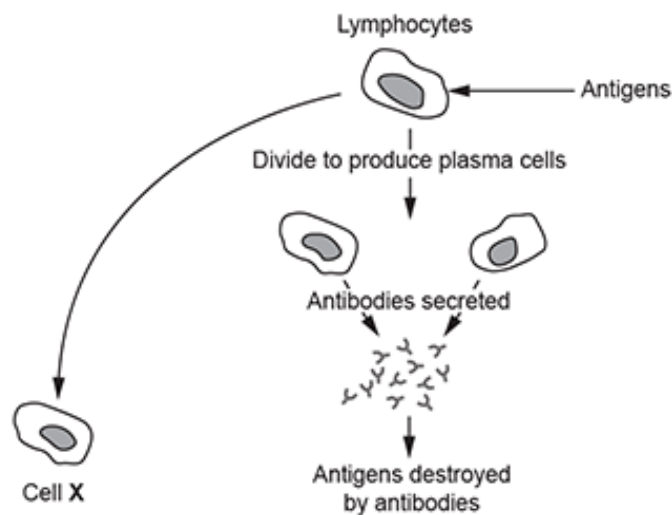
- ii. Some scientists concluded that, 'acrylamide could also cause cancer in humans'.

Other scientists are **not** sure about the effect of acrylamide on humans, despite the results of the animal experiments.

Suggest **one** reason why.

[1]

4. The diagram shows how lymphocytes in the immune system respond to antigens.



What is the function of cell X?

- A Cell X will live for many years and engulf foreign bacteria and viruses.
- B Cell X will produce antibodies that will destroy plasma cells.
- C Cell X will respond rapidly if the antigen reinfects the body again.
- D Cell X will respond to antigens from different pathogens.

Your answer

[1]

5. All types of white blood cell contain a nucleus.

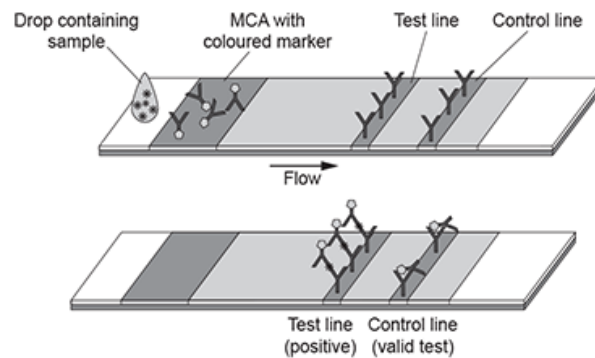
Which function of white blood cells does **not** require a nucleus?

- A Changing shape to squeeze out of capillaries
- B Dividing by mitosis after detecting a pathogen
- C Producing antibodies which are made of proteins
- D Producing enzymes to digest pathogens

Your answer

[1]

6. The diagram shows how monoclonal antibodies (MCA) are used in a test to detect pathogens.



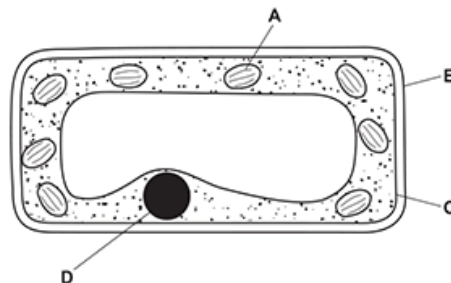
Which statement describes how the tests work?

- A MCA carry the antigens along to bind with other antibodies on the test line.
- B MCA have antibiotics attached that combine with both the test and control antibodies.
- C The coloured marker combines with antigens and with antibodies on the test line.
- D The drop contains antibodies that get carried along by the MCA.

Your answer

[1]

7. The diagram shows a labelled plant cell.



Which part of the plant cell gives **physical** protection against disease?

Your answer

[1]

8(a). Multiple sclerosis is an auto-immune disease that destroys nerve cells.

