## Global challenges – 2021/20 GCSE Gateway Biology Combined Science A

**1.** Nov 2021/Paper_J250/02/No.5

What do white blood cells produce to defend the body against tuberculosis?

**A** Antibodies

**B** Antigens

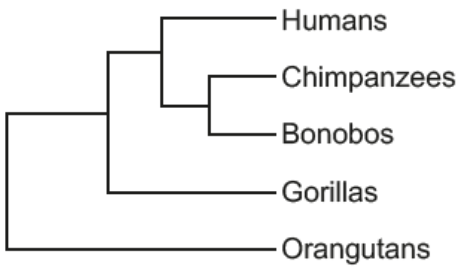
**C** Plasma

**D** Platelets

Your answer ☐ **[1]**

**2.** Nov 2021/Paper_J250/02/No.6

The diagram shows a phylogenetic tree produced using DNA analysis.




What does the phylogenetic tree show about the classification of humans?

**A** It shows bonobos and chimpanzees to be human's closest relations.

**B** It shows bonobos and orangutans to be human's closest relations.

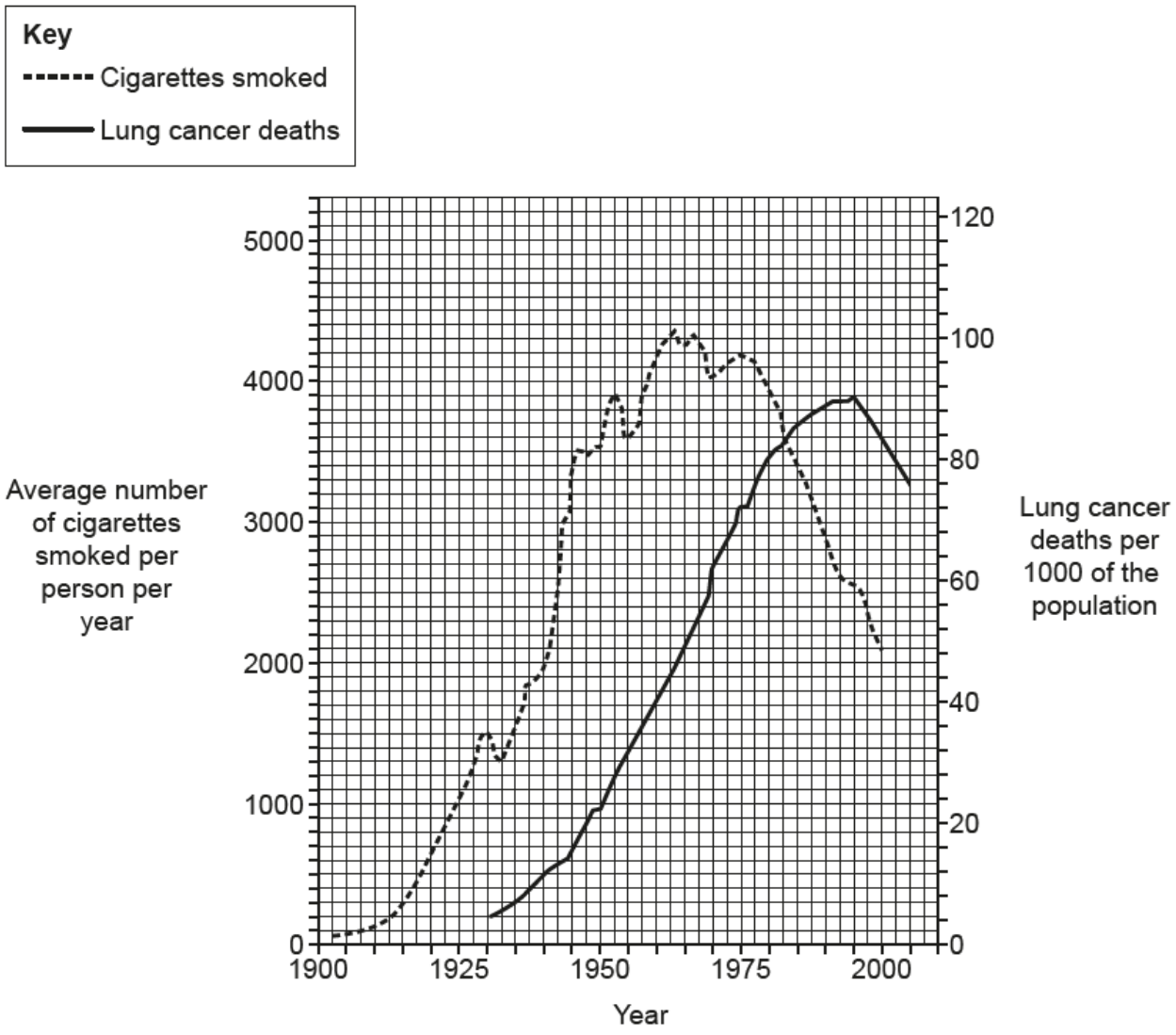
**C** It shows gorillas and chimpanzees to be human's closest relations.

**D** It shows gorillas and orangutans to be human's closest relations.

Your answer ☐ **[1]**

**3.** Nov 2021/Paper_J250/02/No.10

The graph shows the link between smoking cigarettes and lung cancer.




The average number of cigarettes smoked per person starts to fall in 1975.

How many years later did the number of lung cancer deaths also start to fall?

**A** 5

**B** 10

**C** 15

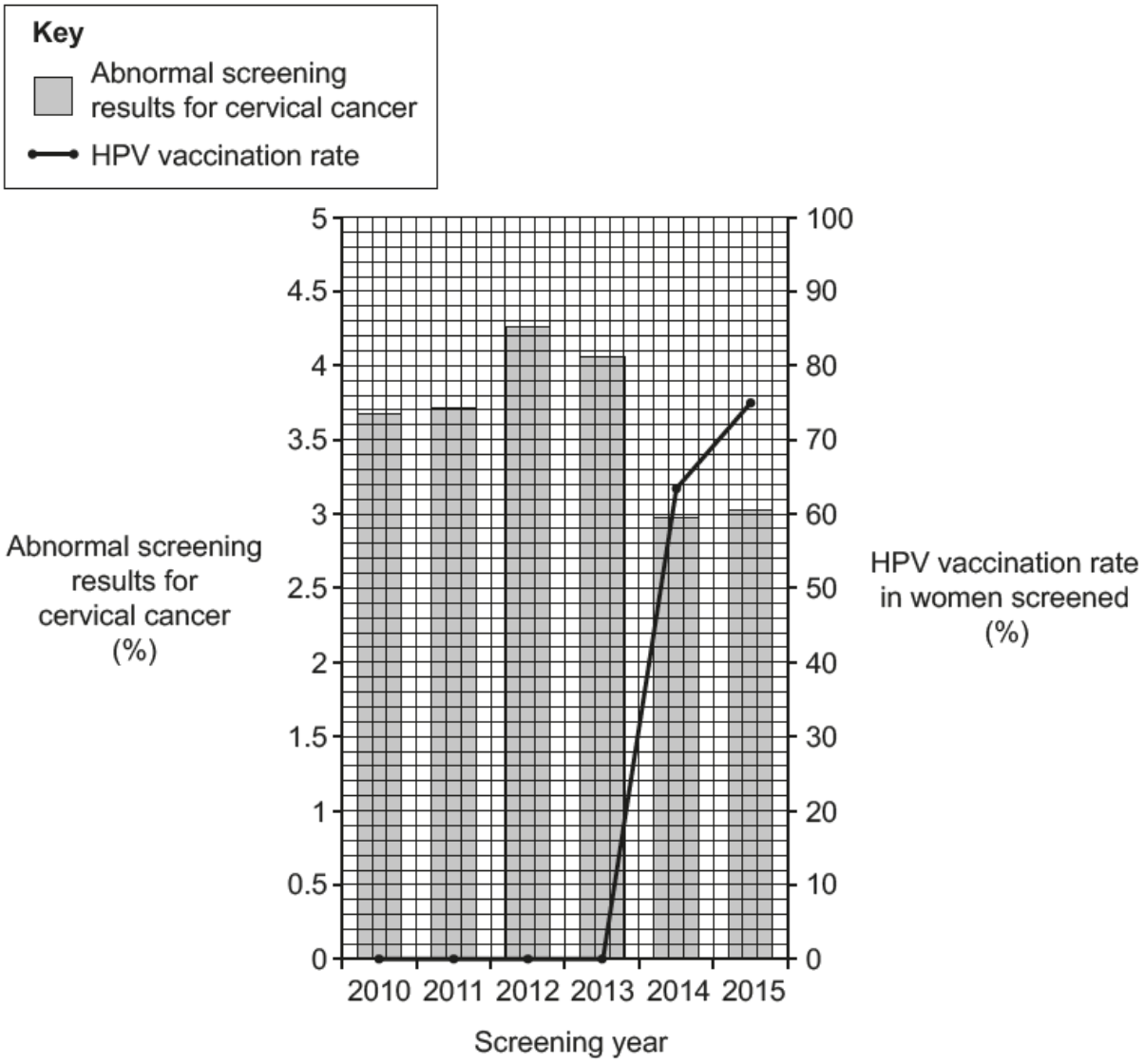
**D** 20

Your answer ☐ **[1]**

**4.** Nov 2021/Paper_J250/02/No.12

HPV (human papilloma virus) is a pathogen that causes cervical warts.

The graph shows data for HPV vaccination rates from a country where women are screened for cervical cancer.




**(a)** Use the graph to describe the relationship between the HPV vaccination and risk of cervical cancer.

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

**(b)** Explain how the vaccine for HPV prevents the pathogen causing cervical warts.

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..... **[2]**

**5.** Nov 2020/Paper_J250/02/No.2

Why are bacteria needed to recycle nitrogen in an ecosystem?

**A** Bacteria are microscopic

**B** Bacteria decompose organic material

**C** Bacteria reproduce rapidly

**D** Bacteria respire anaerobically

Your answer ☐ **[1]**

**6.** Nov 2020/Paper_J250/02/No.6

Which type of medicine is used to treat HIV?