The body's immune system usually only destroys invading cells but in auto-immune diseases the body starts to destroy its own cells.

Describe **two** ways that the body's immune system destroys invading cells.

1

2

[2]

(b). Suggest **two** reasons why multiple sclerosis is so difficult to treat.

[2]

9. Scientists are using stem cells to try and cure cystic fibrosis.

They are trying two methods:

- 1) using stem cells from cloned embryos
- 2) converting skin cells from a donor into adult stem cells.

What is the advantage of the **second** method?

- A** Adult stem cells are less likely to be infected by viruses.
- B** Adult stem cells can form a wider range of tissues.
- C** Embryos will not need to be destroyed.
- D** Stem cells produced from donor skin cells are less likely to be rejected.

Your answer

☐

[1]

10. Mole rats are rodents that live in Africa. Mole rats rarely develop cancer. One theory to explain this involves two 'over-crowding' genes. These genes slow down the cell cycle when cells come into contact with each other.

Explain how slowing down the cell cycle can protect mole rats from developing cancer.

[2]

11. Different cells are used in the production of monoclonal antibodies.

Which cells produce the monoclonal antibodies?

- A** Hybridoma cells
- B** Plasma cells
- C** Tumour cells
- D** White blood cells

Your answer ☐

[1]

12. Which of these treatments is **not** an example of genomic medicine?

- A** Advising people who have certain alleles to make changes in their lifestyle
- B** Designing drugs that are specific to a person's alleles
- C** Removing a female's ovaries if she has alleles that make her more likely to develop ovarian cancer
- D** Using genetic engineering to produce new medicines

Your answer ☐

[1]

13. The table shows some different treatments for cardiovascular disease.

Which treatments for cardiovascular disease work by directly reducing blood pressure?

Treatment	Main method of action
antiplatelets	reduce the action of platelets
beta blockers	block the effects of adrenaline
nitrates	widen blood vessels
statins	reduce cholesterol levels in the blood

- A** Antiplatelets and beta blockers
- B** Beta blockers and nitrates
- C** Nitrates and antiplatelets
- D** Statins and nitrates

Your answer ☐

[1]

14. Amyloidosis is a group of inherited conditions that affect people’s health.

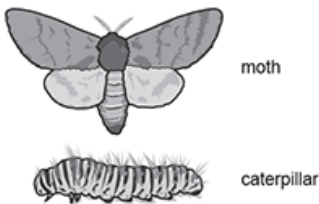
The most common type of amyloidosis is caused by a dominant allele (**A**) of a gene.

Scientists are now developing a new treatment called gene silencing.
They have developed a drug that destroys the mRNA that codes for the amyloid protein.

Explain why this technique is called **gene silencing**.

[2]

15. Pine processionary moths lay eggs that develop into larvae and then into caterpillars, as shown in the diagram.



The caterpillars are a major pest, eating and killing pine trees.

The caterpillars are fed on by birds such as cuckoos. The caterpillars are also parasitised by fungi.

Scientists have tried to use natural plant defence methods on the larvae to conserve the pine trees.

The table shows the effects of two plant-based oils on the larvae in laboratory conditions and on the pine trees.

Type of oil	Deaths per 1000 larvae	
	In the laboratory	On the pine tree
Ginger	712	874
Rosemary	300	761
Control treatment	13	22

- i. Calculate the percentage increase in the death of larvae on the pine trees compared to in the laboratory for the control treatment.

Percentage change = % **[2]**

- ii. More larvae die in the natural environment of the pine trees than in the laboratory for all treatments.

Suggest **one** reason why.

..... **[1]**

- iii. Evaluate the use of the two plant oils in the control of the larvae.

Use data from the table.