**A** Antibiotics

**B** Antigens

**C** Antiseptics

**D** Antivirals

Your answer ☐ **[1]**

**7.** Nov 2020/Paper_J250/02/No.7

This capture-recapture formula is used to estimate population size:

$$\text{Population size} = \frac{\text{number in first sample} \times \text{number in second sample}}{\text{number of marked individuals in second sample}}$$

The table shows the results for one estimation of a beetle population.

| | **Number of beetles** |
|---|---|
| **First sample** | 12 |
| **Second sample** | 10 |
| **Marked individuals in second sample** | 4 |

Use the capture-recapture formula to estimate the beetle population.

**A** 26

**B** 30

**C** 120

**D** 480

Your answer ☐ **[1]**

**8.** Nov 2020/Paper_J250/02/No.8

Different methods are used to identify which disease an animal has.

Which method is **not** used to identify diseases?

**A** Analysing the DNA of the pathogen.

**B** Detecting antigens in the animal's blood.

**C** Genetically engineering the pathogen.

**D** Visual appearance of animal.

Your answer ☐ **[1]**

**9.** Nov 2020/Paper_J250/02/No.12

A scientist investigates how the distance from a road affects the growth of lichens.

**(a)** At the **start** of the investigation the scientist makes this statement.

> **As the distance from a road increases, then the number of lichens will increase because there is less pollution.**

What type of statement is this?

Put a (ring) around the correct answer.

**Analysis** **Conclusion** **Evaluation** **Hypothesis**

**[1]**

**(b)** Read the method the scientist uses.

- Choose a site where a road is next to an area of trees.
- Use a measuring tape to choose a tree 5 m from the road.
- Place a clear plastic grid (25 × 25 cm) on the tree, 1 metre above the ground.
- With a pen, dot each 1 $cm^2$ grid area where there are lichens.
- Count the dots on the clear plastic grid.
- Move the clear plastic grid sideways and repeat until the whole circumference of the tree trunk is measured, and record the results.
- Repeat this on more trees at 5 m intervals, up to 25 m away from the road.

**Fig. 12.1** shows their investigation.

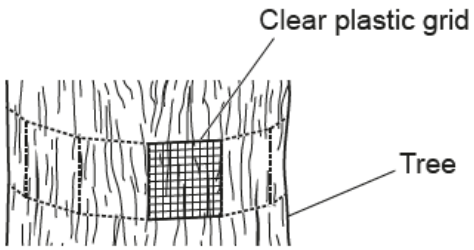


**Fig. 12.1**

**(i)** Write down **one** variable that is controlled in this investigation.

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

**(ii)** What name describes the clear plastic grid used by the scientist?

Put a (ring) around the correct answer.

**Line transect** **Pitfall trap** **Pooter** **Quadrat**

**[1]**

**(iii)** How could the scientist improve their method to reduce the level of uncertainty in the results?

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

**(c)** **Fig. 12.2** shows one clear plastic grid for the tree at **5** metres.

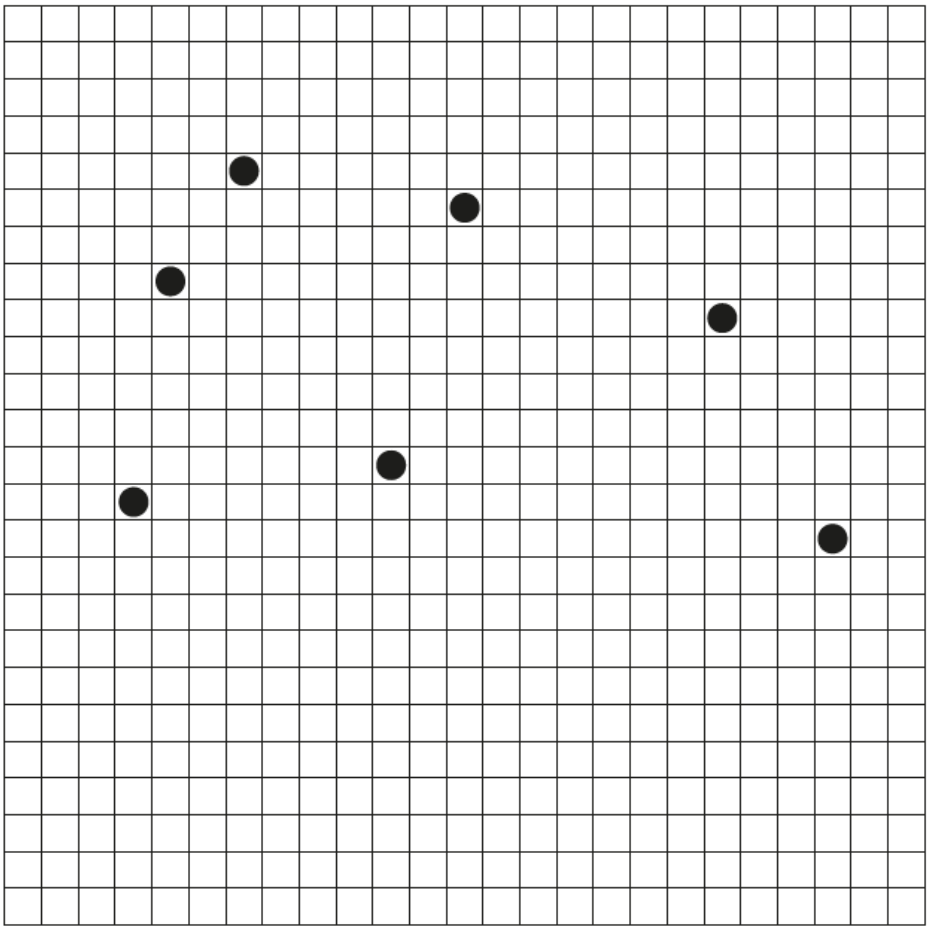

**Fig. 12.2**

**(i)** The other grids around the circumference for the tree at 5 metres had 3, 8, 3 and 6 dots.

Find the **median** for lichens found at 5 metres. Include the result in **Fig. 12.2**.

Median = ..... **[2]**

**(ii)** **Fig. 12.3** is a scatter diagram of some of the scientist's results.

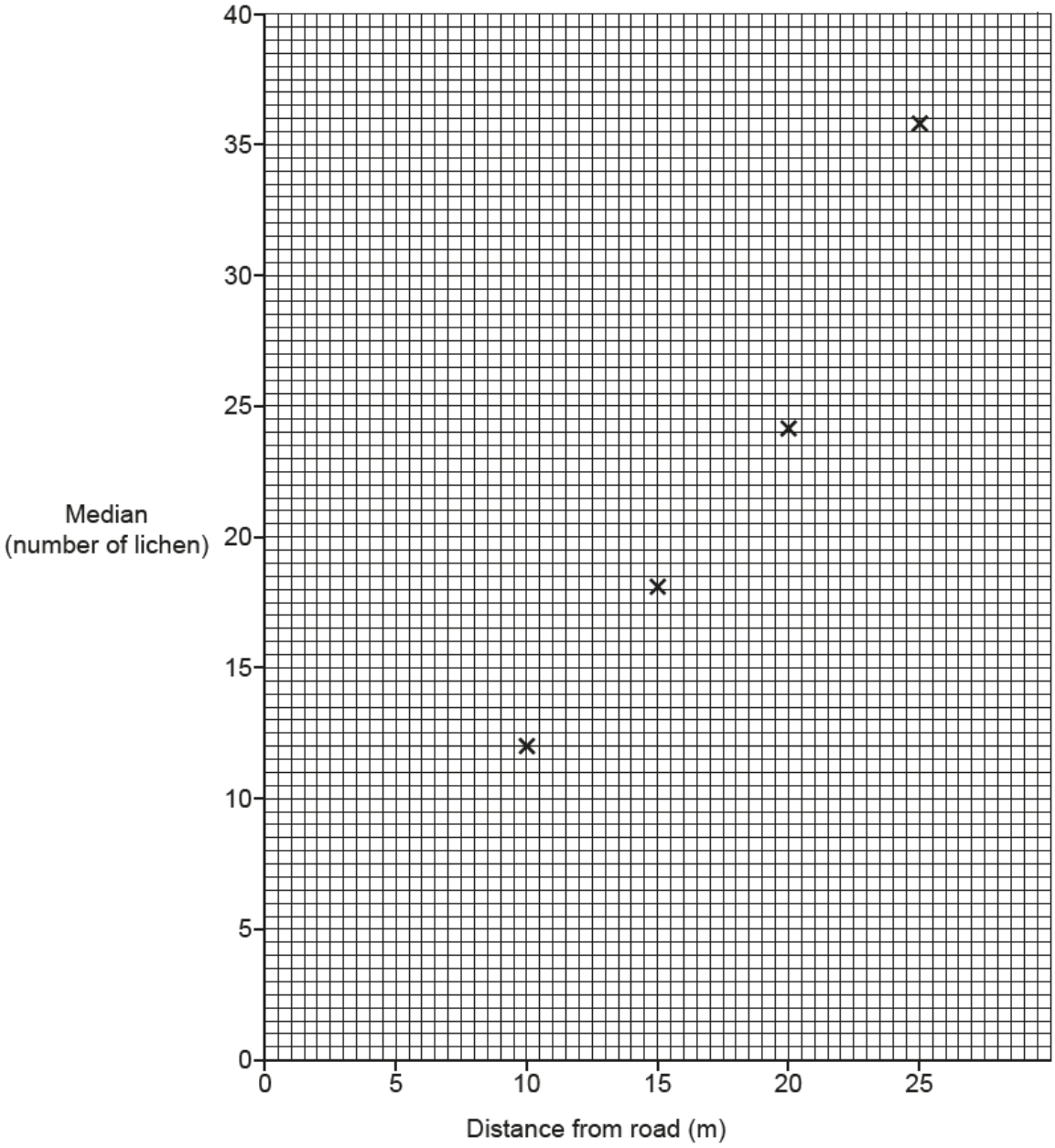


**Fig. 12.3**

Explain the results seen in **Fig. 12.3**.

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..... **[2]**

**(d)** Lichens are made up of algae and a fungus living together.

Algae are single celled organisms that photosynthesise. The fungus produces a threadlike structure that spreads to protect the algae.