..... **[3]**

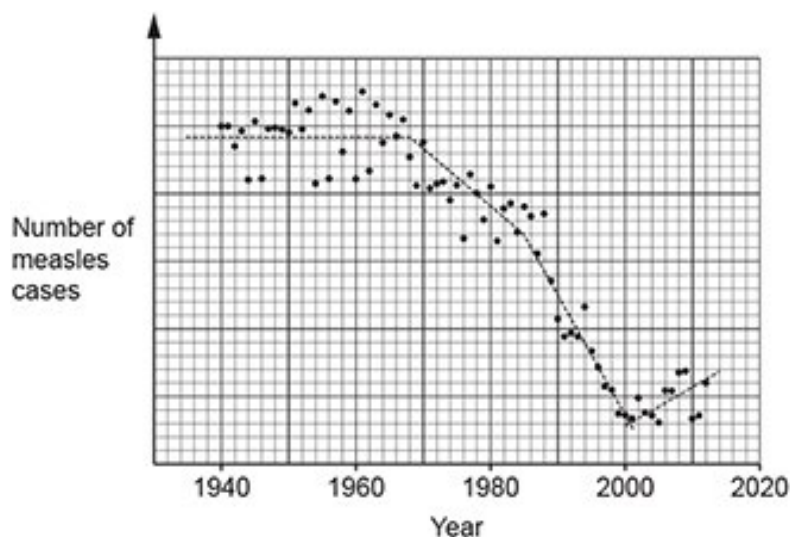
16(a). Measles is an infectious disease caused by a virus.

A vaccine is available to protect people against measles.

Explain how vaccinations can protect people against diseases such as measles.

..... **[3]**

(b). The graph shows the number of cases of measles in the UK from 1940 to 2012.



In 1968, vaccinations against measles started for children.

Since then, there have been two other significant events that have affected the number of measles cases.

Use the graph to suggest a year when each event occurred.

Give **one** reason for your choice of year for each event.

- i. The measles vaccine was given as a triple vaccine called MMR. This was more convenient because MMR vaccinated children for three diseases at the same time.

Year _____

Reason _____

----- [2]

- ii. A report claiming a link between the MMR vaccine and an increased risk of the disorder called autism.

Year _____

Reason _____

----- [2]

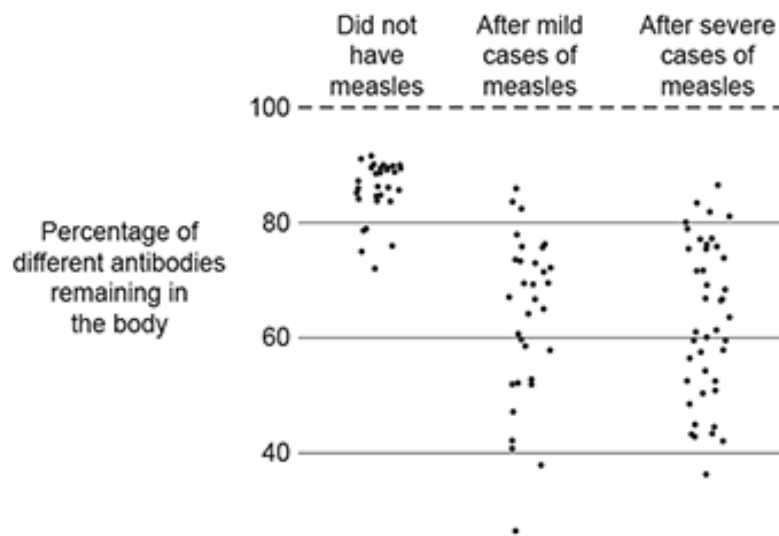
(c). A study looked at how measles infections can affect the number of antibodies for other pathogens in a person's body.

The study included three groups of children:

- children who did not have measles
- children with mild cases of measles
- children with severe cases of measles.

The study measured the percentage of different antibodies remaining in the children six weeks after infection.

The diagram shows the results. The result for each child is marked with a dot.



Most people recover from measles but may get ill again with different symptoms afterwards.

How do the findings shown in this diagram explain this after-effect of a measles infection?

17(a). The diagram shows a tulip plant. Many gardeners like to grow tulip plants.