What name describes the type of interdependence shown by the algae and the fungus?
Write down **one** reason for your answer.

Type of interdependence .....

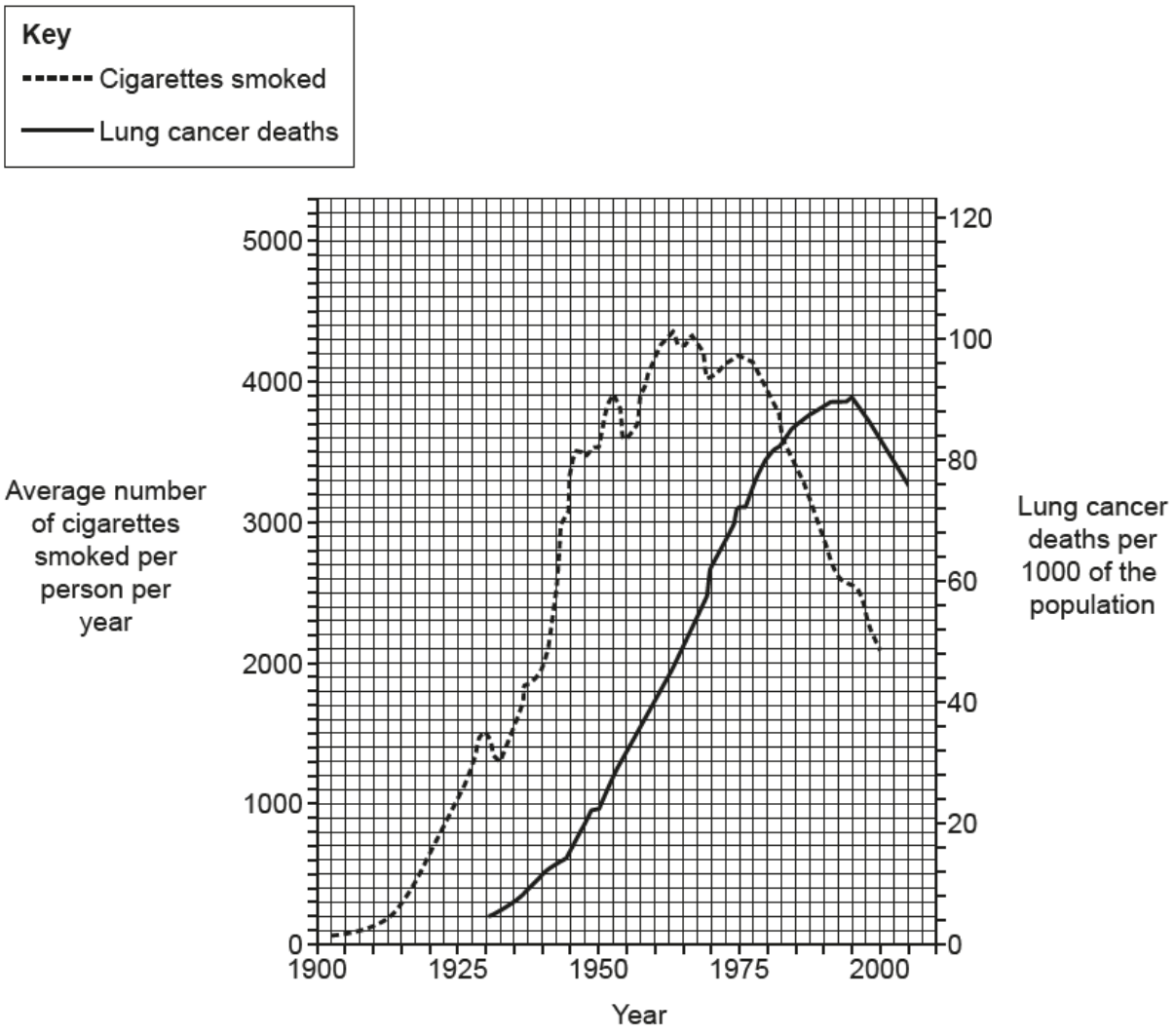
Reason .....

.....

..... **[2]**

**10.** Nov 2021/Paper_J250/08/No.2

The graph shows the link between smoking cigarettes and lung cancer.




The average number of cigarettes smoked per person starts to fall in 1975.

How many years later did the number of lung cancer deaths also start to fall?

**A** 5

**B** 10

**C** 15

**D** 20

Your answer ☐ **[1]**

**11.** Nov 2021/Paper_J250/08/No.11

White clover plants have two variants.

Cyanogenic variants produce a toxin when their cells are damaged.
Acyanogenic variants do not produce a toxin.

The cells of clover plants can be damaged by freezing temperatures or by snails eating the leaves.
The toxin kills snails but also damages the plant.

**Table 11.1** shows growing regions of the two variants.

| Variant | Regions where most often found |
|---|---|
| acyanogenic | colder climates |
| cyanogenic | warmer climates |

**Table 11.1**

**(a)** Complete the **hypothesis** to link each variant to the region it is most often found.

Acyanogenic variants are found in colder climates because .....

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Cyanogenic variants are found in warmer climates because .....

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**[2]**

**(b)** To investigate a hypothesis a field study is needed.

Sampling techniques are used to estimate the population size of each variant in different areas.

**(i)** Why are sampling techniques used instead of counting the total number of individual plants in each area?

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

**(ii)** Two students investigate the variant plants living at altitudes of 0–250 metres.

The students use random sampling as a starting point of their investigation. They then go on to complete a transect.

Explain how random sampling differs from a transect.

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..... **[2]**

**(iii)** Explain why using a transect would **develop** and **improve** their investigation.

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..... **[2]**

**(c)** **Fig. 11.1** shows the number of cyanogenic variant plants found in a total clover population of 200 at different altitudes.

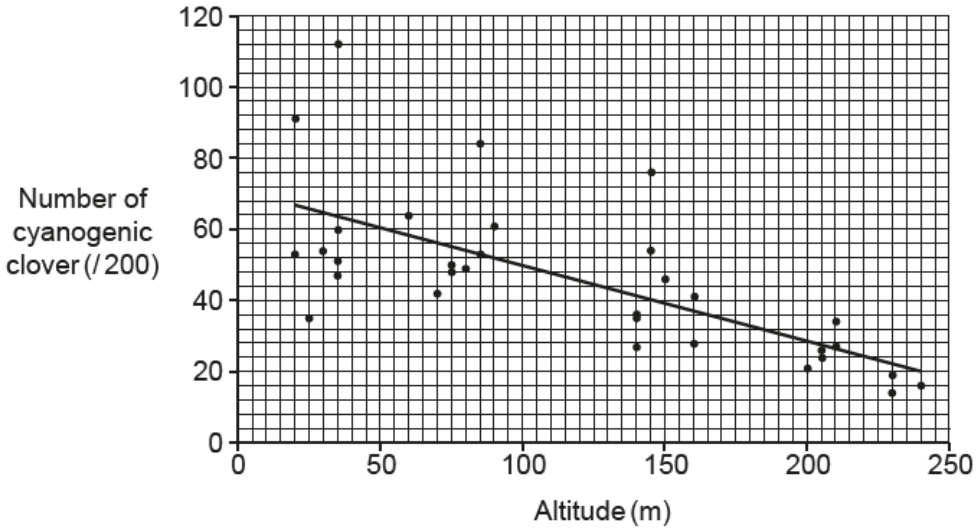


**Fig. 11.1**

**(i)** What conclusion can be made about the effect of altitude on the distribution of **cyanogenic** clover?

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

**(ii)** Predict the altitude where you would expect to find mostly **acyanogenic** clover plants. Explain why most clover plants are acyanogenic at that altitude.

Altitude .....

Explanation .....

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**[1]**

**(d)** Use the theory of natural selection to explain how the **cyanogenic** variant of white clover plant could have developed.

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

**12.** Nov 2021/Paper_J250/08/No.13

**(a)** Describe the relationship between health and disease.

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..... **[2]**

**(b)** **(i)** HPV (human papilloma virus) causes cervical warts.

**Fig. 13.1** is a diagram representing the size of HPV as it would be seen using an electron microscope.

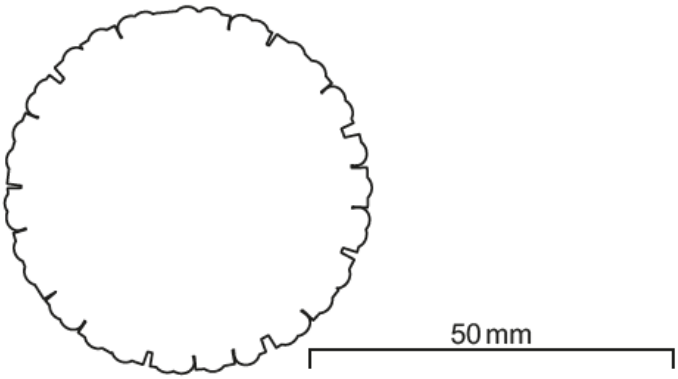


**Fig. 13.1**

The HPV shown in **Fig. 13.1** has a diameter of 50 mm. The actual HPV has a diameter of 55 nanometres.

Calculate the magnification of the HPV shown in **Fig. 13.1**.

Give your answer to **2** significant figures.

Magnification = × ..... **[3]**

**(ii)** Women can be given a vaccine to protect against HPV.

Explain why the vaccine produces an immune response to HPV but does not cause cervical warts.

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..... **[2]**

**(iii)** **Fig. 13.2** shows data for HPV vaccination rates from a country where women are screened for cervical cancer.