In 1637, tulip growers found that a small number of their tulip plants produced flowers with different coloured stripes.

Until recently, there were two possible theories that explained the colours of these tulips.

- Theory 1 - The stripes are caused by a mutation in the gene that produced the chemical that coloured the flower.
- Theory 2 - The stripes are caused by a pathogen that infects the plant and changes the production of the coloured chemical.

Put ticks (✓) or crosses (X) in the table to show whether each theory would produce changes in the phenotype and in the genotype of the tulip plants.

	Theory 1	Theory 2
Changes the phenotype of the tulip plant		
Changes the genotype of the tulip plant		

[2]

(b). Scientists now know that the colour changes are caused by a virus which infects the tulip tissue.

- The virus is injected into the phloem of the tulip by feeding insects.
- Although the infected bulbs produce attractive flowers, the infected bulbs become weaker every year until they die.

i. 2.0×10^9 tulips are grown in the Netherlands every year. This uses 14 200 hectares of land.

1.5% of all the tulips grown are infected.

Calculate how many infected tulips there are in one hectare of land.

Number of infected tulips = [2]

- The text box shows the results of a trial of the machine in a field containing 1000 tulips.

- All 15 infected tulips identified
- 14 not infected tulips identified as infected
- 971 not infected tulips identified as not infected

Use data from the text box in your answer.

[illegible]

18(a). Amyloidosis is a group of inherited conditions that affect people's health.

The most common type of amyloidosis is caused by a dominant allele (**A**) of a gene.

Allele (**A**) codes for the production of a protein called amyloid.

Amyloid can block the blood vessels that leave the pancreas and the thyroid gland, preventing the release of hormones.

Complete the sentences to explain the symptoms that might be shown by person **2** in **(a)**.

Symptoms of person **2** can include:

- Being unable to control blood due to a lack of the hormones
..... and
- Being unable to control rate due to a lack of the hormone
.....

[4]

(b). One treatment that doctors use for amyloidosis involves:

- Killing all the plasma cells in the body.
- Then giving the patient healthy stem cells.

Explain how this treatment could help people with amyloidosis.

[2]

19. Which statement is correct about HIV/AIDS?

- A** AIDS is a virus that weakens the immune system.
- B** HIV and AIDS are alternative names for the same disease.
- C** HIV is a pathogen and AIDS is a set of infections.
- D** HIV is a virus that produces toxins which kill an infected person

Your answer ☐

[1]

20. New medicines can be tested in different ways.

Which is the main reason for testing a new medicine using tissue culture?

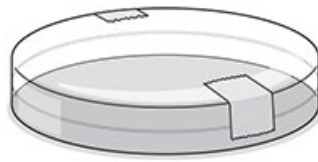
- A** To predict the effects on body systems.
- B** To see if it affects other organs.
- C** To see if it harms cells.
- D** To see if it reduces symptoms.

Your answer ☐

[1]

21. A scientist inoculates an agar plate with bacteria.

The plate is now ready to be incubated.



Why do they seal the lid with two strips of tape, rather than sealing it all round the lid?

- A** If sealed all round the lid, no bacteria could grow.
- B** To make it easier to remove the lid after incubation.
- C** To prevent water condensing on the lid of the Petri dish.
- D** To reduce the chance of pathogenic anaerobic bacteria growing on the dish

Your answer ☐

[1]

22. Which of these is a use of monoclonal antibodies?

- A** Detecting antigens in pregnancy testing.
- B** Removing cholesterol from blocked arteries
- C** Sterilising instruments used in operations.
- D** Vaccinating people against type 2 diabetes.

Your answer ☐

[1]

23. Which is a description of an antigen?

- A** A chemical group on the surface of a pathogen.
- B** A chemical that kills bacteria or stops them dividing.
- C** A drug that is used to kill viruses.
- D** A protein molecule made by white blood cells.

Your answer

☐

[1]

END OF QUESTION PAPER