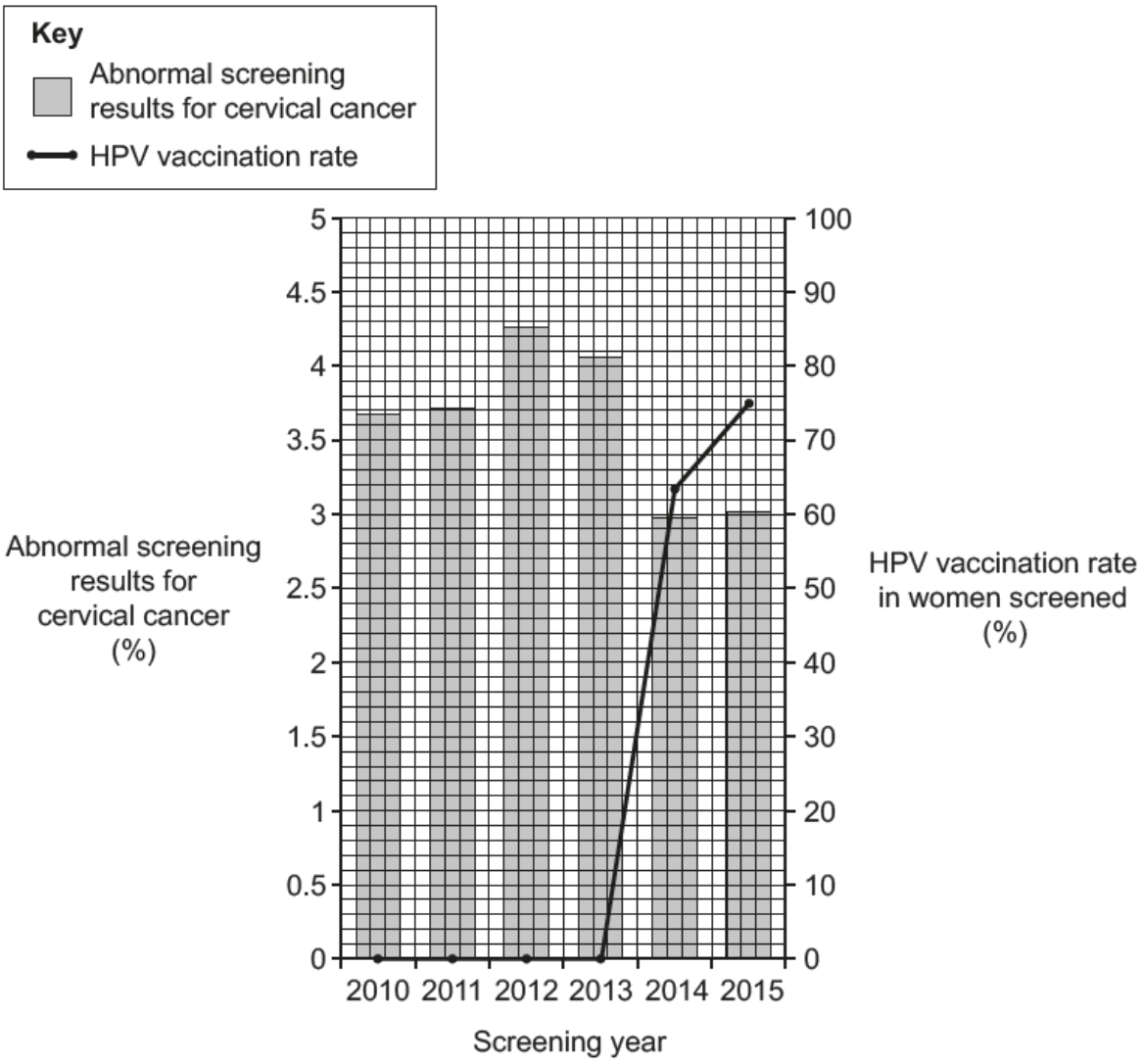


**Fig. 13.2**

Cervical cancer is a non-communicable disease. Non-communicable diseases are not usually prevented by vaccination.

Use the data in **Fig. 13.2** and your scientific knowledge to explain why a vaccination can be used to prevent cervical cancer.

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

**(c)** Describe **two** ways scientists test new vaccines to ensure they are safe for humans.

1 .....

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2 .....

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**[2]**

**13.** Nov 2020/Paper_J250/08/No.8

Chalara ash dieback is a fatal disease affecting ash trees. It is caused by a fungus growing on the leaves.

When the leaves fall to the ground the fungus releases spores spreading the disease.

Which of these would help prevent the spread of Chalara ash dieback?

**A** Collecting the fallen leaves to make compost that is then added to the soil.

**B** Cutting off infected leaves and branches, and leaving them on the ground to decay.

**C** Stopping the import of ash seeds, plants and trees from countries with infected trees.

**D** Replanting young ash trees to replace those that have died.

Your answer ☐ **[1]**

**14.** Nov 2020/Paper_J250/08/No.12

A patient has a urinary tract infection caused by bacteria. The doctor needs to know the best antibiotic to use to treat the infection.

They send a sample of the patient's urine for testing. The bacteria in the urine are grown on agar jelly plates. On the plates are four different antibiotic discs.

Aseptic techniques are used to prepare the agar jelly plates.

**Fig. 12.1** shows the neck of a glass bottle containing the agar jelly being heated in a flame for 2 seconds. This is done before the agar jelly is poured into the Petri dish.

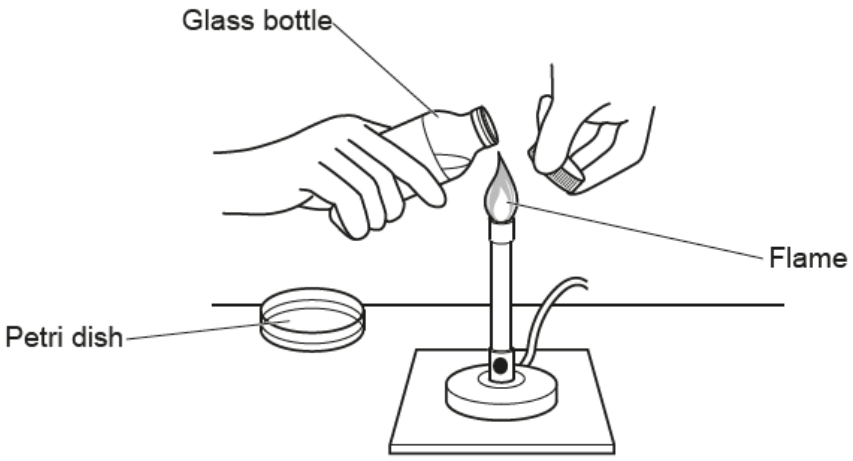


**Fig. 12.1**

**(a) (i)** Suggest why the scientist uses a glass bottle and **not** a plastic bottle.

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

**(ii)** The neck of the glass bottle is heated before transferring the agar jelly to the Petri dish.

Explain why.

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..... **[2]**

**(b)** **Fig. 12.2** shows the results of the four different antibiotics **A**, **B**, **C** and **D**.

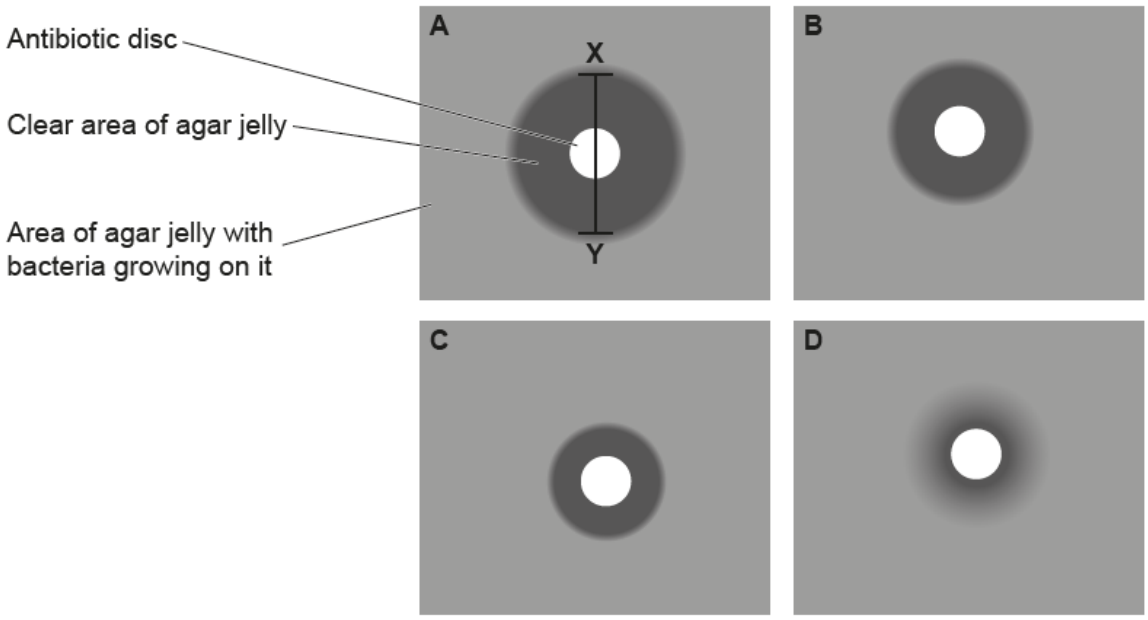


**Fig. 12.2**

**(i)** The line **XY** is the diameter of clear agar jelly for Antibiotic **A**.

Use the line **XY** to calculate the cross-sectional area of clear agar jelly for Antibiotic **A**.

The area of a circle = $\pi r^2$

$\pi = 3.14$

Give your answer to **3** significant figures.

Cross-sectional area = ..... $mm^2$ **[3]**

**(ii)** The cross-sectional area of clear agar jelly including the antibiotic disc for Antibiotic **C** is 177 $mm^2$.

Which antibiotic, **A** or **C**, should the doctor use to treat the patient? Explain your answer.

Antibiotic .....

Explanation .....

..... **[2]**

**(c)** Some bacteria are resistant to antibiotics.

Explain why antibiotic resistant bacteria show evidence of evolution.

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..... **[2]**

**15.** Nov 2020/Paper_J250/08/No.15

**(a)** Complete the sentence about cancer.

Cancer is the result of changes in cells that lead to uncontrolled ..... and ..... .

**[2]**

***(b)** Treatment of lung cancer can involve surgery and painful chemotherapy.
Survival rates for lung cancer are low.

Replication of damaged DNA can lead to cancer. A gene called p53 prevents the replication of damaged DNA. Lung cancer and faults in the p53 gene are linked.

Gene therapy involves replacing faulty genes.

Explain why gene therapy could be used to treat lung cancer and discuss the issues involved in using this type of treatment.

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..... **[6]**